Acta Bot. Croat. 74 (1), 143–150, 2015

CODEN: ABCRA 25
ISSN 0365-0588
eISSN 1847-8476

Short communication

Manihot grahamii Hook. (Euphorbiaceae), a new alien species for the Eurasian area with nomenclatural, taxonomical, morphological and ecological notes

Mauro Iberite[1*], Duilio Iamonico[2]

[1] Department of Environmental Biology, University of Rome Sapienza, piazzale Aldo Moro 5, 00185 Rome, Italy

[2] Laboratory of Phytogeography and Applied Geobotany, Department PDTA, Section Environment and Landscape, University of Rome Sapienza, via Flaminia 72, 00196 Rome, Italy

Abstract – *Manihot* is a native genus of the Northern and Southern America with diversity centres in Brazil, Mexico and Guatemala. Some taxa have colonized other continents (except Europe) where they are considered aliens. During recent floristic surveys we found the genus in the Agro Pontino area (Lazio region, Central Italy, Southern Europe). This is the second record in Europe for the genus and the first of *M. grahamii* for the Eurasian area. At present this taxon is to be considered as naturalized alien species in Agro Pontino (and thus in Italy and Europe). To better clarify the taxonomic and nomenclatural data, the names *Janipha loeflingii* var. (ß) *multifida* (≡ *M. grahamii*) and *Jatropha carthaginensis* (≡ *M. carthaginensis*) were lectotypified respectively on a specimen from K and an iconography by Jacquin.

Key words: Asia, Europe, Italy, lectotypification, *Manihot* Mill., *Manihot carthaginensis* (Jacq.) Müll. Arg., status of naturalization, synonymy

Introduction

Manihot Mill. (Euphorbiaceae, Crotonoideae) is a genus of about 75–100 species distributed in America, from Arizona to Argentina and West Indies (Rogers and Appan 1973, Chacón et al. 2008, APGIII 2009). Its distribution area is disjunct: none of the North and Central American species occur in South America. Centres of diversity are two: Brazil, with about 80 species (66 endemic, according to Cordeiro and Secco 2010) and from Mexico to Guatemala with 18 species. Molecular studies confirm this disjunction, showing a

* Corresponding author, e-mail: mauro.iberite@uniroma1.it

dichotomy between the Mesoamerican and South American *Manihot* species (Chacón et al. 2008). Out of its native range, *Manihot* was recorded as alien genus, in North America (11 species; Usda 2012), Asia (4 species; Radcliffe-Smith 1986; Li and Gilbert 2008; Ibin 2012), Africa (7 species; Sanbi 2005–2010, Biota Africa 2012) and Australia (6 species; Apni 2012). Recent floristic surveys in the Agro Pontino area (Lazio region, central Italy, Southern Europe) allowed to find a population referring to the genus *Manihot* and in particular to *M. grahamii* Hook. This gathering represents the second record of the genus *Manihot* in Europe and the first of *M. grahamii* in the Eurasian area. Due to the difficulties in the identification, it was necessary to investigate the nomenclatural aspects of this species and *M. carthaginensis* (Jacq.) Müll. Arg., being *M. grahamii* related to this name in the past. Taxonomical notes, morphological data in comparison with the related species *M. inflata* Mueller and *M. janiphoides* Mueller and ecological observations were provided.

Material and methods

The present study was the result of personal field investigations, examination of the specimens kept in the Herbaria RO, LINN, K, P, W (abbreviations according to Thiers 2011) and the analysis of literature (protologues included). The nomenclature follows Rogers and Appan (1973). The status of naturalization was evaluated according to Pyšek et al. (2004), Richardson and Pyšek (2006), Ricciardi and Cohen (2007). The descriptions are based on personal observations of diagnostic characters (leaves shape and inflorescence structure).

Results and discussion

According to Rogers and Appan (1973) *M. grahamii* is included in the Sect. *Heterophyllae* Pax emend. Rogers & Appan (18 sections are recognized in the genus *Manihot*) a South American group characterized by low to medium tall plants (shrubs or small tree), with not tomentose abaxial surface of the leaves blade and leaves lobes entire to pandurate, inflorescence in panicle, bracts and bracteoles foliaceous and entire. Plants from Italy (Agro Pontino area, Central Italy) clearly refer to this section. Among the *taxa* included into the Sect. *Heterophyllae*, *M. grahamii* seems to be related to *M. inflata* and *M. janiphoides*. All these species are included in the group of *taxa* with bracts and bracteoles setaceous less than 25 mm wide and inflorescence in a panicle with one main axis and spaced flowers. The analyses of the morphological features and qualitative characters shows that *M. grahamii* is characterized by leaves blade glabrous abaxially, 7-lobed or more with lobes at the base more than 25 mm wide, while *M. janiphoides* has leaves lobe densely pubescent and *M. inflata* has leaves 3–5 lobed each lobe at the base less that 25 mm wide.

