

An Online Checklist of Banana Cultivars

R. Crichton¹, A. Vezina¹ and I. Van den Bergh²

¹Bioversity International/CGIAR Research Program on Roots, Tubers and Bananas (RTB), Parc Scientifique Agropolis II, 34397, Montpellier Cedex 5, France

²Bioversity International/CGIAR Research Program on Roots, Tubers and Bananas (RTB), W. De Croylaen 42, 3001 Heverlee, Belgium

Keywords: Classification, varieties, *Musa*, nomenclature, plantain, ProMusa, taxonomy.

Abstract

Banana cultivars have been given a multitude of names which is a reflection of both their morphological diversity and of the socio-linguistic diversity of the people naming them in numerous local languages around the world. The many names for banana cultivars, including synonyms and homonyms, in combination with further difficulties in cultivar description and classification means that we cannot accurately quantify such important details as how many cultivars there are and where they are distributed. We have created the Online Checklist of Banana Cultivars on the ProMusa website to bring the large amount of existing information on banana cultivar names and related relevant information into one easily accessible and searchable resource (<http://www.promusa.org/Banana+cultivar+checklist>). As of 08 August 2014 the Online Checklist of Banana Cultivars contains 6965 entries, with 4911 unique local names, corresponding to 1940 cultivars, in 39 subgroups, in 15 groups, in 93 locations, with the information being sourced from 38 references. We hope that the checklist will be a valuable resource for the banana community and that it will stimulate efforts to resolve outstanding issues related to the description, nomenclature and classification of the banana cultivars, including arriving at an internationally accepted name for each cultivar and elucidating a well-defined classification system.

INTRODUCTION

Banana cultivars have been given a multitude of names which is a reflection of both their morphological diversity and of the socio-linguistic diversity of the people naming them in numerous local languages around the world (Jacob, 1952; Stover and Simmonds, 1987; Rossel, 1998; Swennen, 1990). Within the vernacular names for banana cultivars are a high number of synonyms – different names for the same cultivar; and homonyms – the same name for different cultivars. For instance, the commercial cultivar ‘Poovan’ (AAB genome, Mysore subgroup) has at least 27 synonyms in India alone (Singh et al., 2001), including ‘Rasthali’, ‘Sugandam’ and ‘Ladiyachampa’ (Uma and Sathiamoorthy, 2002), while the name ‘Lady’s Finger’ is used as a homonym to refer to a Pome (AAB) cultivar in India (Uma and Sathiamoorthy, 2002), a Muraru (AA) cultivar in Eastern Africa (Karamura et al., 2012), and a Sucrier (AA) cultivar in Hawaii (Simmonds, 1966), amongst others.

The many names for banana cultivars, including synonyms and homonyms – a situation “which bristles with great difficulties” (Jacob, 1952) is considered one of the “major problems in banana and plantain research” (De Langhe, 1990), and in combination with further difficulties in cultivar description and classification (discussed below) means

that we cannot accurately quantify such important details as how many cultivars there are and where they are distributed. As a consequence, we cannot, for example, readily target in-situ conservation/on-farm management activities or germplasm collecting missions to the regions with the greatest diversity of cultivars, or subgroups, or (genome) groups. Nor can we easily monitor cultivar diversity dynamics over time and space, in response to, e.g. the arrival of pests and diseases or the introduction of synthetic hybrids with high yields; nor state with conviction how representative ex-situ collections are of the in-situ genetic diversity.

However, the huge number of names for banana cultivars “need not be an insurmountable obstacle if a well cross-indexed check list is available for the tracing of local names” (Allen, 1965) and indeed, many researchers have created such checklists for specific regions and/or subgroups (e.g. Allen, 1965; Simmonds, 1966; Rossel, 1998; Swennen, 1990; Uma and Sathiamoorthy, 2002; Valmayor et al., 2002; Kepler and Rust, 2011; Karamura et al., 2012).

In an effort to bring the large amount of existing information on banana cultivar names and related relevant information into one easily accessible and searchable resource, we have created a checklist of banana cultivars on the ProMusa website: <http://www.promusa.org/Banana+cultivar+checklist>. This paper describes the development and structure, the current content and uses, the current limitations, and the next steps for the Online Checklist of Banana Cultivars.

THE DEVELOPMENT AND STRUCTURE OF THE CHECKLIST

The Online Checklist of Banana Cultivars was developed by the authors for the purpose of providing an exhaustive list of all the names that exist for banana cultivars, with associated information on their location, synonyms, classification, and related relevant information. The content of the checklist was sourced from published and unpublished references and continues to be regularly updated with new information. A beta version of the checklist was reviewed by a number of researchers from the banana community and their comments and suggestions were taken into account before it was made publicly available on 17 October 2013.

