



State of our knowledge of online resources of the types of names of *Agave* L. (Agavaceae / Asparagaceae) with a list of names attributed to William Trelease, with notes on types, online resources and etymology

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Abstract

The application of plant names is inextricably linked to type specimens, and understandably considerable resources and effort have been spent over the past several years on creating and disseminating images of such specimens, for example through JSTOR Global Plants (JGP). As part of a gap analysis of images of types accessible on the worldwide web, 512 names, including 276 that are names of accepted taxa, published in the genus *Agave* and types with which they are associated were investigated to determine the state of our knowledge of the nomenclature of this horticulturally popular and economically important genus. The electronically available type specimens of the 192 names of *Agave* established by William Trelease, the most prolific author of plant names in the genus, are analysed in some detail and ten of his names are typified. In addition, the accuracy of the information associated with web-accessible type specimens of *Agave* names is recorded. We established that 76% of the images of *Agave* name types are associated with incorrect metadata.

Key words: plant taxonomy, Agavaceae, *Agave*, Asparagaceae, lectotypification, online resources, specimen images, types

Introduction

Latin binomials remain the most common way in which plant species are referred to in scientific circles and, increasingly, beyond. These Latin (or latinised) names are mostly associated with type specimens that fix their use (McNeil *et al.* 2012). Given the importance of type specimens, several major grants have been made available over the past decade by institutions, foundations and governments to assist with creating and disseminating images of types (see for example Smith 2004, Smith *et al.* 2011, and Walters *et al.* 2010 on the African Plants Initiative (API) which has received significant support from The Andrew W. Mellon Foundation). The API has since been expanded through a Latin American Plants Initiative, to a Global Plants Initiative (GPI).

Images of types online

As part of efforts to improve the spread of names for which images, as well as associated metadata are held in JSTOR Global Plants (JGP), we conducted an analysis of the availability of images online for the types of the names of the genus *Polygala* Linnaeus (1753) in southern Africa (Smith & Figueiredo 2013). The species of *Polygala* are mostly small herbs from which herbarium specimens are easily prepared and imaged. We found that images were available online for 52% of the types of that group, and the error rate in the metadata associated with those images was 74%.

With an alarming error rate of nearly 75%, we decided to extend the analysis, and for this paper selected a group of plants from the unrelated genus *Agave* Linnaeus (1753), which additionally has characters very distinct from those of *Polygala*. Agaves are small to very large leaf succulents that belong to the family Asparagaceae (alternatively Agavaceae). We studied the availability of images of types of *Agave* names on the web and analysed the accuracy of the metadata associated with those images.

Agave parreyi Hort. in Trelease (1912c: 93)

«*A. parreyi* Hort. ex Trelease» was cited by Thiede (2001) as ‘nom. inval., art.61.1’. Trelease cited the name as ‘*A. Parreyi* Croucher, Gard. Chron. n. a. 14: 374.’ in synonymy so he did not validate it.

Agave paryi Hort. in Trelease (1912c: 93)

«*A. paryi* Hort. ex Trelease» was cited by Thiede (2001) as ‘nom. inval., art.61.1’. Trelease cited the name as ‘*A. Paryi* Ellemeet, Belg. Hort. 1871: 121.’ in synonymy so he did not validate it.

Agave payrii Hort. in Trelease (1912c: 93)

«*A. payrii* Hort. ex Trelease» was cited by Thiede (2001) as ‘nom. inval., art.61.1’. Trelease cited the name as ‘*A. Payrii* De Laet, Cat. 1904: 38.’ in synonymy so he did not validate it.

