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REVIEW OF THE HISTORY, TAXONOMY AND NOMENCLATURE OF *ENSETE* AND THE OBJECTIVES AND EXPECTATIONS OF THE INTERNATIONAL WORKSHOP ON *ENSETE VENTRICOSUM* (WELW.) CHEESMAN

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ABSTRACT: The history, taxonomy and nomenclature of the genus *Ensete* and particularly the Ethiopian enset, *E. ventricosum*, have been put in African and global perspective; although the genus *Ensete* occurs widespread in Africa, on Madagascar and in parts of Asia, and the species *E. ventricosum* is widespread in tropical Africa, the early history of its scientific study is closely linked to Ethiopia, where it is domesticated. A full synonymy of the genus *Ensete* has been compiled in an appendix. The objectives of the International Workshop on "Enset (*Ensete ventricosum*) for Sustainable Development: Current Research Trends, Gaps and Future Direction for a Coordinated Multidisciplinary Approach in Ethiopia" are outlined. It is intended to bring together researchers from both the natural and social sciences in order to capture the wealth of vital scientific information from various research areas carried out in the past four to five decades and identify research gaps in their areas of expertise. On the way forward to reach a consensus on the need to fill the gaps identified, for a concerted effort for a multidisciplinary approach, the scientific results from research to feed into policy and the identification of a centre of excellence for enset research and its sustainable use through a declaration.

Key words/phrases: Enset (*Ensete ventricosum*), Research and research gaps, Unique Ethiopian crop, Way forward.

INTRODUCTION

Enset, with the scientific name *Ensete ventricosum* (Welw.) Cheesman, is a very important crop in Ethiopia, and it was first described in the scientific literature as an Ethiopian food plant. It is therefore of interest to place it in a wider context, historical and geographical. In the *Flora of Ethiopia and Eritrea* the enset plant is described like this in the family *Musaceae* (Lye and Edwards, 1997): a robust perennial monocot plant with swollen base up to 3 m in circumference and the pseudo-trunk (false stem, formed of leaf-bases) growing to about 12 m tall, but usually less. Leaves in a basal rosette

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when young, oblong to oblanceolate, 7 x 1 m, bright to dark-green, with midrib and other parts of the leaf sometimes pale to dark red or dark purple, rarely the whole lower side of the leaf reddish (Fig. 1a).

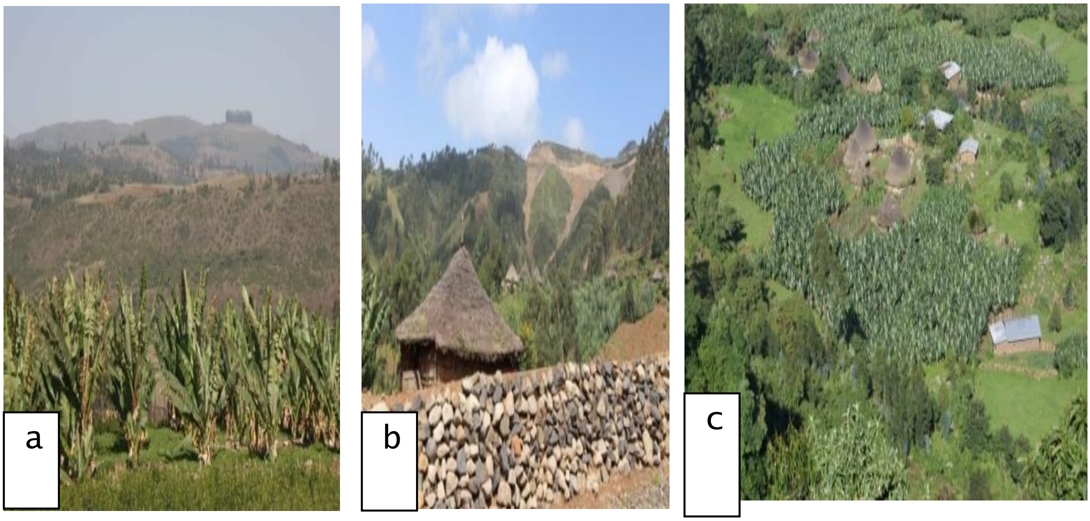

Fig. 1. Habit (left) and varied habitat (b and c).

The *Flora of Ethiopia and Eritrea* has recorded the scientific naming of the enset plant from the point of view of Ethiopia and left out information from the rest of the distribution area, apart from the original collection of *Musa ventricosa* Welw. made in Angola. Here, it is sufficient to give the same information in slightly corrected form and with full titles of the articles, books and journals in which the observations were published and new names proposed. However, the full story of how *Ensete ventricosum* got its scientific name is an interesting tale from history of science, and it is narrated in detail in Appendix 1.

Ensete ventricosum (Welw.) Cheesman in *Kew Bulletin* 2(2): 101. 1948 [1947 publ. 12 Apr 1948];

Musa ventricosa Welw. [Welwitsch] in *Annaes do Conselho Ultramarino, Parte nao official* 1: 587 [no. 45] (1859) - type: Angola, Pungo Andongo, rocky place at small stream, *Welwitsch* 6447 (LISU, BM, K isotypes, specimen at K selected lectotype by Baker and Simmonds, 1954: 405).

Musa ensete J.F. Gmelin in *Caroli a Linné. Systema naturae per regna tria naturae: secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Editio decima tertia, aucta, reformata*, Vol. 2(2): 567 (1791); *Ensete edule* P. F. Horaninow, *Prodromus monographiae*

Scitaminarum: 40. (1862) – type: Ethiopia, plates between p.36 and 37 in J. Bruce, *Travels to discover the source of the Nile, in the years 1768, 1769, 1770, 1771, 1772, and 1773: in five volumes. Volume 5. Select specimens of natural history, collected in travels to discover the source of the Nile, in Egypt, Arabia, Abyssinia, and Nubia* (1790).

