Electronic Journal of Plant Breeding, 9 (3) :1213 - 1220 (Sep 2018) DOI: 10.5958/0975-928X.2018.00149.7
ISSN 0975-928X

Research Article

Correlation and path analysis studies in Mithipagal (*Momordica charantia* L var. muricata)(Willd.)

M. Priyanka, V. Lakshmanan , P. Paramaguru, S. Santha and V. Krishnamoorthy
Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Periyakulam - 625 604, India
E-Mail: priyankared471@gmail.com

(Received:20 Aug 2018; Revised:08 Oct 2018; Accepted:10 Oct 2018)

Abstract
An experiement was conducted to study the association among yield and yield contributing traits in 25 mithipagal genotypes. The experiement was conducted with 25 mithipagal genotypes in RBD with 3 replications in 2017-2018. Correlation studies revealed that yield per vine had significant positive association with individual fruit weight, fruit length, fruit pulp thickness, number of seeds per fruit , fruit girth , hundred seed weight , momordicine, protein, sex ratio and vine length in both seasons indicating the importance of these traits in selection for yield and are identified as yield attributing characters. Path coefficient analysis revealed that positive and high indirect effect was observed by individual fruit weight, number of fruits per vine. Positive and moderate indirect effect was observed for vine length in first season. In second season positive and high direct effect was exhibited by individual fruit weight, fruit girth, and days to first female flower appearance. Positive and moderate direct effect was exhibited by momordicine content, nodes of first male flower, number of fruits per fruit, hundred seed weight.

Key words
mithipagal, correlation, path coefficient analysis, selection

Introduction

India is the second largest producer of vegetables in the world with an annual production of 169.1 million metric tonnes. The vegetables are popularly acclaimed as protective foods for their richness of nutritive and therapeutic values such as minerals and medicinal alkaloids. Among the different vegetables, the cucurbitaceous family consists of larger number of vegetable crops. With 90 genera and over 700 species of economic importance, and includes several of the world's most important vegetables viz., melon (*Cucumis melo*), cucumber (*Cucumis sativus*), watermelon *(Citrullus lanatus)*, Pumpkin

(Cucurbita moschata), squash (*Cucurbita spp)*, bitter gourd *(Momordica charantia)*.Mithipagal(*Momordica charantia* L.var.*muricata*.) (Willd) is an emerging cucurbitaceous vegetable crop owing to its nutritional, medicinal properties and wide adaptability to various agro climatic conditions. It is as called as, neri pagal, kaippan paval, unda paval and siru pavakaai and kuruvithalai paval. It is an under exploited *Momordica spp* distributed in tropical countries and cultivated in certain districts of Tamil Nadu and Kerala for its small size bitter principle and fleshy fruits.

In mithipagal the edible portion is 92-95% of the fruit. The bitter principle in *Momordica spp* is momordicine, a bitter alkaloid. The fruits are used as vegetables in many ways and quite commonly used as cooked, fried and stuffed food forms. The fruits are pickled, canned and dehydrated. The fruits possess cooling, digestive, laxative and has ointment properties. It is also claimed that the fruit powder is used for healing wounds, leprous and malignant ulcers. It is also reported for its usefulness in snake bites. The roots have abortifacient activity (Paul and Raychaudhuri (2010). In Tamil Nadu, rich genetic diversity occurs in mithipagal as wild, semi wild, domesticated and cultivated form. It has a vast scope for growing in marginal lands, with bright sun light where it gives fruits throughout the year. Owing to non-availability of standard varieties, the farmers are cultivating only landraces which have low yield potential, inferior cooking quality with variable size of fruits. One of the primary objectives of any crop improvement programme is the identification of promising genotypes by exploiting variability within the species through proper breeding strategy. Such a study helps to identify the desirable types for further hybridization in the improvement programme.

