Review of the fossil record of *Passiflora*, with a description of new seeds from the Pliocene Gray Fossil Site, Tennessee, U.S.A.

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Abstract

Premise of the research. Passifloroideae (over 700 species), which include the large genus *Passiflora* (over 550 species), are distributed pantropically today. The fossil record of the group is, nevertheless, small and poorly understood. In this study, I provide a critical review of the fossil record of *Passiflora* and Passifloroideae, with a description of a new fossil species based on seeds.

Methodology. I examined thirteen specimens of *Passiflora*-like seeds from the Pliocene Gray Fossil Site, eastern Tennessee, U.S.A. In order to evaluate their affinities, I reviewed the available literature on Passifloroideae with emphasis on *Passiflora*, including images of seeds of over 200 species of *Passiflora*. I also reviewed the literature on the fossil record of Passifloroideae and obtained supplementary images of some fossil taxa.

Pivotal results. Several subgeneric groups within *Passiflora* can be distinguished on the basis of isolated seeds. As a result, I emend the diagnosis of *Passifloroidesperma* Martínez-A.—a fossil genus encompassing seeds assignable to Passifloroideae but not an extant genus therein—to eliminate characters diagnostic for subgeneric taxa within *Passiflora*. Two Miocene fossil seed species from Europe, *Passiflora kirchheimeri* Mai and *P. heizmannii* H.-J. Gregor, are reassigned to *Passifloroidesperma*. Two additional fossil seed species are assigned to *Passiflora*: *Passiflora bulgarica* (Palam.) Hermsen, stat. nov., from the middle Miocene of Bulgaria and *P. appalachiana* Hermsen, sp. nov., from Gray Fossil Site.

Conclusions. The presence of fossil passifloroid seeds in Europe shows that Passifloroideae once occurred in that region, although they are no longer found there today. *Passiflora bulgarica* has characteristics consistent with placement in supersection *Cieca*, a group today confined to the Americas. *Passiflora appalachiana* is similar to modern *Passiflora incarnata*, which is widespread in the eastern United States. *Passiflora appalachiana* is the first plant macrofossil taxon described from Gray Fossil Site that shows a neotropical rather than Laurasian biogeographic connection.

Introduction

The genus *Passiflora* L. (Passifloraceae Juss. ex. Roussel, subfamily Passifloroideae Burnett), the passionflowers, includes over 550 species of vines, lianas, shrubs, and small trees (MacDougal and Feuillet 2004; Ulmer and MacDougal 2004; Feuillet and MacDougal 2007; Hilgenhof 2013; Krosnick et al. 2013a). Passionflowers are known for their unusual flowers, which often have a conspicuous corona made up of one or more series of sterile appendages, as well as stamens and carpels that are fused into an androgynophore (Jørgensen et al. 1984; Ulmer and MacDougal 2004; Feuillet and MacDougal 2007; Bonilla Morales et al. 2015); some species are cultivated as ornamentals, for their edible fruits, or for medicinal purposes (Ulmer and MacDougal 2004; Ocampo Pérez 2007; Yockteng et al. 2011). *Passiflora* is primarily distributed in the Americas—especially the Neotropics—although a small number of species (ca. 25) are native to the Old World tropics in South Asia to China, southeast Asia, and Oceania (Fig. 1; Krosnick and Freudenstein 2005; Ocampo Pérez 2007; Wang et al. 2007;

Krosnick et al. 2009, 2013a, 2013b; Ma et al. 2019). The taxonomy of the genus is complex, with species presently divided into five subgenera: *Astrophea* (DC.) Mast. (66 species), *Decaloba* (DC.) Rchb. (ca. 230 species), *Deidamioides* (Harms) Killip (13 species), *Passiflora* (ca. 250 species), and *Tetrapathea* (DC.) P.S. Green (3 species) (Feuillet and MacDougal 2003; MacDougal and Feuillet 2004; Krosnick et al. 2009, 2013a; Hilgenhof 2013); four of the subgenera are further subdivided in supersections, sections, and/or series (Feuillet and MacDougal 2003; MacDougal and Feuillet 2004). Despite the modern diversity of the genus, few reports of *Passiflora* macrofossils exist, and the majority of these are considered dubious (reviewed by Kozak 2015; Martínez 2017; see also the discussion below). The most credible reports are typically considered to be of selected fossil *Passiflora* seeds from the Miocene of Germany (one of these seeds was used as a fossil calibration by Hearn 2006 and Muschner et al. 2012; see also reviews by Kozak 2015 and Martínez 2017). However, Martínez (2017) argued that *Passiflora* seeds cannot be distinguished from those of other extant genera in subfamily Passifloroideae, and thus that isolated fossil "*Passiflora*" seeds should be referred to the subfamily using the fossil genus *Passifloroidesperma* Martínez-A.