E. ventricosum (Welw.) Cheesman var. *montbeliardii* (Bois) Cufodontis in *Bulletin du Jardin Botanique National de Belgique* 42(3, supplementum, "*Enumeratio plantarum aethiopiae spermatophyta*"): 1593 (1972); *Musa ensete* Gmel. var. *montbeliardii* Bois in *Bulletin du Muséum National d'Histoire Naturelle*, 2e série, Vol. 2: 688 (1931) – type: Ethiopia, Shewa, near Addis Abeba, *M. De Scey-Montebeliard* s.n. (no original material traced).

For the rest of Africa, synonyms of *Ensete ventricosum* have a much more complicated history, with synonyms from almost all parts of the continent. In the taxonomy of the species of *Ensete* in Africa and Asia not all questions have been solved. In Appendix 2, there is a review of the recent views on the synonyms of *Ensete ventricosum*, as well as of the two other currently recognized species of *Ensete* in Africa, *E. homblei* (De Wild.) Cheesman and *E. livingstonianum* (J. Kirk) Cheesman, of the three Asian species, *E. glaucum* (Roxb.) Cheesman, *E. superbum* (Roxb.) Cheesman and *E. lasiocarpa* (Franchet) Cheesman and of the one Malagasy species, *E. perieri* (Claverie) Cheesman. The review of the entire genus in Appendix 2 is a critical compilation of general information in Väre and Häkkinen (2011), in Lebrun and Stork (2012), in WCSP (2018) and other sources for specific details, mainly from regional floras. These sources do not always agree, underlining the need for more general taxonomic studies of *Ensete*. In the context of the future research proposed in this workshop, it is relevant to know also about the other species in the genus.

As an example of the unresolved taxonomic problem in relation to *Ensete*, one can mention the taxonomic status of the Golden Lotus banana, a sacred plant to Buddhist monks in the tropical region of Yunnan and first described as *Musa lasiocarpa* Franchet in 1889, but transferred to *Ensete* by Cheesman as *E. lasiocarpa* (Franchet) Cheesman (1948) and to a monotypic genus, *Musella* (Franchet) H. W. Li (1978), as *M. lasiocarpa* (Franchet) H. W. Li (1978); later again Liu, Kress and Li (2010) found it to be part of the clade I(B) of *Ensete*, as a sister group to the three African species. However, further molecular studies (Li *et al*., 2010) showed it in an ambiguous taxonomic position, both as a sister group of the African species of *Ensete* and as a sister group of all species in the genus. In the former case, the species should remain in *Ensete*, in the latter case, the genus *Musella* should be re-erected; thus even the generic limits of *Ensete* remains unsolved for the moment.

It has been suggested by Laurent-Täckholm (1952) and supported by Baker and Simmonds (1954) that enset cultivation in Northeastern Tropical Africa, particularly in Nubia and possibly also in Northern Ethiopia, may go back thousands of years, to Neolithic time, in areas once in close contact with Egypt. The main evidence for this theory was pictorial representations on pottery; these pictures show plants with a number of characteristic feature of enset. However, Laurent-Täckholm's interpretation of the paintings as representing enset has not been supported by further evidence, and the theory has been rejected by most later researchers, for example Simoons (1965), who argued that evidence for enset cultivation in ancient Egypt is highly inconclusive, that the cultivation of enset for food in northern Ethiopia must be viewed as recent, and that peoples of southwestern Ethiopia are the likely candidates for enset domestication. Taye Bezuneh and Asrat Feleke (1966) and Taye Bezuneh *et al*. (1967) noted that enset has been cultivated as a food and fiber crop in Ethiopia for several centuries and Brandt (1996) attested the fact that its domestication and use as a food and fiber crop is restricted to Ethiopia. It is also documented that Enset farming is believed to be indigenous to Ethiopia (Ehret, 1979) and is a common feature of the farming systems in the south and south-western parts of the country and constitutes what is often termed the 'enset system' (Desalegn Rahmato, 1996). It is worth noting that Bruce (1790) reported that from conversations with people around Lake Tana he had, he was convinced that the enset was native in humid areas of southwestern Ethiopia (see Appendix 1). The various theories regarding domestication and early cultivation of enset was summarised on an ethnological background by Westphal (1975), but without a decisive conclusion. More ethnological and archaeological evidence for the early domestication of enset would be interesting (Fig. 1b and c).

Uses

Enset is a multipurpose crop providing a range of services such as food, forage, medicine, ritual, construction and environment protection, food, medicine, purposes. The different uses are attributed to the existence of different enset varieties (Yemane Tsehaye and Fassil Kebebew, 2006).

- Enset is primarily used as a starch crop as food in the form of amicho, where the inner part of the corm eaten boiled. Its products are also used for other purposes (Fig. 2) such as kocho (fermented material obtained from a mixture of decorticated leaf sheath and corm), bulla (water insoluble starchy product obtained by squeezing the scrapped leaf sheath and corm).
- However, there is also a long tradition for using enset as a vegetative ornamental plant. Bois (1931) quotes a French informant, who had lived in Ethiopia for decades, for information about the many varieties of enset with different uses, some for food and some for ornamental and social purposes. He claimed to have been informed about 40 forms with ornamental uses, many of which with more or less red leaves, either red from the beginning of their growth or with the red leaves developing with age. The red-leaved forms, he reported, were particularly appreciated among the Gurages, who would plant them near their houses.
- A few varieties of enset are reported to have medicinal and religious (ritual) significance for preventive treatment, healing and other therapeutic purposes, and as protection against evil spirits.
- The leaves are the most widely used of all wrapping material, particularly for butter and other products that need to be kept cool and moist. Temporary ovens for baking special bread are made out of Enset leaves on which smouldering dung cakes are placed.
- In Ethiopia the fiber of the plant is also widely used for making bags and ropes and for basketry. The strength is, however, less than that of *Musa textilis* or *Agave*, but is said to be resistant to sea water. It is estimated that about 600 tons of enset fiber per year is sent to the factories (Brandt *et al*., 1997).
- The male flowers produce copious pollen and the female much nectar, which attract large numbers of honeybees (although enset plants are only allowed to flower in the wild).
- Enset has also a number of socio-cultural importance, serving as a symbol for expressing condolence and other rituals (Gebre Yntiso, 1996; Shigeta, 1997; Worku Nida, 1996).