Materials and Methods

The present investigation on of mithipahagal *(Momordica charantia* L .var. *muricata* (Willd.) was conducted during November 2017 to May 2018 at Western block of Horticultural College and Research Institute, Periyakulam. In this experiment 25 genotypes collected from Madurai, Thoothukudi, Thanjavur, Tirunelveli and Virudhunagar districts were raised for evaluation and details of the genotypes are furnished in table.1 These genotypes were raised in randomized block design block replicated three time with twenty five plants in each replication following a spacing of 2 x1.5m.

The experimental plot was ploughed and brought to fine tilth. The seed were soaked in water for 12 hours to improve germination. The soaked seeds were sown in the main field. The plants were thinned to one seedling per hill after germination. Twenty tonnes of FYM / ha with recommended dose of basal fertilizer (6:12:12 g of NPK/plant) were applied to the main field. The cultural operations and plant protection measures were followed as per the package of practices recommended by TNAU for bitter gourd. Observation were recorded on vine length , days to first male flower appearance, days to first female flower appearance, node of first male flower, node of first female flower, sex ratio, number of fruits per vine, individual fruit weight, fruit length, fruit girth, number of seeds per fruit, hundred seed weight, fruit pulp thickness, pulp to seed ratio, yield per plant, TSS, acidity, ascorbic acid, protein and momordicine content.

Simple correlations were worked out by using formula suggested by Falconer (1964). The direct and indirect contributions of various characters to yield were calculated through path coefficient analysis as suggested by Dewey and Lu (1959).

Result and Discussion

The estimates of genotypic correlation coefficients (Table 2 and Table 3) revealed that yield found to be significantly and positively correlated with individual fruit weight, fruit length, fruit pulp thickness, number of seeds per fruit , fruit girth , hundred seed weight , momordicine, protein, sex ratio and vine length in both seasons. The results are in comparison with early findings of Deepthi *et al.* (2014)in bottle gourd. The inter correlation among components characters of yield may provide likely consequences of selection for simultaneous improvement of desirable characters. Vine length exhibited a highly significant and positive association with number of seeds per fruit fruit length, total soluble solids, Individual fruit weight, yield, fruit girth in both seasons. Similar findings was reported by (Rani *et al.*, 2015). Days to first male flower appearance exhibited a significant and positive association with days to first female flower appearance in both seasons. This is in accordance with the early findings of Islam *et al.* (2009) in bitter gourd. Days to first female flower appearance exhibited a highly significant and positive association with sex ratio, node of first female flower appearance in both seasons and supported by Haque *et al.* (2013). Sex ratio was significant and showed positive association with fruit girth, number of seeds per fruit, fruit length in both seasons. This is in similar with earlier findings of Choudhary *et al.* (2014) in ridge gourd. Individual fruit weight had significant and positive association with yield per vine fruit length, hundred seed weight, fruit pulp thickness, number of seeds per fruit and fruit girth for both seasons. This is in accordance with the earlier findings of Veena *et al.* (2013) in cucumber. Fruit length exhibited significant and positive association with number of seeds per fruit, fruit girth, vitamin-C, hundred seed weight, fruit pulp thickness and pulp to seed ratio in both seasons and similar findings was observed by Tamilselvi (2010) in pumpkin and (Kumar *et al.*, 2013) in sponge gourd. Individual fruit weight showed significant positive association with yield per vine fruit length hundred seed weight fruit pulp thickness, number of seeds per fruit and fruit girth in both seasons when supports of findings Ahmed *et al.* (2005). The conclusion that can be reached from the associations analysis is that, selection for days to female flower appearance, number of fruits per vine, fruit length, fruit girth, flesh thickness, average fruit weight may result in simultaneous improvement of fruit yield per vine and also inter correlated among themselves during both seasons. Further, it is clearly indicated that these characters are highly reliable components of fruit yield and could very well be utilized as yield indicator while exercising selection.

