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Correlation and Path Coefficient Analysis of Mundu Chilli for Growth, Yield and Quality Attributes

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KEYWORDS

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ABSTRACT:
An investigation encompassing sixteen growth, yield, and quality attributes was carried out within the F3 generation resulting from the Mundu Chilli cross PKM CA 32 and PKM CA 33 encompassing the interrelationships through path and correlation among the traits. Fruit yield exhibited a noteworthy and positive genotypic association with various traits, including ascorbic acid, number of fruits per plant, oleoresin content. These associations highlight the potential importance of these attributes in contributing to improved fruit yield through selective breeding efforts. In the context of genotypic and phenotypic path analyses conducted to assess fruit yield, The most significant and positively correlated factor with dry fruit output per plant was found to be the oleoresin concentration, closely followed by fruit quantity per plant. Furthermore, there was a direct favourable effect of ascorbic acid on fruit output. On the other hand, the fruit yield path analysis showed that plant height indirectly influenced the number of fruits produced by a plant and the number of days until 50% of the plant flowered. Moreover, oleoresin content, matured fruit production, and 1000 seed weight showed an indirect favourable influence of primary branches per plant. More generally, characteristics that show favourable direct phenotypic and genetic influences on fruit production suggest that improving these particular characteristics may lead to an increase in fruit yield. The characteristics that show favourable direct phenotypic and genetic effects suggest that improving these specific characteristics has the potential to increase fruit output overall.

1. Introduction

Chilli (*Capsicum annum* L.) is a plant with a diploid chromosome having 2n = 24, classified within the Solanaceae family (Kranthi Rekha, 2015). The historical roots of chilli are thought to trace back to Mexico, while additional significant centres of cultivation include Guatemala and Bulgaria (Salvador, 2002). Mundu Chilli holds geographical tag having significant importance in Tamil Nadu as both a vegetable and a spice, cherished for its aromatic qualities, taste, flavour, and spiciness. It plays a crucial role in the diet, with meals lacking chilli being considered bland (Mussema, 2006). The cultivation of mundu chilli serves as a source of income for small-scale farmers, contributing substantially to both the domestic and export markets. In powdered form, chilli is an essential and pungent ingredient, adding flavour and colour. Additionally, the green mundu chilli pods are consumed as a vegetable alongside other food items. There exists a prevailing belief that regular consumption of hot pepper chilli confers resistance against various illnesses, owing to the high vitamin C content in fresh green chilli (Chakrabarty *et al.*, 2017).

In 2023, the Mundu chilli pepper was granted with Geographical Indication (GI tag) owing to its distinctive and intense fiery flavour. This chilli variety is cultivated within the saline belt regions of Viruthunagar, Tuticorin, and Ramanathapuram districts. These areas feature soils with varying levels of alkalinity, ranging from moderate to extreme (pH 7.5-9.5), and experience limited annual rainfall of about 460 mm. Notably, several types of

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Mundu chilli, including "*Oosi mundu*", "*Chatti mundu*" and "*Sathurai mundu*" are available, each exhibiting discernible variations in shape. Its ability to withstand salt and drought, along with its superior market value in comparison to the samba type, positions the Mundu chilli as a preferred choice for farmers cultivating rainfed regions. Nevertheless, the Mundu chilli's yield is relatively modest in Tamil Nadu, recording merely 1.2 tons per hectare (Anonymous, 2022).

The yield of chilli is a multifaceted characteristic influenced by a multitude of contributing factors and their interplay. It is shaped not only by various interconnected attributes influenced by a limited number of genes, but is also significantly impacted by environmental conditions to a larger degree (Iqbal *et al.,* 2015). In this context, the analysis of correlation coefficients proves beneficial in the selection process for yield, allowing the consideration of multiple attributes simultaneously (Sharma *et al.,* 2009). Nonetheless, due to the intricate nature of yield being influenced by numerous component attributes, the overall correlation between these attributes is insufficient to fully elucidate the genuine connections among them (Jyothirmayi *et al.,* 2008). In order to obtain a more accurate comprehension of the relative significance of yield components, path coefficient analysis must be employed in a successful selection programme. The selection of high-yielding genotypes is greatly aided by path coefficient analysis, which separates the entire correlation into direct and indirect effects (Vidya et al., 2018). In crop breeding, correlation and path coefficient analyses have been widely used to identify the relationships between yield and the factors that contribute to it. This has made it easier to identify the factors that have a significant impact on yield and use them as selection criteria (Aman et al., 2020). The purpose of this field experiment was to examine how growth-quality related variables and dry fruit yield interact with mundu chilli.

2. Materials and methods

An experimental study was conducted during the 2021-22 period at the Western Block farm of the Vegetable Science department, HC & RI, TNAU, Periyakulam. The aim was to assess the growth, quality, and yield enhancements of 250 F_3 chilli plants resulting from the crossbreeding of PKM CA 32 and PKM CA 33. Each individual plant within the F_3 population was carefully evaluated and data were collected.