Typification of *Manihot grahamii*

Manihot grahamii was described from Paraná, South America (Hooker 1842). The protologue consists of a diagnosis with habitat, provenance and collector (»*Hab. Woods of the Parana. Tweedie*«) and one synonym (»*Janipha loeflingii...(excl. Syn.)—β multifida*«) cited from Graham (1840: 172–173). Hooker (l. c.) dedicated the *taxon* to R. Graham, observing that *M. grahamii* partially refers to *Janipha loeflingii* Humb., Bompl. et Kunth var. *multifi-*

da Graham. Anyhow a new combination of this name cannot be proposed since a previous homonym was published by Crantz (1766: 67), so Hooker (l. c.) proposed a *nomen novum* avoiding an illegitimate combination. Rogers and Appan (1973: 88) stated the existence of three specimens at K (»*Type syntypes, K-3*«). We found seven sheets at K (The Herbarium Catalogue, Royal Botanical Garden, Kew 2015), two of which (Codes K000600382 and K000600383) cannot be considered for the typification since they were collected by E. Hassler, not by J. Tweedie. The other five *exsiccata* include Tweedie's handwriting and signature. One of these (code K000600377) came from »*Portalegre*« (now the city of Porto Alegre) a locality placed along the South-Eastern coast of South America, in Rio Grande do Sul state (Brazil). Since this locality was not cited in the protologue by Hooker (l. c.) the specimen cannot be eligible as the lectotype. The remains *exsiccata* (Codes K000600378-381) were collected by J. Tweedie from »*parana*« (it probably refers to the current Paraná state, Brazil). However, only one (Code K000600379) includes the date of collection (»*1837*«) and it can be considered certainly original material, while the sheets with Codes K000600378, -380, -381 lack of this information. So, they might refer to a later collection (post 1842, the year of Hooker's publication) and could not be original material. Since the *exsiccatum* K000600379 is the only extant and certain original material, matching with the diagnosis, it is here designated as the lectotype of *M. grahamii*.

***Manihot grahamii* Hook.**, Icon. Pl., 6: t. 530. 1842.

Lectotype (here designated): Argentina, »*a beautiful decidious tree of the parana*«, 1837, *J. Tweedie s. n.* (K000600379!). Image of the lectotype available at http://apps.kew.org/herbcat/getImage.do?imageBarcode=K000600379 ≡ *Janipha loeflingii* Kunth var. (ß) *multifida* Graham, Edinburgh New Philos. J. 29: 172. 1840 non Crantz (1766: 67).

≡ *Manihot tweediana* Müll. Arg., Fl. Bras. (Martius) 11(2): 450. 1873–1874, *nom. illeg., nom. superfl.* (art. 52.1 of the ICN).

Description: Arborescent shrubs to low trees to 3.5 m tall, forming an umbrella-like dense canopy of foliage at the top. Not tuberous roots, light brown epidermis. Trunk up to 10 cm in diameter; bark smooth, reddish brown, peeling readily from trunk, latex in small quantity, light yellowish white. Young stems, glabrous, moderate olive green, internal stem colour of younger stems brilliant yellow green. Leaves alternate, stipules up to 1.0 cm long, filiform, glabrous, caducous; petioles up to 15 cm in length, glabrous, petiole attachment to lamina basal, nonpeltate; lamina greenish without any purplish pigmentation, glabrous, abaxial surface wax pattern smooth, veins on the adaxial lamina surface conspicuous, bright yellowish, glabrous; palmately 7–9 lobed; median lobes oblong pandurate, rarely entire, gradually widening from a narrow base to a prominently dilated apical region which abruptly narrows down and terminates in an acuminate apex, usually as long as 10 cm, base of lobes ca 0.3 cm wide, width between base of sinus and petiole-lamina junction ca 0.8 cm, lowest lobes more or less similar in outline as median lobes but smaller. Inflorescence is a monoecious raceme, as long as 15.0 cm, accompanied by one or two individual pedunculated flowers and an umbel with three flowers; all parts glabrous. Bracteoles and bractlets setaceous. Bell-shaped flowers with five petals fused to one third of the length; pistillate flowers restricted to base of the inflorescence, pedicels ca 1.2 cm long, tepal 1.25 cm long. The fuit is a subspherical three-carpellate capsule, not winged, 1.5 cm long, dehiscence septicidal. Seeds are gray, brown or mottled and oblong in shape, 1.2 cm long, with rib-like projections along the lateral edges, caruncle moderately prominent.