The path analysis indicates that the association of the dependent character with dependent variable is due to their direct effect on it or is a consequence of their indirect effect through other characters. If the correlation between dependent variable and independent character is due to direct effects of the character, it reflects a true relationship between them and selection can be practiced for such a character in order to improve dependent variable. But, if the association is mainly through indirect effect of the character through another component character, the breeder has to select for the later through which the indirect effect is exerted. Path coefficient analysis partitions the correlation into direct and indirect effects and permits critical look to recognize the specific forces acting to produce a given correlation and measures the relative factor. Such an analysis was carried out in the present study with all characters. The path coefficient analysis was carried out by partitioning the correlation coefficients into direct and indirect effects of various characters (Table 4 and Table 5). In the present study, path coefficient analysis revealed that positive and high indirect effect was observed by individual fruit weight and number of fruits per vine. Positive and moderate indirect effect was observed by vine length. Positive and low indirect was observed in sex ratio days to first male flower appearance, total soluble solids, acidity and hundred seed weight in first season. In second season positive and high direct effect was exhibited by Individual fruit weight, fruit girth, and days to first female flower appearance. Positive and moderate direct effect was exhibited by momordicine content, nodes of first male flower, number of fruits per fruit and hundred seed weight in second season and the similar findings was reported Lovely and Devi (2009). It was also observed that the indirect effects through the characters. Vine length recorded positive and high indirect effect through individual fruit weight and fruit girth for both seasons. Similar findings reported that Deepthi *et al.* (2014**).** Days to first male flower appearance recorded positive and very high indirect effect through days to first female flower appearance and fruit length. Similar findings were reported by Khan *et al.* (2015) in bitter gourd. Sex ratio recorded positive and high indirect effect through individual fruit weight and fruit girth. Positive and high indirect effect was observed for days to first female flower appearance, Positive and moderate effect was observed in number of seeds per fruit for both seasons. Similar findings were reported by Sampath and Krishnamoorthy (2017) in pumpkin.

References

Ahmed, N., Hakeem, Z. A., Singh, A. K., & Afroza, B. (2005). Correlation and path coefficient analysis in bottle gourd. Haryana Journal of Horticultural Sciences, 34(1/2), 104-104.

Choudhary, B., Pandey, S., Singh, P., & Pandey, V. (2014). Genetic diversity analysis for quantitative traits in hermaphrodite ridge gourd [Luffa acutangula (Roxb.) L.].

Deepthi, B., Reddy, P., Rao, M. P., & Ashok, P. (2014). Character association and path coefficient analysis in bottle gourd (Lagenaria siceraria Molina Standl.) genotypes. Agriculture: Towards a New Paradigm of Sustainability, 52.

D R Dewey and K H Lu (1959), Correlation and path analysis of components of crested wheat grassseed production, Agronomy Journal, 51, pp. 515-518.

D S Falconer, (1964), An introduction to quantitative genetics, Second Edition, Oliver and Boyd Ltd, Edinburgh, pp. 312-324

Haque, M., Uddin, M., Mehraj, H., & Uddin, A. J. (2013). Evaluation of Snake Gourd (Trichasanthes Anguina L) Test Hybrids Comparing with Four Popular Checks. International Journal of Applied Sciences and Biotechnology, 2(4), 525-528.

Islam, Hossain, Bhuiyan, Husna, & Syed. (2009). Genetic variability and path-coefficient analysis of bitter gourd (Momordica charantia L.). International Journal of Sustainable Agriculture, 1(3), 53-57.

Khan, M., Bhuiyan, S., Saha, K., Bhuyin, M., & Ali, A. (2015). Variability, correlation and path co-efficient analysis of bitter gourd (Momordica charantia L.). Bangladesh Journal of Agricultural Research, 40(4), 607-618.

Kumar, R., Ameta, K., Dubey, R., & Pareek, S. (2013). Genetic variability, correlation and path analysis in sponge gourd (Luffa cylindrica Roem.). African Journal of Biotechnology, 12(6).

Lovely, B., & Devi, D. (2009). Character association and path analysis in Ashgourd (Benincasa hispida Cogn.). Vegetable Science, 36(1), 90-92.