The structure of the checklist is described in Table 1. The information in the Local name and the Location fields is sourced from the citation in the Reference field and intended to be an exhaustive representation of banana cultivar names around the world. The Location information can be at the level of departments (e.g. Canary Islands, Hawaii), countries (e.g. Australia, Thailand) or regions (e.g. South America, Western Africa). The Reference field is linked to the citation for the source of information in Musalit (<http://www.musalit.org/>), where this exists. The Cultivar name field is intended to represent the most well-known name of the cultivar, of which the local names are synonyms. Where no synonyms were provided by the reference, the local name is also used as the cultivar name. All words in the Local and Cultivar names fields have been capitalized and accents or special characters (e.g. é, ü, ã, ç) removed due to incompatibilities with the software used to create the online checklist.

The information in the Cultivar, Clone set – Cluster, Subgroup, and Group fields is intended to represent the most accurate, up-to-date information that we have on banana cultivar classification, but this requires further work from the community (discussed below) and active curation. This information is predominantly sourced from the Reference but also from other sources of information, especially where, for example, research using modern genetic methods has shown that the Cultivar or Subgroup has a

different ploidy level than the one originally postulated by the authors of the Reference using morpho-taxonomic methods.

The Notes field contains further information on the local name and/or cultivar as provided by the reference; most frequently the English translation of the local name. The Page field contains a link to the cultivar page on the Musapedia cultivar diversity portal (<http://www.promusa.org/Diversity+of+banana+cultivars+portal>), if a page for the cultivar exists. The ID field shows the unique identification number of each entry, and the Coms field shows the number of comments made on the entry by users of the checklist, with a link to the comment/s.

THE CURRENT CONTENT AND USES OF THE CHECKLIST

As of 08 August 2014 the Online Checklist of Banana Cultivars contains 6965 entries, with 4911 unique local names, corresponding to 1940 cultivars, in 39 subgroups, in 15 (genome) groups, in 93 locations, with the information being sourced from 38 references. The current content is far from an exhaustive list of all banana names and therefore should not be considered definitive.

The checklist can be used by the research community to find referenced information on banana cultivar names, including synonyms and homonyms, their classification, geographic distribution, and other interesting information. For instance, filtering the checklist for the Cultivar name ‘Poovan’ shows that this cultivar has at least 53 reported synonyms (Local names) in India, which is nearly double the previously reported number of 27 synonyms (Singh et al. 2001); and filtering for the Group AB shows that cultivars of this group have a reported distribution in India, Sri Lanka, the Philippines, Papua New Guinea, the Solomon Islands, Hawaii, the Dominican Republic, Jamaica, the Caribbean, Guyana, Kenya, Tanzania, Uganda and Rwanda (Online Checklist of Banana Cultivars, 2013).

The Notes field provides interesting insights into the meaning of the Local names, for instance: from the Solomon Islands - ‘Broken Heart’, where to have a broken heart over something means that you love it very much, ‘Tohepusia’ which means not to share with (because it is so good), and ‘Huki Matawa’ which means banana from Heaven; from Thailand - ‘Klue Nom Sawan’ which means milk from Heaven, and ‘Klue Tiparot’ which means angel’s food banana; from Myanmar - ‘Pya-ye San’ which means spread with honey, and ‘Shwe Hnget-pyaw’ which means golden banana that the birds told humans they could eat; from Cameroon – ‘Do Koko’ which means fingers of gorilla, and ‘Sia Bako’ which means to look up at the sun, named because of the erect bunch (Online Checklist of Banana Cultivars, 2013).

THE CURRENT LIMITATIONS OF THE CHECKLIST

The Online Checklist of Banana Cultivars is as reliable as the content that it contains. Some of the issues noticed by the authors during the compilation of the checklist are briefly bullet-pointed below and we would request the community to be mindful of these when undertaking and publishing relevant work.

- The unintentional creation of synonyms (local names) through uncertainties in alphabet usage when recording or translating from one language to another, spelling mistakes, and ambiguous punctuation;
- A lack of cross-referencing of work on the banana cultivars in a region or subgroup to earlier work, leading to multiple, similar checklists that are relatively independent of one another;

- The compilation of checklists that rely on secondary sources of information, and thus may perpetuate earlier mistakes and may not accurately represent the status of banana cultivars in a region at the time of publication.

Furthermore, the Online Checklist of Banana Cultivars will never be able to provide a definitive account of banana cultivar abundance and distribution until the following issues of description, nomenclature and classification are resolved.