Fig. 2. Some uses of enset. a: food for humans; b: feed for cattle; c: for medicine and d: for fiber.

Enset has a perennial leaf canopy over the soil and a heavy mulch cover from leaf litter. Owing to the large leaves and 'open-tube like' leaf architecture, enset plants cultivated on hill slopes and can intercept rainwater and reduce soil erosion (Tesema Chekun, 1998; Tadesse Kippie, 2001).

Important attributes

Enset has a number of important attributes as a cultivated plant. First, the plant can be harvested at any time during the year and be harvested at any stage over a several year period. Second, enset foods can be stored for long periods. Third, the crop produces the highest starch yield per unit land area of any crop in Ethiopia. Fourth, the enset system has the highest human carrying capacity as evidenced by the population density of the enset growing regions as opposed to cereal growing regions. Owing to all these qualities, the enset farming system provides a long-term, sustainable food supply, with potentially low off-farm input. However, it responds well to fertilization and high nitrogen inputs give increased yields; as a perennial crop, human waste is sometimes used in young plantations. Enset suffers from a wide range of fungal, bacterial, viral and nematode infections, most of which are poorly characterized but lead to poor yields in second crops grown in the field. Bacterial wilt (*Xanthomonas campestris* pv. *musacearum*) has been a serious problem (Dagnachew Yirgou and Bradbury, 1968; 1974; Adane Abraham, 2018). There is probably some genetic variation in susceptibility between genotypes. Strict biosecurity measures including disinfection of tools after use on each plant, and removal and burning of infected material and replacement by other crops for several years, supported by intensive educational programmes and distribution of disease-free planting material, can control bacterial wilt and reduce disease pressure from other pathogens.

In cultivation, enset is planted at any time of the year and is traditionally propagated vegetatively. Unlike species in the genus banana (*Musa*), in which the stems are branched below ground and produce a clump of shoots above ground, it is widely reported in the literature that in the genus *Ensete* the entire plant is unbranched and monocarpic, meaning that each plant is supposed to die after flowering (Lock, 1993; Lock and Diniz, 2010). Indeed, most enset accessions do not produce suckers, although there are observations to the contrary, that some varieties produce suckers. This is interesting from a taxonomic, as well as from a practical point of view, and should be studied and reported on in more detail. The enset is propagated from cuttings or sometimes the outer part of harvested corms (after removal of the starchy centre), which are filled with manure and replanted. Fields are initially planted at high density, and thinned each year (to typically <1000 plants/ha) with the removed plants being used for animal feed, food or replanted in another field. There are substantial differences in agronomy between areas, although the contributions of genetic, environmental and cultural factors are not known. As mentioned above, the enset plant is monocarpic, flowering after 3 to 6 years (not greatly synchronized), and gives the highest starch yield when harvested as soon as floral initiation is observed. Early harvest gives poor yields of starch since the plant only stores reserves in the period leading up to flowering, and overexploitation of young plants has been a problem. There are several hundred named varieties or landraces of enset.

The recent phylogenies show that he genus is relatively sharply divided into Asian and African members, but little is known about the potential hybridization of these species, and experiments with possible gene transfer in breeding programmes has to our knowledge not been done. An overview of all described species is given in Appendix 2, but some of the species are not well defined. Among the species on the African mainland, *E. ventricosum* is particularly distinctive by its large seeds, which may be up to 23 mm in largest diameter (Lock and Diniz, 2010), while the seeds of the two other African species, *E. livingstonianum* and *E. homblei*, are less than 9 mm in largest diameter and it is possible that they are forms of one single variable species (Lock and Diniz, 2010). *Ensete* is one of two genera, along with *Musa* (and perhaps *Musella*, if this is considered distinct from *Ensete*), in the Musaceae. *Ensete ventricosum* is a fertile diploid with 2n = 18, with a genome size similar to *Musa acuminata*, and can be easily propagated by seed, as can be observed from the considerable number of seedlings around an enset plant, which has been allowed to develop fruits in the wild.

Despite all these merits, the enset agriculture was deprived of the research attention it deserved and was highly neglected as compared to the attention given to cereals. Much of energy and financial resources was devoted to the improvement of cereals by various successive governments. In addition, when the Vavilov Centre of origin for cultivated crops was identified in the 1950s, this crop was not among the ones considered important. The information available traditionally (folk taxonomy) has not been adequately captured and related with modern molecular knowledge (Admasu Tsegaye, 2002). Enset needs further research and even breeding programmes to ensure it can maintain its place among high yielding, sustainable and perennial starch staple crops that have cultural acceptance.

Research and research gaps on enset

In the workshop over 20 scientific papers in thematic areas in both Natural and Social Sciences including: Agronomy, Agroforestry, Ethnobotany, Genetics, Modelling, Industrial application, Food security, Nutrition and Dietary aspects, and Socio-economics, were presented. However, of all the papers presented only 12 are included in this supplementary issue. These include articles on: trends and gaps (Masresha Fetene and Getahun Yemata, 2018); the centre of origin and domestication (Endashaw Bekele, 2018);

ethnobotany (Zemede Asfaw, 2018); improving indigenous knowledge (Karlsson *et al*., 2018); biotechnological studies (Genet Birmeta, 2018); physiology (Struik, 2018); diseases (Adane Abraham, 2018); diversity, challenges and management (Melesse Maryo *et al*., 2018); land use and agroforestry systems (Tesfaye Abebe, 2018); experiences and strategies (Zerihun Yemataw *et al*., 2018) and enhancing innovative research (Wilkin *et al*., 2018). Each of these themes are presented in detail as individual articles in this issue.