Rani, K. R., Raju, C. S., & Reddy, K. R. (2015). Variability, correlation and path analysis studies in bitter gourd (Momordica charantiaL.). Agricultural Science Digest - A Research Journal, 35(2). doi: 10.5958/0976-0547.2015.00037.3

Sampath, S., & Krishnamoorthy, V. (2017). Genetic Variability, Correlation and Path Analysis in Pumpkin (Cucurbita moschata Duch. ex. Poir). Int.J.Curr.Microbiol.App.Sci, 6(6), 3027-3035.

Tamilselvi. (2010). Studies on heterosis and combining ability in pumpkin (Cucurbita moschata Duch. ex Poir). M.Sc. (Hort.

Veena, R., Sidhu, A. S., Pitchaimuthu, M., & Souravi, K. (2013). Character association for fruit yield and yield traits in cucumber (Cucumis sativus L.). Electronic Journal of Plant Breeding, 4(1), 1108-1112.

Electronic Journal of Plant Breeding, 9 (3) :1213 - 1220 (Sep 2018) DOI: 10.5958/0975-928X.2018.00149.7
ISSN 0975-928X

Table 1. Source of mithipagal genotypes

S.No.	Genotypes	Place of collection
1	**MC-1**	Pudhupatti, Madurai district
2	**MC-2**	Kovil patti, Tuticorin district
3	**MC-3**	Krishnapuram, Tirunelveli district
4	**MC-4**	Kamudhy, Ramanad district
5	**MC-5**	Aladipatti, Virdhunagar district
6	**MC-6**	Suryampatti, Thanjavur district
7	**MC-7**	Marungulam, Thanjavur district
8	**MC-8**	Nattham, Dindigul district
9	**MC-9**	Vilupuram,Vilupuram district
10	**MC-10**	Cuddalore, Cuddalore district
11	**MC-11**	Varchiyur, Tuticorin district
12	**MC-12**	Rajapalayam, Vridhunagar district
13	**MC-13**	Pattukottai, Thanjavur district
14	**MC-14**	Sathur, Vridhunagar district
15	**MC-15**	Dindigal local, Dindigal district
16	**MC-16**	Vengarai, Thanjavur district
17	**MC-17**	Tamilpadi, Vridhunagar district
18	**MC-18**	Vandiyur, Madurai district
19	**MC-19**	Thirunelveli, Thirunelveli district
20	**MC-20**	Kovilpatti, Tuticorin district
21	**MC-21**	Suryanarayana kovil, Thanjavur
22	**MC-22**	Simmakkal, Madurai district
23	**MC-23**	Orathanadu, Thanjavur district
24	**MC-24**	Vilathikulam, Tuticorin district
25	**MC-25**	Thanjavur, Thanjavur district

Electronic Journal of Plant Breeding, 9 (3) :1213 - 1220 (Sep 2018) DOI: 10.5958/0975-928X.2018.00149.7
ISSN 0975-928X

Table 2. Simple correlation coefficients for yield and yield attributing characters of mithipagal genotypes in season I