Description: Achieving the Comprehensive Morphotaxonomic Description of Banana Cultivars

The morphotaxonomic diversity of the banana cultivars is due to their genetic background (ploidy level and wild species contributions), somatic mutations, and phenotypic plasticity across crop cycles (time) and locations (space). According to De Langhe (1990), “Numerous researchers are convinced that the lack of standardized tools and methods for proper identification of cultivars is one of the basic reasons for the slow rate of progress in this crop”. It is therefore vital that morphotaxonomic characters of the banana cultivars are described using a comprehensive list of descriptors (e.g. IPGRI, 1996) that contain sufficient “necessary characters for identification” (Kepler and Rust, 2011) to allow the identification and circumscription of cultivars. It is also important that the interpretation of the character states is standardized amongst researchers so as not to introduce apparent morphological differences between cultivars due to an ‘observer effect’ (or ‘curator’, ‘researcher’ effect).

Nomenclature: Arriving at an Internationally Accepted Name for Each Banana Cultivar

The comprehensive description of banana cultivars would allow for the better detection of synonyms and homonyms amongst their given names. Once the synonymous names for a cultivar are known, one of them could be chosen to be used as the ‘internationally accepted name’ for the cultivar. As stated by Allen (1965), “It would be foolish to pretend that there is any such thing as a ‘correct’ common name of universal application but it is precisely there that the trouble lies”. Whilst it is generally recommended that people continue to use their own local names for the banana cultivars (Simmonds, 1966; Stover and Simmonds, 1987), at the very least the ‘internationally accepted’ cultivar name would be used in the Cultivar column of the Online Checklist of Banana Cultivars to link all the synonymous names in the Local names field together.

To aid this effort, we have included a ‘Name status’ column in the checklist to refer to the legitimacy of the Cultivar name as the internationally accepted name for the cultivar - this column is currently hidden but can be made visible once the community begins to take action towards this goal.

Classification: Elucidating a Well-defined Classification System for Banana Cultivars

The system of classification of the banana cultivars in common usage is the system developed by Simmonds and Shepherd (1955) that has the hierarchical levels of cultivar, occasionally clone set (Karamura, 1998; Pickersgill and Karamura, 1999) or some other intermediate group, subgroup, and (genome) group, as described in Table 1. However, as remarked upon many years later by one of the original authors, “This system was elaborated in the early 1950s, based on the observations, to some degree subjective, of one person working in a single environment. The intention then, as it is believed that

Simmonds would agree, was only to elucidate the genomic structure of the cultivars and not to create an international taxonomic tool, as the system has recently tended to become. For this purpose it has admitted weaknesses...” (Shepherd, 1990).

Though further elaborated upon in 1987 by Stover and Simmonds, the classification levels remain undefined and therefore the circumscription of the biological entities into cultivars, clone sets, subgroups and groups is not standardized amongst researchers, resulting in much confusion. For instance, Stover and Simmonds (1987) introduced the following inconsistency in the same paragraph: “... it is sometimes convenient to distinguish collectively a set of clones related to each other by bud mutation from a single original clone – thus we have the Cavendish subgroup of the AAA Group. ... Similarly we can use the name Plantain Subgroup even though it is far from certain that a single clone was the parent of the subgroup; possibly two or three related clones were responsible”.

Furthermore, the issue of synonymy also applies to the names of the subgroups, e.g. Lujugira-Mutika and EAHB (East African Highland bananas), Mysore and Poovan, Pome and Prata; as well as inconsistent spelling and/or punctuation, e.g. Popo’ulu and Popoulu.

To aid efforts towards defining the classification system of the banana cultivars and their first classification or revision into natural hierarchical groups, we have included a ‘Classification status’ column in the checklist to refer to the legitimacy of the classification structure - again this column is currently hidden but can be made visible once the community begins to take action towards this goal.

CONCLUSIONS AND NEXT STEPS FOR THE CHECKLIST

As stated by Cheesman as long ago as 1932, “Since difficulties of nomenclature and classification cause much confusion in the literature of this group [banana cultivars], all names employed in the present study are as non-committal as possible. ...in the present state of knowledge it seems better to use only varietal names for cultivated clones. Even with these caution is necessary, and little reliance can be placed on apparent or reported synonymy, because the group is particularly difficult to study systematically on any but living material”. The resolution of the above-mentioned long-standing issues in the description, nomenclature and classification of the banana cultivars – in combination with the standardized adoption and application of the solutions by the research community on living material around the world – would enable us to authoritatively answer many of the outstanding questions we have regarding banana cultivar evolution, abundance and distribution.

We hope the Online Checklist of the Banana Cultivars will be a valuable resource for the banana community, both as a source of information on the cultivars and as a tool to monitor the progress towards arriving at an internationally accepted name for each cultivar, and elucidating a well-defined classification system. We will continue to update the checklist with information from more references and experts and we request submissions of information from all members in the community (please contact the corresponding author r.crichton@cgiar.org or the manager of the ProMusa website musapedia@promusa.org).

The suggested citation for the checklist is: Online Checklist of Banana Cultivars. 2013. <http://www.promusa.org/Banana+cultivar+checklist>. (accessed DD/MM/YYYY).