The evaluation encompassed 250 F_3 chilli plants, arising from the mating of PKM CA 32 and PKM CA 33, with a focus on their yield and quality attributes. The assessment adhered to the recommended agronomic guidelines provided by TNAU Agri Portal for chilli cultivation. Observations were meticulously recorded for 16 characteristics that contribute to growth, yield, and quality. These attributes included plant height (cm), primary branches per plant, fruit length (cm), single fresh fruit weight (g), days to 50% flowering, ripe fruit yield per plant (g), number of fruits per plant, dry fruit yield per plant (g), number of seeds per fruit, single fresh fruit weight (g), thousand seed weight (g), colour value (ASTA), oleoresin (%), capsaicin (%), ascorbic acid (mg per 100g) and proline (µg per g). The calculations of GCV and PCV were conducted using the methods outlined by Burton & De Vane (1953). Furthermore, anticipated Genotypic and Broad Sense Heritability were estimated using formulas proposed by Johnson *et al.* (1955) and Allard (1960) respectively. Lastly, the methodology developed by Dewey and Lu (1959) was employed to establish both phenotypic and genotypic correlation coefficients.

3. Data analysis

3.1 Correlation coefficient

The correlation coefficients between various character combinations at both phenotypic (P) and genotypic (G) levels were calculated using the formula introduced by Al-Jibouri *et al.,* 1958 and later referenced by Aman *et al.,* 2020.

$$P = \frac{\text{pcoy x . y}}{\sqrt{\delta^2 \text{ px . } \delta^2 \text{py}}}$$

$$Gx_{y^2} = \frac{\text{gcoy x . y}}{\sqrt{\delta^2 \text{ px . } \delta^2 \text{py}}}$$

In the given context, where "P" signifies the phenotypic correlation coefficient and "G" represents the genotypic correlation coefficient, the equation includes the following components: "pcov x·y" and "gcov x·y" stand for the phenotypic and genotypic covariances between the variable's "x" and "y," respectively and "δ^2px" and "δ^2gx" denote the phenotypic and genotypic variances, respectively, for the variable "x". Correspondingly, "δ^2py" and "δ^2gy" relate to the phenotypic and genotypic

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variances, respectively, for the variable "y". This formula enables the computation of correlation coefficients between combinations of traits at both phenotypic and genotypic levels by utilizing these elements. It's important to emphasize that the specific process of calculation involves substituting the values of these variables and covariances into the formula to determine the correlation coefficients.

3.2 Path coefficient analysis

The calculation of path coefficient analysis was conducted using the formula provided as follows (Dewey and Lu, 1959; Aman *et al.*, 2020).

$$r_{ij} = P_{ij} + \sum r_{ik} \, . \, P_{jk}$$

In the context provided, r_{ij} represents the connection between an independent characteristic (related to yield) and the specific variable "j" (yield). This connection is gauged through phenotypic and genotypic correlation coefficients. "P_{ij}" indicates the constituents of the direct impacts exerted by the independent characteristic i on the dependent characteristic "j", which are quantified using path coefficients. Furthermore, "$\sum r_{ik} \, . \, P_{jk}$" signifies the cumulative components of indirect impacts from a particular independent characteristic "i" on a specific dependent characteristic "j". These indirect effects occur through all other independent characteristics denoted as "k". The contribution of the remaining unknown characters is measured as the residual as given by:

$$P_R = \sqrt{(1 - \sum P_{ij} r_{ij}}$$

4. Results and Discussion

4.1 Phenotypic and genotypic correlation for the cross PKM CA 32 X PKM CA 33

The calculated phenotypic and genotypic correlation coefficients for the sixteen examined traits is presented in Table 1 and diagrammatic representation of phenotypic and genotypic correlation is illustrated in Figure 1 and 2 respectively. Plant height displayed significant positive correlations with days to fifty percent flowering (0.295 P, 0.296 G), capsaicin (0.278 P, 0.280 G), single fresh fruit weight (0.269 P, 0.273 G), and proline (0.269 P, 0.256 G). Furthermore, it exhibited non-significant positive correlations with the number of fruits per plant (0.157 P, 0.153 G) and primary branches per plant (0.117 P, 0.110 G). These findings are consistent with the results obtained by Ukkund *et al.* (2007). Their study similarly revealed that plant height displayed a positive and noteworthy correlation with capsaicin, single fresh fruit weight and fruit yield per plant. It's inherent that taller plants necessitate a prolonged duration to reach maturity, which in turn results in the development of longer and larger fruits. Primary branches per plant had a significant positive correlation with colour value (0.306 P, 0.308 G). It also demonstrated non-significant positive correlations with single fresh fruit weight (0.222 P, 0.219 G) and oleoresin content (0.208 P, 0.210 G).