Future direction on enset research and the way forward

During the workshop a series of paper presentations were made and followed by fruitful discussions. The discussions following the presentations revealed the uniqueness of the crop, the status of its biodiversity in Ethiopia and its potential to become an important food crop and industrial crop in Ethiopia and beyond. At the end of the workshop, there were final discussions, which highlighted and stressed the importance of enset for food security, especially for the rural poor, and the importance for the livelihood and culture of many peoples of Ethiopia. The workshop was concluded by signing a declaration on the future direction where enset research should go, known as the "Addis Ababa Declaration on Enset", which is attached as declaration at the end.

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Appendix 1. The history behind the synonymy of *Ensete ventricosum* as published in the Flora of Ethiopia and Eritrea

There are many discoveries and debates behind the synonymy of *Ensete ventricosum*, as published in the Flora of Ethiopia and Eritrea, beginning with the oldest records of the name *Ensete* in scientific literature. We can follow the debate backwards, because the works that improves the taxonomy and nomenclature refer to each other, the younger ones to the older ones. Scientific names have to be based on specific preserved plant material, the so-called types, which help us to fix what the scientists mean by a particular name. That is not an easy task for the enset plants, which are big and difficult to preserve in museums and herbaria.

Here we start with the third line in the synonymy: "*Musa ensete* Gmel. (1791); *Ensete edule* Horan. (1862) – type: Ethiopia, Icones, p. 47 in Bruce (1790)", which brings us to the first scientific description of the enset plant, that by James Bruce, based on what he observed himself and heard from people he spoke with during his visit to Ethiopia around 1770, mainly in Gondar and the area around Lake Tana. Bruce stated that the enset plant had been brought to that area from "Narea" (elsewhere in the work often spelt Enarea; he had been informed that it was native in moist areas with swamps and many rivers, located south-west of the kingdom of "Gurague" and north of the kingdom of "Caffa". On the map, which Bruce published with his Travels, the kingdom of Enarea is located approximately at 8° 30′ N and 35° 10′ E, which is between the modern towns of Metu and Dembidolo. No material of enset is preserved from Bruce's visit to Ethiopia, but there are drawings made by his assistant, the Italian artist Luigi Balugani, and these are reproduced in Bruce's books. "Bruce (1790)" refers to volume 5, *Select Specimens of Natural History* in the work by James Bruce: *Travels to discover the source of the Nile, in the years 1768, 1769, 1770, 1771, 1772, and 1773*. Two plates which show the entire enset plants, one in leaf and early flowering and one in late flowering or fruiting, are inserted between page 36 and 37. Bruce argued that the enset plant did not belong to the banana genus, *Musa*, and he called it *Ensete*, but gave no name for it in Linnaeus' system of botanical nomenclature.

The next in the history of that line is "*Musa ensete* Gmel. (1791)", which refers to a book by the German naturalist J.F. Gmelin, *Caroli à Linné, ... Systema naturae per regna tria naturae, secundum classes,ordines, genera, species, cum characteribus, differentiis. Editio decima tertia*, *aucta, reformata* [The systems of the three kingdoms of nature, according to classes, orders, genera and species, with differential characters. Edition 13, augmented and revised], Tomus II(2); the name and reference to Bruce is on p. 567. This work is one of many updated versions of Linnaeus' *Systema Naturae*, in which descriptions and names of newly discovered plants and animals were incorporated between the already known ones. Gemlin disagreed with Bruce and considered the enset plant to be a banana, *Musa*, but to acknowledge that he based his name on Bruce's description and plates, his name for the plant included the word *ensete*, according to the Linnean principles: *Musa ensete* Gmel.

Next in the history of that line is "*Ensete edule* Horan. 1862." Horan. is an abbreviation standing for the Russian botanist Paulus Federowitsch Horaninow, who wrote a book called *Prodromus Monographiae Scitaminearum* [Forerunner of a monograph of the banana-like plants], published in 1862. He explained on p. 40 how he had studied both living and dried material of the plant at the Royal Botanic Gardens, Kew, to which institutions seeds had been sent from the British Consul to Abyssinia [Ethiopia] in 1753; and Horaninow concluded that it differed from the true bananas of the genus *Musa* both in features of the flowers and the seeds, for which reason he agreed with Bruce that it was a distinct genus. Horaninow lists the generic name as "*Ensete* Bruce", but now the generic name is referred to as "*Ensete* Bruce ex Horan." Or, as in Flora of Ethiopia and Eritrea, as "*Ensete* Horan." Since there is no tradition in botany that allows the species name to repeat the name of the genus, Horaninow could not use Gmelin's *ensete* as a species name, and he therefore coined the name *edule*, referring to Bruce's description of how the plant was used for food in Ethiopia.

The last point in that line deals with the type material. Two British economic botanists, Richard Eric Defoe Baker and Norman Willison Simmonds, had summarised knowledge about *Ensete* in a paper, *The Genus Ensete in Africa*, in *Kew Bulletin* 8(3): 405-416 (1953). Here they stated that the plates between p. 36 and 41 in the 1790-edition of Bruce's Travels represented the only material left on which to base the names of Bruce, Gmelin and Horaninow, and that these two plates should be the type (the indication of the pages in *Flora of Ethiopia and Eritrea* is therefore not completely correct). However, two Finnish botanists, Henry Väre and Markku Häkkinen, have tried to find original material to serve as types of all published names of *Ensete* and have described the results in their work *Typification and check-list of Ensete Horan.-names with nomenclatural notes*, published in the journal *Adansonia* 3. Ser., 33(2): 191-200 (2011). In this work, they state that the type of Gmelin's and Horaninow's names is "pl. 21, figs 1 and 2 (lecto-, designated by Baker & Simmonds …)" and that the plates are found in Volume 6 of Bruce's *Travels*. This is strange, as the volume number is wrong for the original edition of Bruce's *Travels*, which was originally printed by J. Ruthven for G.G.J. and J. Robinson, and published in Edinburgh and London. In this original publication, the plates are not numbered and the page references given by Väre and Häkkinen are also wrong; their information must be based on a secondary edition of Bruce's *Travels*, that printed by Zacharia Jackson in Dublin for P. Wogan, L. White, P. Birne, W. Porter, W. Sleater, J. Jones, J. Moore, B. Dormin, C. Lewis W. Jones, G. Draper, J. Miliken, and R. White [1790-1791]. In this secondary edition, the natural history is in Vol. 6, *Ensete* is dealt with on p. 45-50, and the two illustrations of the plant are numbered as pl. 21, n.1 and 2. The statement of Baker and Simmonds, based on the original edition of Bruce's *Travels*, should stand.

