Genetic Diversity Assessment of Local Finger Millet Accessions Based on Morphological Characteristics

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Abstract

Diversity of thirty three local finger millet accessions was assessed using eleven morphological characteristics in hierarchical cluster analysis with Euclidian distance using average linkage method based on the field experiment conducted at Grain Legumes and Oil crops Research and Development Center, Angunakolapellessa. Two major clusters were observed and first cluster was separated from main group at the Euclidian distance of 10. Ten better performing lines (Ac12282, Ac12276, Ac12225, Ac11264, Ac11408, Ac12269, Ac12448, Ac12465, Ac12285 and Ac12089) were selected based on weight of dried panicle, seed weight of panicle and milling percentage. Out of the ten best yield performers eight belong to one major cluster resembling the close relatedness of the accession having better yield performances and most probably belong to the same genetic makeup.

Key words: Finger millet, Genetic diversity, Cluster analysis

Introduction

The Participatory Plant Breeding process aims to consolidate the farmer's role in setting breeding goals and selecting diverse genetic materials (Bhuwon 2008). Maintenance of crop diversity within on-farm conditions would enhance the conservation and sustainable utilization of genetic diversity of different crop varieties. In Sri Lankan context, on farm diversity of crops has been degraded rapidly within few decades due to introduction of new varieties, exotic hybrids and changing from old subsistence agriculture to modern irrigated cropping systems. Therefore, regaining of lost diversity and protection of existing diversity by encouraging on farm diversity conservation measures is important to develop sustainable agriculture with minimized risk. This study was planned to assess genetic diversity and to select better performing lines of collected local germplasm samples of finger millet from the Plant Genetic Resource Center (PGRC), Gnnoruwa, Peradeniya, Sri Lanka, at the field of Grain Legumes and Oil crops Research and Development Center (GLORDC), Angunakolapellessa.

Materials and Methods

The experiment was established using seed samples of 33 local finger millets accessions in 3 rows of 3m length as a non replicated trial at GLORDC, Angunakola pellassessa. The established lines were evaluated based on the descriptor published by PGRC, Sri Lanka for finger millet evaluation. Data were collected using randomly selected five plants from the middle row of each finger millet accession. Average values of eleven measured characteristics (plant height, number of tillers, number of fingers per panicle, length of fingers, width of fingers, dry weight of panicle, seed weigh of panicle, milling percentage, thousand seed weight, shape of the panicle and size of the panicle) were calculated and used as a basic data matrix of 33 x 11 for cluster analysis with average linkage method and Euclidian distance in SPSS computer package.