Days to fifty percent flowering exhibited significant positive correlations with plant height (0.295 P, 0.296 G) and 1000 seed weight (0.268 P, 0.269 G). Additionally, it displayed non-significant positive correlations with proline (0.225 P, 0.218 G) and ascorbic acid (0.219 P, 0.217 G). Fruit length demonstrated significant positive correlations with fruit girth (0.402 P, 0.391 G) and ripened fruit yield (0.255 P, 0.250 G). Furthermore, it displayed non-significant positive correlations with oleoresin content (0.205 P, 0.197 G) and dry fruit yield per plant (0.115 P, 0.119 G). Fruit girth exhibited significant positive correlations with fruit length (0.402 P, 0.391 G), the number of seeds per fruit (0.348 P, 0.347 G), and ripened fruit yield per plant (0.241 P, 0.232 G). It also had a non-significant positive correlation with ascorbic acid (0.127 P, 0.175 G).

Single fresh fruit weight displayed significant positive correlations with 1000 seed weight (0.383 P, 0.384 G), capsaicin content (0.283 P, 0.282 G), plant height (0.269 P, 0.273 G), and days to 50% flowering (0.265 P, 0.266 G). Additionally, it demonstrated non-significant positive correlations with the number of fruits per plant (0.229) and primary branches per plant (0.222). The number of fruits per plant exhibited significant positive correlations with ascorbic acid (0.300 P, 0.291 G), dry fruit yield per plant (0.257 P, 0.256 G), and single fresh fruit weight (0.229 P, 0.225 G). Furthermore, it possessed non-significant positive correlations with 1000 seed weight (0.152 P, 0.151 G) and plant height (0.157 P, 0.154 G). This suggests that plants carrying a greater number of larger fruits are associated with increased yields. This observation aligns with prior findings from studies such as those conducted by Ben-

Chaim and Paran, (2000) and Rohini and Lakshmanan, (2015).

Ripened fruit yield per plant had significant positive correlations with fruit length (0.255 P, 0.250 G) and fruit girth (0.241 P, 0.232 G). Additionally, it displayed a non-significant positive correlation with capsaicin content (0.095 P, 0.088 G). The strong and positive correlation observed between specific traits and ripened fruit yield per plant (presumably denoting agricultural yield) implies that these traits play a significant role in enhancing fruit yield productivity. Consequently, considering the selection of these traits for targeted breeding could be a promising strategy. This outcome is consistent with the research conducted by other scholars such as Sreelathakumary and Rajamony, (2002) as well as Usman *et al.* (2017). These researchers similarly found noteworthy and statistically significant connections between attributes like fruit length, fruit weight, number of fruits, and plant height during harvest, with yield per plant. This collective evidence underscores the potential effectiveness of deliberately selecting and breeding plants with these specific traits to cultivate higher fruit yield per plant productivity.

The number of seeds per fruit exhibited a significant positive correlation with fruit girth (0.348 P, 0.347 G). Additionally, it displayed a non-significant positive correlation with proline (0.144 P, 0.117 G). 1000 seed weight showed a significant positive correlation with single fresh fruit weight (0.383 P, 0.384 G), capsaicin content (0.323 P, 0.324 G), and days to fifty percent flowering (0.269 P, 0.269 G). Furthermore, it had a non-significant positive correlation with plant height (0.212 P, 0.215 G) and the number of fruits per plant (0.152 P, 0.151 G). Capsaicin content demonstrated a significant positive correlation with 1000 seed weight (0.323 P, 0.324 G), single fresh fruit weight (0.282 P, 0.282 G), and plant height (0.278 P, 0.280 G). It also displayed a non-significant positive correlation with days to fifty percent flowering (0.217 P, 0.216 G) and proline (0.201 P, 0.176 G).

Oleoresin content exhibited a significant positive correlation with dry fruit yield per plant (0.258 P, 0.254 G). Additionally, it displayed a non-significant positive correlation with primary branches per plant (0.208 P, 0.210 G) and fruit length (0.206 P, 0.197 G). However, it showed a negative significant correlation with capsaicin content (-0.274 P, -0.275 G). It also had non-significant negative correlations with the number of fruits per plant (-0.154 P, -0.152 G) and plant height (-0.120 P, -0.127 G) at the phenotypic level. Ascorbic acid demonstrated significant positive correlations with dry fruit yield per plant (0.306 P, 0.300 G) and the number of fruits per plant (0.300 P, 0.291 G). Furthermore, it displayed non-significant positive correlations with days to 50% flowering (0.219 P, 0.217 G) and fruit girth (0.181 P, 0.175 G). Colour value exhibited significant positive correlations with primary branches per plant (0.306 P, 0.308 G) and proline (0.242 P, 0.246 G). Proline showed significant positive correlations with plant height (0.269 P, 0.256 G) and colour value (0.242 P, 0.246 G). Additionally, it possessed non-significant positive correlations with days to fifty percent flowering (0.225 P, 0.218 G) and single fresh fruit weight (0.172 P, 0.169 G). In many instances, the genotypic correlations were found to be stronger than the phenotypic correlations, underscoring the considerable heritability of these traits. A comparable observation was made by Rana *et al.* (2015), who noted that, overall, the genotypic correlation coefficients tended to surpass the phenotypic correlation coefficients in the study of chilli genotypes.

