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Correlation and path analysis studies in cowpea [*Vigna unguiculata* (L.) Walp] genotypes

Teppavari Susmitha, N Seenivasan, K Nagaraju, P Saidaiah and SR Pandravada

Abstract
A study was conducted in cowpea [*Vigna unguiculata* (L.) Walp] to estimate correlation coefficients and path coefficient analysis of vegetable pod yield by 25 genotypes collected from NBPGR, Regional Station, Rajendranagar, Hyderabad, check variety arca Garima from IIHR, Bangalore. Vegetable cowpea 26 accessions were sown in a RBD with two replications. Plant descriptors quantitative traits (plant height, primary branches per plant, days to 50% flowering, days to maturity, pods per clusters, clusters per plant, pods per plant, fresh weight of ten pods, fresh seed weight, pod length, seeds per pod, 100 seed weight, pod wall proportion, seed yield per plant, pod yield per plant), qualitative traits (crude fibre, crude protein, Total sugars) were recorded. Positive and significant correlation was found between pod yield per plant and seed yield per plant followed by pods per plant, seeds per pod. In path coefficient analysis, the characters *viz*., seed yield per plant followed by pods per plant and fresh weight of ten pods at harvest exhibited positive direct effects on pod yield per plant. The promising genotypes *viz*., EC-390210, EC-390364, IC-206240 and IC-259069 exhibited better performance for these characters can be used in further improvement of vegetable cowpea.

Keywords: Correlation, direct effect and indirect effect, path analysis, cowpea

Introduction
Vegetable cowpea [*Vigna unguiculata* (L.) Walp.] recognised as a crop of African origin, cowpea also known as black eye pea, it is a herbaceous annual crop mostly grown in the dry argon-ecologies of the tropics in Latin America, Africa and south Asia (Boukar *et al*., 2019) [3]. It is a quick green manure crop and short duration, photo insensitive variety with resistance to biotic and abiotic stresses has very high potential for diversification of cropping systems. (Rajpoot and Rana 2016) [20]. Vegetable cowpea belongs to the family Fabaceae, it is a self-pollinated leguminous crop.

Cowpea is grown across the world on an estimated 14.5 million ha of land planted each year and the total annual production is 6.2 million metric tons. Over the last three decades, global cowpea production grew at an average rate of 5%, with 3.5% annual growth in area and 1.5% growth in yield, and the area expansion accounting for 70% of the total growth during this period (Boukar *et al*. 2016) [4]. About 84% of the world's production area and 83.4% of the world overall production of cowpea is from Africa, with over 80% of African production in West Africa (Kebede and Bekeko 2020) [9].

India is the second largest producer of vegetable next to China. Total area under vegetable in India is 10.1 million ha with 18.31 million tons production. Total area under vegetable in Telangana 53946 ha with production 1.215 million tons (RSSS, 2019-20) [21]. Total cowpea production in India 5562 tons that is cultivated in 552 ha (NHB data, 2018-19) [16]. Cowpea is grown chiefly in central and peninsular regions of India. It is mainly grown in Uttar Pradesh, Punjab, Haryana, Rajasthan and Madhya Pradesh.

Vegetable cowpea is one of the most important leguminous vegetable crops. Vegetable cowpea whether utilized for green pods as vegetable, pods are rich in protein (22-24%), carbohydrate (55-66%), water (11-12%), crude fibre (5.9-7.3%), ash (3.4-3.9%), fat (1.3-1.5%), phosphorous (0.146%), calcium (0.104-0.076%), iron (0.005%). The crop has the potential of providing the nutritional requirements of developing countries, especially for women and children.

Material and Methods
The present investigation was carried out during *Rabi* season 2020-2021 at PG research block

of College of Horticulture, Majerle, Wanaparthy district, Sri Konda Laxman Telangana State Horticultural University, mulugu, siddipet, Telangana during Rabi season 2020-2021. The experimental material comprised of 26 germplasm lines of vegetable cowpea and were sown in a Randomized Block Design (RBD) with two replications, each genotype was sown in one row 5.4 m length with inter row spacing of 60 cm and inter plant spacing of 45 cm under drip irrigation. The total area of experiment was 250 sq. m and net plot size was 5.4 m x 0.92 m.

Five plants in each plot were tagged from the net plot of each treatment in each replication for recording the observations. The observations recorded for eighteen different traits includes quantitative traits *viz.*, plant height, primary branches per plant, days to 50% flowering, days to maturity, pods per clusters, clusters per plant, pods per plant, fresh weight of ten pods, fresh seed weight, pod length, seeds per pod, 100 seed weight, pod wall proportion, seed yield per plant, pod yield per plant and qualitative traits *viz.*, crude fibre, crude protein, Total sugars.