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	**1.000**	0.214	0.013	0.267	-0.207	0.09	0.129	0.578**	0.623	0.400*	0.662**	0.416*	0.611*	0.308	0.253	0.189	0.282	-0.03	0.256	0.403
2		**1.000**	0.549**	0.450*	0.372	0.505**	0.436*	0.023	0.188	0.217	0.333	-0.094	0.292	0.086	-0.076	0.181	0.199	0.106	-0.04	0.079
3			**1.000**	0.479*	0.737**	0.597**	0.478*	0.078	0.332	0.446*	0.490*	-0.004	0.365	0.384	0.344	0.485**	0.703**	0.582*	0.321	0.293
4				**1.000**	0.443*	0.142	0.478*	0.22	0.273	0.173	0.289	0.336	0.343	0.406*	0.25	0.596**	0.391	0.372	0.481**	0.246
5					**1.000**	0.534**	0.34	-0.061	0.229	0.352	0.226	-0.03	0.008	0.055	-0.072	0.439*	0.587**	0.548*	0.250	0.134
6						**1.000**	0.271	0.342	0.588**	0.628**	0.606	0.084	0.293	0.232	-0.080	0.190	0.498**	0.437*	0.111	0.439**
7							**1.000**	0.105	0.063	0.446*	0.244	0.303	0.450*	0.108	0.249	0.445*	0.229	0.256	0.296	0.267
8								**1.000**	0.796**	0.588**	0.611**	0.687**	0.666**	0.341	0.361	0.147	0.324	0.222	0.367	0.802**
9									**1.000**	0.722**	0.793**	0.537**	0.606**	0.514**	0.216**	0.283	0.612**	0.418*	0.380	0.714**
10										**1.000**	0.653**	0.596**	0.712**	0.413*	0.340	0.492**	0.586**	0.541**	0.483*	0.592**
11											**1.000**	0.289	0.667**	0.452*	0.402*	0.260	0.654**	0.316	0.449*	0.648**
12												**1.000**	0.623**	0.508**	0.414*	0.245	0.339	0.471*	0.597**	0.562**
13													**1.000**	0.508**	0.545**	0.348	0.424*	0.333	0.631**	0.682**
14														**1.000**	0.465*	0.266	0.596**	0.591**	0.525**	0.334
15															**1.000**	0.400*	0.478*	0.410*	0.609**	0.355
16																**1.000**	0.556**	0.493*	0.475*	0.284
17																	**1.000**	0.781*	0.578**	0.496**
18																		**1.000**	0.638**	0.457*
19																			**1.000**	0.543**

****Significant at 1 per cent level** *** Significant at 5 per cent level**

1. Vine length (m)	**8. Individual fruit weight (g)**	**15. Total soluble solids (^{0} brix.)**
2. Days to first male flower appearance	**9. Fruit length (cm)**	**16.Acidity**
3. Days to first female flower appearance	**10. Fruit girth (cm)**	**17.Vitamin-C**
4. Nodes of first male flower appearance	**11. Number of seeds per fruit**	**18.Protein**