Dry fruit yield per plant displayed significant positive correlations with ascorbic acid (0.306 P, 0.300 G), the number of fruits per plant (0.257 P, 0.256 G), and oleoresin content (0.258 P, 0.254 G). It also had a non-significant positive correlation with fruit length (0.115 P, 0.118 G). However, it exhibited a negative significant correlation with ripened fruit yield per plant (-0.293 P, -0.294 G). Additionally, it showed non-significant negative correlations with proline (-0.160 P, -0.158 G) and plant height (-0.150 P, -0.144 G) at the phenotypic level.

4.2 Path-coefficient analysis of dry fruit yield with other quantitative traits

4.2.1 Direct effect of various characters on dry fruit yield per plant in the cross PKM CA 32 X PKM CA 33

In the cross of PKM CA 32 and PKM CA 33, a significant assessment involving path coefficient analysis was performed. The diagonal values in this analysis represent the direct effects. The results indicated that oleoresin content (0.429, 0.403) exhibited the highest positive direct impact on the dry fruit yield per

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plant, followed by the number of fruits per plant (0.282, 0.269), and ascorbic acid content (0.172, 0.177). Conversely, ripened fruit yield per plant (-0.280, -0.282), single fresh fruit weight (-0.258, -0.235), proline content (-0.135, -0.111), and colour value (-0.129, -0.134) demonstrated negative direct effects on dry fruit yield per plant, both at the phenotypic and genotypic levels respectively. Naik (2008) study similarly reported comparable results, where a significant ($p \leq 0.01$) and positive correlation was observed between chilli yield and various factors. The genotypic and phenotypic path analysis between dry fruit yield and yield contributing traits in selected F_3 generation progenies from the cross PKM CA 32 x PKM CA 33 is represented in Table 2 and Figure 3 and 4 respectively.

4.2.2 Indirect effects of various characters on dry fruit yield per plant in the cross PKM CA 32 X PKM CA 33

In the context of the PKM CA 32 X PKM CA 33 crossbreeding, both phenotypic and genotypic path analyses revealed certain relationships. Plant height displayed a positive indirect effect on dry fruit yield per plant through several factors, including the number of fruits per plant (0.045), days to 50% flowering (0.030), and colour value (0.016). Conversely, it had a negative indirect effect through single fresh fruit weight (-0.069), oleoresin content (-0.052), and proline content (-0.036). Furthermore, primary branches per plant showed a positive indirect effect on dry fruit yield per plant through oleoresin content (0.089), ripened fruit yield (0.066), and 1000 seed weight (0.012). On the flip side, it had a negative indirect effect through ascorbic acid content (-0.067), single fresh fruit weight (-0.057), and colour value (-0.039). These outcomes aligned with the discovery made by Aklilu *et al.,* 2016.

It showed a positive indirect effect on the number of dry fruits produced per plant (0.0382), ascorbic acid content (0.0377), and capsaicin content (0.019) with respect to the days to 50% flowering. Fruit length showed a positive indirect relationship with proline content (0.035), oleoresin content (0.088), and single fresh fruit weight (0.062) on dry fruit output per plant. Fruit girth was positively correlated with ascorbic acid concentration (0.030), plant height (0.020), and single fresh fruit weight (0.017) in terms of the amount of dry fruit produced per plant. On the other hand, matured fruit production per plant (-0.067), seed number per fruit (-0.031), and oleoresin content (-0.029) all showed negative indirect effects. Prior research has yielded comparable results for the beneficial direct influence of attributes, with the exception of features like fruit diameter, days to 50% flowering, days to first harvest, and the quantity of fruit produced per plant (Rohini and Lakshmanan, 2015; Shumbulo et al., 2017). While factors including plant height, the number of primary branches, the number of secondary branches, and the length of the fruit showed good direct impacts, other studies (Srilakshmi, 2006) have reported negative direct effects of fruit diameter and days to 50% flowering on fruit output.

The single fresh fruit weight had a positive indirect effect on the number of fruits per plant (0.064), days to 50% flowering (0.027), and oleoresin content (0.081) on the dry fruit yield per plant. However, it showed a negative indirect effect through the ascorbic acid content (-0.020) and 1000 seed weight (-0.035). Ascorbic acid content (0.052) and ripened fruit production (0.033) per plant were positively impacted by the number of fruits on each plant, which in turn was positively correlated with dry fruit yield per plant. It did, however, have an adverse indirect effect on the weight of a single fresh fruit (-0.059) and the oleoresin content (-0.066). With the exception of the quantity of fruit per plant and fruit diameter, indirect impacts of fruit length and diameter were negative for all variables. The residual effect shows that the remaining features that were not included in this study had a cumulative direct negative influence on yield. This suggests that the majority of the features taken into account in this study are those that account for the variation (99.7%) shown in the dependent variable, which is the number of fruits produced by each plant.