Correlation coefficients for yield and other traits in all the 26 genotypes were worked out as suggested by Johnson *et al.* (1955) [8]. Path coefficient analysis as suggested by Wright (1921) [23] and elaborated by Dewey and Lu (1959) [6].

Results and Discussion

Correlation coefficient studies

Yield is the end product of interactions of many factors known as contributing components and hence it is a complex trait (Kumar *et al.* 2016) [10]. Grafius (1959) [7] reported that there may not be any single gene for yield as such but operates only through its components.

In the present study pod yield per plant exhibited positive and significant correlation with seed yield per plant (0.935) similar results were confirmed by Baranda *et al.* (2017) [2], Panchta *et al.* (2019) [18]. Pods per plants (0.926) and seeds per pod (0.725) shows positive significant correlation with pod yield and the similar results are reported by Panchta *et al.* (2019) [18], Pagadhar *et al.* (2019) [17], Surpura and Sharma (2017) [2]. Clusters per plant (0.912) shows positive significant correlation, similar results were confirmed by Nagalaxmi *et al.* (2020) [15], Panchta *et al.* (2019) [18]. Fresh weight of ten pods (0.765) significant and positively associated with pod yield, result is on par with Akansha *et al.* (2021) [1], pod yield shows positive significant correlation with pods per cluster (0.723) similar results were confirmed by Panchta *et al.* (2019) [18]. Pod yield shows positive significant correlation with pod length (0.628) similar findings were confirmed by Pagadhar *et al.* (2019) [9], Walle *et al.* (2018) [24], Surpura and Sharma (2017) [2], Patel *et al.* (2016) [19]. Pod yield shows positive significant correlation with crude fibre (0.526), total sugar (0.462) similar kind of observations noticed by Patel *et al.* (2016) [19]. The selection for these characters is helpful in pod yield improvement (Table 1).

