

DNA Fingerprinting of Yam Cultivars Using Microsatellite (SSR) Markers for Identification of Synonyms and Homonyms

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- Yams (*Dioscorea* spp.) are monocotyledonous, Family: *Dioscoreaceae* with over 600 species
- Six economically important cultivated species: *D. rotundata*, *D. alata*, *D. cayenensis*, *D. bulbifera*, *D. dumetorum*, and *D. esculenta*
- Constitute over 90% of the food yams produced in the tropics
- 90% of world production from Africa accounting to 21% of root and tuber consumption
- Nigeria produces over 70% of yams
- *D. rotundata* (white yam/Guinea yam) contributes 80% of yams from West Africa

Synonyms and Homonyms

- Several varieties of yams (improved cultivars and local landraces) grown by the farmers in West Africa are mostly known by their local names
- These includes synonyms (different names for the same variety) and homonyms (same name for different varieties)
- Accurate identification of varieties is critical to the production and distribution of quality planting materials.
- Identification of yam cultivars using morphological characteristics requires expertise and trait analysis at different developmental stages of the crop



List of Accessions from Nigeria and Ghana

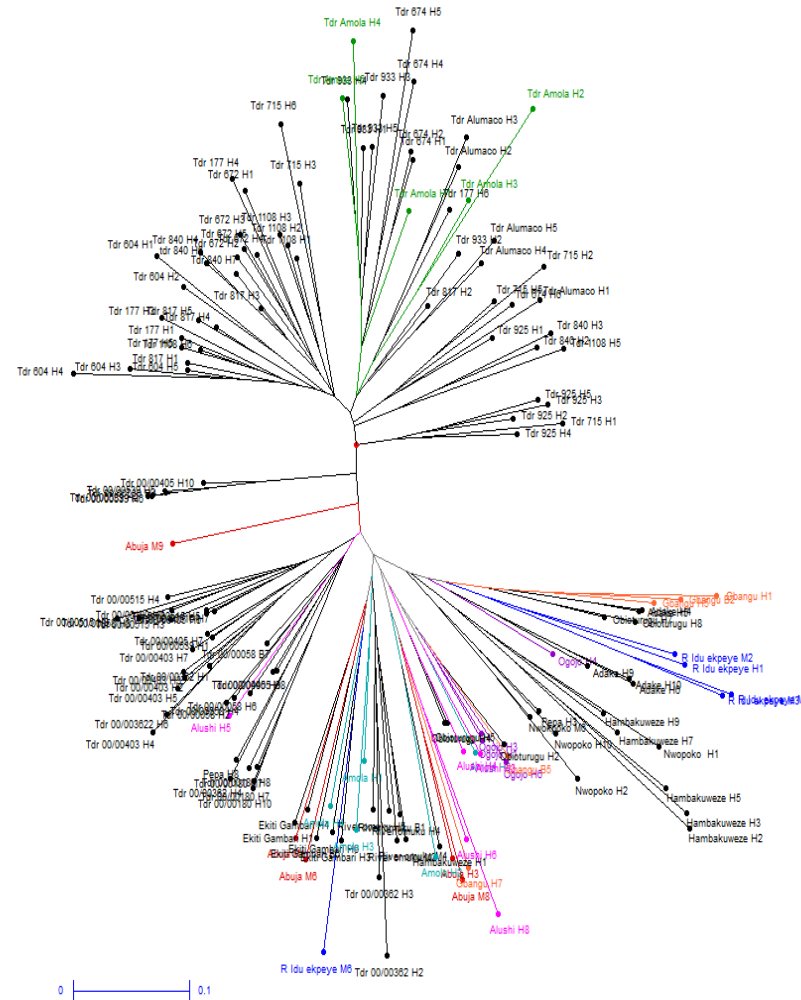
S/No.	Accession	DISTRICT	Pona	Labako	Fuseini	Fushem bla	Nim o	Asobay ere	Kasobay ere	Bush yam	Taila	Baaf u	Munti um	Dent e	Much o	
1	Makakusa															
2	Dan anachia (Idu epeye)															
3	Ekiti Gambari															
4	Dan anachia (R. Omuku)	NANUMBA	2	2												
5	Amola															
6	Ogoja	Savelugu/Nantong	1	1						1						
7	Gbangu															
8	Obioturugu	Mion	2		1											
9	Adaka		1	1												
10	Alushi		1	1		1										
11	Hambakuweze		1	1												
12	Nwopoko		1	1												
13	Pepa	Tolon		1												
14	Tdr 00/00362		1	1								1				
15	Tdr 00/00403		1	1												
16	Tdr 00/00539		1	1												
17	Tdr 00/00405	East Gonja		2												
18	Tdr 00/00515		2	2												
19	Tdr 00/00058									2						
20	Tdr 00/00180															
21	Tdr 89/02672	Zabzugu														
22	Tdr 94/01108			2	1											
23	Tdr 95/19 177		2	2						1						
24	Tdr 96/00604		2	2												
25	Tdr 96 /01817	Brong-ahafo	2	2									1			
26	Tdr 97/ 00840	Brong-ahafo	1	1	1			1	1							
27	Tdr97/00 925	Ashanti	2	2	2		2	2	2		2					2
28	Tdr 97/01715	Northern	1	1											1	
29	Tdr 98/00933															
30	Tdr 99/02674															
31	Tdr Alumaco															
32	Tdr Amola															

