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# Morpho-agronomic characterization of cucumber germplasm for yield and yield associated traits

**Zubair Khan[1], Azhar Hussain Shah[1*], Rehmani Gul[2], Abdul Majid[1], Uzma Khan[1], Habib Ahmad[3]**

[1]*Department of Botany, Hazara University, Mansehra, Pakistan*

[2]*Research Officer, Agriculture Research Institute Swat, Pakistan*

[3]*Department of Genetics, Hazara University, Mansehra, Pakistan*

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## Abstract

In present research work 24 genotypes of cucumber were evaluated to find out their similarities and differences based on numerical traits. The experiment was laid out in Randomized Complete Block Design (RBCD) with two replications. Numerical traits of the genotypes were measured according to the coding criteria specified by European Cooperative Programmed for Plant Genetics Resources (ECPGR) 2008. Data showed great variation for almost all the traits. Maximum germination (67.5%) was observed in genotype Mardan local while minimum germination (17.5%) was recorded in genotype 28295. The genotypes Haripur local and 28293 showed early flowering. Similarly highest yield was observed in USA Poinsett, Dargai local and Mardan local. These genotypes could be chosen for crossing with other genotypes like 28295 and Sialkot selection having low germination rate and low yield to get a better genotype of cucumber with high germination and maximum yield. Correlation analysis represent that yield was positively correlated with fruit length (.523** P≤0.01) and fruit width (.439* P≤0.01). While fruit per plant showed positive significant correlation with vine length. Present findings are applicable in cucumber cultivation in swat and other areas with similar climatic conditions. This will intern help to improve the economic return and revenue generation of the farmers.

* **Corresponding Author:** Azhar Hussain Shah ✉ drahshu@gmail.com

## Introduction

Cucumber (*Cucumis sativus* L.) belongs to family Cucurbitaceae which is comprised of 118 genera and 825 species. Members of this family are spread mainly in tropical and subtropical regions of the world (Wang *et al*., 2007). The most efficiently important cucurbits according to world total production are water melon (*Citrullus lanatus* L.), cucumber (*Cucumis sativus* L.*)* and melon (*Cucumis melo* L.) (FAO, 2006). Cucumber is also called "Khira" and resident to Asia and Africa, where it has been used for 3,000 years. Today cucumbers are cultivated all over the world for well-liked salad and pickle. Though less healthful than most fruit, the fresh cucumber supply thiamine, vitamin C, niacin, phosphorus, iron, calcium and nutritional character (Gopalan *et al*., 1982). Cucumber also serves as insect killer due to steroid stuffing (Wang *et al*., 2007).

Although important cucumber production occurs in North Central America and Europe but half of world cucumber production occurs in Asia. Asian countries with high cucumber make up are Turkey, Iran, Uzbekistan, Japan and Iraq. In Pakistan, cucumber is grown round the year from sea level to 2500 meters successfully as money-making crop and total area under cucumber cultivation is 1108 hectare with an average production of 5.85 ton $ha^{-1}$ (Akhunzada *et al*., 2007). Although Cucumber is one of the main crop in Pakistan but its yield is quiet low due to (i) non accessibility of varieties well suited for specific production zones, ( ii) diseases caused due to low struggle to biotic and biotic stresses, (iii) lack of appropriate cultural practices (Fertilization, irrigation and hoeing etc.). Among these, the most common cause of little productivity is the agriculture of low varieties (Miano *et al*., 1991). Cucumber production can be increased by bringing extra area under its cultivation or by adopting superior varieties and superior cultural practices but it is very difficult to increase the area due to the composition with other crops. Only possible solution to increase the yield of cucumber is to select high yielding genotypes according to the agro diametric condition of different area and their characterization (Al-Rawahi *et al*., 2011).

Characterization of cucumber is of great significance for present and future genetic development program of the crop. For a successful transmission agenda, genetic diversity and changeability participate essential role. While morphological representation is the chief step in explanation and understanding of genetic means (Smith and Smith, 1989). Keeping this in view in present study attempt has been made to characterize cucumber germplasm at morphological basis to assess the genetic pattern of morphological character of cucumber, to identify the most suitable and high yielding variety and to quantify yield potential of cucumber germplasm for future utilization.