Before Horaninow's work in 1862, another line – the first and second one in the synonymy - had started with the publication of the name "*Musa ventricosa* Welw. 1859." The Austrian botanist Friedrich Martin Josef Welwitsch had in Angola, in an area called Pungo Andongo, collected a plant, which he considered a species of Musa; it was collected as a wild plant near a small stream and had his collecting number 6447. The plant was described very briefly and named *Musa ventricosa* Welw. as no. 45 on p. 587 in an article called *Apontamentos phyto-geographicos*, in a rare Portuguese journal called *Annaes do Conselho Ultramarino*. *Parte nao official* 1: 527-592 (1859). Welwitsch collected many duplicates of his collection and duplicates of this particular one (collection no. 6447) are therefore distributed them to a number of herbaria. Again, indication of the type material is slightly controversial. Welwitsch must have based his description on all the material he collected, of which the largest number of specimens of no. 6447 (7 sheets, mostly with leaves) are at the Portuguese herbarium LISU, and some of them carry descriptions by Welwitsch; for this reason, the authors of the *Flora of Ethiopia and Eritrea* considered the material at LISU to be holotype, that is the type material, on which Welwitsch had based his description; but Baker and Simmonds have designated as lectotype material of no. 6447 at K, which also had a description by Welwitsch attached.

Next in this historical line is "*Ensete ventricosa* (Welw.) Cheesman. 1947." This is actually the first line of the synonymy, for that is the name we accept today. Ernest Entwisle Cheesman was an English botanist noted for his general work on the family Musaceae at the Royal Botanic Gardens, Kew, in the 1940s. Cheesman finally made it clear that Bruce and Horaninow were right, *Ensete* and *Musa* were indeed two different genera, that there are no wild species of *Musa* in Africa, only *Ensete*, and that *Ensete* is distinguished by being strictly monocarpic, has large seeds and that the chromosome set is based on a haploid chromosome number of 9. In a paper in *Kew Bulletin* 2(2), called *Classification of the bananas. 1. The genus Ensete* (p. 97-106), he accepted both the name *Ensete edule* Horan. from Ethiopian plants, and *Ensete ventricosum* (Welw) Cheesman from Angolan plants, but also 23 other species of *Ensete*, and based the names in *Ensete* on species originally described in the genus *Musa*. He also clearly noted that not all of these might stand further studies, particularly studies, which might well demonstrate that some of them were synonymous.

The last line in the synonymy of the Flora of Ethiopia and Eritrea deals with names of a variety with dark red to purplish stain on the trunk and underside of the leaves. It refers to a form collected outside Addis Ababa by a certain M. Maurel, former director of the school of l'Alliance Française in Addis Ababa, and was communicated to the Museum d'Histoire Naturelle in Paris by the French embassy secretary marquis de Scey-Montbéliard. The plant is described in a paper, *Bananies d'Abyssinie a feuilles rouges*, published in *Bulletin du Museum National d'Histoire Naturelle*, 2e Série, vol. 2: 688-690 (1931), by "M. D. Bois", which must stand for Madame or Mademoiselle Désiré Bois, professor at the Jardin des Plantes, the botanical garden in Paris. She states that she had received this plant for cultivation in the botanical garden and named and described it as *Musa ensete* Gmel. var. *montbeliardi* Bois (in a footnote on p. 688). Georg Cufodontis reviewed between 1953 and 1972 the entire botanical literature on the Horn of Africa in a work called *Enumeratio plantarum aethiopiae spermatophyta* [Enumeration of Ethiopian Seed Plants], published as a supplement series to the *journal Bulletin du Jardin Botanique de l'Etat, Bruxelles* (for the later parts renamed as *Bulletin du Jardin Botanique National de Belgique*). When dealing with the genus Ensete (on p. 1593 in the final fascicle in *Bulletin du Jardin Botanique National de Belgique* 42(3), Supplement): 1579-1657, 1972), he accepted the status of the red-leaved enset-plants as a formal variety, but transferred it to the correct species name as *Ensete ventricosum* (Welw.) Cheesman var. *montbeliardii* (Bois) Cufod. The type of this variety is in the *Flora of Ethiopia and Eritrea* indicated as being a holotype at the Museum National d'Histoire Naturelle in Paris, but that was only guesswork, and, until today, no type material of var. *montbeliardii* has been found. The plant was probably only cultivated in the garden, and no herbarium material made of it.

Appendix 2: Global overview of the genus *Ensete* with full synonymy and distributional data.

Unlike the synonymy in the *Flora of Ethiopia and Eritrea*, a full synonymy of *Ensete ventricosum* will at least include the synonyms below from a range of African countries. This has been done here in a complete review of all hitherto described species of *Ensete*. The list is a compilation of the information in Väre and Häkkinen (2011), Lebrun and Stork (2012) and WCSP (2018), supplemented with data from other sources where necessary. Invalid and illegitimate names are not included. Standard abbreviations have been used for the literature references. In many cases the type material is mounted on two or more sheets, due to the size of the plant, but in agreement with the International Code of Nomenclature for Plants, Algae and Fungi, one plant mounted on two sheets can be the type.

The species of *Ensete* are here listed in agreement with the sequence in the cladogram of Liu, Kress and Li (2010), with the exception that *E. lasiocarpa* is placed between the African and Malagassy species and the Asian species, and that the little studied *E. perrieri* (not in the phylogeny) is placed at the end of the African species.

Ensete Bruce ex Horaninow, *Prodr. Monogr. Scitam*: 40 (1862);

- type species: *Ensete edule* Bruce ex. Horan., *Prodr. Scitam*: 40 (1862).

Seven species in the tropical and warm temperate regions from West Africa to New Guinea.