ACKNOWLEDGEMENTS

The authors wish to acknowledge colleagues in Bioversity International's Commodity Systems & Genetic Resources programme, and members of the ProMusa and MusaNet networks who tested the Online Checklist of Banana Cultivars before it was publicly available and provided useful comments on its functionality. The authors are grateful for financial support from the CGIAR Research Program on Roots, Tubers and Bananas (RTB, <http://www.rtb.cgiar.org/>).

Citations

- Allen, P.H. 1965. Annotated index of Philippine *Musaceae*. Philippine Agriculturist 49:320-411.
- Cheesman, E.E. 1932. Genetic and cytological studies of *Musa*. I. Certain hybrids of the Gros Michel banana. Journal of Genetics 26:291-312.
- De Langhe, E. 1990. Identification of genetic diversity in the genus *Musa*: a general introduction. Identification of Genetic Diversity in the Genus *Musa*. Los Baños, Philippines 05-10 September 1988. p. 8-16.
- IPGRI. 1996. Descriptors for banana (*Musa* spp.). IPGRI, Rome.
- Jacob, K.C. 1952. Madras Bananas: a Monograph. The Superintendent Government Press, Madras.
- Karamura, D.A. 1998. Numerical taxonomic studies of the East-African Highland bananas (*Musa* AAA-East Africa) in Uganda. Ph.D. Thesis. University of Reading, UK.
- Karamura, D.A., Karamura, E. and Tinzaara, W. (eds.). 2012. Banana Cultivar Names, Synonyms and their Usage in East Africa. Bioversity International, Kampala.
- Kepler, A.K. and Rust, F.G. 2011. The World of Bananas in Hawai'i: Then and Now. Traditional Pacific and Global Varieties, Cultures, Ornamentals, Health and Recipes. Pali-O-Waipio press, Hawaii.
- Online Checklist of Banana Cultivars. 2013. <http://www.promusa.org/Banana+cultivar+checklist>. (accessed 08/08/2014).
- Pickersgill, B. and Karamura, D.A. 1999. Issues and options in the classification of cultivated bananas, with particular reference to the East African Highland bananas. Proc. Third International Symposium on the Taxonomy of Cultivated Plants. Edinburgh, UK 20-26 July. p. 159-167.
- Rossel, G. 1998. Taxonomic-linguistic study of plantain in Africa. Ph.D. Thesis. University of Leiden, Netherlands.
- Shepherd, K. 1990. Observations on the Simmonds-Shepherd system of genomic classification of banana cultivars. *Musa* Conservation and Documentation. Leuven, Belgium 11-14 December 1989. p. 47.
- Simmonds, N.W. and Shepherd, K. 1955. The taxonomy and origins of the cultivated bananas. Journal of the Linnean Society of London: Botany 55:302-312.
- Simmonds, N.W. 1966. Bananas. Second Edition. Tropical Agricultural Series. Longman, New York.
- Singh, H.P, Uma, S. and Sathiamoorthy, S. 2001. A Tentative Key for Identification and Classification of Indian Bananas. NRCB (ICAR), Tiruchirapalli.
- Stover, R.H. and Simmonds, N.W. 1987. Bananas. Third Edition. Tropical Agricultural Series. Longman, New York.

- Swennen, R. 1990. Limits of morphotaxonomy: names and synonyms of plantains in Africa and elsewhere. Identification of Genetic Diversity in the Genus *Musa*. Los Baños, Philippines 05-10 September 1988. p. 172-210.
- Uma, S. and Sathiamoorthy, S. 2002. Names and Synonyms of Bananas and Plantains of India. NRCB (ICAR), Tiruchirapalli.
- Valmayor, R.V., Espino, R.R.C. and Pascua, O.C. 2002. The Wild and Cultivated Bananas of the Philippines. PARRFI, Los Baños.

Tables

Table 1. The structure of the Online Checklist of Banana Cultivars.

Field	Description
ID	The unique identification number of each entry.
Page	The link to the cultivar page on the Musapedia cultivar diversity portal, if a page for the cultivar exists.
Local name	The local name of the cultivar.
Location	The location where the local name is used.
Reference	The reference from which the information in the Local name and Location fields was sourced, with a link to the citation of the reference in MusaLit.
Cultivar	The most well-known name of the cultivar that the local name is referring to.
Clone set – Cluster	The occasionally used classification level between cultivar and subgroup.
Subgroup	The classification level used to denote a natural grouping of related cultivars.
Group	The classification level used to denote the genetic background of the subgroup, most frequently the ploidy level and the presumed proportion of contributions to the genome by the ancestral wild species <i>M. acuminata</i> and <i>M. balbisiana</i> using the system developed by Simmonds and Shepherd (1955).
Notes	Related relevant information, most frequently the English translation of the Local name.
Coms	The number of comments made on the entry by users of the checklist, with a link to the comment/s.