## Materials and methods

*Source of Genetic Material*

Twenty four genotypes of cucumber were selected in order to evaluate the amount of variation that may exist for morphogenetic characteristics. Among these twenty four genotypes four (28293, 28294, 28295 and Sialkot selection) were obtained from National Agriculture Research Centre (NARC) Islamabad, Pakistan. Four genotypes (Money, Royal Holand, Gurge and Bangy) were obtained from Agriculture Research Institute Swat. Four genotypes (USA Poinsett, Germany Poinsett, India Poinsett, and Agro tip) were obtained from Mardan market. Twelve genotypes were collected from different area of Pakistan (Peshawar, Mardan, Dargai, Mansehra, Bajawar, Arang, Buner, Timergara, Dir, Talash, Haripur and Nowshehra).

*Experimental Site and Field Operations*

The research was conducted at Agriculture Research Institute (ARI) Swat Pakistan during May to August 2012. Land was ploughed once with mould board plough. Soil was brought to a fine tilt by crushing the clods and harrowing two times. Later, the land was smoothened with wooden plank. The experiment design was Randomized Complete Block Design (RBCD) with 2 replications. The total area of the experiment was 576 $m^2$. Each replication consisted of

24 rows. The crop was seeded directly after the soil is well prepared. Fertilizers, Irrigation and Pest management was done on proper time. Half dose of fertilizers was applied at the time of sowing and half dosage of fertilizers was applied after 28 days. Randomly five plants from each row were selected for data.

Statistical Analysis

Correlation analysis was performed for quantitative data using SPSS 16.0. and analysis of variance(ANOVA) was done by Statistix 8.1.

**Results and discussion**

*Percent germination and days to 50 % heading*

Percent germination was studied after sowing in each genotype. Great variability displayed among cucumber genotypes for all the traits. Germination percentage showed a great variation among the cucumber genotypes (Table 1). Maximum germination (67.5%) was recorded for genotype Mardan local while minimum (17.5%) in genotype 28295. Similarly the cucumber genotypes showed significant variation in days to 50% flowering. Greatest number of days (44.5) to 50% flowering was recorded for genotypes Haripur local and 28293 whereas minimum number of days (34.5) was recorded for genotype Sialkot selection. From the (Table 1) it is clear that the genotype 28294 took maximum number of days (54.5) for fruit initiation and genotypes Gurge, Haripur local and Mardan local took 43.5 days. These results are similar with the finding of Hamid *et al.*, (2002) and Ahmed *et al.*, (2004). These variations in seed germination, days to 50% flowering, fruit initiation could be possibly due to genetic makeup of the cultivars, which responded differently to the environmental conditions.

