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The taxonomy of *Agave lophantha* Schiede (1829) and *A. univittata* Haw. (1831) (Asparagaceae subfam. Agavoideae / Agavaceae) and the typification of both names

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Abstract: In the past the names *Agave lophantha* Schiede (1829) and *A. univittata* Haw. (1831) (Asparagaceae: Agavoideae / Agavaceae) were variously regarded as referring to the same species, or to two different taxa at either species or infraspecific ranks. In clarifying the nomenclature and taxonomy associated with these two names we show that they apply to the same taxon. We further neotypify both names with the same specimen, Howard Scott Gentry, [Arthur] Barclay & [Juan] Arguelles 20410, (US 2558492, barcode 00044294), which is held in US.

Keywords: Agavaceae; *Agave* L.; *Agave lophantha* Schiede; *Agave univittata* Haw.; Asparagaceae: Agavoideae; flora of Mexico; synonymy; taxonomy; typification

INTRODUCTION

The name *Agave lophantha* Schiede (Schiede, 1829: 581–582) (Asparagaceae: Agavoideae / Agavaceae) has been variously interpreted as either validly published (see for example Otto, 1842: 51; Roemer, 1847: 287; Kunth, 1850: 838; Salm-Dyck, 1859: 96; Koch, 1860: 48; Jacobi, 1864: 542; Baker, 1877: 368; Terracciano, 1885: 30; Baker, 1888: 167; Trelease, 1914: 237; Berger, 1915: 91; Trelease, 1920: 136–137; Jacobsen, 1954: 135; Gentry, 1982: 157; Irish & Irish, 2000: 134; Thiede, 2001: 45; Heller, 2003: 93; Richter, 2011: 33; Espejo Serna 2012: 215; Pilbeam, 2013: 124; Villaseñor, 2016: 619, and Thiede, 2020) or not validly published (see for example Breitung, 1959: 93; Reveal & Hodgson, 2002: 449; Hochstätter, 2015: IX: 38; and Hawker, 2016: 24, 25, 95–97). Smith *et al*. (2018) argued that the name was indeed validly published, based on the cryptic, but nonetheless sufficient, descriptive statement included in Schiede (1829). In the spirit of Recommendation 14A.1. of the *International Code of Nomenclature for algae, fungi, and plants* (*ICN*) (Turland *et al*., 2018: 46) [applicable to proposals for the conservation of names] and Recommendation 56A.1. of the *ICN* [applicable to proposals for the rejection of names (see Turland *et al*., 2018: 137)] and to avoid premature nomenclatural changes in databases and literature, and pending the outcome of a request for a binding decision on whether the name was validly published (Smith *et al*., 2018), the name *A. lophantha* is here treated as validly published. In addition, two of the arguably most widely used references on *Agave* (Gentry, 1982 and Thiede, 2001, and also Thiede, 2020) treated the name *A. lophantha* as validly published.

In contrast to the uncertainty that has reigned concerning the valid publication of the name *Agave lophantha*, there has never been doubt that Haworth (1831: 415) validly published the name *A. univittata* Haw.

However, doubt has existed whether the names *Agave lophantha* and *A. univittata* apply to the same species, or to two different taxa. We discuss and clarify the nomenclature and taxonomy associated with these two names and argue that they apply to the same taxon. To fix the application of the names *Agave lophantha* and *A. univittata* we here typify both names with the specimen *Howard Scott Gentry, [Arthur] Barclay & [Juan] Arguelles 20410*, (US 2558492, barcode 00044294), which is held in US. Herbarium codes follow Thiers (2019).

Figure 1. Some forms of *Agave lophantha*, such as this one, have uniformly greyish green leaves. Photograph: Gideon F. Smith (Desert Botanical Garden Phoenix, Arizona, USA, 11 April 2014).