Passifloroideae (16 genera, over 700 species, mostly neotropics and paleotropics; Fig. 1) are the largest subfamily of Passifloraceae, a family that includes about 27 genera and over 1000 species of plants primarily distributed in the tropics (Stevens 2001 onwards). The family is divided into four subfamilies: Malesherbioideae Burnett, Turneroideae Eaton, Passifloroideae, and Pibirioideae M.W.Chase & Christenh. (Stevens 2001 onwards; APG III 2009; Maas et al. 2019). Passifloraceae are characterized by the presence of cyclopentenoid cyanogenic glycosides (Stevens 2001

84 onwards; APG II 2003; Maas et al. 2019). Distinctive morphological characteristics
85 shared by some or all subfamilies of Passifloraceae include extrafloral glands (i.e., leaf
86 glands/nectaries or glandular hairs), a floral tube formed by the perianth, a corona, an
87 androgynophore, a tricarpellate ovary with parietal placentation, and arillate seeds (APG
88 II 2003; Arbo 2007; Feuillet and MacDougal 2007; Kubitzki 2007; Maas et al. 2019). All
89 three subfamilies of Passifloraceae for which seeds are known
90 (Malesherbioideae/*Malesherbia* Ruiz & Pav., Passifloroideae, Turneroideae) have a
91 seed coat with a layer of elongated, sclerified cells (palisade/radial in *Malesherbia* and
92 Passifloroideae, oblique in Turneroideae) and often foveolate or reticulate sculpture
93 (Johri et al. 1992; Arbo 2007; Feuillet and MacDougal 2007; Kubitzki 2007; Gonzalez
94 and Arbo, 2013; Martínez 2017). Notably, seeds of Passifloroideae can easily be
95 distinguished from seeds of other subfamilies of Passifloraceae because passifloroid
96 seeds are usually compressed (Stevens 2001 onwards; Martínez 2017). They also have
97 ruminate endosperm (Dathan and Singh, 1973; Johri et al. 1992; Feuillet and
98 MacDougal 2007; Gurski 2015; Martínez 2017), which is absent (Turneroideae: Johri et
99 al. 1992) or not reported and here presumed absent (Malesherbioideae) in the other
100 subfamilies. For a discussion of other differentiating seed characteristics at the
101 subfamily level in Passifloraceae, see Martínez (2017).
102 For this study, I reassessed the morphological variation among seeds of taxa
103 within Passifloroideae—with particular focus on subgroups within the genus
104 *Passiflora*—primarily on the basis of published images and descriptions. Based on my
105 findings, I emend the circumscription of *Passifloroidesperma* and provide updated
106 classifications for fossil seed species and subspecies from Europe. I also describe a

new species of fossil *Passiflora* seeds from the early Pliocene Gray Fossil Site (GFS), eastern Tennessee, U.S.A. The GFS seeds are similar to the seeds of the eastern North American native species *Passiflora incarnata* L. (purple passionflower/maypop) and provide a new, neotropical biogeographic connection for the Gray Fossil Site macroflora.

Fossil record of Passifloroideae

The fossil record of Passifloroideae has been reviewed recently by Kozak (2015, who also covered Turneroideae) and Martínez (2017). Each provided evaluations of pollen, leaf, and seed records, although their treatments overlap only partially in taxonomic coverage and occurrences. They considered most fossil pollen reports dubious (Table A3), including pollen from the Paleogene (*Spirosyncolpites spiralis* González-Guzmán) and Neogene (*Stephanocolpites* sp. Hammen) of northern South America and the Neogene of Mexico (*Passiflora*) (for original reports, see Graham 1976; Hoorn 1994; Jaramillo et al. 2010a, b). Martínez (2017: 1858) rated only one—*Syncolpites* sp. Hammen from the late Miocene of Patagonia, Argentina (Palazzesi et al. 2014)—to be of "medium" reliability. Palazzesi et al. (2014, see their supplementary information) compared this pollen to pollen of extant *Passiflora caerulea* L. (as "*Passiflora coerulea*"). Examination of published images of a Patagonian *Syncolpites* grain (see supp. fig. 3C, F in Palazzesi et al. 2014), however, shows that it has more apertures than a *P. caerulea* pollen grain (cf. *P. caerulea* pollen, fig. 35 in Amela García et al. 2002); furthermore, the apertures (holes) in the *Syncolpites* grain are distributed

over the entire surface of the grain rather than equatorially, as in *P. caerulea* (cf. *P. caerulea* pollen, fig. 35 in Amela García et al. 2002; see also Table A3). Thus, the assignment of the Patagonian fossil pollen to *Passiflora* based on similarity to *P. caerulea* pollen is not supported. A final fossil pollen report not covered in prior reviews is *Retistephanocolpites* "*passionis*" (ined., name proposed in a thesis) from the Miocene of Brazil; this pollen type was considered to have affinities to *Passiflora* or possibly Bignoniaceae Juss. (D'Apolito 2016; see also Table A3).

Both Kozak (2015) and Martínez (2017) considered reports of passifloroid macrofossils from the Late Cretaceous—including the seed *Carpolithus passifloriformis* K.I.M.Chesters from Nigeria (Chesters 1955) and the leaf *Passiflora antiqua* Newb. from the northeastern U.S.A. (Newberry 1895)—to be unreliable. *Carpolithus passifloriformis* is represented by one seed (Chesters 1955). Chesters (1955; see also Martínez 2017) noted that the seed differs from modern passifloroid seeds in size and seed coat sculpture (i.e., presence of a vertical furrow, number of pits), and thus indicated uncertainty about its affinities. The holotype of *Passiflora antiqua* is a bilobed leaf from Woodbridge, New Jersey (Fig. 2A; Newberry 1895; Berry 1911). While bilobed leaves occur in extant *Passiflora* (Fig. 2B; MacDougal and Feuillet 2004; Ulmer and MacDougal 2004; Milward-de-Azevedo et al. 2012; Krosnick et al. 2013a; Boza Espinoza et al. 2018), it seems more likely that *P. antiqua* is a poorly preserved example of similar leaves from Woodbridge assigned to *Bauhinia cretacea* Newb. (Fig. 2C; Newberry 1886, 1895; Berry 1911). Newberry (1895) separated *P. antiqua* and *B. cretacea* based on overall size, apex angle, and venation pattern. Newberry's "*Bauhinia*" leaves have been linked to *Liriophyllum* Lesq. (Herendeen et al. 1992) and