Iconography: Fig. 1 in Hooker (1842, available from http://www.biodiversitylibrary.org/item/54440#page/257/mode/1up).

Chromosome number: 2n = 36 (Cruz 1968, sub *M. tweedieana* Muell.).

Status of naturalization: *M. grahamii* was intentionally introduced in Italy (Agro Pontino area) from seeds collected in natural environment around Buenos Aires (Argentina) by an Italian emigrant in 1971 (direct evidence token by M. Iberite). *M. grahamii* was cultivated in private gardens, in Agro Pontino, during the 70's and 80's. The plants have always produced flowers, fruits and fertile seeds (pers. obs. by M. Iberite). The cultivated plants were eradicated during the first years of the 80's. Despite of this, from then to nowadays, the occurring of the species has been casual always deriving from seeds. The population found (Fig. 1) consists of 34 individuals of different ages (stem diameter ranging from 1.5 to 10 cm) and it has occurred on the site for about ten years. The young individuals prove that the population replaces itself. So, according to Pyšek et al. (2004), Richardson and Pyšek (2006), Ricciardi and Cohen (2007) *M. grahamii* is to be considered a naturalized alien species.

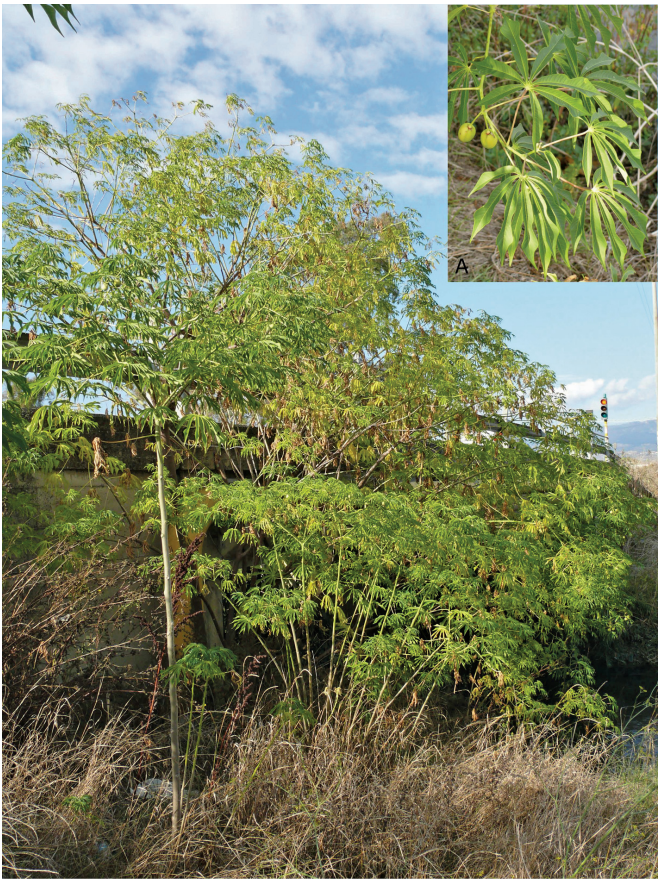

Fig. 1. *Manihot grahamii* Hook. in Agro Pontino (Lazio region, Italy), on clay substrate along ditches near Latina. A) detail of leaves and fruits.

Habitat and climate of the site: *M. grahamii* grows on clay substrate along ditches. The altitude is about 20 m a.s.l. Flowering time is June to August. The climate of the Agro Pontino is characterized by average annual temperatures of 15.5 °C and rainfall of 931 mm; the average temperature in January is 8.4 °C. The absolute minimum temperature was –9.2 °C (January 1985; Aeronautica Militare Italiana 2013). It is interesting to note that *M. grahamii* is one of the two *Manihot* taxa that is able to thrive in regions out of tropical and subtropical areas with occasional but predictable frost (Roger and Appan 1973: 7). The climate conditions of the Agro Pontino area match with the ecological range of the species.