Figure 2. A widely encountered form of *Agave lophantha* with a distinct, light green, central stripe on the adaxial leaf surface, a leaf ornamentation that corresponds to descriptive statements generally associated with the name *Agave univittata*, which we regard as a synonym of *A. lophantha*. Photograph: Gideon F. Smith (cultivation, north-central South Africa, 03 May 2018).

TAXONOMY OF *AGAVE LOPHANTHA* AND *A. UNIVITTATA*

One of the arguments that have been advanced for the recognition of *Agave lophantha* and *A. univittata* as two separate species is that *A. lophantha* has monochromatic green leaves (Fig. 1), while *A. univittata* is regarded as having a lighter green or yellowish longitudinal stripe running down the length of its leaves adaxially (Figs. 2 and 3). However, the cryptic descriptive statement that appeared as part of the protologue of the name *A. lophantha* does not mention this leaf character. It went unnoticed by previous workers on Agave that Schiede, who published the name *A. lophantha*, had sent a specimen of this species to the Botanical Garden in Berlin, Germany, where it was described by Koch (1860: 46) as "juniora medio stria lata, pallidiore, longitudinali instructa" [English: "when young furnished with a broad pale longitudinal mid-stripe"], and by Jacobi (1864: 543) as "obscure-viridibus medio fascia pallidiore" and "schmutzig dunkelgrün mit einem breiten, blasseren Mittelstreifen" [English: "dark green with a broad paler mid-stripe"]. However, Baker (1877: 368; 1888: 167) and Trelease (1914: 236) described the leaves of *A. lophantha* as uniformly green without a stripe, and contrasted this with *A. univittata*, the leaves of which have such a median stripe adaxially (Koch 1860: 47; Jacobi 1864: 544; Baker 1877: 368; 1888: 367; Trelease 1914: 237 [as *A. lophantha* var. *univittata*]). Note that the abaxial leaf surfaces are generally uniformly green, often with darker, very thin longitudinal lines (Fig. 4).

As far as we could ascertain, Baker (1892: 2) was the first to express doubt whether *Agave univittata* and *A. lophantha* are distinct species. He stated: "I do not think *lophantha* is really distinct specifically from *A. univittata*, Haworth, which has long green leaves with a pale band down the middle."

Berger (1898: 592) stated that: "*Agave lophantha* ist stets einfarbig im Typus, doch können Ausläufer derselben junge Pflanzen bilden mit deutlichem, gelbem Mittelbande, es ist das die von Haworth als Art aufgestellte und seither so geführte *A. univittata*" [English: "*Agave lophantha* is always typically unicoloured, but when offsetting may form young plants with a distinct, yellow median stripe, which is *A. univittata* established by Haworth as a species and since then treated as such"].

Later, for *Agave lophantha*, Berger (1915: 91) provided a detailed description, with full reference to the protologue ["Linnaea IV (1829) 582"], but with the additional note: "ohne Beschreibung" [English: "without description"], a view with which we disagree (see "**INTRODUCTION**"). For *A. lophantha* Berger (1915: 91) stated: Leaves "ohne oder mit nur sehr undeutlichem Mittelbande" [English: "without or with only very indistinct median stripe"]. Despite the observation published earlier (Berger, 1898: 592; see previous paragraph), he listed *A. univittata* as a species distinct from *A. lophantha*.

Trelease (1914: 237) published the new combination *Agave lophantha* var. *univittata* (Haw.) Trelease, and was the first author who formally treated both names as being applicable to variants of the same species. Maire & Weiller (in Maire, 1960: 84) published the new combination *A. univittata* var. *lophantha* (Schiede) Maire & Weiller, which is listed by the World Checklist of Selected Plant Families (WCSP, Govaerts *et al.*, 2011) as a "*nom. illeg.*", likely because the name *A. lophantha* is there regarded as not having been validly published, a view we do not agree with (see: http://wcsp.science.kew.org/namedetail.do?name_id=310955; accessed 07 May 2018).