153 *Liriodendrites* Johnson (Wang et al. 2014, see their additional file 4; Fig. 2D).
154 *Liriophyllum* (Albian–Cenomanian, North America) and *Liriodendrites* (Cretaceous–
155 Paleocene, Eurasia and North America) are bilobed leaf types with probable
156 (*Liriophyllum*) or possible (*Liriodendrites*) affinities to Magnoliaceae (cf. *Liriodendron* L.)
157 (Dilcher and Crane 1984; Johnson 1996; Alekseev 2009; Wang and Dilcher 2009, 2018;
158 Romanov and Dilcher 2013; Wang et al. 2014; Harris and Arens 2016).
159 Cenozoic fossil leaves have been reported from deposits in Europe, the
160 Americas, and Antarctica (Table A4). The first published fossil passifloroid leaves were
161 from Italy and were originally assigned to *Granadilla* Mill. (synonym of *Passiflora*)
162 (Massalongo 1850; IFPNI International Editorial Board 2014–2020); they have all since
163 been reassigned to unrelated genera (Massalongo 1859). Many remaining reports of
164 fossil *Passiflora* leaves from the nineteenth to mid-twentieth centuries are each based
165 on few (ca. one to four) specimens of unlobed or trilobed leaves (Table A4; Friedrich
166 1883a, b; Britton 1893; Berry 1919, 1939; Hollick 1927; Hunger 1939; Fischer 1950);
167 the reliability of these reports is questionable, and they have been omitted from recent
168 reviews of fossil Passifloroideae (Kozak 2015; Martínez 2017). Another genus,
169 *Passifloraephyllum* Rásky, with the sole species *Passifloraephyllum kraeuselii* Rásky
170 (Rásky 1960), is based on a single partial leaf specimen from the Oligocene of Hungary
171 (Rásky 1960; revised age after Hably and Fernandez Marron 1998); Rásky (1960)
172 compared the fossil leaf to leaves of several extant species of *Passiflora* (e.g.,
173 *Passiflora sexflora* Juss.). *Passifloraephyllum* was used as a calibration in a study by
174 Kozak (2015), who accepted it as a reliable record. In contrast, it was called
175 “unconfirmed” by Krosnick et al. (2013a: 704, as *Passiflora*) and considered dubious by

Martínez (2017). Its relationship to Passifloroideae is equivocal. Pole (1994) described one partial leaf specimen from the Eocene of New Zealand with morphology similar to leaves of *Passiflora edulis* Sims; the relationships of this specimen are uncertain (Pole 1994; Kozak 2015).

Fossil *Passiflora* leaf species based on larger suites of specimens (ca. 10 or more) include *Passiflora nikolaevii* Budantsev (likely including *Passiflora feuilletii* Torres, nom. nud.), *Passiflora braunii* R.Ludw., and *Passiflora basiloba* Smiley. Of these, the oldest is *P. nikolaevii*, which is based on about 10 leaves from the Paleogene of King George Island, Antarctica (Budantsev 2012); these leaves are broad and bilobed with a truncate apex (Torres 2003; Budantsev 2012). Notably, *Passiflora* species with bilobed leaves tend to occur in the large monophyletic supersection *Decaloba* (DC.) Rchb. (MacDougal and Feuillet 2004; Ulmer and MacDougal 2004; Krosnick et al. 2013a; Boza Espinoza et al. 2018), and Budantsev (2012) compared *P. nikolaevii* leaves to bilobed leaves of the extant species *Passiflora biflora* Lam. of supersection *Decaloba* (Fig. 2B). While the bilobed-truncate morphology of *P. nikolaevii* is suggestive of a relationship to *Passiflora*, illustrations of the material do not show much architectural detail; thus, further investigation is necessary. *Passiflora braunii* was originally described on the basis of leaves, fruits, and seeds from the Miocene of Germany (Ludwig 1859–1860; IFPNI International Editorial Board 2014–2020). The illustrated *P. braunii* leaves (Ludwig 1859–1860: pl. 48, figs. 1–10) are simple, unlobed dicot leaves and are apparently not from the same plant as the reproductive material, which has been reassigned to *Spirematospermum* M.Chandler ex Kirchh. (discussed further below; see also Fischer et al. 2009 for leaf taxa associated with *Spirematospermum*);