**Table 1.** Variation in Quantitative characteristics among cucumber genotypes.

| Genotypes | Germination % age | days to 50 % flowering | days to fruit initiation | days to edible maturity | Vine Length (cm) | fruits per plant | fruits per kilogram | fruit Length (cm) | fruit width (cm) | yield (Tons ha$^{-1}$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Peshawar local | 65.0 | 37.5 | 44.5 | 57.5 | 168.75 | 7.40 | 5.20 | 18.22 | 4.84 | 7.40 |
| Mardan local | 67.5 | 39.5 | 43.5 | 59.0 | 142.05 | 6.30 | 5.40 | 18.09 | 4.80 | 8.80 |
| Dargai local | 62.5 | 39.0 | 46.5 | 64.5 | 195.40 | 9.10 | 5.15 | 17.84 | 5.70 | 9.35 |
| Bajawar local | 50.0 | 41.5 | 47.5 | 67.5 | 150.85 | 6.80 | 4.85 | 17.51 | 6.05 | 7.30 |
| Buner local | 27.5 | 38.0 | 44.5 | 64.5 | 138.90 | 6.10 | 4.80 | 18.98 | 5.75 | 3.65 |
| Arang local | 47.5 | 42.5 | 44.0 | 61.5 | 130.60 | 5.20 | 5.70 | 17.32 | 5.00 | 4.65 |
| Timergara local | 62.5 | 35.5 | 50.5 | 66.5 | 200.15 | 10.8 | 3.70 | 20.43 | 6.40 | 8.00 |
| Dir local | 32.5 | 43.5 | 45.0 | 61.5 | 169.00 | 7.50 | 3.65 | 18.34 | 5.85 | 4.25 |
| Talash local | 35.0 | 41.5 | 47.5 | 63.5 | 222.70 | 11.6 | 5.65 | 17.87 | 5.70 | 3.75 |
| Nowshehra local | 57.5 | 35.5 | 50.5 | 67.0 | 197.95 | 9.30 | 5.45 | 17.25 | 6.10 | 8.15 |
| Haripur local | 42.5 | 44.5 | 43.5 | 62.5 | 222.00 | 11.3 | 5.40 | 18.28 | 5.40 | 3.70 |
| Mansehra local | 25.0 | 35.0 | 48.0 | 65.5 | 188.00 | 8.50 | 6.15 | 15.93 | 4.60 | 1.30 |
| Agro tip | 62.5 | 38.5 | 50.5 | 68.5 | 192.70 | 9.00 | 6.10 | 16.04 | 5.25 | 7.35 |
| India Poinsett | 60.0 | 37.5 | 47.0 | 63.5 | 185.10 | 8.30 | 6.55 | 14.96 | 5.05 | 7.30 |
| Germany Poinsett | 52.0 | 39.5 | 49.0 | 68.5 | 165.30 | 7.20 | 5.70 | 17.92 | 5.20 | 4.65 |
| USA Poinsett | 60.0 | 36.5 | 44.0 | 63.5 | 172.10 | 7.80 | 5.55 | 17.84 | 5.30 | 10.3 |
| Gurge | 37.5 | 41.5 | 43.5 | 61.5 | 144.15 | 6.40 | 5.25 | 17.1 | 4.75 | 2.80 |
| Bangy | 52.5 | 39.5 | 49.5 | 67.5 | 135.30 | 5.50 | 6.00 | 15.89 | 4.85 | 5.85 |
| Royal Holland | 47.5 | 43.5 | 47.5 | 68.5 | 119.70 | 4.30 | 5.80 | 18.59 | 4.50 | 5.60 |
| Money | 62.5 | 37.0 | 52.5 | 71.5 | 137.85 | 5.80 | 6.95 | 14.04 | 4.55 | 4.25 |
| 28293 | 47.5 | 44.5 | 49.5 | 65.0 | 190.60 | 8.70 | 6.50 | 15.87 | 4.40 | 2.70 |
| 28294 | 27.5 | 41.5 | 54.5 | 69.5 | 163.40 | 7.10 | 7.30 | 12.80 | 4.60 | 1.30 |
| 28295 | 17.5 | 35.5 | 52.5 | 71.5 | 120.85 | 4.50 | 7.00 | 13.18 | 4.60 | 0.55 |
| Sialkot selection | 25.5 | 34.5 | 45.5 | 67.5 | 125.65 | 4.85 | 6.20 | 14.88 | 5.15 | 0.65 |

*Days to maturity*

The cucumber genotypes displayed significant differences (Table 1) for days to edible maturity. Greater number of days (71.5) was recorded for genotypes 28295 and 28293 respectively. While lowest number of days (57.5) was recorded for genotype Peshawar local. Our results agreed with those of Resende (1999) and Ahmed *et al.*, (2004) who also stated that great variability are present in days to edible maturity due to the genetic differences in cucumber genotypes.

**Table 2.** Correlation analysis of cucumber genotypes.

| | VL | FL | FW | TNF/P | Y ton/ha |
|---|---|---|---|---|---|
| VL | 1 | | | | |
| FL | .279 | 1 | | | |
| FW | .442* | .597** | 1 | | |
| TNF/P | .985** | .353 | .514* | 1 | |
| Y ton/ha | .254 | .523** | .439* | .267 | 1 |

Note: **=Correlation is significant at the 0.01 level, *=Correlation is significant at the 0.05 level, ns=Non significant, VL= Vine length, FL=Fruit Length, FW=Fruit Width, TNF/P=Total number of fruits per plant, Y ton/ha=Yield tons per hectare.