Gentry (1982: 157) was also of the opinion that both names, *Agave lophantha* and *A. univittata*, refer to the same species. He treated the name *A. lophantha* as validly published and included *A. univittata* in its synonymy. We agree with this view, based on the arguments that an original plant of Schiede had leaves *with* a mid-stripe, and that at the type locality of *A. lophantha* plants with unicoloured and striped leaves occur together (see below).

Note that Thiede (2001) treated several of the synonyms listed below under *Agave lechuguilla* Torr.

Figure 3. Specimens of *Agave lophantha* growing in their habitat. Both specimens have pale green, longitudinal mid-stripes on their adaxial leaf surfaces. Photograph: Greg Starr (hill *ca*. 5km northeast of Aramberri at an elevation of *ca*. 1015m [3333 ft] above sea level, Mexico, Nuevo León, 06 May 2019).

TYPIFICATION OF THE NAME *AGAVE LOPHANTHA*

In the protologue of the name *Agave lophantha*, Schiede (1829) did not indicate a type for the name, nor was original material cited, or is known to exist, that would be eligible for designation as lectotype. Espejo Serna & López-Ferrari (1993: 18) regarded *Agave lophantha* as a "nom. nud.", a statement with which we disagree, and they stated: "TIPO: Veracruz, Malpays de Naulingo [Naolinco]. No se cita ejemplar en el protólogo". For *A. univittata* they noted: "TIPO: No se obtuvo información". For neither of these names did they therefore designate types. More than 150 years after Schiede (1829) described *Agave lophantha*, this matter was for the first time addressed by Gentry (1982: 159) when he noted that he "…found three sheets of dried flower specimens in Missouri Botanical Garden [presumably in the Garden's Herbarium, MO] labeled "Trelease 2/28/05 [28 February 1905] Malpais de Naulingo (type loc.)-6."".

We found the following four Trelease herbarium specimens of *Agave lophantha* at MO, all of which have different MO accession numbers, and were collected at the type locality of *Agave lophantha* as recorded by Schiede (1829):

- "Malpays de Naulingo (type loc.); 2/28/05; *Trelease 6*;"; barcode MO 3346899". Additional unsigned label states "Topotype". Part of an inflorescence.
- "Malpays de Naulingo (type loc.); 2/28/05; *Trelease 6*; barcode MO 3346900". Additional unsigned label states "Topotype". Two flower pairs.
- "Malpays de Naulingo, Mex. Exceptional form with evanescent band; 8/19/03; *Trelease s.n.*; barcode MO 2536146". Determinavit strip signed by Howard Scott Gentry in "Sept. '77" states "Topotype". Single leaf.

Figure 4. Close-up of a leaf of *Agave lophantha* showing the usual lack of a central green stripe on the abaxial surface. Faint darker green, longitudinal lines are visible though. Photograph: Gideon F. Smith (Desert Botanical Garden Phoenix, Arizona, USA, 11 April 2014).

- "Malpays de Naulingo, Mex. The typical white-banded form. See photo [presumably the drawing attached to the specimen]; 8/19/03; *Trelease 8*; barcode MO 3285810". Two leaves and a drawing of a leaf apex and leaf margin.

A further MO specimen sheet (barcode MO 3346901), devoid of preserved plant material, has three sheets of paper containing handwritten notes attached to it. While one of these sheets unambiguously indicates that it was written by Trelease, the handwriting on all three coincides with that of Trelease's.

"Topotype" that appears on three of the four specimens listed above is an unofficial term that has no standing under the *ICN*. This term is usually applied to a specimen of a plant collected from the original type locality (Turland, 2013: 62). A stricter interpretation is that it is a specimen (of a plant) collected from the same locality as the holotype and usually on a different date. Note that the name *Agave lophantha* does not have a holotype.