199 the connection of the leaves to *Passiflora* is equivocal (Kirchheimer 1957). *Passiflora*
200 *basiloba* is based on 15 specimens of 3–5-lobed leaves from the Miocene of the
201 Ellensburg flora of Washington, U.S.A. (Smiley 1963; Gross 2021); the leaves have a
202 long middle lobe, shorter lateral lobes, a cordate base, and no teeth (Smiley 1963).
203 Smiley (1963) compared *P. basiloba* to leaves of the modern species *Passiflora foetida*
204 L., a widespread New World species that is today found as far north as Texas (Smiley
205 1963; Goldman and MacDougal 2015). As with *P. braunii*, *P. basiloba* is in need of
206 reinvestigation.
207 The remainder of the macrofossil record of Passifloroideae comprises
208 reproductive material, mostly Cenozoic seeds from Europe (Tables A1, A5; Fig. 3A–D).
209 The first published fruits and seeds attributed to *Passiflora*, material assigned to
210 *Passiflora braunii* (Ludwig 1859–1860) and *Passiflora pomeria* (Schloth.) Poppe (Poppe
211 1866), have since been moved to *Spirematospermum wetzleri* (Heer) M.Chandler ex.
212 Kirchh., an extinct monocot species (Kirchheimer 1957; Koch and Friedrich 1971;
213 Fischer et al. 2009). The remaining fossil passifloroid seed reports include
214 *Passifloroidesperma sogamosense* Martínez-A. from the Eocene of Colombia (Martínez
215 2017), *Passiflora* cf. *kirchheimeri* Mai from the Eocene of Germany (Henniger et al.
216 2011), *Passiflora heizmannii* H.-J.Gregor and *Passiflora* spec. from the Miocene of
217 Germany (Gregor 1982), *Passiflora kirchheimeri* Mai from the Miocene of Germany and
218 Poland (Mai 1960, 1967, 2000; Czeczott & Skirgiełło 1967; Gregor 1978), and
219 *Passiflora kirchheimeri* Mai subspecies *bulgarica* Palam. from the Miocene of Bulgaria
220 (Palamarev 1971; Palamarev et al. 1999, 2005). All of these taxa are based on small
221 seeds with reticulate-foveolate (or reticulate-foveate) surface sculpture and, where

described, a palisade seed coat (Tables A2, A5). Kozak (2015) and Martínez (2017) differed somewhat in their assessments of the reliability of these reports, although both agreed that at least some occurrences of *Passiflora kirchheimeri* credibly represent Passifloroideae (for details, see Table A5). Martínez (2017) recommended transferring the fossil taxa *Passiflora heizmannii*, *Passiflora kirchheimeri*, and *Passiflora kirchheimeri* subspecies *bulgarica* to the fossil genus *Passifloroidesperma*, which encompasses fossil seeds with characteristics of Passifloroideae.

Materials and Methods

Fossil Passifloroideae

The thirteen fossil seeds representing a new species of *Passiflora* studied for this project come from Gray Fossil Site (GFS), Gray, eastern Tennessee, U.S.A. The deposits at the site represent sediments from sinkholes that developed in carbonate bedrock (Shunk et al. 2006, 2009; Whitelaw et al. 2008). The GFS sinkhole sediments are divided into three facies; plant and vertebrate macrofossils occur in the laminated (middle) facies and the underlying transition zone between the laminated and graded (lower) facies, with well-preserved plant macrofossils occurring from about 505–500 m above sea level (Shunk et al. 2006; Gong et al. 2010; Liu and Jacques 2010). While there is some debate as to whether the site includes palynomorph-bearing Paleogene deposits (Zobaa et al. 2011; Odom et al. 2019), the macrofossil-bearing sediments are interpreted as being from a Neogene lake or pond thought to be near the Miocene-

Pliocene boundary in age (Parmalee et al. 2002; Wallace and Wang 2004; Shunk et al. 2006, 2009; Gong et al. 2010; Liu and Jacques 2010). Recent age estimates from two independent sources—overlap in stratigraphic ranges of selected mammal taxa and cosmogenic nuclide burial dating—indicate a likely early Pliocene (Blancan) age of at least 4.5 Ma (Samuels et al. 2018; Odom et al. 2019). The Neogene GFS paleobiota includes large and small vertebrates (e.g., Parmalee et al. 2002; Wallace and Wang 2004; Mead et al. 2012; Bourque and Schubert 2015; Czaplewski 2017; Jasinski and Moscato 2017; Doughty et al. 2018; Samuels et al. 2018; Short et al. 2019), plant macrofossils (Gong et al. 2010; Liu and Jacques 2010; Brandon 2013; Noll 2013; Huang et al. 2014, 2015; Quirk and Hermsen 2020; Siegert and Hermsen 2020), pollen and spores (Wallace and Wang 2004; Ochoa et al. 2012; Worobiec et al. 2013; Liu and Quan 2020), and fungi (Worobiec et al. 2018).

All Gray Fossil Site *Passiflora* seeds included in this study are permanently curated in the collections of the East Tennessee State University Museum of Natural History (ETMNH) at Gray Fossil Site, Gray, Tennessee, U.S.A. They include a total of 13 seeds: two whole seeds (ETMNH 22625, 22627), nine half seeds (i.e., seeds that split longitudinally so that only one face or the other is preserved: ETMNH 21283, 22626, 22630–22636), and two seeds broken irregularly (ETMNH 22628, 22629). Specimens were examined with a Nikon SMZ18 stereomicroscope and images were captured with a Nikon DS-Ri2 camera using NIS Elements Br software (1991–2018, Laboratory Imaging). Lighting was lateral, with specimens oriented longitudinally or transversely. NIS Elements was used to take measurements. Reported seed

dimensions (other than seed coat thickness) are based on measurements taken on the outer surface of each seed for the sake of consistency.

Other fossil Passifloroideae were investigated using the published literature and online databases (i.e., IFPNI International Editorial Board 2014–2020; GBIF.org 2020d). New images of *Passiflora kirchheimeri* subspecies *bulgarica* were obtained courtesy of the Paleobotanical Collection, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (IBER-PB), Sofia, Bulgaria; these include images of four seeds on a slide labelled "*Passiflora*" and "III/13 Чукурово [Chukurovo] *P. suberosa* L." New combinations and changes in status for other fossil seed species from Europe are based entirely on published descriptions and illustrations, as cited below. *Passiflora antiqua*, *Bauhinia cretacea*, and *Liriodendrites* are illustrated here (Fig. 2A, C, D) using images captured by the Division of Paleobotany, Peabody Museum of Natural History (YPM), Yale University, New Haven, Connecticut, U.S.A. (Gall 2020a–c).