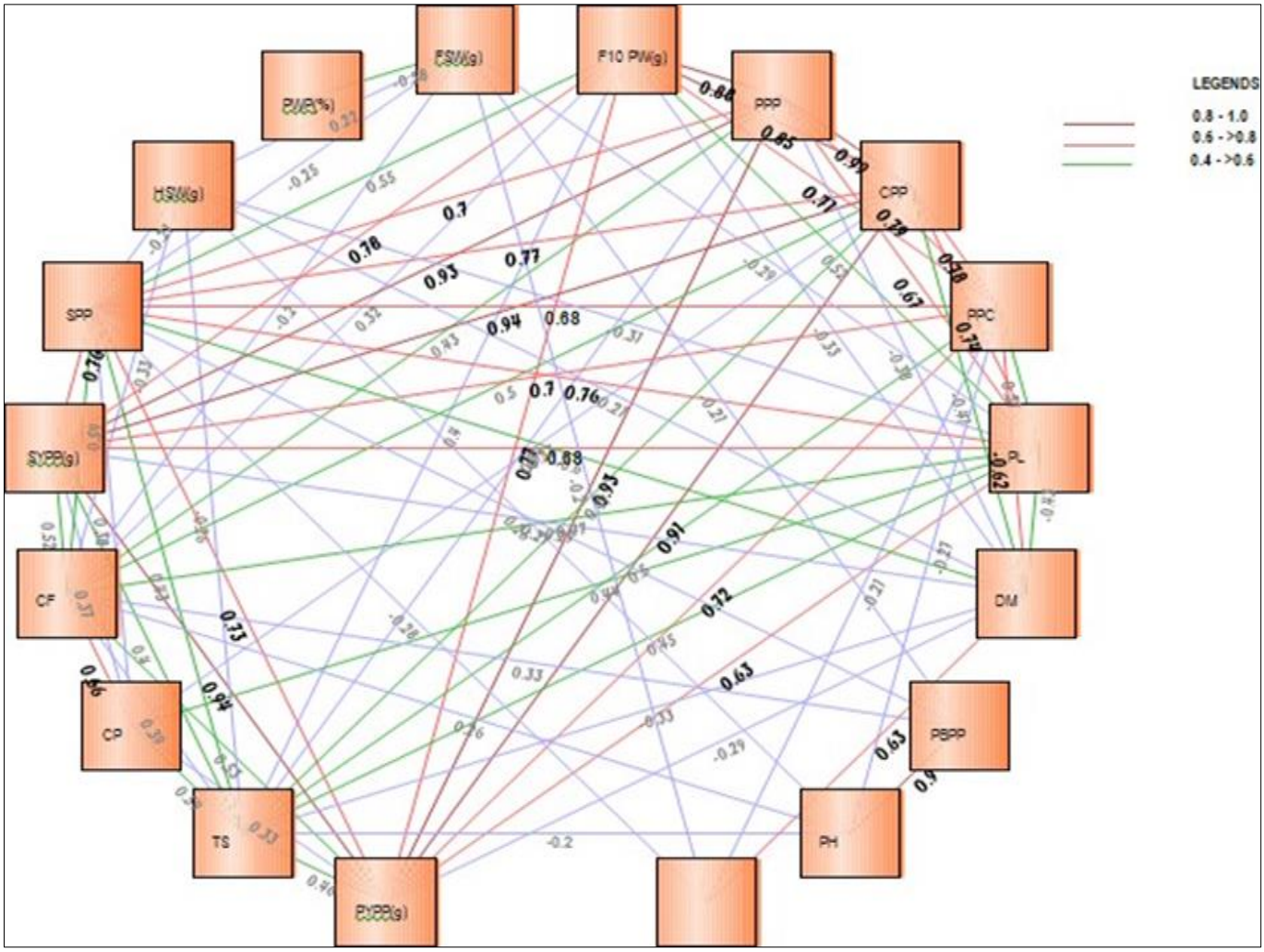

Fig 1: Genotypic correlation coefficients among yield and yield attributes in 26 genotypes of cowpea for eighteen characters

Days to 50% flowering exhibited positive and significant correlation with days to maturity (0.634). Similar results reported by Surpura and Sharma (2017) [2], Kumar *et al.* (2016) [10]. Plant height exhibited positive and significant correlation with primary branches per plant (0.895) similar results reported by Lal *et al.* (2014) [13]. Number of primary branches per plant exhibited positive and significant correlation with plant height (0.895), similar results reported by Lal *et al*. (2014) [13] and Pagadhar *et al*. (2019) [17]. Days to maturity flowering exhibited positive and significant correlation with days to 50% flowering (0.634) Similar results reported by Kumar *et al*. (2016) [10], Surpura and Sharma *et al.* (2017) [2].

Pod length exhibited positive and significant correlation with pods per cluster (0.510), clusters per plant (0.737), pods per plant (0.674), fresh weight of 10 pods (0.523), seeds per pod (0.757), seed yield per plant (0.683), crude fiber (0.474), crude protein (0.439) and total sugars (0.45) similar results were confirmed by Chaudhary *et al*. (2020), Surpura and Sharma (2017) [2], Pagadhar *et al*. (2019) [17] for number of pods per plant. Akhansha *et al*. (2021) for fresh weight of ten pods, Patel *et al*. (2016) [19], Baranda *et al*. (2017) [2], Lal *et al.* (2014) [13], Surpura and Sharma (2017) [2], Chaudhary *et al.* (2020) [5] for seeds per pod, Chaudhary *et al*. (2020) [5], Kumar *et al*. (2016) [15] for seed yield per pod, Chaudhary *et al.* (2020) [5] for protein.

Number of pods per cluster exhibited positive and significant correlation with pod length (0.510), clusters per plant (0.783), pods per plant (0.793), fresh weight of ten pods (0.707), seeds per plant (0.685), seed yield per plant (0.701), total sugars (0.496). The results are in accordance with the findings of Palve *et al*. (2018) for clusters per plant, pods per plant, hundred seed weight. Similar results observed in Panchta *et al*. (2019) [18] for seed yield per plant and clusters per plant.

Number of clusters per plant exhibited positive and significant correlation with pod length (0.737), pods per cluster (0.783), pods per plant (0.985), fresh weight of ten pods (0.852), seeds per pod (0.768), seed yield per plant (0.936), crude fiber (0.504) and total sugar (0.407). Similar results reported by Baranda *et al*. (2017) [2], Kumar *et al*. (2016) [10] for pods per plant.

Number of pods per plant exhibited positive and significant correlation with pod length (0.674), pods per cluster (0.793), clusters per plant (0.985), fresh weight of ten pods (0.879), seeds per pod (0.699), seed yield per plant (0.931), crude fiber (0.427) and total sugars (0.389), similar kind of findings was recorded by Manisha *et al*. (2018) [14] for clusters per plant, pods per plant, primary branches per plant, hundred seed weight. Pagadhar *et al*. (2019) [17] recorded similar results for seeds per pod, pod length.

