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GENETIC VARIABILITY AND CHARACTER ASSOCIATION IN SOME STRAINS OF SHIITAKE MUSHROOM (*Lentinula edodes*)

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ABSTRACT

Ahmed A, Hossain MS, Hoque KMF, Hossain K, Sarker NC (2013) Genetic variability and character association in some strains of shiitake mushroom (*Lentinula edodes*). *Int. J. Expt. Agric.* 3(1), 9-12.

Genetic variability, correlation and path coefficient for economic yield and yield contributing traits in 10 strains of shiitake mushroom were studied. The strain Le-15 was the earliest in days to primordia initiation and maturity of fruiting body, whereas Le-2 was to be late in days to primordia initiation and maturity of fruiting body. Among the strains, Le-16 showed the highest number of effective fruiting body, while Le-15 exhibited the lowest number. Le-15 produced the lowest economic yield, while Le-6 and Le-8 produced the highest economic yield. Highest PCV% and GCV% was found for number of effective fruiting body. High heritability coupled with high genetic advance as percentage of mean was found for all the traits. Days to maturity of fruiting body, number of effective fruiting body, diameter of pillius, length of stalk and thickness of pillius showed positive and high direct effect on economic yield.

Key words*: *variability, selection parameters, shittake mushroom

INTRODUCTION

Shiitake mushroom (*Lentinula edodes*) is the second most popular edible mushroom (Chang 1999 and Chiu *et al*. 1999). It is very mush popular in all over the world for their nutritional value, taste and medicinal importance (Wasser 2005). Many strains of shiitake mushroom are available in the world which is extensively cultivated. The strains of this valuable mushroom vary widely particularly in the time required for mycelium colonization, bump formation, fruiting body development and productivity (Triratana and Tantikanjana, 1987).

The yield which is the ultimate expression of various yield contributing characters is a polygenic trait and is influenced by the many genetic factors as well as environmental fluctuations. Therefore, selection based on yield attributes was suggested to be more effective rather yield alone. However, according to Burton (1952), Al Jibouri *et al*. (1958) and Dewey and Lu (1959) for the improvement of any crop through breeding, it is essential to know the extent of variability present in the crop species, nature of association between the traits and the contribution of different traits towards yield. The present study was therefore undertaken to determine the extend to genetic variability, nature of interrelationship of between and among the traits and contribution of different yield contributing traits towards economic yield in shiitake mushroom.

MATERIALS AND METHODS

The experiment was conducted at National Mushroom Development and Extension Center, Savar, Dhaka during September, 2010 to January, 2011 to study the genetic variation, character association and path analysis in ten strains of shiitake mushroom designated as Le-2, Le-4, Le-6, Le-8, Le-9, Le-10, Le-11, Le-12, Le-15 and Le-16. For each 500g spawn packet sun dried saw dust, wheat bran and rice husk were mixed together at 160, 80 and 10g respectively. Water was added to adjust moisture content at 65% and $CaCO_3$ was mixed at the rate of 0.2% of the mixture. Polypropylene bags of 25cm×17cm size were filled with 500g of substrate mixture and packets were tied, plugged and covered as mentioned above.

The experiment was laid out in a randomized complete block design (RCBD) with three replications and each replication contains ten individuals of each strain. Data on mycelium growth rate, duration to complete mycelium running for bump formation, days to primordia initiation, days to maturity of fruiting body, number of effective fruiting body, length of stalk, diameter of stalk, diameter of pillius, thickness of pillius and economical yield were recorded and statistically analyzed using the MSTAT-C computer programme.

RESULTS AND DISCUSSION

Genetic Parameters

Mean with ranges, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), broad sense heritability (h^2_b) and genetic advance as percentage of mean (GA) for different traits were calculated and are presented in Table 1. In that table, we observed that effective fruiting body number, thickness of pillius, diameter of stalk and economic yield showed high PCV and GCV values than the other traits which indicated that selection of these traits would be effective. Effective fruiting body number showed the highest values for PCV and GCV. The minimum differences between phenotypic and genotypic coefficients of variation indicated that the variations among the genotypes for these traits were mainly due to genetic factors.