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References

- Alvarez de Zayas, A. (1996) Los agaves de Cuba central. *Fontqueria* 44: 117–128.
- Berger, A. (1913) Eine neue *Agave*. *Agave vilmoriniana* Berger, nov. spec. *Repertorium specierum novarum regni vegetabilis* 12: 503.
- Berger, A. (1915) *Die Agaven. Beiträge zu einer Monographie*. Gustav Fischer Verlag, Jena, 288 pp.
- Brandege, T.S. (1890) A collection of plants from Baja California, 1889. *Proceedings of the California Academy of Science*, II, 2: 117–216.
- Breitung, A.J. (1968) *The Agaves*. Edited by C.Glass and R.A.Foster. The Cactus and Succulent Journal 1968 Yearbook. Abbey Garden Press, Reseda, California, 107 pp.
- Croucher, G. (1873) *Agave peacockii*. *Gardener's Chronicle* 1873: 1400.
- Descourtilz, M.E. (1827) *Flore pittoresque et médicale des Antilles*, vol. 4, Chappron, Renard, Levrault & Malepeyre, Paris, 338 pp.
- Eggl, U. & Newton, L.E. (2004) *Etymological dictionary of succulent plant names*. Springer-Verlag, Berlin, Heidelberg.
- Engelmann, G. (1875) Notes on *Agave*. *Transactions of the Academy of Science of St. Louis* 3: 291–322.
- García-Mendoza, A. & Lott, E.J. (1994) *Agave*. In: Davidse, G., Sousa S., M. & Chater, A.O. (eds) *Flora Mesoamericana* Vol. 6 Alismataceae a Cyperaceae. Universidad Nacional Autónoma de México, Missouri Botanical Garden, The Natural History Museum (London). Mexico, St Louis, London, pp. 40–44.
- García-Mendoza, A. (2011) Agavaceae. *Flora del valle de Tehuacán-Cuicatlán*, fascículo 88. Universidad Nacional Autónoma de México, Mexico, 102 pp.
- Gentry, H.S. (1972) *The Agave family in Sonora*. U.S.D.A. Agriculture Handbook no. 399. Agricultural Research Service, USDA, Washington, 195 pp.
- Gentry, H.S. (1978) *The Agaves of Baja California*. Occasional Papers of the California Academy of Sciences no. 130, 119 pp.
- Gentry, H.S. (1982) *Agaves of continental North America*. The University of Arizona Press, Tucson.
- Govaerts, R., Zonneveld, B.J.M. & Zona, S.A. (2011) *World Checklist of Asparagaceae*. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; <http://apps.kew.org/wcsp/> Retrieved 2011-01-22
- Greene, E.L. (1885) Studies in the botany of California and parts adjacent II. *Bulletin of the California Academy of Sciences* 1: 179–228.
- Haworth, A.H. (1812) *Synopsis plantarum succulentarum*. R. Taylor & Co., London.
- Jacobi, G.A. (1864) Versuch zu einer systematischen Ordnung der Agaveen. *Hamburger Garten-Blumenzeitung* 20: 539–562.
- Jacobi, G.A. (1865) Versuch zu einer systematischen Ordnung der Agaveen. *Hamburger Garten-Blumenzeitung* 21: 249–263.
- Jacobi, G.A. (1869) Nachträge zu dem Versuch einer systematischen Ordnung der Agaveen. *Abhandlungen der Schlesischen Gesellschaft für vaterländische Cultur. Abtheilung für naturwissenschaften und Medicin* 1868: 138–176.
- Jacobi, G.A. (1869b) Ueber einige von dem botanischen Reisenden Karl Besserer neu eingeführte Agaven. *Wochenschrift des Vereines zur Beförderung des Gartenbaues in den Königl. Preussischen Staaten für Gärtnerie und Pflanzenkunde* 12: 177–180.
- Johnston, I.M. (1924) Expedition of the California Academy of Sciences to the Gulf of California in 1921. *Proceedings of the California Academy of Sciences*, ser. 4, 12: 951–1218.