Fresh weight of ten pods at harvest exhibited positive and significant correlation with pod length (0.523), pods per cluster (0.707), clusters per plant (0.852), pods per plant (0.879), seeds per pod (0.552), seed yield per plant (0.782), total sugars (0.398). Number of seeds per pod exhibited positive and significant correlation with pod length (0.757), pods per cluster (0.685), clusters per plant (0.768), pods per plant (0.699), fresh weight of ten pods (0.552), seed yield per plant (0.757), crude fiber (0.594) and total sugars (0.425), These results were in agreement with earlier findings Panchta *et al*. (2019) [18], Surpura and Sharma (2017) [2] for days to 50% flowering, pod length, pods per plant, hundred seed weight, seed yield per plant. Baranda *et al*. (2017) [2] for pod length and clusters per plant.

Seed yield per plant exhibited positive and significant correlation with pod length (0.683), pods per cluster (0.701), clusters per plant (0.936), pods per plant (0.931), fresh weigh of ten pods (0.782), seeds per pod (0.757), crude fiber (0.52), total sugar (0.425) Similar results reported by Kumar *et al.* (2016) [10] for days to 50% flowering, clusters per plant, pods per plant, pods per cluster, pod length Panchta *et al*. (2019) [18] also reports similar findings for pods per cluster, pods per plant and seeds per pod.

Crude fiber exhibited positive and significant correlation with pod length (0.474), clusters per plant (0.504), seeds per plant (0.594), seed yield per plant (0.520) crude protein (0.655), total sugars (0.389). Crude protein exhibited positive and significant correlation with pod length (0.439), crude fiber (0.655) and total sugars (0.591). Total sugars exhibited positive and significant correlation with pod length (0.450), pods per cluster (0.496), clusters per plant (0.407), pods per plant (0.389), fresh weight of ten pods (0.398), seeds per pod (0.425), seed yield per plant (0.401), crude fiber (0.389) and crude protein (0.591). Total sugars exhibited positive and significant correlation with pod length (0.450), pods per cluster (0.496), clusters per plant (0.407), pods per plant (0.389), fresh weight of ten pods (0.398), seeds per pod (0.425), seed yield per plant (0.401), crude fiber (0.389) and crude protein (0.591) (Fig: 1).

Path coefficient analysis

Path coefficient analysis was carried out to find out direct and indirect contribution of each of the characters on yield. The genotypic correlation coefficient being more important was portioned in to direct and indirect effects which are presented in Table 2.

Direct effect

The dependent variable taken into consideration for path analysis was pod yield per plant. Among the eighteen characters analysed, thirteen characters showed positive direct effect and the remaining four characters showed negative direct effects on pod yield per plant. The highest positive direct effect was registered by seed yield per plant, followed by pods per plant and fresh weight of ten pods at harvest, pod length. Low positive direct effect was registered by pod wall proportion (G-0.138, P-0.135). Negative direct effect was recorded through plant height (-0.096), days to maturity (-0.285), fresh seed weight (-0.167), hundred seed weight (-0.068) these results were in agreement with earlier findings Akansha *et al.* (2021) [1], Khandait *et al.* (2016) [11], Lal *et al.* (2014) [13] for pods per plant, pod length. Patel *et al.* (2016) [19] Days to 50% flowering, total sugars. Manisha *et al.* (2018) [14] for pods per plant, fiber content, pod length, seeds per plant. Kalambe *et al.* (2019) [12], Pagadhar *et al.* (2019) [17] reports similar for number of primary branches per plant. This suggested that direct selection based on these characters (pods per plant and fresh weight of ten pods at harvest, pod length) would result in high breeding efficiency for improving pod yield per plant (Fig: 2).