Classification system

Circumscription of Passifloraceae herein follows APG IV (2016; see also APG II 2003; APG III 2009; Stevens 2001 onwards). The family includes four subfamilies (Stevens 2001 onwards), three of which (Malesherbioideae, Turneroideae, and Passifloroideae) were previously recognized as distinct families (APG 1998; APG II 2003; APG III 2009); the fourth (Pibirioideae) has only recently been described (Maas et al. 2019). Thus, subfamily Passifloroideae in this study is equivalent to Passifloraceae

289 as recognized in much of the older literature (e.g., APG 1998; Feuillet and MacDougal
290 2007; Goldman and MacDougal 2015).
291 Passifloroideae include 16 extant genera; although 17 were previously
292 recognized (Feuillet and MacDougal 2007; Tokuoka 2012; Martínez 2017), *Hollrungia*
293 K.Schum. is now included in *Passiflora* (Krosnick et al. 2009). Within *Passiflora*, the
294 infrageneric classification system of Feuillet and MacDougal (2003) and MacDougal and
295 Feuillet (2004) has been followed to the extent possible. Because this system did not
296 include a species list for *Passiflora*, most species were attributed to infrageneric taxa
297 following other sources (Table A6; Jørgensen [no date]; Cervi 2003; Feuillet and
298 MacDougal 2003, 2008; Ulmer and MacDougal 2004; Vanderplank 2004, 2013; Hansen
299 et al. 2006; Feuillet 2007; Jørgensen and Vásquez 2009; Krosnick et al. 2009, 2013a;
300 Vanderplank and Zappi 2011; Yockteng et al. 2011; Bernacci and Souza 2012;
301 Hilgenhof 2013; Koch et al. 2013; Bonilla Morales 2014; Porter-Utley 2014; Nardin et al.
302 2015; Ocampo et al. 2015; Ocampo Pérez and Molinari 2017; Rome and Coppens
303 d'Eeckenbrugge 2017; Boza Espinoza et al. 2018; Ocampo Pérez et al. 2018; Silva et
304 al. 2018; Svoboda and Harris 2018; Esquerre-Ibañez 2019; Ma et al. 2019). The small
305 genera *Hollrungia* and *Tetrapathea* (DC.) Rchb. were included in *Passiflora* subgenus
306 *Tetrapathea*—which was not part of the Feuillet and MacDougal (2003) and MacDougal
307 and Feuillet (2004) system—following Krosnick et al. (2009). Authorship of species
308 names in extant *Passiflora* and other extant taxa follows Feuillet and MacDougal (2002)
309 and/or IPNI (2020) to the extent possible.
310
311 *Comparison to modern species*

The seeds from Gray Fossil Site were compared to seeds of Passifloroideae primarily using published photographs and descriptions. Seeds of over 200 extant species of *Passiflora* (not including hybrids) have been illustrated in photographs and/or scanning electron micrographs in publications or theses; these species represent all five subgenera, all supersections, and many of the sections and series of *Passiflora* (Tables A6, A7; Mai 1960; Czeczott and Skirgiełło 1967; MacDougal 1994; Gilbert and MacDougal 2000; Deginani 2001; Pérez-Cortéz et al. 1995, 2002, 2009; Vanderplank 2004; Pérez-Cortéz 2007; González-Benito et al. 2009; Cárdenas-Hernández et al. 2011; Mondin et al. 2011; Vanderplank and Zappi 2011; Bernacci and Souza 2012; Milani 2014; Gurski 2015; Ocampo et al. 2015; Silva et al. 2016, 2020; Mezzonato-Pires et al. 2017; Martínez 2017; Ocampo Pérez and Molinari 2017; Boza Espinoza et al. 2018; Ocampo Pérez et al. 2018; Esquerre-Ibañez 2019; Ma et al. 2019; Silveira et al. 2019). Some additional photographs were available in online databases (Kirkbride et al. 2006; USDA, NRCS 2019–2020). Seeds of three species (*Passiflora caerulea*, *Passiflora edulis* Sims, and *Passiflora incarnata*) were obtained from Sheffield's Seed Company (Locke, New York) and examined, but provided no novel information (however, the *P. caerulea* seeds were morphologically similar to seeds of *P. edulis*, in contrast to *P. caerulea* seeds figured in other publications). Species with figured seeds were sorted into infrageneric taxa (subgenera, supersections, sections, and series) to look for patterns in seed characteristics that might be phylogenetically significant and/or diagnostic at the infrageneric level (Tables A6, A7).