Results and Discussion

Based on the cluster analysis of finger millet accessions, two major clusters were observed. First cluster was separated from main group at the Euclidian distance of 10 (Figure 1). This group was consisted of accessions distributed in North Central, Central and North Western Provinces of Sri Lanka. Some accessions collected from Central province were grouped with North central province accessions; some were clustered with Uva province and Southern provinces. Uva province accessions (Moneragala) and Southern province (Hambantota) accessions clustered together before joining the major cluster. Accessions from Anuradapura were found throughout the cluster diagram showing more diverse collection of finger millet germplasm.
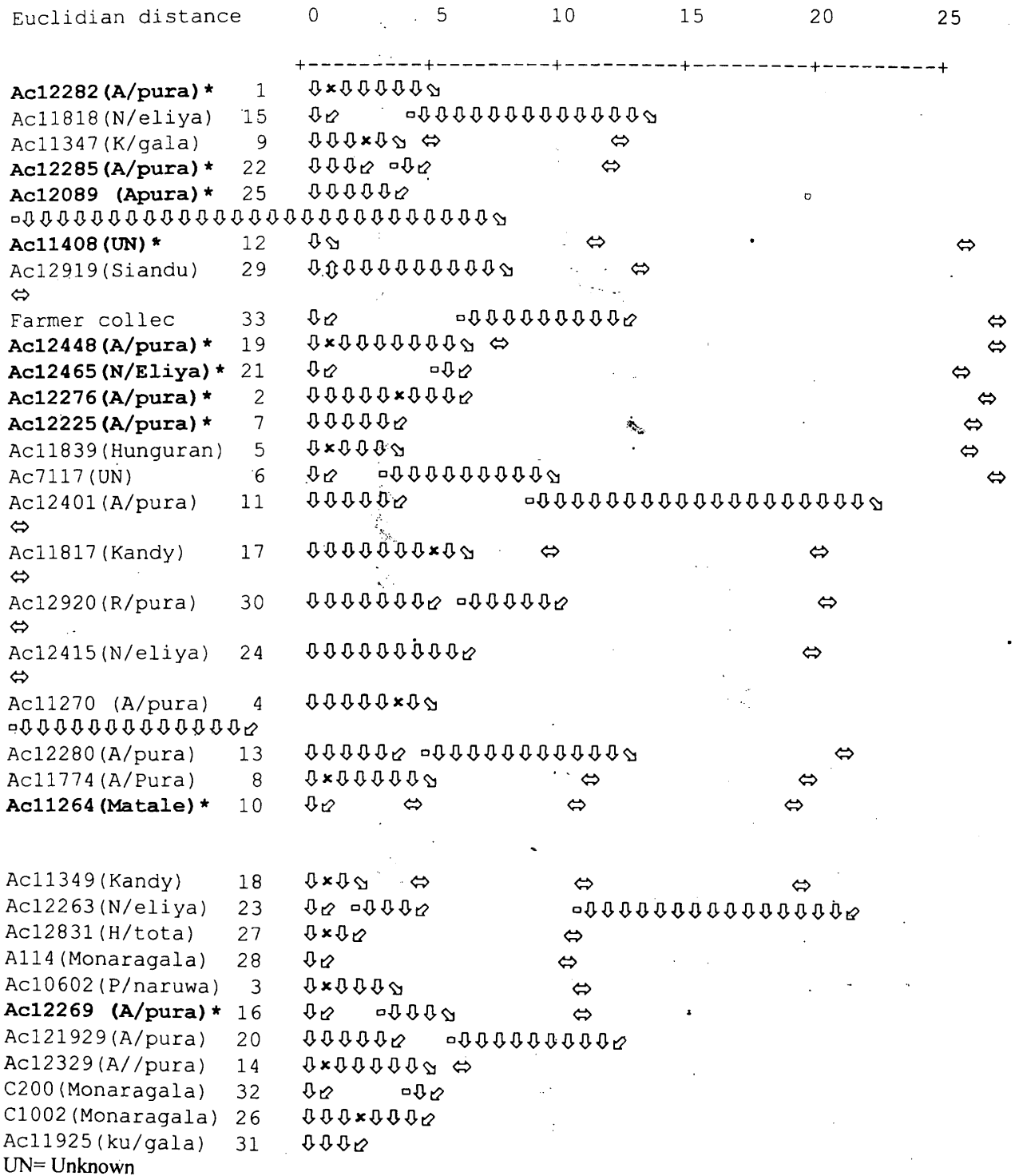
Euclidian distance

| | 0 | 5 | 10 | 15 | 20 | 25 |


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Euclidian distance        0      5      10     15     20     25
                         +--------+--------+--------+--------+--------+
Ac12282(A/pura)*     1
Ac11818(N/eliya)    15
Ac11347(K/gala)      9
Ac12285(A/pura)*    22
Ac12089 (Apura)*    25

Ac11408(UN)*        12
Ac12919(Siandu)     29

Farmer collec       33
Ac12448(A/pura)*    19
Ac12465(N/Eliya)*   21
Ac12276(A/pura)*     2
Ac12225(A/pura)*     7
Ac11839(Hunguran)    5
Ac7117(UN)           6
Ac12401(A/pura)     11

Ac11817(Kandy)      17

Ac12920(R/pura)     30

Ac12415(N/eliya)    24

Ac11270 (A/pura)     4

Ac12280(A/pura)     13
Ac11774(A/Pura)      8
Ac11264(Matale)*    10


Ac11349(Kandy)      18
Ac12263(N/eliya)    23
Ac12831(H/tota)     27
A114(Monaragala)    28
Ac10602(P/naruwa)    3
Ac12269 (A/pura)*   16
Ac121929(A/pura)    20
Ac12329(A//pura)    14
C200(Monaragala)    32
C1002(Monaragala)   26
Ac11925(ku/gala)    31
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UN= Unknown

Figure 1: Dendrogram of finger millet accessions based on morphological characteristics.