*Vine length (cm)*

Vine length presented in Table 1 varied greatly among all cucumber genotypes. Genotype Talash local recorded maximum vine length (222.7 cm) and genotype 28295 showed minimum vine length (120.85 cm) as shown in Table 1. Our finding are similar with Abusaleha and Dutta, (1990) and Hossain *et al.*, (2010) who also studied vine length and found great variation in it. This variability shows that a great genetic diversity is present among cucumber genotypes. Vine length positively correlated with total number of fruit per plant (985** P≤0.01) and fruit width (.442* P≤0.01) whereas vine length showed non significant correlation with other traits. These results are also in accordance with the finding of Hossain *et al.*, (2010) and Abusaleha and Dutta (1988) who also represented that vine length have positive significantly correlated with fruit width and total number of fruit per plant. This is because if the length of vine increases there will also increases the number of nodes for fruit initiation.

*Per plant fruits and fruits per kilogram*

Significant variability was present in fruit per plant among all genotypes. The maximum number (11.2) of fruits per plant was present in genotype Buner local while the minimum number (3.85) of fruits per plant was present in genotypes Money as shown in Table 4.10. Hossain *et al.*, (2010) also reported that number of fruit per plant varied significantly among the accessions. This variability may due to the different environmental conditions or may be the genetic variation. Total number of fruit per plant showed positive significant relationship with vine length (.985** P≤0.01) and fruit width (.514* P≤0.01). These results are similar with Hossain *et al.*, (2010) and Abusaleha and Dutta, (1988) who also reported that a significant positive correlation was present between total number of fruit per plant, vine length and fruit width. Fruit per kilogram reveal significant variation between the genotypes as shown in Table 1. Genotype 28294 showed the maximum number (7.3) of fruit per kg whereas genotype Dir local showed minimum number (3.65) of fruits per kg. Our results are similar with Hamid *et al.*, (2002) who stated that among cucumber genotypes great variability are present in fruit per kg.

*Fruit length (cm) and fruit width (cm)*

In this study fruit length showed great variation among all the genotypes. Genotype Timergara local recorded the highest length (20.43 cm) of fruit and

the genotypes 28294 recorded the lowest length (12.8 cm) of fruit as shown in Table 1. These results are agreed to that obtained by Sharma *et al.*, (2000), Krishna Prasad and Singh (1994), Hormuzdi and More, (1989) and Hossain *et al.*, (2010) who also found significant differences in fruit length in their study. The fruit width data presented in Table 1 revealed that different cucumber genotypes exhibit significant differences. Greater fruit width (6.4) was showed by genotype Timergara local. On the other hand cucumber genotypes 29293 and Royal Holland showed lowest fruit width (4.4 cm) and (4.5 cm). Variation in fruit width was also reported by Saha *et al.* (1992) and Hossain *et al.*, (2010) in their study. A strong positive correlation was present between fruit width and fruit length (.597$^{**}$ P≤0.01). These results are supported by the study of Eifediyi *et al.*, (2011) who also found positive significant relationship among fruit width and fruit length. Fruit length (.523$^{**}$ P≤0.01) and fruit width (.439$^{*}$ P≤0.01) are also positively correlated with yield tons/ha. Result of the correlation analysis represents that yield was positively correlated with vine length. Lawal (2000) reported very high positive correlation between fruit length and cucumber fruit yield. Moreover Eifediyi *et al.*, (2011) found no significant positive correlation between fruit width and fruit yield. Fruit width also positively correlated with total number of fruit per plant (.514$^{*}$ P≤0.01). Our results are against with the results of Hossain *et al.*, (2010) who found no relationship between fruit width and total number of fruit per plant. These variations are due to the differences in environmental conditions, the genetic diversity of genotypes, or the presence of available nutrients.

Maximum germination has been observed in the genotype Mardan local followed by genotypes Peshawar local, Dargai local, Timergara local and Agro tip. While genotypes Peshawar local, Mardan local, Arang local, Dir local and Gurge showed early days to maturity which can be chosen for business production in Pakistan. Similarly the genotypes Timergara local, Royal Holland, Buner local, Dir local, Haripure local, Peshwar local and Mardan local showed maximum fruit length. On the other hand highest yield was observed in genotypes USA Poinsett, Dargai local, Mardan local, Peshawar local, Agro tip and India Poinsett.

Based on these results the genotypes Mardan local, Peshwar local, Dargai local Agro tip and India Poinsett are found suitable for the swat environment and these genotypes should be grown in other areas of Pakistan and must be characterized at using molecular markers such as SSR, RFLP etc. to investigate environmental influence on yield.

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