5. Nodes of first female flower appearance	**12. 100 seed weight (g)**	**19.Momordicine**
6. Sex ratio	**13. Fruit pulp thickness’**	**20. Yield per vine (kg)**
7. Number of fruits per vine	**14.Pulp to seed ratio**	

Electronic Journal of Plant Breeding, 9 (3) :1213 - 1220 (Sep 2018) DOI: 10.5958/0975-928X.2018.00149.7
ISSN 0975-928X

Table 3. Simple correlation coefficients for yield and yield attributing characters of mithipagal genotypes in season II

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	**1.000**	0.215	-0.04	0.152	-0.47	0.189	0.184	0.631**	0.621**	0.305	0.570*	0.449*	0.683**	0.348	0.216	0.202	0.374	0.11	0.532*	0.653*
2		**1.000**	0.397*	0.241	0.112	0.385	0.359	-0.151	-0.038	0.028	0.189	0.066	0.228	-0.143	-0.097	-0.09	-0.015	-0.128	-0.171	-0.038
3			**1.000**	-0.006	0.426*	0.437*	0.018	0.006	0.131	-0.019	0.367	-0.346	0.077	0.068	0.05	0.063	0.335	0.001	-0.258	0.024
4				**1.000**	0.106	-0.182	0.026	-0.112	-0.059	-0.304	0.022	-0.033	-0.049	0.043	0.065	0.148	-0.113	-0.26	-0.19	-0.099
5					**1.000**	0.295	-0.141	-0.221	-0.044	-0.185	0.132	-0.262	-0.482*	-0.288	-0.528*	-0.008	0.102	-0.113	-0.361	-0.248
6						**1.000**	0.022	0.264	0.484*	0.427*	0.570*	0.031	0.106	0.055	-0.268	-0.036	0.343	0.218	-0.189	0.230
7							**1.000**	0.027	-0.084	0.283	0.032	0.357	0.359	-0.035	0.013	0.125	-0.139	0.077	-0.013	0.320
8								**1.000**	0.755	0.538**	0.553**	0.602**	0.647**	0.358	0.377	-0.026	0.475**	0.537**	0.484*	0.942**
9									**1.000**	0.574**	0.629**	0.433*	0.413*	0.406*	-0.087	0.132	0.481**	0.256	0.279	0.680*
10										**1.000**	0.375	0.494**	0.547**	0.367	0.116	0.264	0.235	0.366	0.306	0.565*
11											**1.000**	0.083	0.338	0.128	0.083	0.106	0.477**	-0.03	0.171	0.511**
12												**1.000**	0.437*	0.24	0.089	-0.016	0.092	0.387	0.610*	0.669**
13													**1.000**	0.412*	0.445*	0.079	0.232	0.371	0.520*	0.711**
14														**1.000**	0.288	0.153	0.458*	0.446*	0.391	0.312
15															**1.000**	0.0240	0.221	0.278	0.287	0.365
16																**1.000**	0.380	-0.144	0.182	-0.012
17																	**1.000**	0.473*	0.28	0.394
18																		**1.000**	0.269	0.519**
19																			**1.000**	0.454*