1. ***Ensete ventricosum*** (Welw.) Cheesman, *Kew Bull*. 2(2): 101 (1948 [1947, publ. 12 Apr 1948]);

Musa ventricosa Welw., *Apontamentos Phytogeogr*.: 587 (1859) - type: Angola, Pungo Andongo, (Rocky places near rivulets, 10° S lat.), 1857, *Welwitsch* 6447 (K, lectotype, designated by Baker and Simmonds, 1953, according to Väre and Häkkinen, 2011; BM, LISU isotypes).

Musa ensete Gmel, *Linn. Syst. Nat., ed. 13, amend*. 2(2): 567 (1791); *Ensete edule* Horan., *Prodr. Monog. Scitam*.: 40 (1862) – type: Ethiopia, illustrations between p. 36 and 37 in Vol. 5, *Select specimenes nat. hist*., in Bruce: *Travels* (1790), lectotype, designated by Baker and Simmonds (1953), according to Väre and Häkkinen (2011).

Musa proboscidea Oliv., in *Hooker's Icon. Pl.* 18: t. 1777 (1888) [1887-1888, publ. Oct 1888]; *Ensete proboscideum* (Oliv.) Cheesman, *Kew Bull*. 2(2): 102. (1948 [1947, publ. 12 Apr 1948]) - Type: Tanzania, Ukami hills, 100 miles inland to the west of the island of Zanzibar, 1885, *J. Kirk* 1777 (K, K000099716, lectotype, designated by Baker and Simmonds, 1953, according to Väre and Häkkinen, 2011).

Musa buchananii Baker, *Ann. Bot.* (*Oxford*) 7: 207 (1893); *Ensete buchananii* (Baker) Cheesman, *Kew Bull.* 2(2): 102 (1948 [1947, publ. 12 Apr 1948]) – type: Malawi, Shire highlands, [1885], *J. Buchanan* 470 (K, K000099717, lectotype, designated by Baker and Simmonds, 1953, according to Väre and Häkkinen, 2011).

Musa schweinfurthii K. Schum. & Warb. in K.Schum., *Das Pflanzenreich* IV, 45, Musac.: 14. (1900) [4 Oct 1900]; *Ensete schweinfurthii* (K. Schum. & Warb.) Cheesman, *Kew Bull.* 2(2): 103 (1948 [1947 publ. 12 Apr 1948]) – type: South Sudan, Niamniam, wild in Baginosa, 28.5.1870, *Schweinfurth* (2. Ser.), 130 (BM, BM000911547 and BM000911547, lectotype, designated by J.M Lock, 1993, according to Väre and Häkkinen, 2011).

Musa arnoldiana De Wild., *Bull. Soc. Etud. Col. Brux.* 8: 339 (1901); *Ensete arnoldianum* (De Wild.) Cheesman, *Kew Bull*. 2(2): 103. (1948 [1947 publ. 12 Apr 1948]) - Type: Democratic Republic of Congo, Congo, Région de Dembo, 1901, *J.Gillet* 1850 (BR, BR880762 and BR880764, lectotype, designated by Baker and Simmonds, 1953, according to Väre and Häkkinen, 2011).

Musa holstii K. Schum., *Bot. Jahrb. Syst.* 34(1): 121 (1904) [22 Mar 1904]; *Ensete holstii* (K. Schum.) Cheesman, *Kew Bull*. 2(2): 103 (1948 [1947 publ. 12 Apr 1948]) – Type: Tanzania, West Usambara, Sakara, 25.9.1902, *A. Engler* 2254 (B lectotype, designated by J.M. Lock, 1993, according to Väre and Häkkinen, 2011; BM, K, isotypes).

Musa ulugurensis Warb. & Moritz, *Tropenpflanzer* 8: 116 (1904); *Ensete ulugurense* (Warb. & Moritz) Cheesman, *Kew Bull*. 2(2): 103. (1948 [1947 publ. 12 Apr 1948]) – type: an unnumbered plate with illustration of the plants at p. 117 (lectotype, designated by Väre and Häkkinen, 2011).

Musa fecunda Stapf, *J. Linn. Soc., Bot.* 37: 528. 1906 [1904-1906 publ. 1906]; *Ensete fecundum* (Stapf) Cheesman, *Kew Bull.* 2(2): 103 (1948 [1947 publ. 12 Apr 1948]) – type: Uganda, Toro, Isunga, *M.T. Dawe* 521 (K, lectotype, K000099679, K000099680, designated by Baker and Simmonds, 1953, according to Väre and Häkkinen, 2011).

Musa laurentii De Wild., *Miss. Em. Laurent*, vol.1: 371 (1907); *Ensete laurentii* (De Wild.) Cheesman, *Kew Bull*. 2(2): 103 (1948 [1947 publ. 12 Apr 1948]) - type: Democratic Republic of Congo, Stanleyville (Kisangani), 15.1.1904, *E. & M. Laurent s.n*. (BR, lectotype, BR000000880768, designated by Baker and Simmonds, 1953, according to Väre and Häkkinen, 2011).

Musa bagshawii Rendle & Greves, *J. Bot.* 48: 169 (1910); *Ensete bagshawei* (Rendle & Greves) Cheesman, *Kew Bull*. 2(2): 103 (1948 [1947 publ. 12 Apr 1948]) - Type: Uganda, Foweira, Unyoro at 3500 ft., 25.4.1907, *Bagshawe 1582* (BM, BM000911549, BM000911550, lectotype, designated by Baker and Simmonds, 1953, according to Väre and Häkkinen, 2011).

Musa davyae Stapf, *Bull. Misc. Inform. Kew* 1913(3): 102. [1 May 1913]; *Ensete davyae* (Stapf) Cheesman, *Kew Bulletin* 2(2): 104 (1948 [1947 publ. 12 Apr 1948]) - Type: Mozambique, Amatongas forest, 27.XI.1907, *W. H. Johnson s.n.* (K, lectotype, designated by Väre and Häkkinen, 2011).