Gentry (1982: 159) additionally cited one of his own gatherings collected at Naolinco, the type locality of *Agave lophantha*, as recorded by Schiede (1829), "*Gentry 20410*, DES, MEXU, US", as "Topotype" (Fig. 5). One specimen at US and two specimens at MEXU are available online. The specimen cited by Gentry at DES cannot be located in any database such as those accessible at SEINet, GBIF, and EDIT; it is most likely the specimen now kept at ARIZ (ARIZ 266702, n.v.); ARIZ purchased Gentry's specimens from DES just before his death (Valenzuela-Zapata & Nabhan, 2003: xiv). Two further specimens accessible via GBIF and EDIT are at XAL (n.v.) [see: https://www.gbif.org/occurrence/1896193864] and MICH (n.v.) [see: https://www.gbif.org/occurrence/1989130921]. The specimen kept at US (US 2558492, barcode 00044294) consists of two leaves and two photographs, but it should, according to the collecting label, be attributed to "Howard Scott Gentry, Barclay & Arguelles". Gentry (1982: xiv) indeed acknowledged that his "…field trips and collec-

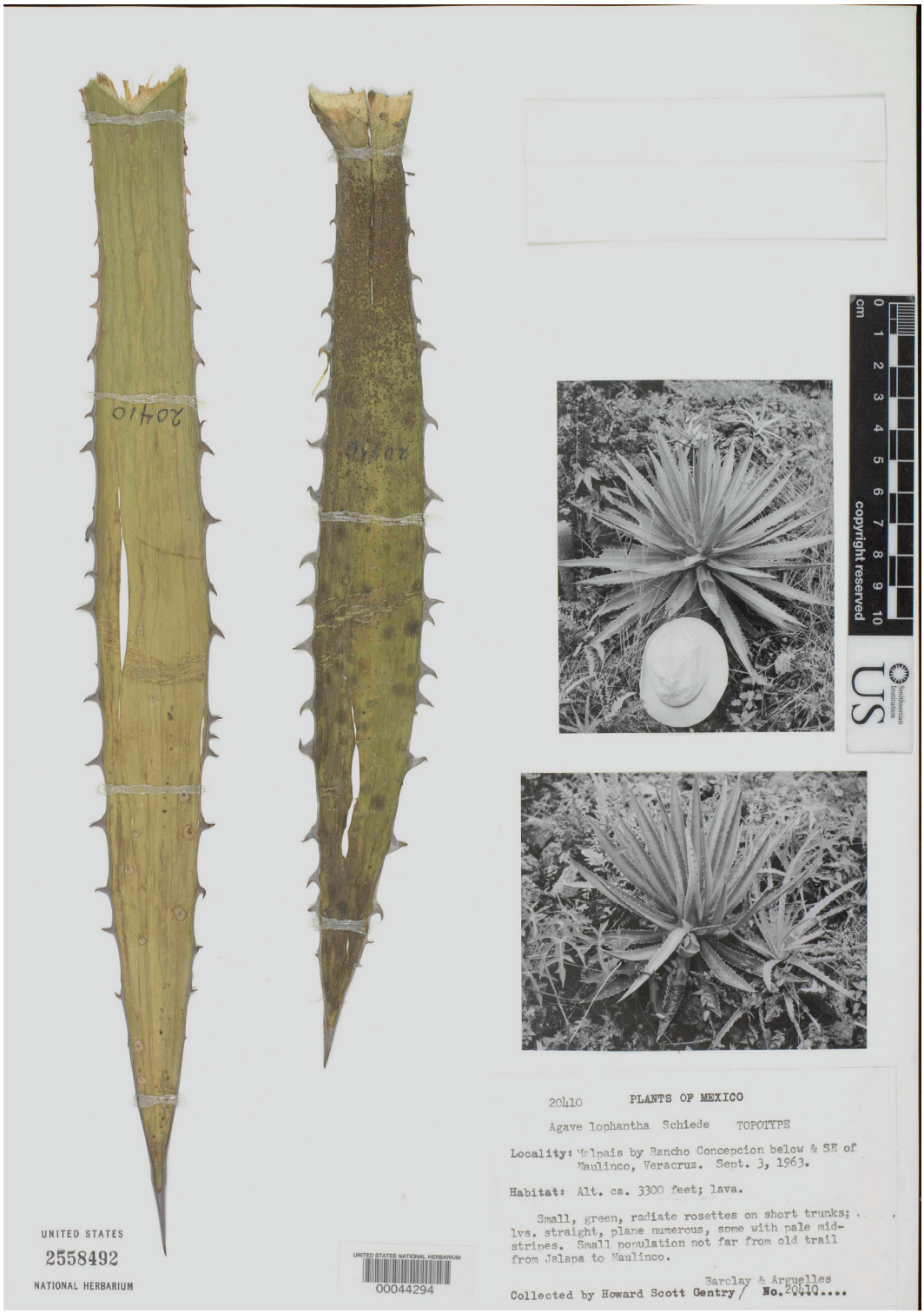

Figure 5. Specimen (*Howard Scott Gentry, [Arthur] Barclay & [Juan] Arguelles 20410*) of *Agave lophantha* held in the United States National Herbarium (US), Washington, D.C., USA, designated as neotype of the names *Agave lophantha* and *A. univittata* (US 2558492, barcode 00044294). Image reproduced with permission, courtesy of the United States National Herbarium (US).

tions were greatly benefitted by Juan Arguelles of San Bernardo, Sonora; [and] by Arthur Barclay of ARS, Beltsville, Maryland…". Gentry (1982) stopped short of designating a specimen of *Gentry et al. 20410* as the type of the name *A. lophantha*. We here formally designate the specimen at US as neotype of the name *Agave lophantha*, as follows:

Agave lophantha Schiede in *Linnaea* 4: 581–582 (1829). **Type**: MEXICO. "Veracruz. Malpais by Rancho Concepcion below & SE of Naulinco [Naolinco]", 03 September 1963, *Howard Scott Gentry, [Arthur] Barclay & [Juan] Arguelles 20410*, (US 2558492, barcode 00044294), US, (neo-) (Figure 5), **designated here**, MEXU 130459 (digital image!), MEXU 376405 (digital image!) (isoneo-).

NOTE ON THE TYPE SPECIMEN:

The label attached to the neotype, *Howard Scott Gentry, [Arthur] Barclay & [Juan] Arguelles* 20410, reads: "…lvs. […] some with pale mid-stripes". Similarly, the top-most notes sheet attached to the MO herbarium sheet (MO 3346901, barcode MO-426228 [from MO database, not on the sheet]), in the hand of Trelease, stated that: "…the upper face mostly [the latter word doubly underlined] with a whitish-green median stripe". Therefore, these observations of Gentry *et al*. and Trelease indicate unambiguously that even at the type locality of *Agave lophantha* at Naolinco, both variants, i.e., with a median leaf stripe (= *A. univittata*) and without such a stripe (= *A. lophantha*), occur together in the same location. This strengthens our argument to regard these two names as referring to the same species.

The specimen *Ogden & Gilly 51133* from MEXICO, "Opposite side of railroad from highway to Tampico, about 10 kms. east of Cd. VALLES", 21. Feb. 1951 (MEXU 58534, digital image!) with leaves with a "yellowish stripe down middle of upper surface of many of them" likewise indicates the co-occurrence of plants with leaves with and without median stripe in the same location.