Fruit length (0.020) and oleoresin content (0.019) of ripened fruit yield per plant showed a positive indirect influence on dry fruit yield per plant, whereas the number of fruits per plant (-0.033) and weight of a single fresh fruit (-0.017) showed a negative supplementary effect. In a similar vein, the number of seeds per fruit showed a negative auxiliary effect through the number of fruits per plant (-0.047) and proline content (-0.019), but a good indirect effect through the single fresh fruit weight (0.037) and fruit girth (0.029). Additionally, 1000 seed weight showed a favourable indirect influence on the quantity of fruits produced per plant (0.043), the amount

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of capsaicin (0.029), and the number of days until 50% of the plants blossom (0.027). On the other hand, it had an adverse indirect influence on the dry fruit production per plant through the single fresh fruit weight (-0.099) and ripened fruit yield per plant (-0.026). The number of flowers per plant appears to have promise as a direct and indirect selection criterion for increasing fruit yield, as evidenced by the stronger and positive direct influence of flower quantity on dry fruit yield. Choosing the tallest plants with lots of branches and ignoring other characteristics may result in lower fruit production in the accessions that are chosen. Conversely, picking plants with more blossoms and branches would help to maximise the amount of fruit produced. The variables taken into account in these genotypic path analyses explained 99.79% of the variation in fruit production overall, according to the residual value (0.2136). On the other hand, unresearched characteristics that are not included in this study could have a negative direct effect on fruit yield.

Capsaicin content showed a favourable indirect effect on the number of seeds per fruit (0.015) and the number of days to 50% flowering (0.022) on the dry fruit yield per plant. On the other hand, it demonstrated a negative indirect influence on the dry fruit production per plant through the oleoresin content (-0.118), single fresh fruit weight (-0.072), and 1000 seed weight (-0.029). Similarly, through primary branches per plant, oleoresin concentration showed a positive indirect effect on dry fruit output per plant (0.011). On the other hand, it showed that the dry fruit yield per plant was negatively impacted by the single fresh fruit weight (-0.048) and the ripened fruit yield per plant (-0.043).

Through the number of fruits per plant (0.085), weight of a single fresh fruit (0.0301), and yield of ripened fruit per plant (0.027), ascorbic acid demonstrated a favourable indirect effect on dry fruit production per plant. On the dry fruit production per plant, however, it demonstrated a negative indirect influence through the oleoresin content (-0.061) and primary branches per plant (-0.012). Similar to this, colour value showed a positive indirect effect on oleoresin content (0.0349) and single fresh fruit weight (0.0369) on dry fruit output per plant. On the other hand, it had an adverse indirect influence on the dry fruit production per plant through proline (-0.0327) and ascorbic acid (-0.0343). Proline also showed a favourable indirect influence on capsaicin content (0.018) and days to 50% flowering (0.023) on dry fruit production per plant.

5. Conclusion

Enhancing chilli fruit yield necessitates a thoughtful consideration of traits associated with yield. In this research, the observed correlations, whether genotypic or phenotypic, consistently followed a similar pattern across all studied characteristics in the cross PKM CA 32 X PKM CA 33. Notably, the genotypic correlations tended to be higher than the phenotypic correlations in most instances. This finding underscores the substantial heritability of these traits, underscoring their significance in the context of selective breeding strategies. Fruit yield exhibited a noteworthy and positive genotypic association with various traits, including ascorbic acid, number of fruits per plant, oleoresin content. These associations highlight the potential importance of these attributes in contributing to improved fruit yield through selective breeding efforts.

The results of the genotypic path analysis and phenotypic path analysis for fruit yield showed that ascorbic acid had a positive direct impact on fruit yield, while the oleoresin content had the largest direct positive effect on dry fruit yield per plant, followed by the number of fruits per plant. However, the path analysis for fruit yield showed that, through days to 50% flowering and fruit number per plant, plant height had a positive indirect effect on dry fruit yield per plant. With regard to oleoresin content, matured fruit production, and 1000 seed weight, the primary branches of each plant showed a beneficial indirect effect. In general, characteristics that show favourable direct phenotypic and genetic effects on fruit yield imply that enhancing these particular characteristics may eventually result in a rise in fruit yield.