Nigeria: List of SSR markers

Marker	Major.Alele.Frquency	AlleleNo	GeneDiversity	PIC
D 39	0.1410	38.0000	0.9486	0.9464
Da1C12	0.8141	5.0000	0.3202	0.2975
Da1A01	0.9423	4.0000	0.1100	0.1062
Da1F08	0.2628	11.0000	0.8361	0.8166
YM 26	0.3333	8.0000	0.8095	0.7871
D 55	0.4872	5.0000	0.6648	0.6139
Dab2C05	0.4872	9.0000	0.6827	0.6427
Dab2C12	0.3397	8.0000	0.7536	0.7171
Dpr3F04	0.2115	13.0000	0.8600	0.8450
D 47	0.6474	7.0000	0.5447	0.5138
YM 30	1.0000	1.0000	0.0000	0.0000
D 24	0.1667	24.0000	0.9066	0.8996
D 3	0.7628	7.0000	0.4038	0.3871
D 2	0.3333	11.0000	0.7947	0.7681
D ab2D08	0.2821	12.0000	0.8017	0.7749
Mean	0.4808	10.8667	0.6291	0.6077

Software used: PowerMarker

Dendrogram: Clustering of Varieties from Nigeria



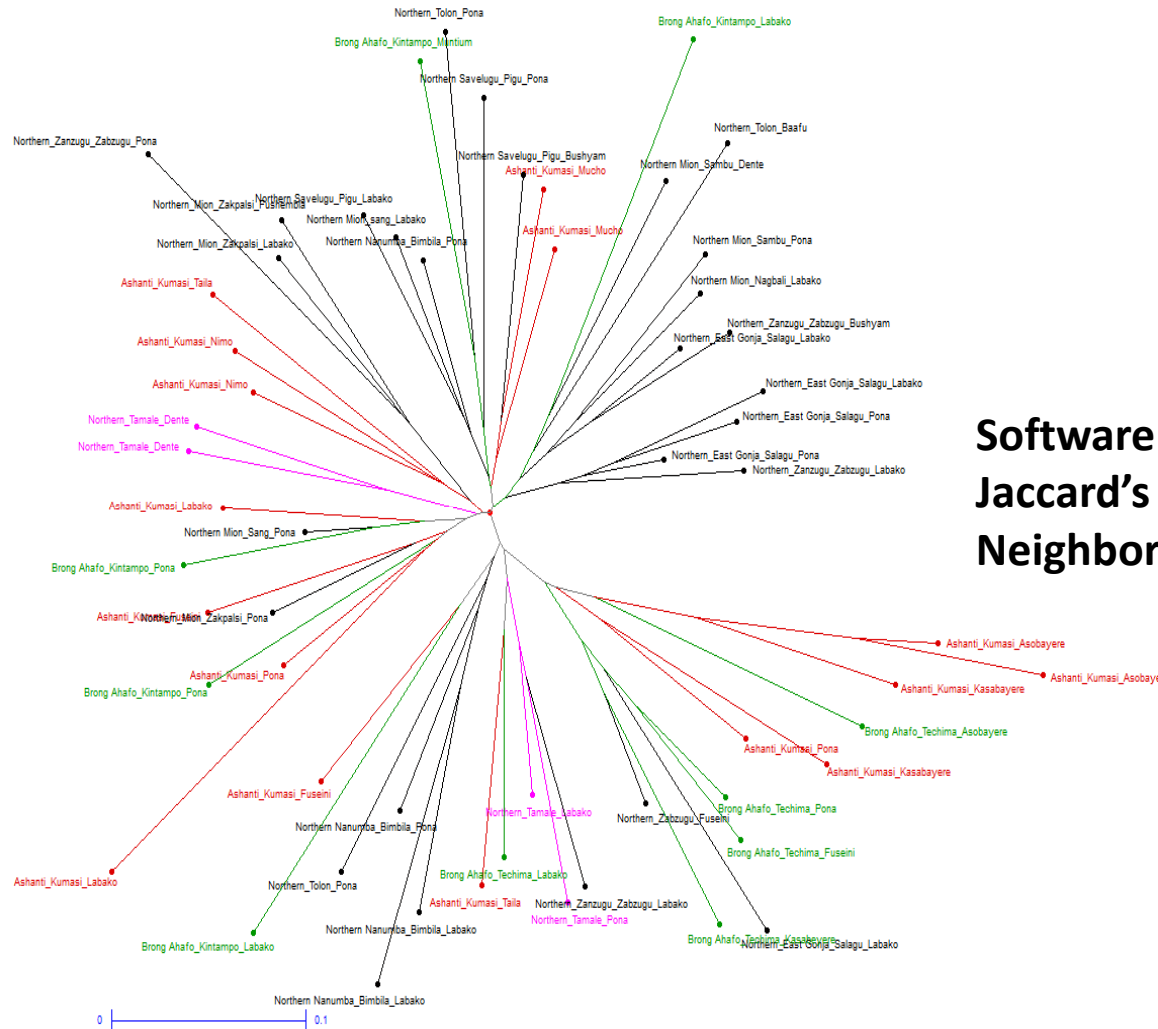
Software used: DarWin 5.0
Jaccard's dissimilarity method
Neighbor-joining clustering