****Significant at 1 per cent level** *** Significant at 5 per cent level**

1. Vine length (m)
2. Days to first male flower appearance
3. Days to first female flower appearance
4. Nodes of first male flower appearance
5. Nodes of first female flower appearance
6. Sex ratio
7. Number of fruits per vine
8. Individual fruit weight (g)
9. Fruit length (cm)
10. Fruit girth (cm)
11. Number of seeds per fruit
12. 100 seed weight (g)
13. Fruit pulp thickness'
14.Pulp to seed ratio
15. Total soluble solids (^{0} brix.)
16.Acidity
17.Vitamin-C
18.Protein
19.Momordicine
20. Yield per vine (kg)

Electronic Journal of Plant Breeding, 9 (3) :1213 - 1220 (Sep 2018) DOI: 10.5958/0975-928X.2018.00149.7
ISSN 0975-928X

Table 4.Direct and indirect effects of yield components on fruit yield in mithi pagal genotypes in season I

Traits	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	**1.649**	-0.012	-0.019	0.248	0.183	0.025	-0.27	2.207	-3.858	1.265	0.385	0.19	-1.332	-0.132	-0.18	-0.155	0.052	-0.005	0.279
2	0.356	**-0.055**	1.458	0.453	-0.319	0.173	-0.993	0.07	-1.127	0.727	0.196	-0.05	-0.655	-0.034	0.041	-0.156	0.038	0.024	-0.047
3	-0.017	-0.044	**1.819**	0.281	-0.37	0.145	-0.963	-0.19	-0.435	0.593	0.214	-0.058	-0.575	-0.116	-0.114	-0.358	0.118	0.128	0.391
4	0.582	-0.035	0.729	**0.702**	-0.136	0.005	-1.223	1.063	-1.178	0.552	0.111	0.186	-0.916	-0.188	-0.072	-0.597	0.066	0.086	0.704
5	-0.539	-0.031	1.201	0.17	**-0.560**	0.145	-0.656	-0.542	-0.146	0.684	0.045	-0.04	0.113	0.066	0.191	-0.356	0.105	0.127	0.302
6	0.152	-0.035	0.972	0.013	-0.298	**0.272**	-0.446	1.164	-2.765	1.455	0.299	0.012	-0.423	-0.054	0.141	-0.072	0.07	0.084	0.096
7	0.23	-0.028	0.903	0.443	-0.19	0.063	**-1.939**	-0.036	0.657	0.725	0.07	0.083	-0.648	0.018	-0.088	-0.356	0.025	0.039	0.317
8	1.121	-0.001	-0.106	0.23	0.094	0.097	0.022	**3.246**	-4.332	1.058	0.303	0.251	-1.139	-0.1	-0.152	-0.085	0.042	0.028	0.386
9	1.304	-0.013	0.162	0.169	-0.017	0.154	0.261	2.883	**-4.878**	1.339	0.408	0.202	-1.174	-0.168	-0.128	-0.109	0.096	0.083	0.429
10	1.125	-0.021	0.582	0.209	-0.207	0.213	-0.758	1.853	-3.523	**1.854**	0.344	0.218	-1.312	-0.081	-0.114	-0.351	0.106	0.135	0.653
11	1.248	-0.021	0.767	0.153	-0.049	0.16	-0.265	1.934	-3.916	1.253	**0.509**	0.082	-1.217	-0.14	-0.193	-0.108	0.098	0.054	0.471
12	0.871	0.008	-0.293	0.363	0.063	0.009	-0.451	2.269	-2.754	1.129	0.116	**0.359**	-1.141	-0.185	-0.263	-0.226	0.057	0.089	0.67
13	1.264	-0.021	0.601	0.37	0.037	0.066	-0.723	2.127	-3.294	1.399	0.356	0.235	**-1.738**	-0.176	-0.27	-0.282	0.063	0.052	0.747
14	0.596	-0.005	0.578	0.36	0.10000	0.04	0.098	0.89	-2.241	0.408	0.194	0.182	-0.834	**-0.366**	-0.263	-0.118	0.092	0.116	0.568
15	0.562	0.004	0.394	0.096	0.203	-0.073	-0.324	0.934	-1.184	0.401	0.187	0.179	-0.889	-0.183	**-0.527**	-0.353	0.08	0.087	0.828
16	0.367	-0.012	0.935	0.602	-0.286	0.028	-0.99	0.398	-0.763	0.934	0.079	0.117	-0.703	-0.062	-0.267	**-0.696**	0.084	0.104	0.532
17	0.524	-0.013	1.32	0.286	-0.362	0.117	-0.294	0.828	-2.868	1.206	0.306	0.125	-0.669	-0.207	-0.258	-0.358	**0.163**	0.15	0.645
18	-0.058	-0.009	1.512	0.391	-0.462	0.149	-0.486	0.584	-2.617	1.624	0.179	0.207	-0.587	-0.276	-0.297	-0.47	0.159	**0.154**	0.667
19	0.495	0.003	0.763	0.531	-0.182	0.028	-0.659	1.344	-2.249	1.3	0.257	0.258	-1.395	-0.223	-0.468	-0.398	0.113	0.11	**0.931**

Residual value (.588)

1. Vine length (m)
2. Days to first male flower appearance
3. Days to first female flower appearance
4. Nodes of first male flower appearance
5. Nodes of first female flower appearance
6. Sex ratio
7. Number of fruits per vine
8. Individual fruit weight (g)
9. Fruit length (cm)
10. Fruit girth (cm)
11. Number of seeds per fruit
12. 100 seed weight (g)
13. Fruit pulp thickness'
14.Pulp to seed ratio
15.Total soluble solids (^{0} brix.)
16.Acidity
17.Vitamin-C
18.Protein
19.Momordicine
20. Yield per vine (kg)

Electronic Journal of Plant Breeding, 9 (3) :1213 - 1220 (Sep 2018) DOI: 10.5958/0975-928X.2018.00149.7
ISSN 0975-928X

Table 5. Direct and indirect effects of yield components on fruit yield in mithipagal genotypes in season II