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Tables and Figures:

Table 1. Genotypic and Phenotypic correlation coefficient between dry fruit yield and yield contributing traits in selected F3 generation progenies from the cross PKM CA 32 x PKM CA 33

Characters		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	G	0.110	0.296*	-0.171	-0.367*	0.273*	0.153	-0.014	0.015	0.215	0.280*	-0.127	-0.093	-0.131	0.256*	-0.143
	P	0.117	0.295*	-0.187	-0.364*	0.269*	0.157	-0.010	0.007	0.212	0.278*	-0.120	-0.087	-0.123	0.269*	-0.150
2	G		-0.057	-0.254*	-0.268*	0.219*	-0.110	-0.232*	-0.009	-0.136	-0.251*	0.210*	-0.382*	0.308*	0.121	-0.047
	P		-0.056	-0.251*	-0.272*	0.222	-0.111	-0.237*	-0.006	-0.134	-0.250*	0.208	-0.388**	0.306*	0.124	-0.045
3	G			-0.049	0.021	0.266*	0.133	0.043	-0.062	0.269*	0.215*	-0.085	0.217*	-0.119	0.218	0.031
	P			-0.052	0.023	0.265*	0.135	0.043	-0.063	0.269*	0.216	-0.084	0.219	-0.118	0.225	0.030
4	G				0.391*	-0.234*	-0.068	0.250*	-0.012	-0.104	-0.023	0.197	0.035	0.001	-0.247*	0.118
	P				0.402**	-0.241*	-0.066	0.255*	-0.018	-0.108	-0.026	0.205	0.041	0.008	-0.262*	0.115
5	G					-0.071	0.045	0.232*	0.347*	-0.113	0.017	-0.062	0.175	-0.007	-0.070	0.034
	P					-0.067	0.038	0.241*	0.348*	-0.112	0.016	-0.067	0.181	-0.008	-0.049	0.035
6	G						0.225*	0.066	-0.142	0.384*	0.282*	0.184	-0.116	-0.144	0.169	-0.127
	P						0.229*	0.067	-0.145	0.383*	0.282*	0.188	-0.116	-0.142	0.172	-0.129
7	G							-0.123	-0.162	0.151	0.052	-0.152	0.291*	-0.039	-0.035	0.256*
	P							-0.117	-0.167	0.152	0.049	-0.154	0.300*	-0.037	-0.014	0.257*
8	G								-0.091	0.091	0.088	0.047	-0.082	-0.088	-0.019	-0.294*
	P								-0.082	0.093	0.095	0.045	-0.095	-0.097	-0.050	-0.293*
9	G									-0.183	-0.164	-0.043	0.065	-0.094	0.116	-0.060
	P									-0.187	-0.172	-0.039	0.077	-0.086	0.144	-0.064
10	G										0.324*	0.048	-0.146	-0.161	-0.004	-0.105
	P										0.323*	0.050	-0.144	-0.159	-0.003	-0.106
11	G											-0.275*	0.035	-0.117	0.176	-0.131
	P											-0.274*	0.043	-0.112	0.200	-0.134
12	G												-0.137	0.085	0.029	0.254*
	P												-0.142	0.081	0.031	0.258*
13	G													-0.187	0.058	0.300*
	P													-0.199	0.031	0.306*
14	G														0.246*	-0.090
	P														0.242*	-0.086
15	G															-0.158
	P															-0.160

1) Plant height (cm)
2) Primary branches per plant
3) Days to 50% flowering
4) Fruit length (cm)
5) Fruit girth (cm)
6) Single fresh fruit weight (g)
7) Number of fruits per plant
8) Ripe fruit yield/plant (g)
9) Number of seeds per fruit
10) 1000 seed weight (g)
11) Capsaicin content (mg/g)
12) Oleoresin content (%)
13) Ascorbic acid (mg/100g)
14) Colour value (ASTA)
15) Proline (µg/g)
16) Dry fruit yield / plant (g)

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Table 2. Genotypic and Phenotypic path analysis between dry fruit yield and yield contributing traits in selected F3 generation progenies from the cross PKM CA 32 x PKM CA 33