Seed characteristics of non-*Passiflora* Passifloroideae were primarily investigated based on a table of morphological characteristics compiled by Martínez (see appendix S2 in Martínez 2017), supplemented with published descriptions and drawings (Masters 1871; Sleumer 1970; de Wilde 1971, 1972, 1973, 1974, 1976; Robyns 1989, 1995; Gentry 1992; Verdcourt 1998; Breteler 1999, 2003; Hearn 2007; de Vos and Breteler 2009; Feuillet 2009, 2010, 2011, 2020; MacDougal 2011; Ngumbau et al. 2017). Photographs of two to three species of *Adenia* Forssk. (*Adenia* sp.: Martínez 2017; *Adenia angulosa* G.W.Hu & Q.F.Wang and *Adenia gummifera* Harms: Ngumbau et al. 2017), one species of *Dilkea* Mast. (*Dilkea ovalis* Feuillet, as part of an herbarium sheet: Feuillet 2009), and one species of *Ancistrothyrsus* Harms (*Ancistrothyrsus scopae* Feuillet, as part of an herbarium sheet: Feuillet 2020) were located in publications; a photograph of an *Adenia huillensis* (Welw.) A.Fern & R.Fern seed was found in an online database (Kirkbride et al. 2006). For the most part, seed characteristics of non-*Passiflora* Passifloroideae were found to be similar to the characteristics reported by Martínez (2017), although the characteristics of *Dilkea* differed substantially. This discrepancy appears to have occurred because an herbarium specimen (Herbario Universidad de Antioquia HUA0008478, identified as *Dilkea acuminata* Mast., image and data from JSTOR 2015) consulted for Martínez's study may be misidentified. The seeds of HUA0008478, which are obovate and coarsely foveate (Martínez 2017), do not match the seed characteristics reported for *Dilkea* in publications (discussed below, and also see Feuillet 2009, 2010, 2011; MacDougal 2011).

Results

Order—Malpighiales Juss. ex Bercht. & J.Presl

Family—Passifloraceae Juss. ex Roussel

Subfamily—Passifloroideae Burnett

Genus—Passifloroidesperma *Martínez-A., emend. Hermsen*

Original generic diagnosis (Martínez 2017: 1860). "Seeds compressed; shape ovoid, obovoid or elliptic, bilaterally symmetrical or slightly asymmetrical; apex with a prominent to inconspicuous apical appendage, with or without lateral protrusions; base acute, obtuse, truncated or rounded; length less than 20 mm; length to width ratio around 1:1 to 2:1; seed surface foveolate, coarsely foveolate, reticulate-foveolate or transversally grooved; seed endosperm ruminate; seed coat with prismatic palisade cells."

Emended generic diagnosis. Seeds compressed; shape obovate, oblong, or elliptical, bilaterally symmetrical to slightly asymmetrical; apical appendage present or absent, solitary when present (i.e., lateral protrusions absent and apex not tridentate); base variable (pointed, rounded, truncate); length typically 10 mm or less, sometimes up to 15 mm; length-to-width ratio 1:1 to 2.5:1; surface reticulate-foveate to reticulate-foveolate, size and number of foveae/foveolae variable; endosperm ruminate (i.e., interior of seed coat with projections); seed coat with radially oriented palisade cells.

Type species. Passifloroidesperma sogamosense Martínez-A.

Other included species. See Tables A1, A5.

Distribution. See Tables A1, A5; Fig. 3A, B, D.

Remarks. Martínez (2017) summarized the seed characteristics for each genus of Passifloroideae (see appendix S2 in Martínez 2017) and concluded that the genera could not be reliably distinguished from one another on the basis of seed characteristics alone. Thus, Martínez (2017) erected the genus *Passifloroidesperma* to encompass fossil seeds attributable to Passifloroideae. A review of the literature for the current study also failed to find seed characters that distinguish amongst most genera of Passifloroideae, with the caveat that seeds of most genera are poorly documented (Tables A6, A7). The typical passifloroid seed is small (usually 10 mm or less in length); often elliptical, obovate, or oblong; compressed; with or without an apical appendage; and has a pitted surface (for references, see Materials and Methods, as well as Tables A6, A7). The single passifloroid genus that can be consistently distinguished on the basis of its seeds is the New World genus *Dilkea*. Seeds of *Dilkea* (ca. 12 species) differ from those of other Passifloroideae in being relatively large (13–20 mm in length), uncompressed to slightly compressed, and ovate, elongated, or medially constricted; their ornamentation is smooth to pustulate (Feuillet 2009, 2010, 2011; McDougal 2011).

Notably, the combination of ruminate endosperm and palisade seed coat that characterizes passifloroid seeds is rare among angiosperms as a whole; a review by Martínez (see tables 2, 3 in Martínez 2017) indicated that this character combination is only known in Passifloraceae (equivalent to Passifloroideae in this study), Dipterocarpaceae Blume, and Myristicaceae R.Br. In seeds of Dipterocarpaceae and Myristicaceae, ruminations in the endosperm (or embryo) often form at least in part from

403 the chalazal region, are not created by the palisade layer, and may project far into the
404 seed, appearing convoluted in section (Corner 1976; Johri et al. 1992). In contrast, the
405 ruminate endosperm of seeds of Passifloroideae is caused by differential growth of the
406 palisade cells in the seed coat, causing the inner surface to appear uneven, i.e., bumpy
407 or, in cross or longitudinal section, undulate (Dathan and Singh 1973; Corner 1976;
408 Johri et al. 1992; Feuillet and MacDougal 2007; Milani 2014; Gurski 2015; Martínez
409 2017). Thus, identification of fossil passifloroid seeds to the subfamily level should be
410 reliable if the most diagnostic features—particularly overall size and form,
411 ornamentation, compression, seed coat structure, and inner wall surface—are
412 preserved.