List of SSR Markers: Ghana

Marker	Major.Allele.Frequency	AlleleNo	GeneDiversity	PIC
YM26	0.5862	6.0000	0.6070	0.5718
D47	0.5862	7.0000	0.6177	0.5902
D49	0.8103	5.0000	0.3300	0.3123
DPr3D04	0.5862	6.0000	0.5820	0.5299
Da1D08	0.3103	14.0000	0.8312	0.8140
D24	0.4483	9.0000	0.6920	0.6469
Da1A01	0.4655	7.0000	0.7063	0.6699
D100	0.6552	10.0000	0.5523	0.5362
D31	0.2069	20.0000	0.8977	0.8899
YM13	0.4655	18.0000	0.7444	0.7268
D58	0.7759	8.0000	0.3882	0.3764
D10	0.9310	2.0000	0.1284	0.1202
Da1F08	0.2241	12.0000	0.8603	0.8452
D39	0.3103	14.0000	0.8246	0.8056
Dab2C05	0.8103	5.0000	0.3294	0.3109
D76	0.4828	4.0000	0.6611	0.6058
Da1C12	0.4483	7.0000	0.7045	0.6635
YM30	0.5172	5.0000	0.5844	0.5040
Dab2C12	0.8103	4.0000	0.3276	0.3068
Dab2D08	1.0000	1.0000	0.0000	0.0000
D51	0.5862	6.0000	0.5815	0.5289
D50	0.3621	8.0000	0.7842	0.7576
D70	0.2759	12.0000	0.8413	0.8238
Mean	0.5502	8.2609	0.5903	0.5625

Software used: PowerMarker

Dendrogram: Varieties from Ghana



Software used: DarWin 5.0
Jaccard's dissimilarity method
Neighbor-joining clustering