Musa ruandensis De Wild., *Bull. Jard. Bot. État Bruxelles* 8: 111 (1923); *Ensete ruandense* (De Wild.) Cheesman, *Kew Bull*. 2(2): 104 (1948 [1947 publ. 12 Apr 1948]) - Type: Democratic Republic of Congo, Kisantu, 30.V.1923, *J. Gillet s.n.* (BR, BR000000880761, lectotype, designated by Baker and Simmonds, 1953, according to Väre and Häkkinen, 2011).

Musa rubronervata De Wild., *Bull. Jard. Bot. État Bruxelles* 8: 112. (1923); *Ensete rubronervatum* (De Wild.) Cheesman, *Kew Bull*. 2(2): 104 (1948 [1947 publ. 12 Apr 1948]). - Type: Democratic Republic of Congo, Kisantu, 1923, *J. Gillet s.n*. (BR, BR000000880759, designated by Väre and Häkkinen, 2011).

Musa ensete Gmel. var. *montbeliardii* Bois in *Bull. Mus. Hist. Nat. Paris*, 2. sér. 2: 688 (1931); *Ensete ventricosum* (Welw.) Cheesman var. *montbeliardii* (Bois.) Cufod. in *Enum. Pl. Aeth. Sperm*.: 1593 (1972) – type: Ethiopia, Shewa, near Addis Abeba, *M. De Scey-Montebeliard* s.n. (P, type material lost, no neotype selected).

Musa kaguna Chiov. *Raccolte Botaniche fatte dai Missionari della consolata nel Kenya*: 119 (1935) – Type: Kenya, "Mt. Kenya e Aberdare, commune ovunque nel Kikuyu e nel Meru (Balbo)". *Musa kaguna* is almost certainly a species of *Ensete*, and probably a synonym of *E. ventricosum*. The plant collection of "Missioini della Consolata" was at TOM, but the herbarium is being transferred to FT. The type material may probably be lost.

Distributed in moist montane or submontane forests of Ethiopia (where widely cultivated, presumably outside its natural range), South Sudan, Uganda, Kenya, E. Democratic Republic of Congo, Rwanda, Burundi, Tanzania, Zambia, Malawi, Mozambique, Zimbabwe, Angola (Pungo Andongo), N part of South Africa (Lebrun and Stork, 2012; Anonymous, 2018).

2. ***E. homblei*** (Bequaert ex De Wild.) Cheesman, *Kew Bull.* 2(2): 103 (1948 [1947, publ. 12 Apr 1948]);

Musa homblei Bequaert ex De Wild., in *Ann. Mus. Colon. Marseille,* 2. Sér., 10: 332 (1912) – type: Democratic Republic of Congo, Katanga, E'ville (Elisabethville), termitière (savane boisée), 5.1912, *H. Homblé* 671 (BR, lectotype, BR000000880858, BR000000880860, BR000000880859, designated by Baker & Simmonds, 1953, according to Väre and Häkkinen, 2011).

At 1000-1200 m on termite mounds and rocky slopes in *Brachystegia* woodland in the extreme southern part of the Democratic Republic of Congo and in Zambia (Lebrun and Stork, 2012; Anonymous, 2018).

According to Lock and Diniz (2010), this species could be an environmental modification of *E. livingstonianum* or an indraspecific taxon under that species; the question should be subject to closer studies.

3. ***E. livingstonianum*** (J. Kirk) Cheesman, *Kew Bull*. 2: 101 (1948 [1947, publ. 12 Apr 1948]);

Musa livingstonianum J. Kirk, in *J. Linn. Soc*. 9: 128 (1867) – type: Malawi, "Manganja Hills", *J. Kirk* s.n. (lectotype K, K000975139, designated by Goyder, 2014).

Musa gilletii De Wild., *Revue des Cultures Coloniales* (Paris) 8: 102 (1901); *Ensete gilletii* (De Wild.) Cheesman, *Kew Bull*. 2(2): 103 (1948 [1947, publ. 12 Apr 1948]). — Type: Democratic Republic of Congo, Bas-Congo, Kisantu (à Luvituku), 1900, *J. Gillet 700* (BR, BR0000008808654, BR0000008808639, BR0000008808622 and BR0000008808615, lectotype designated by Baker & Simmonds, 1953, according to Väre and Häkkinen, 2011).

Musa religiosa J. Dyb., *Revue Horticole* 72: 262 (1900); *Ensete religiosum* (J.Dyb.) Cheesman, *Kew Bull.* 2(2): 103 (1948 [1947, publ. 12 Apr 1948]) —type: Democratic Republic of Congo, "Jardin colonial" s.n. (BR, BR000000880660, lectotype designated by Väre and Häkkinen, 2011).

Musa elephantorum K. Schum. & Warb., *Das Pflanzenreich* IV,45, Musac.: 14 (1900); *Ensete elephantorum* (K. Schum. & Warb.) Cheesman in *Kew Bull*. 2(2): 102 (1948 [1947, publ. 12 Apr 1948]) – type: Cameroun, Yaunde Station, Berg Boukollo im Grasfelde an Abhängen, *Zenker* s.n. (B, all type material lost). Goyder (2014) has recorded it as a synonym of *Ensete livingstoniana*.

Musa chevalieri Gagnep., *Mém. Soc. Bot. France* 2: 87 (1908); *Ensete chevalieri* (de Wild.) Cheesman, *Kew Bull*. 2: 103 (1948 [1947, publ. 12 Apr 1948]) — Type: [Central African Republic], Haut Oubangi, Fort Sibut, 6.XI.1902, *A.J.B.Chevalier 6059* (P, lectotype, P00439288, designated by Väre and Häkkinen, 2011).

From low altitudes to 1000-1900 m a.s.l at forest edges, in hilly grasslands and woodlands, on rocky escarpments, in old clearings and *Pouteria altissima* forest in Sierra Leone, Guinean Republic, Ivory Coast, S. Mali (?), Ghana, Benin, Togo, Nigeria, Cameroon, Central African Republic, Democratic Republic of Congo, Angola, Zambia, Malawi and Mozambique (Lebrun and Stork, 2012; WCSP, 2018; Anonymous, 2018).