Characters		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	G	-0.055	-0.006	-0.016	0.009	0.020	-0.015	-0.008	0.000	-0.000	-0.012	-0.015	0.007	0.005	0.007	-0.014	-0.143
	P	-0.056	-0.006	-0.016	0.010	0.020	-0.015	-0.008	0.000	-0.000	-0.012	-0.015	0.006	0.005	0.007	-0.015	-0.150
2	G	0.004	0.042	-0.002	-0.010	-0.011	0.009	-0.004	-0.009	-0.000	-0.005	-0.010	0.009	-0.016	0.013	0.005	-0.047
	P	0.006	0.050	-0.002	-0.012	-0.013	0.011	-0.005	-0.012	-0.000	-0.006	-0.012	0.010	-0.019	0.015	0.006	-0.045
3	G	0.027	-0.005	0.094	-0.004	0.002	0.025	0.012	0.004	-0.005	0.025	0.020	-0.008	0.020	-0.011	0.020	0.031
	P	0.030	-0.005	0.101	-0.005	0.002	0.026	0.013	0.004	-0.006	0.027	0.021	-0.008	0.022	-0.012	0.022	0.030
4	G	-0.002	-0.003	-0.000	0.014	0.005	-0.003	-0.001	0.003	-0.000	-0.001	-0.000	0.002	0.000	0.000	-0.003	0.118
	P	0.004	0.005	0.001	-0.021	-0.008	0.005	0.001	-0.005	0.000	0.002	0.000	-0.004	-0.000	-0.000	0.005	0.115
5	G	-0.021	-0.015	0.001	0.022	0.058	-0.004	0.002	0.013	0.020	-0.006	0.001	-0.003	0.010	-0.000	-0.004	0.034
	P	-0.030	-0.022	0.002	0.033	0.083	-0.005	0.003	0.020	0.029	-0.009	0.001	-0.005	0.015	-0.000	-0.004	0.035
6	G	-0.064	-0.051	-0.062	0.055	0.016	-0.235*	-0.053	-0.015	0.033	-0.090	-0.066	-0.043	0.027	0.034	-0.040	-0.127
	P	-0.069	-0.057	-0.068	0.062	0.017	-0.258*	-0.059	-0.017	0.037	-0.099	-0.072	-0.048	0.030	0.036	-0.044	-0.129
7	G	0.041	-0.029	0.036	-0.018	0.012	0.060	0.269*	-0.033	-0.043	0.040	0.014	-0.041	0.078	-0.010	-0.009	0.256*
	P	0.044	-0.031	0.038	-0.018	0.010	0.064	0.281*	-0.033	-0.047	0.042	0.014	-0.043	0.084	-0.010	-0.004	0.257*
8	G	0.004	0.065	-0.012	-0.070	-0.065	-0.018	0.034	-0.282*	0.025	-0.025	-0.024	-0.013	0.023	0.025	0.005	-0.294*
	P	0.002	0.066	-0.012	-0.071	-0.067	-0.018	0.032	-0.280*	0.023	-0.026	-0.026	-0.012	0.026	0.027	0.014	-0.293*
9	G	-0.001	0.000	0.005	0.001	-0.029	0.012	0.013	0.007	-0.086	0.015	0.014	0.003	-0.005	0.008	-0.010	-0.060
	P	-0.000	0.000	0.005	0.001	-0.031	0.013	0.015	0.007	-0.089	0.016	0.015	0.003	-0.006	0.007	-0.012	-0.064
10	G	-0.018	0.011	-0.022	0.008	0.009	-0.032	-0.012	-0.007	0.015	-0.083	-0.027	-0.004	0.012	0.013	0.000	-0.105
	P	-0.019	0.012	-0.024	0.009	0.010	-0.034	-0.013	-0.008	0.016	-0.090	-0.029	-0.004	0.013	0.014	0.000	-0.106
11	G	0.020	-0.018	0.015	-0.001	0.001	0.020	0.003	0.006	-0.011	0.023	0.072	-0.019	0.002	-0.008	0.012	-0.131
	P	0.025	-0.022	0.019	-0.002	0.001	0.025	0.004	0.008	-0.015	0.029	0.091	-0.025	0.004	-0.010	0.018	-0.134
12	G	-0.051	0.085	-0.034	0.079	-0.025	0.074	-0.061	0.019	-0.017	0.019	-0.111	0.403**	-0.055	0.034	0.012	0.254*
	P	-0.051	0.089	-0.036	0.088	-0.029	0.081	-0.066	0.019	-0.017	0.021	-0.117	0.429**	-0.061	0.034	0.013	0.258*
13	G	-0.016	-0.067	0.038	0.006	0.031	-0.020	0.051	-0.014	0.011	-0.026	0.006	-0.024	0.177	-0.033	0.010	0.300*
	P	-0.015	-0.066	0.037	0.007	0.031	-0.020	0.051	-0.016	0.013	-0.024	0.007	-0.024	0.172	-0.034	0.005	0.306*
14	G	0.017	-0.041	0.016	-0.000	0.001	0.019	0.005	0.012	0.012	0.021	0.015	-0.011	0.025	-0.134	-0.033	-0.090
	P	0.016	-0.039	0.015	-0.001	0.001	0.018	0.004	0.012	0.011	0.020	0.014	-0.010	0.025	-0.129	-0.031	-0.086
15	G	-0.028	-0.013	-0.024	0.027	0.007	-0.018	0.003	0.002	-0.012	0.000	-0.019	-0.003	-0.006	-0.027	-0.110	-0.158
	P	-0.036	-0.016	-0.030	0.035	0.006	-0.023	0.001	0.006	-0.019	0.000	-0.027	-0.004	-0.004	-0.032	-0.135	-0.160

1) Plant height (cm)
2) Primary branches per plant
3) Days to 50% flowering
4) Fruit length (cm)
5) Fruit girth (cm)
6) Single fresh fruit weight (g)
7) Number of fruits per plant
8) Ripe fruit yield/plant (g)
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13) Ascorbic acid (mg/100g)
14) Colour value (ASTA)
15) Proline (µg/g)
16) Dry fruit yield / plant (g)"