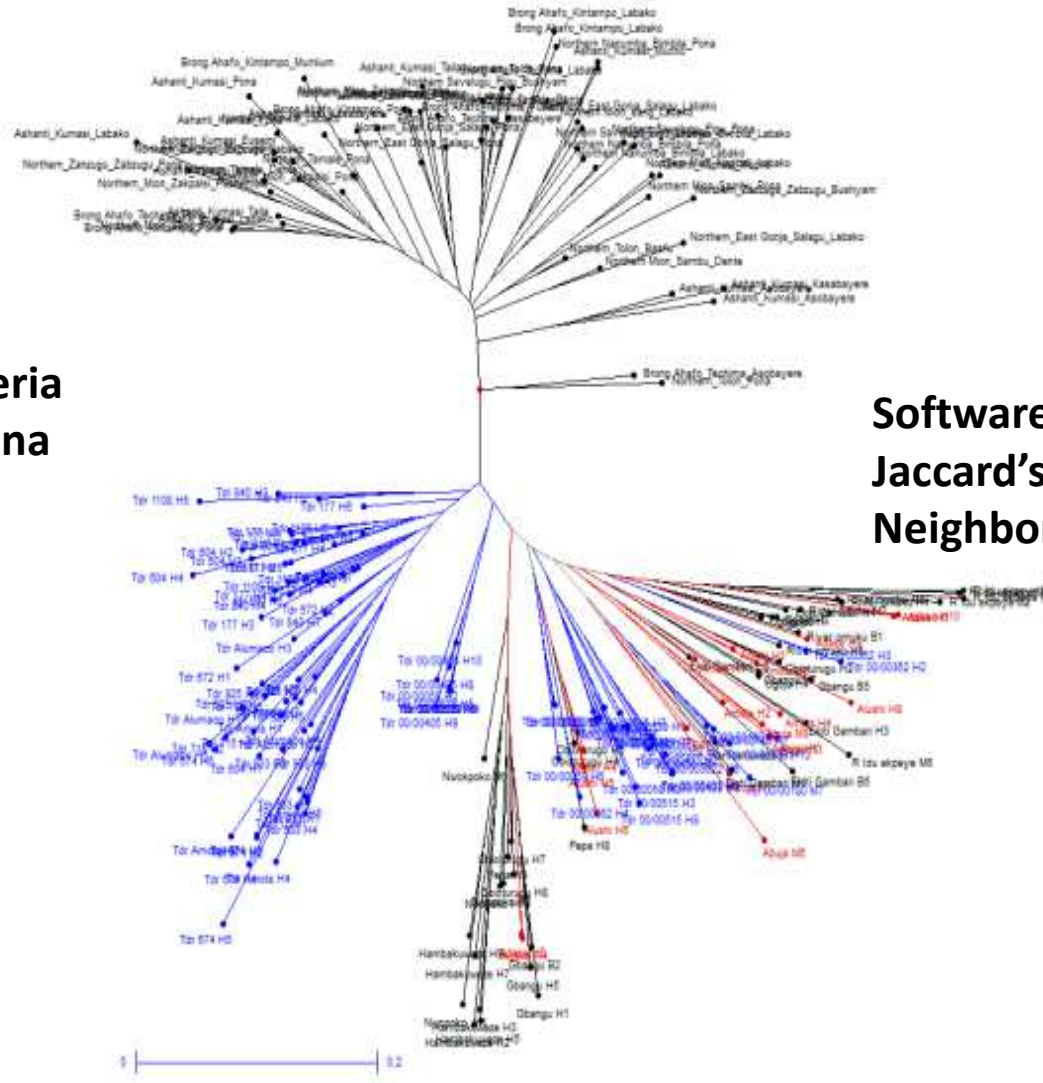
List of SSR Markers:Common

Marker	Major.Allele.Frqency	AlleleNo	GeneDiversity	PIC
YM26	0.4019	9.0000	0.7723	0.7478
D47	0.5000	11.0000	0.7011	0.6751
D24	0.1355	27.0000	0.9204	0.9150
Da1A01	0.8131	7.0000	0.3310	0.3206
Da1F08	0.1916	18.0000	0.8941	0.8851
D39	0.1028	41.0000	0.9536	0.9517
Dab2C05	0.5748	12.0000	0.6257	0.5960
Da1C12	0.6682	9.0000	0.5279	0.5047
YM30	0.7336	5.0000	0.4313	0.3980
Dab2cC12	0.4673	9.0000	0.6943	0.6534
Dab2D08	0.2710	13.0000	0.8212	0.7981
Mean	0.4418	14.6364	0.6975	0.6769