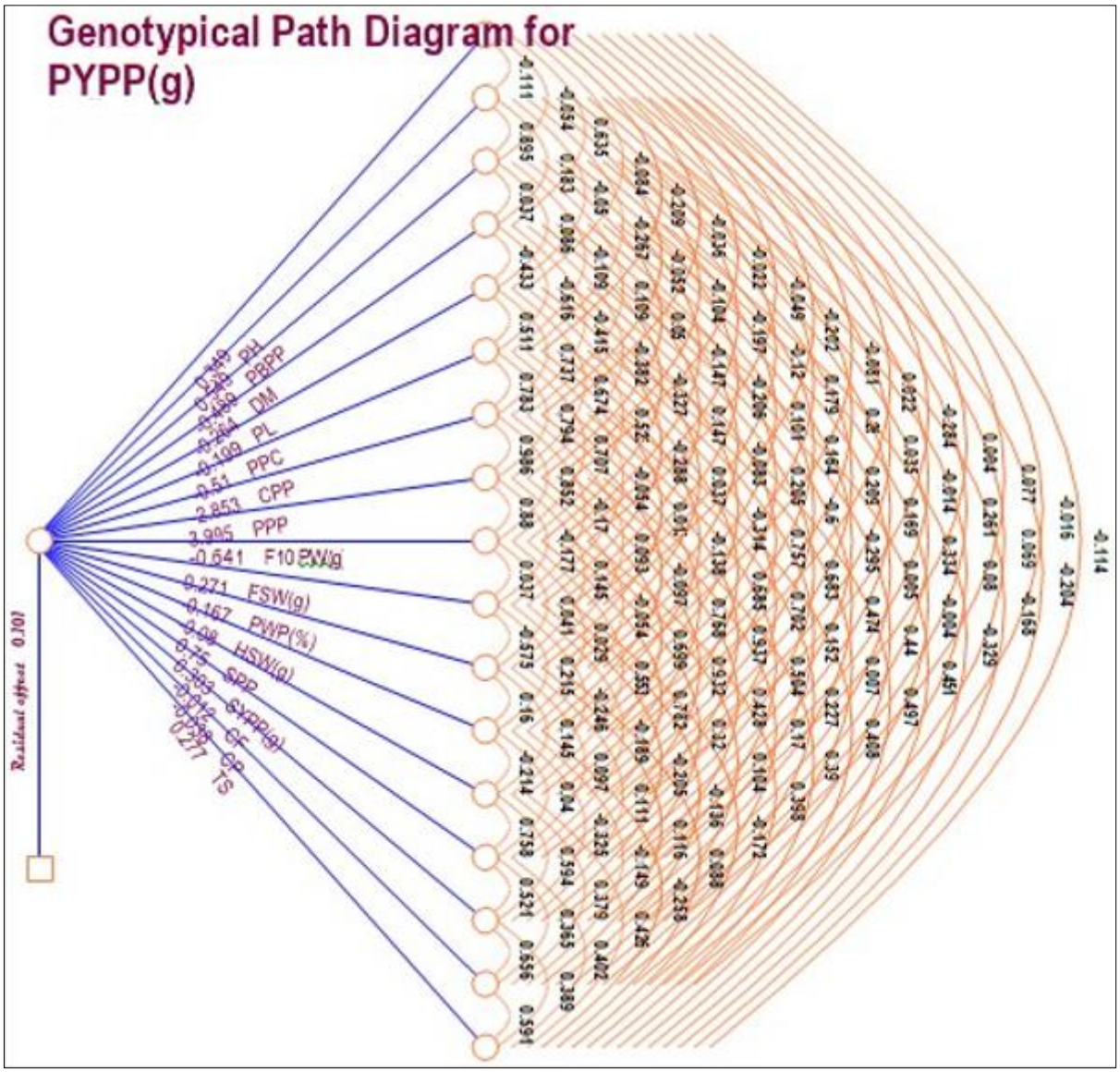

Fig 2: Genotypic path diagram for vegetable pod yield per plant in vegetable cowpea

Table 1: Genotypic correlation coefficients among yield and yield attributes in twenty-six genotypes of vegetable cowpea