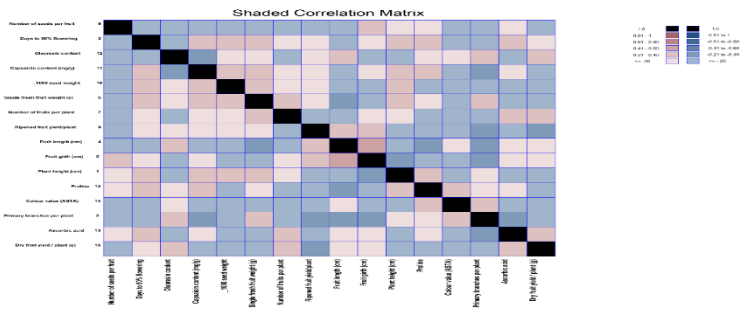

Fig 1. Diagrammatic representation of phenotypic correlation coefficient between dry fruit yield and yield contributing traits from the cross PKM CA 32 x PKM CA 33

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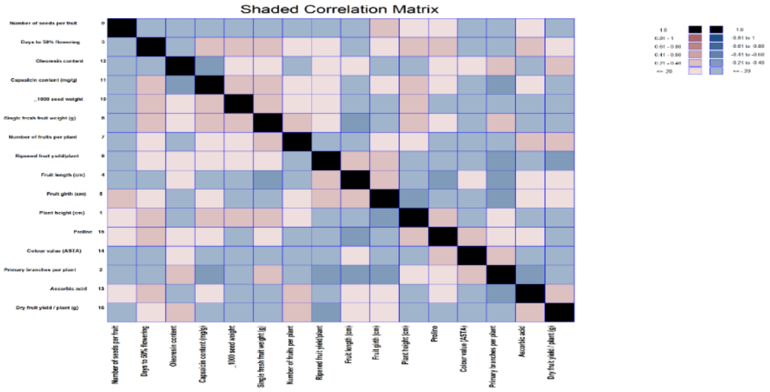

Fig. 2. Diagrammatic representation of genotypic correlation coefficient between dry fruit yield and yield contributing traits from the cross PKM CA 32 x PKM CA 33

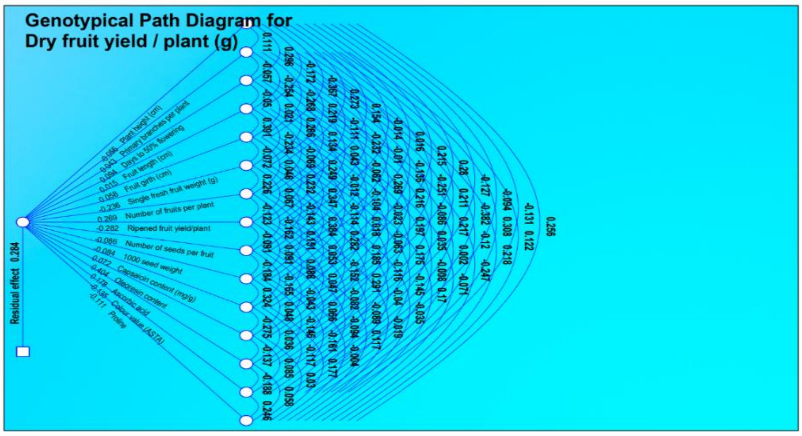

Fig. 3. Diagrammatic representation of genotypic path analysis between dry fruit yield and yield contributing traits in selected F3 generation progenies from the cross PKM CA 32 x PKM CA 33

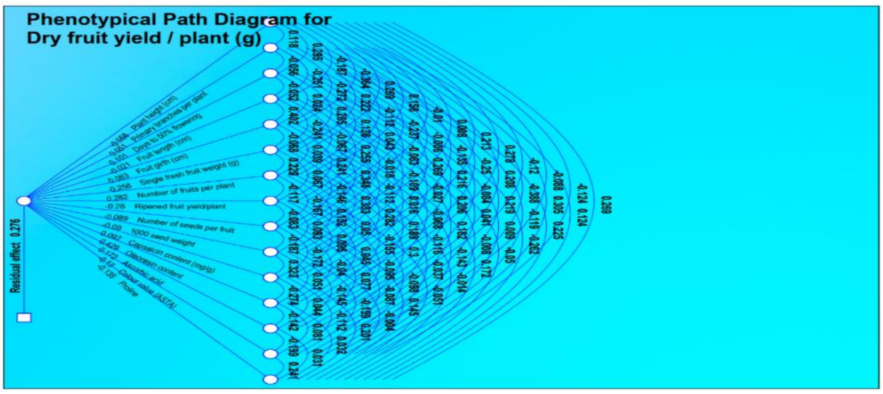

Fig. 4. Diagrammatic representation of genotypic path analysis between dry fruit yield and yield contributing traits in selected F3 generation progenies from the cross PKM CA 32 x PKM CA 33