Software used: PowerMarker

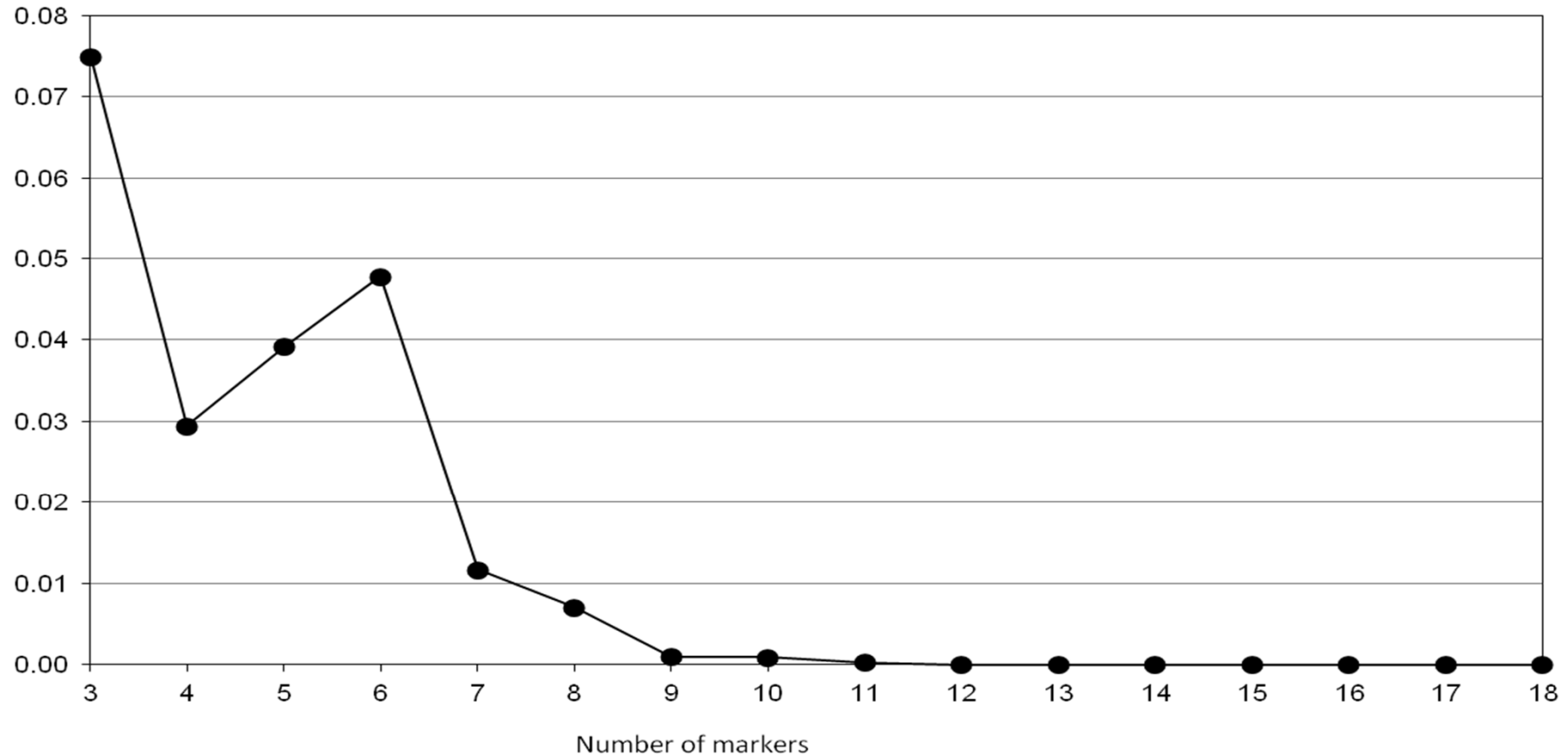
Dendrogram: Varieties from Nigeria and Ghana

60 varieties: Nigeria
58 varieties: Ghana



Software used: DarWin 5.0
Jaccard's dissimilarity method
Neighbor-joining clustering

P (MRD \leq 0.15)



Statistical cut-off for genetic distances: With the increase in the number of markers, P (MRD \leq 0.15) diminishes: if more markers are added, the probability of differentiating accessions increases.

- A total of 59 and 94 alleles were recorded across 15 and 23 SSRs with a mean of 3.93 and 4.08 for samples from Nigeria and Ghana, respectively.
- The dendrogram showed Local varieties grouped together in one cluster while improved lines grouped in Clusters 2 and 3 for samples from Nigeria.
- Few improved lines grouped together with landraces: a probability that popular name (s) are being used for marketing purpose resulting in **synonymy**.
- The dendrogram showed that the tubers collected from different yam growing regions of Ghana with different names grouped together in the same cluster.
- The situation in Ghana indicates the use of popular preferred name (s), related to preference, taste or marketing but are genetically different resulting in **homonymy**.
- The combined dendrogram showed that the samples from Nigeria and Ghana grouped in two different clusters and may be a situation of **homonymy or synonymy**.

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