- Kearney, T.H. & Peebles, R.H. (1939) Arizona plants: new species, varieties, and combinations. *Journal of the Washington Academy of Sciences* 29: 474–492.
- Ker Gawler, J.B. (1817) An account of a new species of *Agave*, from the ‘«Biblioteca Italiana», Milan, 1816. *Journal of Science and the Arts, London* III, 2: 86–90.
- Koch, K. (1860) Die Agaveen. *Wochenschrift des Vereines zur Beförderung des Gartenbaues in den Königlich Preussischen Staaten für Gärtnerei und Pflanzenkunde* 3: 20–24, 26–30.
- Koch, K. (1862) Einige Worte über der Tonel’schen Agaveen in Gent. *Wochenschrift des Vereines zur Beförderung des Gartenbaues in den Königlich Preussischen Staaten für Gärtnerei und Pflanzenkunde* 5: 197–199.
- Koch, K. (1865) Agaveen – studien. *Wochenschrift des Vereines zur Beförderung des Gartenbaues in den Königlich Preussischen Staaten für Gärtnerei und Pflanzenkunde* 8: 100–104.
- Kunkel, L.O. (1959) William Trelease February 22, 1857 – January 1, 1945. *Memoirs of the National Academy of Sciences* 35: 307–332.
- Laferrère, J.E. (1995) Neotypification of *Agave rhodacantha* (Agavaceae). *Haseltonia* 3: 33.
- Lemaire, C. (1861) Plantes recommandées. *L’Illustration Horticole* 8: t. 289.
- Lemaire, C. (1864) Espèces nouvelles d’*Agave*. *L’Illustration Horticole* 11: 63–66.
- Linnaeus, C. (1753) *Species Plantarum*. Laurentii Salvii, Stockholm, 560 pp.
- McNeill, J., Barrie, F.R., Buck, W.R., Demoulin, V., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Marhold, K., Prado, J., Prud’homme van Reine, W.F., Smith, G.F., Wiersema, J.H. & Turland, N.J. (eds.) 2012. *International Code of Nomenclature for algae, fungi, and plants (Melbourne Code) adopted by the Eighteenth International Botanical Congress Melbourne, Australia, July 2011*. Koeltz Scientific Books, Königstein. [Regnum Vegetabile 154].
- Miller, P. (1768) *The Gardeners Dictionary*. Ed. 8, John and Francis Rivington, London.
- Nomenclature Commission. (1907) American Code of Botanical Nomenclature *Bulletin of the Torrey Botanical Club* 34(4): 167–178.
- Ochoterena, I. (1913) Plantas deserticas mexicanas. *Memorias y Revista de la Sociedad Científica Antonio Alzate* 33: 93–113.
- Perrine, H. (1838) *Agave sisalana*. *U.S. House Representatives Report. no. 564. 25th Congress*: 87 (1838).
- Poisson, M.J. (1901) Note sur l’*Agave weberi*. *Bulletin du Muséum National d’Histoire Naturelle (Paris)* 7: 230–232.
- Rogers, G.K. (2000) A taxonomic revision of the genus *Agave* (Agavaceae) in the Lesser Antilles, with an ethnobotanical hypothesis. *Brittonia* 52: 218–233.
- Rose, J.N. (1900) *Agave expatriata* and other agaves flowering in the Washington Botanic Garden in 1898. *Annual Report of the Missouri Botanical Garden* 11: 79–83.
- Salm-Reifferscheid-Dyck, J. (1834) *Hortus dyckensis : ou catalogue des plantes cultivées dans les jardins de Dyck*. Arnz, Dusseldorf.
- Salm-Reifferscheid-Dyck, J. (1859) Bemerkungen über die Gattungen *Agave* und *Fourcroya* nebst Beschreibung einiger neuen Arten. *Bonplandia (Hannover)* 7: 86–96.
- Smith, G.F. (2004) The African Plants Initiative: a big step for continental taxonomy. *Taxon* 53: 1023–1025.
- Smith, G.F. & Figueiredo, E. (2013) Type specimens online: what is available, what is not, and how to proceed. Reflections based on an analysis of the images of type specimens of southern African *Polygala* L. (Polygalaceae) accessible on the worldwide web. *Taxon* 62: 801–806.
- Smith, G.F., Roux, J.P., Raven, P. & Figueiredo, E. (2011) African herbaria support transformation on the continent. *Annals of the Missouri Botanical Gardens* 98: 272–276.
- Standley, P.C. (1923) New species of plants from Salvador. *Journal of the Washington Academy of Sciences* 13: 363–371.
- Standley, P.C. (1927) New plants from Central America VII. *Journal of the Washington Academy of Sciences* 17: 161–171.
- Tagliabue, G. (1816) Storia e descrizione del nuovo genere di Pianta denominato Littaea. *Biblioteca Italiana ossia Giornale di letteratura scienze ed arti* 1: 100–110.
- Thiede, J. (2001) *Agave*. In: Egli, U. (ed.), *Illustrated handbook of succulent plants. Monocotyledons*. Springer-Verlag, Berlin, pp. 6–76.
- Thiers, B. (2013) *Index Herbariorum: A global directory of public herbaria and associated staff*. <http://sciweb.nybg.org/science2/IndexHerbariorum.asp> (accessed 6 Jun. 2013).
- Trelease, W. (1907) *Agave macroacantha* and allied Euagaves. *Annual Report of the Missouri Botanical Garden* 18: 233–256.
- Trelease, W. (1908) Variegation in the Agaveae. In: von Linsbauer, K. (ed) *Wiesner-Festschrift im Auftrage des Festkomitees*. C. Konegen, Wien, pp 332–356.
- Trelease, W. (1908b) *Agave rigida - Furcraea rigida - Agave angustifolia*. *Annual Report of the Missouri Botanical Garden* 19: 273–287.
- Trelease, W. (1909) The Mexican fiber agaves known as zapupe. *Transactions of the Academy of Sciences of St. Louis* 18: 29–37.
- Trelease, W. (1912) The Agaves of lower California. *Annual Report of the Missouri Botanical Garden* 22: 37–66.
- Trelease, W. (1912b) A dwarf form of *Agave angustifolia*. *Annual Report of the Missouri Botanical Garden* 22: 99–100.