Table 1. Range, mean, phenotypic coefficient of variation (PCV%), genotypic coefficient of variation (GCV%), heritability in broad sense (h^2_b%), and genetic advance in percentage of mean (GA%) of economic yield and yield contributing traits in shiitake mushroom

Characters	Range	Mean	PCV%	GCV%	h^2_b(%)	GA(%)
DPI	74.00 - 110.00	92.43	14.10	13.89	97.02	28.19
DMF	79.00 - 116.00	98.70	13.44	13.22	96.65	26.77
EFB	5.00 - 26.00	15.57	36.28	33.75	86.55	64.69
DP	3.35 - 6.56	4.82	18.11	14.93	67.99	25.36
TP	0.65 - 1.50	0.88	23.46	20.23	74.39	35.94
LS	3.00 - 6.75	4.57	18.71	15.31	66.89	25.79
DS	0.54 - 1.90	0.92	29.65	21.18	51.04	31.17
EY	72.00 - 168.00	119.23	22.14	19.77	69.70	36.36

Note:
DPI = Days to primordia initiation
DMF = Days to maturity of fruiting body
EFB = Effective fruiting body number
DP = Diameter of pillius
TP = Thickness of pillius
LS = Length of stalk
DS = Diameter of stalk
EY = Economic yield

High heritability along with high genetic advance as percentage of mean were obtained for all the traits studied suggesting that these traits are controlled by additive genes and further selection towards their improvement could be possible. In the present study, days to primordia initiation showed highest heritability closely followed by days to maturity of fruiting body. Fangcon *et al*. (1993) found highest heritability for peak fruiting period in shiitake mushroom.

Table 2. Genotypic (r_g) and phenotypic (r_p) correlation coefficients for different pairs of yield contributing traits and economic yield/spawn packet in shiitake mushroom

Characters		DMF	EFB	DP	TP	LS	DS	EY
DPI	r_g	0.994**	0.185	-0.417	-0.550	-0.016	-0.478	0.224
	r_p	0.984**	0.192	-0.325	-0.477	-0.029	-0.309	0.219
DMF	r_g		0.207	-0.423	-0.581	-0.014	-0.496	0.268
	r_p		0.208	-0.363	-0.491	-0.028	-0.360	0.236
EFB	r_g			-0.934**	-0.846**	-0.675*	-0.693*	0.652*
	r_p			-0.749*	-0.766**	-0.552	-0.476	0.582
DP	r_g				0.878**	0.490	0.510	-0.305
	r_p				0.738*	0.407	0.556	-0.165
TP	r_g					0.640*	0.921**	-0.538
	r_p					0.588	0.729*	-0.439
LS	r_g						0.745*	-0.086
	r_p						0.536	-0.096
DS	r_g							-0.710*
	r_p							-0.352

Note: * indicates significant at 5% level of probability
** indicates significant at 1% level of probability

Table 3. Path coefficient analysis showing direct (bold and diagonal) and indirect effects of yield contributing traits on economic yield in shiitake mushroom at genotypic level

Characters	DPI	DMF	EFB	DP	TP	LS	DS	Total genotypic correlation with economic yield
DPI	**-4.825**	5.778	0.754	-1.216	-0.458	-0.017	0.208	0.224
DMF	-4.830	**5.772**	0.844	-1.235	-0.484	-0.015	0.216	0.268
EFB	-0.892	1.194	**4.079**	-2.725	-0.706	-0.699	0.401	0.652*
DP	2.010	-2.443	-3.808	**2.918**	0.732	0.507	-0.221	-0.305
TP	2.653	-3.354	-3.453	2.562	**0.833**	0.662	-0.443	-0.538
LS	0.078	-0.083	-2.755	1.429	0.533	**1.035**	-0.323	-0.086
DS	2.307	-2.866	-2.825	1.487	0.850	0.771	**-0.434**	-0.71*

Residual effect, R = 0.672

Correlation coefficient

Correlation studies regarding economic yield and yield contributing traits were calculated and presented in Table 2. Days to primordial initiation showed highly significant and positive correlation with days to maturity of fruiting body which indicated the late primordia initiation would increase maturity days. Negative and significant correlation were found for effective fruiting body number with diameter and thickness of pillius, length and diameter of stalk with effective fruiting body number; diameter of stalk with economic yield. Pandey *et al.* (2008) observed highly significant association between yield and diameter of fruiting body in oyster mushroom. Highly significant positive correlation were found for thickness of pillius with diameter of pillus and length of stalk; diameter of stalk with thickness of pillius and length of stalk. Effective fruiting body number exhibited positive significant correlation with economic yield at genotypic lavel. Fangcon (1995) and Xuel *et al.* (2006) found highly significant and positive association of number of fruiting body with yield which was in agreement with the present findings.