413 Two characteristics included in the original diagnosis of *Passifloroidesperma*, a
414 tridentate seed apex and transversely sulcate (grooved) seed coat ornamentation, are
415 restricted mostly to specific subgroups within *Passiflora*. The tridentate seed apex is
416 found in supersections *Laurifolia* (Cervi) Feuillet & J.M.MacDougal, *Passiflora*, and
417 *Stipulata* Feuillet & J.M.MacDougal (especially section *Dysosmia* DC.) of subgenus
418 *Passiflora*, although it is not consistently present in any of these supersections (Table
419 A7). In some cases, the tridentate apex consists of a prominent central appendage
420 flanked by two less prominent lateral appendages (as in *Passiflora foetida* in
421 supersection *Stipulata*: Deginani 2001; Pérez-Cortéz et al. 2002, 2009; Ulmer and
422 MacDougal 2004; Vanderplank 2004, 2013; Pérez-Cortéz 2007; Mondin et al. 2011;
423 Gurski 2015; USDA, NRCS 2019–2020). In other cases, the base of the central apical
424 appendage appears to be sunken between lateral shoulders (see Pérez-Cortéz et al.
425 2002; for specific examples, see *Passiflora cacao* Bernacci & M.M.Souza and *Passiflora*

426 *edulis* in supersection *Passiflora*: Deginani 2001; Pérez-Cortéz et al. 2002; Vanderplank
427 2004; Pérez-Cortéz 2007; Mondin et al. 2011; Bernacci & Souza 2012; USDA, NRCS
428 2019–2020; *Passiflora seemannii* Griseb. in supersection *Laurifolia*: Vanderplank 2004;
429 Pérez-Cortéz 2007). While Martínez (see appendix S2 in Martínez 2017) also
430 documented “protrusions” in *Dilkea* and *Efulensia* C.H.Wright seeds, these are absent
431 in *Dilkea* (Feuillet 2009, 2010, 2011; McDougal, 2011) and could not be confirmed in
432 *Efulensia* (de Wilde 1974; Robyns 1995). Thus, the tridentate apex tentatively provides
433 justification for assignment to *Passiflora* subgenus *Passiflora*.
434 The sulcate seed coat has a phylogenetically significant distribution within
435 *Passiflora*, although it has originated more than once. The largest sulcate-seeded group
436 is the monophyletic *Passiflora* supersection *Decaloba* (ca. 130 species, New World),
437 which includes sections *Decaloba* DC. and *Xerogona* (Raf.) Killip (Krosnick et al.
438 2013a). Seeds of members of supersection *Decaloba* are usually relatively small (about
439 1.3–6 mm long x 1.1–6 mm wide) and have a transversely sulcate seed coat with about
440 4–12 grooves (MacDougal 1994; MacDougal and Feuillet 2004; Ulmer and McDougal
441 2004; Milward-de-Azevedo et al. 2012; Krosnick et al. 2013a; Milani 2014; Boza
442 Espinoza et al. 2018; Ocampo Pérez et al. 2018; Esquerre-Ibañez 2019; see also
443 selected images in Deginani 2001; Pérez-Cortéz et al. 2002; Vanderplank 2004; Pérez-
444 Cortéz 2007; Mondin et al. 2011; USDA, NRCS 2019–2020; Silva et al. 2020).
445 Transversely sulcate seed coats are also known in two smaller groups: supersection
446 *Auriculata* J.M.MacDougal & Feuillet (8 species) and several species of subgenus
447 *Deidamioides* (Ulmer and MacDougal 2004; see also selected images in Pérez-Cortéz
448 et al. 2002; Vanderplank 2004; Pérez-Cortéz 2007; Silva et al. 2020). Notably, neither

449 supersection *Auriculata* or subgenus *Deidamioides* is monophyletic (Krosnick et al.
450 2013a).

451 The emended diagnosis above is based on Martínez's (2017) original diagnosis,
452 modified to incorporate the results of the literature review performed for this study (see
453 references in Materials and Methods, as well as Tables A6, A7). I have removed
454 diagnostic characteristics that can be used to conclusively refer isolated seeds to
455 existing genera of Passifloroideae; these include seeds over 15 mm in length (the upper
456 limit once *Dilkea* is removed), seeds with a transversely sulcate seed coat, and seeds
457 with a tridentate apex. It should be noted that the sulcate seed coat and tridentate apex
458 are not necessarily the only features that can be used to distinguish *Passiflora* seeds
459 from those of other genera of Passifloroideae, they are simply the features relevant to
460 the diagnosis of *Passifloroidesperma.* For other potential diagnostic characters for
461 subgroups of *Passiflora* (e.g., winged seeds in supersection *Pterosperma* (L.E.Gilbert &
462 J.M.MacDougal) J.M.MacDougal & Feuillet: Gilbert and MacDougal 2000; MacDougal
463 and Hansen 2003; Ulmer and MacDougal 2004; Krosnick et al. 2013a; also, selected
464 images in Vanderplank 2004), see Table A7.
465
466 *Species*—Passifloroidesperma kirchheimeri *(Mai) Hermsen, comb. nov.*
467 *Basionym*—Passiflora kirchheimeri *Mai 1960, Paläont Z 34: 82–83, pl. 5, figs. 5–*
468 *8.*
469 *Synonyms*—Passiflora kirchheimeri *Mai. Mai 1967: pl. II, fig. 16. Czeczott and*
470 *Skirgiełło 1967: 156, pl. VII, figs. 4, 5. Gregor 1978: 57, pl. 12, figs. 4, 5. Mai 2000: 41,*
471 *pl. 10, figs. 21, 22.*

Species—Passifloroidesperma heizmannii *(H.-J. Gregor) Hermsen, comb. nov.*

Basionym—Passiflora heizmannii *H.-J. Gregor 1982, Die jungtertiären Floren Süddeutschlands: Paläokarpologie, Phytostratigraphie, Paläoökologie, Paläoklimatologie: 115–116, pl. 11, figs. 24–26.*

Occurrences. Passifloroidesperma kirchheimeri: Early–middle Miocene, Bavaria and Saxony, Germany, and Lower Silesia Vovoideship, Poland (Fig. 3A, B; Mai 1960, 1967, 2000; Czeczott and Skirgiełło 1967; Czeczott 1970; Gregor 1978). *Passifloroidesperma heizmannii*: Early Miocene, Baden-Württemberg, Germany (Fig. 3A, B; Gregor 1982).