- Trelease, W. (1912c) Revision of the agaves of the group *Applanatae*. *Annual Report of the Missouri Botanical Garden* 22: 85–97.
- Trelease, W. (1913) *Agave* in the West Indies. *Memoirs of the National Academy of Sciences* 11: 1–55, 116 pls.
- Trelease, W. (1914) *Agave*. In: Bailey, L.H. (ed) *The standard cyclopedia of horticulture* vol. 1, MacMillan, New York, pp. 230–239.
- Trelease, W. (1915) The Agaveae of Guatemala. *Transactions of the Academy of Sciences of St. Louis* 23: 129–152.
- Trelease, W. (1920) 12. Amaryllidaceae. In: Standley, P.C., Trees and shrubs of Mexico. *Contributions from the United States National Herbarium* 23, pp 105–142.
- Trelease, W. (1925) New species of *Agave* from the Republic of Salvador. *Journal of the Washington Academy of Sciences* 15: 393–395.
- Trelease, W. (1926) *Agave ekmani* s. sp. *Repertorium Novarum Specierum Regni Vegetabilis* 22: 374.
- Trelease, W. (1927) *Agave novae hispaniolenses*. *Repertorium Novarum Specierum Regni Vegetabilis* 23: 362–363.
- Trelease, W. & Nowell, W. (1933) *Agave amaniensis*: a new form of fibre-producing agave from Amani. *Bulletin of Miscellaneous Information, Kew* 1933: 465.
- Ullrich B. (1993) *Agave mitis* var. *albidior*. *Succulentas* 16(1): 32.
- Ullrich, B. (2006) *Agave attenuata* ssp *dentata* (Roez) Ullrich. *Haseltonia* 12: 22–29.
- Verschaffelt, J. (1876) *Catalogue des plantes de l'Etablissement Horticole de Jean Nutyens Verschaffelt*, no 19, Gand.
- Walters, M., Smith, G.F. & Crouch, N.R. (2010) The African Plants Initiative (API) in South Africa. *Taxon* 59: 1943–1946.
- Weber, F.A.C. (1902) Notes sur quelques Agaves du Mexique occidental et de la Basse-Californie. *Bulletin du Muséum d'Histoire Naturelle (Paris)* 8: 218–224.
- Zuccarini, J.G. (1833) Über einige pflanzen aus den gattungen *Agave* und *Fourcroya*. *Nova Acta Physico-Medica Academiae Caesareae Leopoldino-Carolinae Naturae Curiosum* 16: 661–679.