TYPIFICATION OF THE NAME *AGAVE UNIVITTATA*

As was the case with *Agave lophantha* Schiede, Haworth (1831) also did not cite any material when he published the name *A. univittata*. Haworth's personal herbarium of about 20,000 "species" (Stearn, 1965: 25) was acquired by Henry B. Fielding (1805–1851), who in turn bequeathed it to the University of Oxford. Fielding, not realizing the importance of the collection, unfortunately discarded most of the specimens (Stearn, 1965, 1971). A few surviving Haworth specimens are kept in the OXF herbarium; however, no specimens of *Agave* preserved by Haworth are extant in OXF (Serena K. Marner, personal communication). Consequently, a lectotypification is not possible, and a neotype must be designated. In order to fix the conspecificity of *A. univittata* and *A. lophantha*, for which arguments are provided above, we here designate the same specimen with which *A. lophantha* was neotypified, as neotype for the name *A. univittata*, as follows:

Agave univittata Haw. in *Philos. Mag. Ann. Chem*. 10: 415 (1831). **Type**: MEXICO. "Veracruz. Malpais by Rancho Concepcion below & SE of Naulinco [Naolinco]", 03 September 1963, *Howard Scott Gentry, [Arthur] Barclay & [Juan] Arguelles 20410*, (US 2558492, barcode 00044294), US, (neo-), (Figure 5), **here designated**, MEXU 130459 (digital image!), MEXU 376405 (digital image!) (isoneo-).

SYNONYMY OF *AGAVE LOPHANTHA*

Agave lophantha Schiede, *Linnaea* 4: 582 (1829) ≡ *Agave univittata* var. *lophantha* (Schiede) Maire & Weiller, *Fl. Afrique N*. 6: 84 (1959 published 1960), *nom. illeg*. (Art. 52.2). **Type**: MEXICO. "Veracruz. Malpais by Rancho Concepcion below & SE of Naulinco [Naolinco]", 03 September 1963, *Howard Scott Gentry, [Arthur] Barclay & [Juan] Arguelles 20410*, (US 2558492, barcode 00044294), US, (neo-), **here designated**, MEXU 130459 (digital image!), MEXU 376405 (digital image!) (isoneo-).

≡ *Agave univittata* Haw., *Philos. Mag. Ann. Chem*. 10: 415 (1831) ≡ *Agave heteracantha* var. *univittata* (Haw.) A.Terracc., *Prim. Contr. Monogr. Agave*: 31 (1885), *nom. illeg*. (Art. 52.2) ≡ *Agave lophantha* var. *univittata* (Haw.) Trel. in L.H.Bailey, *Stand. Cycl. Hort*. 1: 237 (1914). **Type**: MEXICO. "Veracruz. Malpais by Rancho Concepcion below & SE of Naulinco [Naolinco]", 03 September 1963, *Howard Scott Gentry, [Arthur] Barclay & [Juan] Arguelles 20410*, (US 2558492, barcode 00044294), US, (neo-), **here designated**, MEXU 130459 (digital image!), MEXU 376405 (digital image!) (isoneo-).

= *Agave heteracantha* Zucc., *Flora* 15(2 Beibl.): 97 (1832) ≡ *Agave univittata* var. *heteracantha* (Zucc.) Breitung, *Cact. Succ. J. (Los Angeles)* 31: 114 (1959). **Type**: Not designated.

= *Agave heteracantha* var. *vittata* Regel, *Gartenflora* 7: 312 (1858). **Type**: Not designated.

= *Agave caerulescens* Salm-Dyck, *Bonplandia (Hannover)* 7: 92 (1859) ≡ *Agave lophantha* f. *caerulescens* (Salm-Dyck) Voss, *Vilm. Blumengärtn*. ed. 3, 1: 1036 (1895) ≡ *Agave univittata* var. *caerulescens* (Salm-Dyck) H.Jacobsen in H.Jacobsen & G.D.Rowley, *Natl. Cact. Succ. J*. 28: 4 (1973) ≡ *Agave lechuguilla* var. *caerulescens* (Salm-Dyck) P.Van der Meer, D.Guillot & C.Puche, *Xerophilia* 10: 37–38 (2014), *nom. inval.* (Art. 41.5). **Type**: Not designated.