Occurring in Europe and Asia: the genus *Manihot* was not reported in any of the Italian and European floras (e. g. Tutin 1968, Fiori 1923–1929, Pignatti 1982, Benedí, 1997, Conti et al. 2005, 2007, Daisie 2008, Lambdon et al. 2008, Celesti-Grapow et al. 2009, 2010, Anzalone et al. 2010), while it was recently recorded in Southern Italy (Stinca et al. 2014 – *Manihot esculenta* Crantz). Thus, the record in Agro Pontino area (Lazio region, Central Italy) represents the second record of the genus for Europe. As regard the species *M. grahamii*, since no records appears in the Asian comprehensive floras (e. g. Li and Gilbert 2008, Editorial Committee Of The Flora Of Taiwan 2008, Ibin 2012, Radcliffe-Smith 1986), our gathering can be considered the first in the Eurasian area.

As Graham (l. c.) described its variety under *J. loeflingii* Kunth and Hooker (l. c.) reported it as partial synonym, it appears necessary to investigate this name. *J. loeflingii* was published by Kunth (1817: 107) as *nomen novum pro Jatropha janipha* L., avoiding the publication of the tautonym *Janipha janipha* (see art. 23.4 of the ICN, McNeill et al. 2012). Kunth (l. c.) cited four synonyms from Linnaeus (1767: 126), Jacquin (1763: 256–257) and Loefling (1758: 309, 1766: 309). The Loefling's polynomial was cited by Linnaeus (l. c.) and Jacquin (l. c.) as synonym of *Jatropha janipha* L. and *J. carthaginensis* Jacq. respectively. The Linnaean name is a *nomen novum pro J. carthaginensis*. Since the Jacquin's name was validly published, the Linnaean name is superfluous and it is illegitimate under the art. 52.1 of the ICN (McNeill et al. 2012). The Jacquin's name appears to be as not typified. Jacquin (l. c.) provided a short diagnosis, a long and detailed description, and the provenance (»*Habitat passim Carthagenae*«) and included a plate (»*TAB. CLXII. Fig. I.*«, image available at http://www.botanicus.org/item/31753002894886) that can be considered original material. No specimens of *J. carthaginensis* were found in the Jussieu's collection at P. There is one specimen at W (barcode 0045823,) that bears a plant identifiable as *J. carthaginensis*. However, no date of collection is reported on the original label (at the centre of the sheet), so it could be referred to a later collection (post 1763, the year of publication of Jacquin's *Americanarum Historia*) and could not be original material. So, the image by Jacquin is the only extant original material and it is here designated as the lectotype of the name *J. carthaginensis*. The comparison between the types of *J. janipha* L. and *J. carthaginensis* Jacq. clearly shows that the name refers to the same plant and they can be considered synonyms.

***Manihot carthaginensis* (Jacq.) Müll. Arg.**, Prodr. [A. P. de Candolle] 15(2): 1073. 1866.

≡ *Jatropha carthaginensis* Jacq., Stirp. Amer., 2: 256–257. 1763.

Lectotype (here designated): [Icon] TAB. CLXII Fig. I (Jacquin, 1763).

= *Jatropha janipha* L., Mant. Pl. : 126. 1767, *nom. superfl. nom. illeg.* (art. 52.1 of the ICN)

≡ Janipha loeflingii Kunth, Nov. Gen. Sp. [H.B.K.] 2: 107. 1817, *nom. nov. pro Jatropha janipha* L.

Manihot carthaginensis is morphologically different from *M. grahamii* on the basis of the leaves blade shape: *M. carthaginensis* has leaves lobes deeply pandurate, while *M. grahamii* has entire lobes. This character is also diagnostic at section level, distinguishing the sect. *Heterophyllae* Pax emend. Roger & Appan (14 species) from the sect. *Carthaginensis* (2 species) (Rogers and Appan 1973).

Conclusions

Floristic surveys in Lazio region (Central Italy), extensive analysis of literature and herbarium investigations allowed us to find a population identifiable as *M. grahamii*. The genus *Manihot* is here recorded in Europe for the second time, while *M. grahamii* can be considered the first record for the Eurasian flora. In order to fix the Hooker's name a lectotype and an epitype are designated. For the nomenclatural purpose, the name *Jatropha carthaginensis* is also lectotypified. The morphological observations show that *M. grahamii* is clearly distinct from the related *M. esculenta*, *M. inflata* and *M. janiphoides*. As regards the status of naturalization, threats and distribution, further investigations are needed to verify the possible change of the status of naturalization (invasion?) and the presence of *M. grahamii* in other Italian and European regions. According to the observed and native ecological features, we can expect to find this species mainly in disturbed areas (e.g. ditches or roadsides) of central and southern European countries.