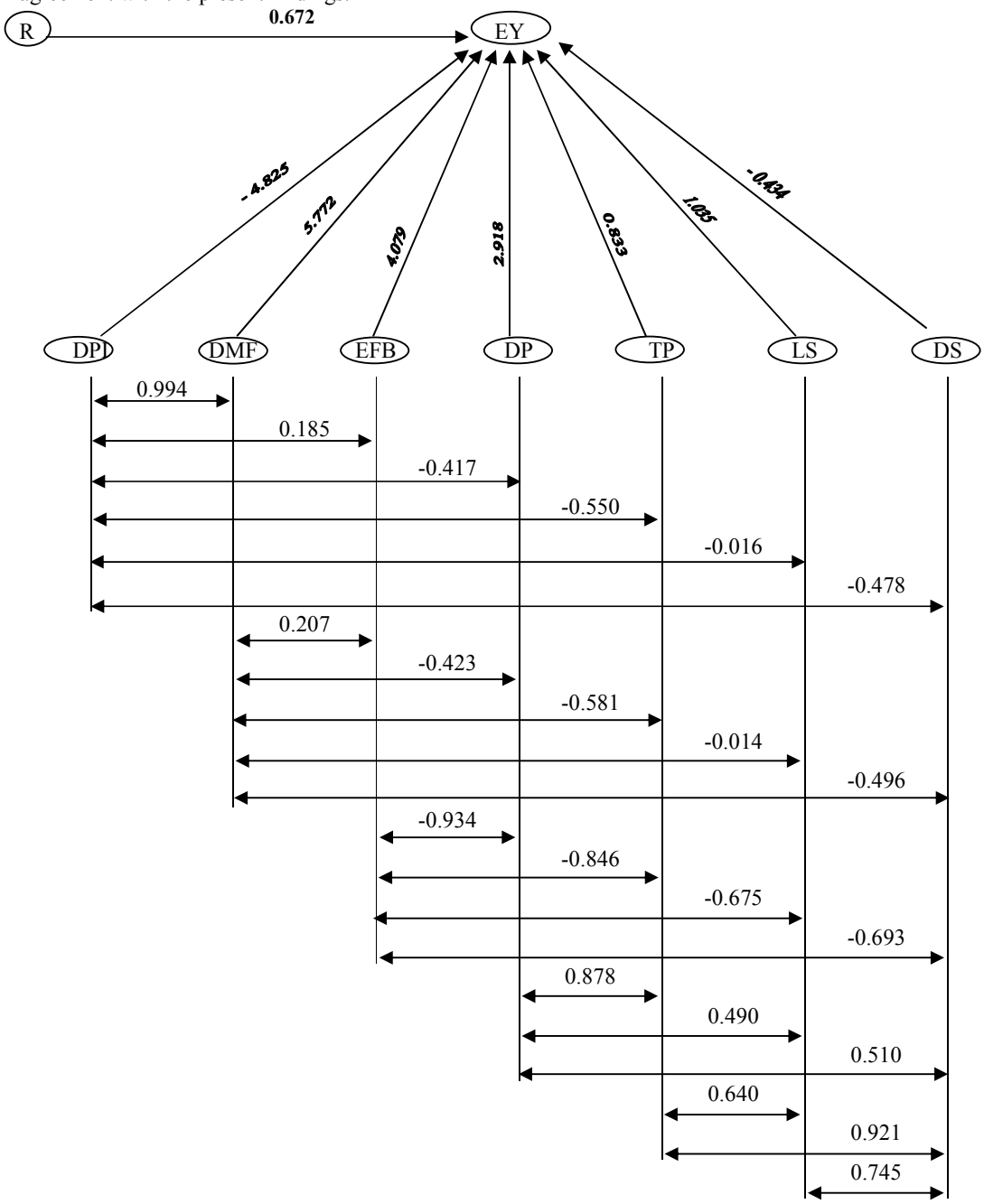

Fig. 1. Genotypic path diagram of yield contributing traits on economic yield. Single arrowed lines indicate direct effects and double arrowed lines indicate correlation coefficients

Path coefficient analysis

Genotypic correlation between economic yield and yield contributing traits were further analyzed through path analysis, which is presented in the Table 3 and Fig. 1. The results indicated that days to maturity of fruiting body had the highest direct positive effect on economic yield followed by effective fruiting body number, diameter of pillius, length of stalk and thickness of pillius, which suggested that these traits contributed maximum to economic yield. The direct effects of diameter of pillius, thickness of pillius and length of stalk were counterbalanced by the negative indirect effects through days to maturity of fruiting body and effective fruiting body number. So, direct selection of these three traits would not give positive response. Days to maturity of fruiting body showed high positive direct effect on economic yield. Indirect effects of this trait via effective fruiting body number and diameter of stalk was positive which made positive correlation with economic yield. Significant positive correlation of effective fruiting body number with economic yield was due to it's indirect effective via days to maturity of fruiting body and diameter of stalk. Kneebone and Mason (1963) reported that greater yields were obtained from the later stage of development of fruiting body. The residual effect was 0.672 indicating the seven traits studied contributed 32.80% of the variability in economic yield in path analysis. Residual effect towards economic yield in this study might be due to varieties of reasons such as causal factor not studied and sampling error.

CONCLUSION

From the study it would be concluded that days to primordia initiation, days to maturity of fruiting body and effective fruiting body number were the potent traits and emphasis should be given to these traits for further breeding programme for the improvement of shiitake mushroom.

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