	D50%F	PH	PBPP	DM	PL	PPC	CPP	PPP	F10 PW	FSW	PWP	HSW	SPP	SYPP	CF	CP	TS	PYPP
D50%F	1.0000	-0.1109	-0.0544	0.6348**	-0.0839	-0.2090	-0.0359	-0.0219	-0.0494	-0.2022	-0.0810	0.0215	-0.2838	0.0041	0.0773	-0.0159	-0.1140	0.0312
PH	-0.1109	1.0000	0.8954**	0.1830	-0.0503	-0.2672	-0.0518	-0.1043	-0.1968	-0.1199	0.1787	0.2603	0.0353	-0.0144	0.2606	0.0695	-0.2036	-0.0960
PBPP	-0.0544	0.8954**	1.0000	0.0367	0.0863	-0.1094	0.1087	0.0502	-0.1475	-0.2060	0.1008	0.1637	0.2093	0.1694	0.3338	0.0800	-0.1683	0.0656
DM	0.6348**	0.1830	0.0367	1.0000	-0.4333*	-0.6157**	-0.4146*	-0.3821	-0.3268	0.1471	-0.0826	0.2054	-0.5997**	-0.2947	0.0053	-0.0037	-0.3292	-0.2863
PL	-0.0839	-0.0503	0.0863	-0.4333*	1.0000	0.5108**	0.7374**	0.6744**	0.5234**	-0.2883	0.0366	-0.3144	0.7571**	0.6832**	0.4743*	0.4396*	0.4509*	0.6286**
PPC	-0.2090	-0.2672	-0.1094	-0.6157**	0.5108**	1.0000	0.7833**	0.7937**	0.7071**	-0.0540	0.0134	-0.1376	0.685**	0.7017**	0.1516	0.0065	0.4966**	0.7234**
CPP	-0.0359	-0.0518	0.1087	-0.4146*	0.7374**	0.7833**	1.0000	0.9857**	0.8523**	-0.1703	0.0931	-0.0973	0.7682**	0.9368**	0.5042**	0.2275	0.4077*	0.9118**
PPP	-0.0219	-0.1043	0.0502	-0.3821	0.6744**	0.7937**	0.9857**	1.0000	0.8798**	-0.1772	0.1454	-0.0542	0.6992**	0.9319**	0.4279*	0.1699	0.3895*	0.9263**
F10 PW	-0.0494	-0.1968	-0.1475	-0.3268	0.5234**	0.7071**	0.8523**	0.8798**	1.0000	0.0370	0.0408	0.0289	0.5529**	0.782**	0.3196	0.1042	0.3985*	0.7658**
FSW	-0.2022	-0.1199	-0.2060	0.1471	-0.2883	-0.0540	-0.1703	-0.1772	0.0370	1.0000	-0.5754	0.2151	-0.2458	-0.1888	-0.2047	-0.1358	-0.1723	-0.1668
PWP	-0.0810	0.1787	0.1008	-0.0826	0.0366	0.0134	0.0931	0.1454	0.0408	-0.5754**	1.0000	0.1596	0.1453	0.0967	0.1106	0.1159	0.0882	0.1383
HSW	0.0215	0.2603	0.1637	0.2054	-0.3144	-0.1376	-0.0973	-0.0542	0.0289	0.2151	0.1596	1.0000	-0.2142	0.0396	-0.3250	-0.1493	-0.2581	-0.0675
SPP	-0.2838	0.0353	0.2093	-0.5997**	0.7571**	0.685**	0.7682**	0.6992**	0.5529**	-0.2458	0.1453	-0.2142	1.0000	0.7579**	0.5943**	0.3788	0.4259*	0.7256**
SYPP	0.0041	-0.0144	0.1694	-0.2947	0.6832**	0.7017**	0.9368**	0.9319**	0.782**	-0.1888	0.0967	0.0396	0.7579**	1.0000	0.5209**	0.3654	0.4018*	0.9357**
CF	0.0773	0.2606	0.3338	0.0053	0.4743*	0.1516	0.5042**	0.4279*	0.3196	-0.2047	0.1106	-0.3250	0.5943**	0.5209**	1.0000	0.6558**	0.3892*	0.5261**
CP	-0.0159	0.0695	0.0800	-0.0037	0.4396*	0.0065	0.2275	0.1699	0.1042	-0.1358	0.1159	-0.1493	0.3788	0.3654	0.6558**	1.0000	0.5911**	0.3347
TS	-0.1140	-0.2036	-0.1683	-0.3292	0.4509*	0.4966**	0.4077*	0.3895*	0.3985*	-0.1723	0.0882	-0.2581	0.4259*	0.4018*	0.3892*	0.5911**	1.0000	0.4624*
PYPP	0.0312	-0.0960	0.0656	-0.2863	0.6286**	0.7234**	0.9118**	0.9263**	0.7658**	-0.1668	0.1383	-0.0675	0.7256**	0.9357**	0.5261**	0.3347	0.4624*	1

*Significant at 5% LOS ** Significant at 1% LOS

D50%F-Days to 50% flowering, PH-plant height, PBPP- No. of primary branches per plant, DM-Days to maturity, PL-pod length, PPC-pods per cluster, CPP-clusters per plant, PPP-pods per plant, F10PW- fresh weight of 10 pods at harvest, FSW-fresh seed weight, PWP-pod wall proportion, HSW-hundred seed weight, SPP- seeds per pod, SYPP- seed yield per plant, CF-crude fiber, CP- crude protein, TS- total sugars, PYPP-pod yield per plant

Table 2: Phenotypic(P) and Genotypic (G) path coefficient analysis indicating direct and indirect effects of component characters on yield in twenty-six genotypes of vegetable cowpea.