Acknowledgements

Thanks are due to Directors and Curators of all quoted herbaria for their support during our visits or loan of specimens/photographs.

References

Aeronautica Militare Italiana, 2013: Servizio Meteorologico: dati 1971–2000. Retrieved March 30, 2013, from www.meteoam.it

A. P. G. III, 2009: An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. Botanical Journal of the Linnean Society 161, 105–121.

Apni, 2012: Australian Plant Name Index. Retrieved March 30, 2013 from http://www.anbg.gov.au/cgi-bin/apni

Biota Africa, 2012: West- Central and East African plants. Retrieved March 30, 2013 from http://www.biota-africa.org/index.php?Page_ID=L900

Benedi, T. G., 1997: Euphrobiaceae. In: Castroviejo, S., Laínz, M., López Gonzáles, G., Montserrat, P., Muñoz Garmendia, F., Paiva, J., Villar, L. (eds.), Flora Iberica, 8, 190–297. Real Jardín Botánico, CSIC, Madrid.

Celesti-Grapow, L., Alessandrini, A., Arrigoni, P. V., Banfi, E., Bernardo, L., Bovio, M., Brundu, G., Cagiotti, M. R., Camarda, I., Carli, E., Conti, F., Fascetti, S., Galasso, G., Gubellini, L., La Valva, V., Lucchese, F., Marchiori, S., Mazzola, P., Peccenini, S., Poldini, L., Pretto, F., Prosser, F., Siniscalco, C., Villani, M. C., Viegi, L., Wilhalm, T., Blasi, C., 2009: Inventory of the non-native flora of Italy. Plant Biosystems 143, 386–430.

Celesti-Grapow, L., Pretto, F., Carli, E., Blasi, C., 2010: Flora vascolare alloctona e invasiva delle regioni d'Italia. Casa EditriceUniversità La Sapienza, Roma.

Chacón, J., Madriñán, S., Debuock, D., Rodriguez, F., Tohme, J., 2008: Phylogenetic patterns in the genus *Manihot* (Euphorbiaceae) inferred from analyses of nuclear and chloroplast DNA regions. Molecular Phylogenetic and Evolution 49, 260–267.

Conti, F., Abbate, G., Alessandrini, A., Blasi, C., 2005: An annotated checklist of the Italian vascular flora. Palombi & Partner, Roma.

Conti, F., Alessandrini, A., Bacchetta, G., Banfi, E., Barberis, G., Bartolucci, F., Bernardo, L., Bonaquisti, S., Bouvet, D., Bovio, M., Brusa, G., Del Guacchio, E., Foggi, B., Frattini, S., Galasso, G., Gallo, L., Gangale, C., Gottschlich, G., Grünanger, P., Gubellini, L., Iiriti, G., Lucarini, D., Marchetti, D., Moraldo, B., Peruzzi, L., Poldini, L., Prosser, F., Raffaelli, M., Santangelo, A., Scassellati, E., Scortegana, S., Selvi, F., Soldano, A., Tinti, D., Ubaldi, D., Uzunov, D., Vidali, M., 2007: Integrazioni alla checklist della flora vascolare italiana. Natura Vicentina 10 (2006), 5–74.

Cordiero, I., Secco, R., 2010: *Manihot.* In Lista de Espécies da Flora do Brasil. Jardim Botânico do Rio de Janeiro. Retrieved March 30, 2013 from http://floradobrasil.jbrj.gov.br/2010/FB017591

Crantz, H. J. N., 1766: Institutiones Rei Herbariae, 1. Impensis Joannis Paulis Kraus, Wien.

Cruz, N.D. 1968: Citologia do gênero *Manihot* Adans. 1. Determinação do número de cromossomos em algumas espécies. Anais da Academia Brasileira de Ciências 40, 91–95.

Daisie, 2008: European invasive alien species. Retrieved March 30, 2013 from http://www.europealiens.org/

Editorial Committee Of The Flora Of Taiwan, 2008: *Manihot* Mill. Flora of Taiwan. 3. Epoch Publishing Co, Taipei.

Fiori, A., 1923–1929: Nuova flora analitica Italiana, 1–2. Ed. M. Ricci, Firenze.

Graham, R., 1840: Description of several new or rare plants which have lately flowered in the neighbourhood of Edinburgh, and chiefly in the Royal Botanic Garden. Edinburgh New Philosophical Journal 29, 171–174.

Hooker, W. J., 1842: *Icones Plantarum*; figures with brief descriptive characters and remarks of new or rare plants, selected from the author's herbarium, 5. Hippolyte Baillière, London.