Table 1: Average performances of finger millet accessions for measured morphological characteristics

Acc No	Plant height cm	No of tillers	No of fingers	Dry weight of 20 panicles (g)	Seed weight of 20 panicles (g)	Milling %	1000 seed weight (g)
acc 12282*	91.0	5.4	8.4	215.0	160.9	74.8	2.5
acc 12276*	97.9	4.8	9.2	187.0	156.1	83.5	2.6
acc 10602	81.6	4.8	7.0	112.1	93.5	83.4	2.4
acc 11270	77.2	5.8	10.2	137.7	113.8	82.7	2.8
acc 11839	65.5	8.6	6.2	76.6	54.9	71.7	2.3
acc 7117	67.0	2.8	4.6	74.0	53.7	72.5	2.7
acc 12225*	84.6	5.6	6.2	183.3	153.0	83.5	2.7
acc 11774	82.6	7.2	7.8	156.8	128.2	81.8	2.5
acc 11347	86.8	3.6	6.4	213.7	175.1	81.9	2.6
acc 11264*	79.6	2.0	9.2	162.8	131.4	80.7	2.9
acc 12401	70.6	6.8	9.6	86.5	60.4	69.8	2.5
acc 11408*	78.4	4.6	7.2	176.1	138.5	78.6	2.7
acc 12280	89.2	4.4	8.0	145.7	114.5	78.5	2.2
acc 12329	77.6	4.8	7.0	129.6	101.2	78.1	2.7
acc 11818	86.0	3.2	8.0	218.4	160.6	73.5	2.8
acc 12269*	79.2	4.2	6.6	118.2	100.3	84.9	2.6
acc 11817	43.2	6.2	7.4	92.3	70.1	75.9	2.7
acc 11349	66.2	3.6	6.8	150.0	124.8	83.3	2.8
acc 12448*	69.0	4.2	7.2	189.0	160.4	84.9	2.5
acc 12192	80.6	6.2	7.6	107.8	83.7	77.7	2.7
acc 12465*	75.6	3.4	6.6	195.5	160.5	82.1	2.7
acc 12285*	77.2	2.8	7.4	212.3	172.7	81.4	2.7
acc 12263	70.4	4.5	7.4	146.2	126.4	86.5	2.8
acc 12415	53.6	3.2	3.8	107.1	82.7	77.2	2.8
acc 12089*	77.4	4.6	9.2	226.8	180.3	79.5	3.1
acc 11332	54.8	6.0	8.4	127.7	102.7	80.4	2.3
acc 12831	77.6	6.2	6.2	142.7	121.0	84.8	2.3
c114	75.2	3.6	7.2	150.0	123.4	82.3	2.2
acc 12919	76.6	4.6	7.2	173.2	132.2	76.3	2.6
acc 12920	60.0	9.6	6.4	89.6	73.7	82.3	2.0
c800	61.0	6.8	6.0	121.2	97.0	80.0	2.4
c200	70.0	6.8	6.0	129.2	100.3	77.6	2.4
Farmer collect	74.4	4.2	5.4	174.2	143.2	82.2	2.4

Ten better performing lines (Ac12282, Ac12276, Ac12225, Ac11264, Ac11408, Ac12269, Ac12448, Ac12465, Ac12285and Ac12089) were selected based on weight of dried panicle, seed weight of panicle and milling percentage (Table 1). Out of the ten best yield performers eight belonged to one major cluster resembling the close relatedness of the accession having better yield performances. As most of them were from the similar geographic areas (Anuradapura) they were most probably coming from the same genetic background. Germplsm samples collected from Monaragala and Hambantota could not be attributed to better yield characteristics.

Conclusion

Considerable amount of genetic diversity was presented within the evaluated local finger millet accessions.

References

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