		D50%f	PH	PBPP	DM	PL	PPC	CPP	PPP	F10 PW(g)	FSW(g)	PWP (%)	HSW(g)	SPP	SYPP(g)	CF	CP	TS
D50%f	P	0.188	-0.021	-0.010	0.116	-0.017	-0.039	-0.007	-0.004	-0.009	-0.037	-0.014	0.006	-0.053	0.001	0.014	-0.003	-0.021
	G	0.349	-0.039	-0.019	0.222	-0.029	-0.073	-0.013	-0.008	-0.017	-0.071	-0.028	0.008	-0.099	0.001	0.027	-0.006	-0.040
PH	P	-0.034	0.308	0.271	0.057	-0.014	-0.081	-0.016	-0.032	-0.060	-0.037	0.055	0.080	0.010	-0.004	0.080	0.023	-0.063
	G	-0.061	0.549	0.491	0.100	-0.028	-0.147	-0.029	-0.057	-0.108	-0.066	0.098	0.143	0.019	-0.008	0.143	0.038	-0.112
PBPP	P	0.016	-0.278	-0.316	-0.012	-0.026	0.037	-0.032	-0.016	0.046	0.063	-0.033	-0.051	-0.064	-0.053	-0.103	-0.025	0.053
	G	0.027	-0.438	-0.489	-0.018	-0.042	0.054	-0.053	-0.025	0.072	0.101	-0.049	-0.080	-0.102	-0.083	-0.163	-0.039	0.082
DM	P	-0.075	-0.022	-0.005	-0.120	0.051	0.073	0.050	0.046	0.039	-0.018	0.009	-0.025	0.072	0.035	-0.001	0.000	0.040
	G	-0.167	-0.048	-0.010	-0.264	0.114	0.162	0.109	0.101	0.086	-0.039	0.022	-0.054	0.158	0.078	-0.001	0.001	0.087
PL	P	0.011	0.006	-0.010	0.051	-0.121	-0.060	-0.087	-0.080	-0.062	0.035	-0.004	0.036	-0.089	-0.081	-0.057	-0.052	-0.054
	G	0.017	0.010	-0.017	0.086	-0.200	-0.102	-0.147	-0.135	-0.104	0.058	-0.007	0.063	-0.151	-0.136	-0.095	-0.088	-0.090
PPC	P	0.036	0.046	0.020	0.105	-0.086	-0.175	-0.134	-0.136	-0.121	0.010	0.000	0.023	-0.116	-0.120	-0.026	-0.001	-0.085
	G	0.107	0.136	0.056	0.314	-0.261	-0.510	-0.399	-0.405	-0.361	0.028	-0.007	0.070	-0.349	-0.358	-0.077	-0.003	-0.253
CPP	P	0.051	0.072	-0.141	0.577	-1.008	-1.074	-1.401	-1.378	-1.190	0.239	-0.129	0.138	-1.065	-1.311	-0.705	-0.319	-0.570
	G	0.102	0.148	-0.310	1.183	-2.104	-2.234	-2.853	-2.812	-2.432	0.486	-0.266	0.278	-2.191	-2.672	-1.438	-0.649	-1.163
PPP	P	-0.045	-0.219	0.105	-0.804	1.397	1.640	2.077	2.111	1.853	-0.374	0.300	-0.113	1.466	1.967	0.901	0.358	0.822
	G	-0.087	-0.417	0.201	-1.526	2.694	3.170	3.938	3.995	3.515	-0.708	0.581	-0.216	2.793	3.723	1.709	0.679	1.556

D50%F-Days to 50% flowering, PH-plant height, PBPP- No. of primary branches per plant, DM-Days to maturity, PL-pod length, PPC-pods per cluster, CPP-clusters per plant, PPP-pods per plant, F10PW- fresh weight of 10 pods at harvest, FSW-fresh seed weight, PWP-pod wall proportion, HSW-hundred seed weight, SPP- seeds per pod, SYPP- seed yield per plant, CF-crude fiber, CP- crude protein, TS- total sugars, PYPP-pod yield per plant.