4. ***E. perrieri*** (Claverie) Cheesman, *Kew Bull.* 2(2): 103 (1948 [1947, publ. 12 Apr 1948]);

Musa perrieri Claverie, *Comptes Rendus de l'Académie des Sciences de Paris* 140: 1612 (1905). — type: Madagascar, Ouest, (Fianarantsoa Province Atsimo-Atsinanana Region, District of Vangaindrano), Ambongo, terrains calcaires, bois rocailleux (stony forest on calcareous ground), 2.1905, *H. Perrier de la Bâthie 1796* (P, lectotype, P00109945, designated by Väre and Häkkinen, 2011).

In Madagascar in habitats as listed for the type material.

5. ***E. lasiocarpa*** (Franch.) Cheesman, *Kew Bull.* 2(2): 102 (1948 [1947, publ. 12 Apr 1948]);

Musa lasiocarpa Franch., *J. de Botanique* (*Morot*) 3: 329 (1889); *Musella lasiocarpa* (Franch.) H.W.Li, *Acta Phytotax. Sinica* 16: 57 (1978). — Type: Franchet (1889), *J. de Botanique* 3: fig. 1 (lectotype, designated by Häkkinen and Väre, 2008).

Musella lasiocarpa (Franch.) H.W.Li var. *rubribracteata* Z.H. Li & H. Ma, in Novon 21(3): 351, f. 1 & 2. (2011) – type: China, Sichuan, Panzhihua City, near Upper Yangtze River, 15.5.2009, Z.H. Li & H. Ma 09SC66

(IFRD, holotype).

Musella lasiocarpa var. *rubribracteata* is a synonym of *E. lasiocarpa*, according to WCSP (2018).

The species occurs in China (S Guizhou, C and W Yunnan) and Vietnam, where it grows wild on rocky slopes or is cultivated in gardens; 1500–2500 m. a.s.l. (Delin and Kress, 2000, Anonymous, 2018).

6. ***E. glaucum*** (Roxb.) Cheesman, in *Kew Bull*. 2(2): 101 (1948 [1947, publ. 12 Apr 1948]). var. *glaucum*

Musa glauca Roxb., *Plants Coast Cormandel* 3: 96 (1819). – type: Illustration, Fig. 300 in *Plants of the Coast of Coromandel* 3: fig. 300 (1819) (lectotype, designated by Argent, 1976).

Musa agharkarii Chakravorti, *Journ. Indian Bot. Soc*. 27: 93 (1948); *Ensete agharkarii* (Chakravorti) D.K. Hore, B.D. Sharma & G. Pandry, *Journal of Economic and Taxonomic Botany* 16(2): 450 (1992) – type: Illustration in *Indian Bot. Soc*. 27: Pl. 1, fig 1-5, lectotype, designated by Väre and Häkkinen, 2011).

The status of *Musa*/*Ensete aghakarii* as synonym of *E. glaucum* var. *glaucum* is accepted from Joe *et al*. (2016) and WCSP (2018). It is not recorded by Anonymous (2018).

The species occurs in open places near forest margins and in grasslands, occasionally near small streams and on river banks, and in moist soil, occasionally in rocky ravines, but very often also cultivated, from near sea level to 2700 m a.s.l. in China (S and W Yunnan), Nepal, Bangladesh, north-eastern India, Myanmar, Indonesia, Taiwan, New Guinea, Philippines, Vietnam, Laos and Thailand (Delin and Kress 2000; Joe *et al*., 2016; Anonymous, 2018).

var. ***wilsonii*** (Tutcher) Häkkinen, in *Adansonia* 3. Sér, 3: 199 (2011).

Musa wilsonii Tutcher, in *Gardeners' Chronicle* ser. 3, 32: 450 (1902); *Ensete wilsonii* (Tutcher) Cheesman, *Kew Bull*. 2(2): 103 (1948 [1947, publ. 12 Apr 1948]) — type: Tutcher, in *Gardeners' Chronicle* ser. 3, 32: fig. 151 (1902) (lectotype, designated by Väre and Häkkinen, 2011).

Ensete wilsonii is often considered a distinct species in the literature, but a variety of *E. glaucum* by Väre and Häkkinen (2011) and WCSP (2018).

The variety grows as wild or cultivated in fertile soil in ravines, from near sea level to 2700 m a.s.l. in China, Yunnan (Delin and Kress, 2000).

7. ***E. superbum*** (Roxb.) Cheesman, *Kew Bull*. 2(2): 100 (1948 [1947, publ. 12 Apr 1948]);

Musa superba Roxb., *Flora Indica* 2: 489 (1824) – type: "East India", *Roxburgh* s.n. (K, K000309030, lectotype, designated by Väre and Häkkinen, 2011).

Ensete lecongkietii Luu, N.L. Vu & Q.D. Nguyen, *Folia Malaysiana* 13(2): 44 (2012) - type: Vietnam, Binh Thuan Province, Ham Thuan Nam District, Thuan Nam Township, Nhan Hill, 5.6.2012, *Luu* 872 (VNM, holotype).

Ensete lecongkietii is described from a plant collected near a village in Vietnam; although accepted by WCSP (2018) and Anonymous (2018), it has been reduced to synonym by Joe *et al.* (2016). They argue that the type specimen was found close to human habitation in Vietnam, and that the distinction of it is based mainly on differences in size and number of anthers in male flowers compared with those of *E. superbum*, thus it only differs from typical *E. superbum* in being smaller in a number of parts, and they consider it a cultivated form of *E. superbum*.

E. superbum is native to India, but cultivated in Myanmar, Thailand and Vietnam (Anonymous, 2018; WCSP, 2018). It occurs mostly in rocky areas or in moist soils, and sometimes in rock crevices and steep rocky cliffs. It takes one to more than six years to flower (Joe *et al*., 2016).

Name probably belonging to the genus *Ensete*, but of uncertain identity:

Musa bacoba Rottb., Descript. Pl. Rarior.: 28 (1776) - type not traced.