Traits	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	**0.286**	-0.030	-0.002	-0.001	-0.081	-0.002	0.058	0.435	0.052	0.033	-0.093	0.016	0.005	-0.029	0.031	-0.029	0.022	-0.004	-0.012
2	0.063	**-0.138**	0.024	-0.002	0.019	-0.004	0.116	-0.106	-0.003	0.003	-0.032	0.002	0.002	0.012	-0.014	0.013	-0.001	0.004	0.004
3	-0.012	-0.057	**0.057**	0.000	0.075	-0.005	0.007	0.004	0.011	-0.002	-0.061	-0.013	0.001	-0.006	0.008	-0.009	0.020	0.000	0.006
4	0.044	-0.034	0.000	**-0.008**	0.018	0.002	0.008	-0.077	-0.005	-0.033	-0.003	-0.001	0.000	-0.004	0.009	-0.021	-0.007	0.008	0.004
5	-0.136	-0.016	0.025	-0.001	**0.171**	-0.003	-0.045	-0.155	-0.004	-0.020	-0.022	-0.010	-0.004	0.024	-0.077	0.001	0.006	0.004	0.008
6	0.054	-0.054	0.026	0.001	0.051	**-0.011**	0.007	0.182	0.040	0.046	-0.093	0.001	0.001	-0.005	-0.039	0.005	0.020	-0.007	0.004
7	0.053	-0.051	0.001	0.000	-0.025	0.000	**0.313**	0.019	-0.007	0.030	-0.005	0.013	0.003	0.003	0.002	-0.018	-0.008	-0.002	0.000
8	0.181	0.021	0.000	0.001	-0.038	-0.003	0.008	**0.689**	0.063	0.058	-0.090	0.022	0.005	-0.030	0.054	0.004	0.027	-0.017	-0.011
9	0.178	0.006	0.008	0.000	-0.008	-0.005	-0.026	0.520	**0.083**	0.062	-0.103	0.016	0.003	-0.034	-0.013	-0.019	0.028	-0.008	-0.006
10	0.087	-0.004	-0.001	0.002	-0.032	-0.005	0.089	0.371	0.048	**0.107**	-0.061	0.018	0.004	-0.031	0.017	-0.038	0.014	-0.012	-0.007
11	0.164	-0.027	0.021	0.000	0.023	-0.006	0.010	0.382	0.052	0.040	**-0.163**	0.003	0.002	-0.011	0.012	-0.015	0.028	0.001	-0.004
12	0.129	-0.009	-0.020	0.000	-0.045	0.000	0.112	0.416	0.036	0.053	-0.014	**0.036**	0.003	-0.020	0.013	0.002	0.005	-0.013	-0.014
13	0.196	-0.032	0.004	0.000	-0.083	-0.001	0.112	0.447	0.034	0.059	-0.055	0.016	**0.007**	-0.035	0.064	-0.011	0.013	-0.012	-0.012
14	0.100	0.020	0.004	0.000	-0.049	-0.001	-0.011	0.247	0.034	0.039	-0.021	0.009	0.003	**-0.084**	0.041	-0.022	0.027	-0.014	-0.009
15	0.062	0.014	0.003	-0.001	-0.091	0.003	0.004	0.260	-0.007	0.013	-0.013	0.003	0.003	-0.024	**0.144**	-0.003	0.013	-0.009	-0.006
16	0.058	0.013	0.004	-0.001	-0.002	0.000	0.039	-0.018	0.011	0.029	-0.017	-0.001	0.001	-0.013	0.004	**-0.141**	0.022	0.005	-0.004
17	0.108	0.002	0.020	0.001	0.017	-0.004	-0.045	0.330	0.040	0.025	-0.078	0.003	0.002	-0.039	0.032	-0.054	**0.057**	-0.015	-0.006
18	0.031	0.018	0.000	0.002	-0.019	-0.002	0.024	0.371	0.021	0.039	0.005	0.014	0.003	-0.037	0.040	0.020	0.027	**-0.032**	-0.006
19	0.023	-0.015	0.001	-0.062	0.002	-0.004	0.334	0.023	0.032	-0.027	0.022	0.003	-0.032	0.0413	-0.025	0.016	-0.008	**-0.022**	**0.152**

Residual effect- (0.119)

1. Vine length (m)

2. Days to first male flower appearance

3. Days to first female flower appearance

4. Nodes of first male flower appearance

5. Nodes of first female flower appearance

6. Sex ratio

7. Number of fruits per vine

8. Individual fruit weight (g)

9. Fruit length (cm)

10. Fruit girth (cm)

11. Number of seeds per fruit

12. 100 seed weight (g)

13. Fruit pulp thickness

14.Pulp to seed ratio

15.Total soluble solids (^{0} brix.)

16.Acidity

17.Vitamin-C

18.Protein

19.Momordicine

20. Yield per vine (kg)