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		D50%f	PH	PBPP	DM	PL	PPC	CPP	PPP	F10 PW(g)	FSW(g)	PWP (%)	HSW(g)	SPP	SYPP(g)	CF	CP	TS
F10 PW(g)	P	0.020	0.084	0.062	0.140	-0.218	-0.296	-0.363	-0.375	-0.428	-0.017	-0.017	-0.013	-0.234	-0.334	-0.136	-0.045	-0.170
	G	0.032	0.126	0.095	0.209	-0.335	-0.453	-0.546	-0.564	-0.641	-0.024	-0.026	-0.019	-0.354	-0.501	-0.205	-0.067	-0.255
FSW(g)	P	-0.038	-0.023	-0.039	0.028	-0.056	-0.011	-0.033	-0.035	0.008	0.195	-0.109	0.042	-0.048	-0.037	-0.040	-0.026	-0.034
	G	-0.055	-0.033	-0.056	0.040	-0.078	-0.015	-0.046	-0.048	0.010	0.271	-0.156	0.058	-0.067	-0.051	-0.056	-0.037	-0.047
PWP (%)	P	0.001	-0.003	-0.002	0.001	-0.001	0.000	-0.002	-0.003	-0.001	0.010	-0.018	-0.003	-0.002	-0.002	-0.002	-0.002	-0.002
	G	0.014	-0.030	-0.017	0.014	-0.006	-0.002	-0.016	-0.024	-0.007	0.096	-0.167	-0.027	-0.024	-0.016	-0.019	-0.019	-0.015
HSW(g)	P	-0.003	-0.023	-0.014	-0.018	0.027	0.012	0.009	0.005	-0.003	-0.019	-0.014	-0.090	0.019	-0.004	0.029	0.013	0.023
	G	-0.002	-0.021	-0.013	-0.017	0.025	0.011	0.008	0.004	-0.002	-0.017	-0.013	-0.080	0.017	-0.003	0.026	0.012	0.021
SPP	P	-0.088	0.010	0.064	-0.188	0.232	0.209	0.240	0.219	0.173	-0.077	0.040	-0.066	0.316	0.237	0.186	0.118	0.134
	G	-0.213	0.027	0.157	-0.450	0.568	0.514	0.576	0.524	0.415	-0.184	0.109	-0.161	0.750	0.568	0.446	0.284	0.319
SYPP(g)	P	0.003	-0.008	0.093	-0.164	0.374	0.384	0.523	0.520	0.436	-0.105	0.053	0.022	0.420	0.559	0.290	0.204	0.224
	G	0.001	-0.004	0.051	-0.089	0.207	0.213	0.284	0.283	0.237	-0.057	0.029	0.012	0.230	0.303	0.158	0.111	0.122
CF	P	0.004	0.015	0.018	0.000	0.026	0.008	0.028	0.024	0.018	-0.012	0.006	-0.018	0.033	0.029	0.056	0.037	0.022
	G	-0.001	-0.003	-0.004	0.000	-0.006	-0.002	-0.006	-0.005	-0.004	0.002	-0.001	0.004	-0.007	-0.006	-0.012	-0.008	-0.005
CP	P	0.001	-0.003	-0.004	0.000	-0.019	0.000	-0.010	-0.008	-0.005	0.006	-0.005	0.007	-0.017	-0.016	-0.029	-0.044	-0.026
	G	0.001	-0.003	-0.003	0.000	-0.017	0.000	-0.009	-0.007	-0.004	0.005	-0.004	0.006	-0.014	-0.014	-0.025	-0.038	-0.023
TS	P	-0.019	-0.034	-0.028	-0.055	0.075	0.082	0.069	0.066	0.067	-0.029	0.014	-0.043	0.071	0.068	0.066	0.100	0.169
	G	-0.032	-0.056	-0.047	-0.091	0.125	0.138	0.113	0.108	0.110	-0.048	0.024	-0.072	0.118	0.111	0.108	0.164	0.277
PYPP(g)	P	0.030	-0.096	0.065	-0.285	0.615	0.709	0.910	0.925	0.763	-0.166	0.135	-0.068	0.719	0.935	0.524	0.334	0.462
	G	0.031	-0.096	0.066	-0.286	0.629	0.723	0.912	0.926	0.766	-0.167	0.138	-0.068	0.726	0.936	0.526	0.335	0.462
Partial R^2	P	0.0056	-0.0294	-0.0207	0.0344	-0.0746	-0.1237	-1.2749	1.9534	-0.3263	-0.0325	-0.0024	0.0061	0.227	0.5221	0.0294	-0.0148	0.078
	G	0.0109	-0.0527	-0.0321	0.0755	-0.1254	-0.3689	-2.601	3.7002	-0.4905	-0.0452	-0.0231	0.0054	0.5441	0.2836	-0.0063	-0.0128	0.128

D50%F-Days to 50% flowering, PH-plant height, PBPP- No. of primary branches per plant, DM-Days to maturity, PL-pod length, PPC-pods per cluster, CPP- clusters per plant, PPP-pods per plant, F10PW- fresh weight of 10 pods at harvest, FSW-fresh seed weight, PWP-pod wall proportion, HSW-hundred seed weight, SPP- seeds per pod, SYPP- seed yield per plant, CF-crude fiber, CP- crude protein, TS- total sugars, PYPP-pod yield per plant

Conclusion

On considering the findings of correlation coefficients and path analysis it is revealed that the traits having high positive significant correlation at genotypic level pod yield per plant with seed yield per plant, pods per plant, seeds per pod, clusters per plant, fresh weight of ten pods, pods per cluster, pod length, crude fibre, total sugar. These characters should form selection criterion in breeding programmes.

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