= *Agave poselgeri* Salm-Dyck, *Bonplandia* (Hannover) 7: 92 (1859) ≡ *Agave lophantha* var. *poselgeri* (Salm-Dyck) A.Berger, *Agaven*: 93 (1915). **Type** (recorded as syntypes(?) by Berger, 1915: 93; however one of these specimens, which were not cited by Salm-Dyck, rather could be designated as neotype): Texas, near El Paso, 1848, *C. Wright*

(K); *G.R. Vasey* (US; K).

= *Agave caerulescens* var. *grisea* Jacobi, *Hamburger Garten- Blumenzeitung* 22: 60 (1866), **syn. nov. Type**: Not designated.

= *Agave lophantha* var. *subcanescens* Jacobi, *Hamburger Garten- Blumenzeitung* 22: 62 (1866) = *Agave univittata* var. *subcanescens* (Jacobi) H.Jacobsen in H.Jacobsen & G.D.Rowley, *Natl. Cact. Succ. J*. 28: 4 (1973). **Type**: Not designated.

= *Agave lophantha* var. *brevifolia* Jacobi, *Hamburger Garten- Blumenzeitung* 22: 62 (1866) ≡ *Agave univittata* var. *brevifolia* (Jacobi) H.Jacobsen in H.Jacobsen & G.D.Rowley, *Natl. Cact. Succ. J*. 28: 4 (1973). **Type**: Not designated.

= *Agave lophantha* var. *gracilior* Jacobi, *Hamburger Garten- Blumenzeitung* 22: 62 (1866) ≡ *Agave univittata* var. *gracilior* (Jacobi) H.Jacobsen in H.Jacobsen & G.D.Rowley, *Natl. Cact. Succ. J*. 28: 4 (1973). **Type**: Not designated.

= *Agave univittata* var. *major* Jacobi, *Hamburger Garten- Blumenzeitung* 22: 63 (1866), **syn. nov. Type**: Not designated.

= *Agave lophantha* var. *angustifolia* A.Berger, *Agaven*: 93 (1915) ≡ *Agave univittata* var. *angustifolia* (A.Berger) H.Jacobsen in H.Jacobsen & G.D.Rowley, *Natl. Cact. Succ. J*. 28: 4 (1973). **Type**: Not designated.

= *Agave lophantha* var. *pallida* A.Berger, *Agaven*: 93 (1915). **Type**: Coahuila, Parras, 1905, *Purpus s.n*. (US US00092203 holo-).

NOMENCLATURAL NOTES:

1. '*Agave lophantha* var. *caerulescens* (Salm-Dyck) Jacobi'. Thiede (2001) listed this name as a synonym of *A. lechuguilla*. "*Agave lophantha* var. *caerulescens* (Salm-Dyck ex Jacobi) Jacobi, Neue Allg. Deutsche Garten- Blumenzeitung 22: 60 (1866)" was also listed by Govaerts *et al*. (2011) as a synonym of *A. univittata*. However, the name described by Jacobi on that page is "A. caerulescens [Salm-Dyck ex Jacobi] [var.] grisea". We were unable to trace the source of this combination and therefore do not include it in the formal synonymy of *A. lophantha*.
2. The designation '*Agave mezortillo* hort. (s.a.)' is listed as a synonym of *Agave lophantha* by Gentry (1982: 157), but it cannot be traced anywhere in the literature. Note though that the common names "maguey mezortillo" or simply "mezortillo" are used for *A. lophantha* in Mexico.
3. '*Agave vittata* Regel in *Gartenflora* 7: 312 (1858)' was listed by Govaerts *et al*. (2011) and others as validly published and legitimate. However, the name published in the *Gartenflora* reference cited was *A. heteracantha* var. *vittata* Regel, which Govaerts *et al*. (2011) listed as a combination made by Regel [in *Index Seminum (LE, Petropolitanus)* 1858: 27 (1859)] based on '*A. vittata* Regel'.

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