Ibin, 2012: Plant database of India. Retrieved March 30, 2013 from http://sec.org.in/jeevsampada/plantsindia/index.php

Jaquin, N. J., 1763*: Selectarum stirpium americanarum historia*. Vindobonae: ex Officina Krausiana.

Kunth, C. S., 1817: *Nova genera et species plantarum* 2. Sumptibus Librariae Graeco-Latino-Germanicae, Paris.

Lambdon, P. W, Pyšek, P., Basnou, C., Hejda, M., Arianoutsou, M., Essl, F., Jarošić, V., Pergl, J., Winter, M., Anastasiu, P., Andriopoulos, P., Bazos, I., Brundu, G., Celesti-Grapow, L., Chassot, P., Delipetrou, P., Josefsson, M., Kark, S., Klotz, S., Kokkoris, Y., Kühn, I., Marchante, H., Perglová, I., Pino, J., Vilá, M., Zikos, A., Roy, D., Hulme, P. E., 2008: Alien flora of Europe: species diversity, temporal trends, geographical patterns and research needs. Preslia 80, 101–149.

Li, B., Gilbert, M., 2008: *Manihot* Mill. In: Wu, Z. Y., Raven, P. H., Hong, D. Y. (eds.), Flora of China, 11, 275–276. Science Press, Beijing.

Linnaeus, C., 1767: *Mantissa Plantarum*. Laurentii Salvii, Stockholm.

Loefling, P., 1758: Iter Hispanicum. Lars Salvii Konstnad, Stockholm.

Loefling, P., 1766: Reise, nach den spanischen Länddern in Europa und America. Goetlieb August Lange, Berlin and Stratfund.

McNeill, J., Barrie, F. R., Buck, W. R., Demoulin, V., Greuter, D. L., Hawksworth, D. L., Herendeen, P. S., Knapp, S., Marhold, K., Prado, J., Proud'Homme Van Reine, W. F., Smith, J. F., Wiersma, J. H., 2012: International code of nomenclature for algae, fungi and plants (Melbourne Code). Gantner, Ruggell.

Pignatti, S., 1982: Flora d'Italia 1–3. Edagricole, Bologna.

Pyšek, P., Richardson, D. M., Rejemánek, M., Webster, G. L., Williamson, M., Kischner, J., 2004: Alien plants in checklist and floras: towards better communication between taxonomist and ecologist. Taxon 53, 131–143.

Radcliffe-Smith, A. 1986: Euphorbiaceae. In: Nasir, E., Ali, S. (eds.), Flora of Pakistan, 172, 1–170. University of Karachi, Karachi.

Ricciardi, A., Cohen, J., 2007: The invasiveness of an introduced species does not predict its impact. Biological Invasions 9, 309–315.

Richardson, D. M., Pyšek, P., 2006: Plant invasion: merging the concepts of species invasiveness and community invasibility. Progress in Physical Geography 30, 409–431.

Rogers, D. J., Appan, S. J. 1973: *Manihot* Manihotoides. Flora Neotropica 13, 1–271.

Sanbi, 2005–2010: Plants of southern Africa: an online checklist. Retrieved March 30, 2013 from http://posa.sanbi.org/searchspp.php

Stinca, A., D'Auria, G., Motti, R., 2014: *Manihot esculenta* (Euphorbiaceae), a new alien species in Italy. Hacquetia 13, 355–357.

The Herbarium Catalogue, Royal Botanical Garden, Kew 2015: Retrived March 30, 2013 from http://apps.kew.org/herbcat/getHomePageResults.do;jsessionid=E3FCABB679A844EF52FF6BEBDD83EE0A?homePageSearchText=manihot+grahamii&x=0&y=0&homePageSearchOption=scientific_name&nameOfSearchPage=home_page

Thiers, B. 2011: *Index Herbariorum*: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. Retrievd March 30, 2013 from http://sweetgum.nybg.org/ih/

Tutin, T. G., 1968: *Euphrobiaceae*. In: Tutin, T. G., Heywood, V. H., Burges, N. A., Moore, D. M., Valentine, D. H., Walters, S. M., Webb, D. E. (eds.), Flora Europaea, 2, 211–226. Cambridge University Press, Cambridge.

Usda, 2012: United States Department of Agriculture. Natural Resources Conservation Service. Retrieved March 30, 2013 from http://plants.usda.gov/java/nameSearch?keywordquery=manihot&mode =sciname&submit.x=0&submit.y=0