Remarks. Martínez (2017: 1858, footnote b beneath table) recommended transfer of *Passiflora heizmannii* and *Passiflora kirchheimeri* to *Passifloroidesperma*, but did not formally create the new combinations. I have here created the new combinations based on both Martínez's (2017) recommendation as well as my own assessment of published descriptions of the species.

Passifloroidesperma kirchheimeri has the characteristics of subfamily Passifloroideae but lacks diagnostic characteristics that could be used to place it within *Passiflora*. Specifically, seeds are compressed, obovate, have a palisade seed coat, an apical appendage with no lateral appendages, and reticulate-foveolate ornamentation (Mai 1960, 1967, 2000); one specimen figured by Mai (1960, 2000) shows wall ingrowths, indicating the presence of ruminate endosperm. The species was originally described by Mai (1960; see also Mai 1967, 2000) based on seeds from lower Miocene

deposits of Wiesa (near Kamenz), Saxony, Germany. Later, Czeczott and Skirgiełło (1967) figured a *P. kirchheimeri* seed from the Lower Silesia region of Poland, and Gregor (1978) figured two seeds from Bavaria, Germany. The specimens figured by Gregor (1978) appear, however, poorly preserved and lack the prominent apical appendage characteristic of *P. kirchheimeri*. Both Kozak (2015) and Martínez (2017) considered the German occurrences of *P. kirchheimeri* to be reliably assigned to Passifloroideae (for further details, see Table A5). In my opinion, the type material from Wiesa is well documented enough to be considered a reliable report of Passifloroideae; other Miocene occurrences (Czeczott and Skirgiełło 1967; Gregor 1978) are likely reliable by assignment to the species. Notably, de Wilde (1971) suggested that seeds of this species could belong to *Adenia*, although did not provide supporting details for this opinion.

Passifloroidesperma heizmannii is based on three specimens from Langenau (near Ulm), Baden-Württemberg, Germany (Gregor 1982). The seeds are small and elliptical to somewhat obovate. Unlike *Passifloroidesperma kirchheimeri*, *P. heizmannii* does not have a clearly defined apical extension (see plate 11, figs. 25, 26 in Gregor 1982). The seed surface appears finely reticulate-foveolate (Gregor 1982). Both Kozak (2015) and Martínez (2017) indicated uncertainty as to whether this taxon represents Passifloroideae. According to Gregor (1982), the seeds do have a palisade seed coat, which would support an assignment to Passifloroideae. No published figures illustrate the seed coat structure or the inner seed coat surface, however, and the endosperm type (i.e., inner seed coat surface) was not described. Thus, some ambiguity remains about the assignment of this material.

Two additional reports of *Passiflora* seeds that potentially belong within *Passifloroidesperma* are not included in the formal taxonomy here because they were not formally described. Henniger et al. (2011) illustrated two seed fragments from the Eocene of Karsdorf, Saxony-Anhalt, Germany (Fig. 3A, B), as *Passiflora* cf. *kirchheimeri*. The fragments have finer pits than the Miocene material and the fragment showing a putative apex (pl. 2, fig. 11 in Henniger et al. 2011) lacks an extended appendage; the structure of the seed coat (i.e., presence of palisade cells and/or ruminate endosperm) was not described. Thus, the affiliation of these specimens with the otherwise Neogene species *Passifloroidesperma kirchheimeri* is uncertain. Gregor (1982) described a *Passiflora* seed based on an impression from the upper Miocene at Derching in Bavaria, Germany (Fig. 3A, B), and indicated that it has a palisade seed coat (the seed coat structure was not figured).

Finally, a single seed from Bulgaria (Fig. 4A)—found in the same locality (Fig. 3A, C, D) as *Passiflora bulgarica* (stat. nov., below)—has morphology consistent with *Passifloroidesperma*, although its wall structure and details of its internal surface are unknown.

Genus—Passiflora *L.*

Subgenus—Decaloba *(DC.) Rchb.*

Supersection—Cieca *(Medic.) J.M.MacDougal & Feuillet*

Species—Passiflora bulgarica *(Palam.) Hermsen, stat. nov. (Fig. 4B, C)*

Basionym—Passiflora kirchheimeri *Mai subspecies* bulgarica *Palam. 1971, Palaeontographica Abt. B 132: 156–157; pl. 22, figs. 5, 7; pl. 24, figs. 16–18.*

Synonyms—Passiflora kirchheimeri *Mai subspecies* bulgarica *Palam. Palamarev et al. 1999: pl. 3, fig. 5.*

Original species diagnosis (Palamarev 1971: 157). “Samen eiförmig, beidseitig schwach konvex, 4,5 mm lang; 3—3,5 mm breit; 1,5 mm dick. Aufgesetzte Spitze mit kurzem „Schnäbelchen“ mit Mikropyle. Sklerotesta mit polygonalen Vertiefungen. Die Testa 150—200*μ* dick, aus langen, radial gestreckten Palisadenzellen.”

Emended species diagnosis. Seed slightly falcate (tapering at both ends and slightly asymmetrical) with convex sides, 4.5 mm long, 3–3.5 mm wide, and 1.5 mm thick; apical appendage short to absent; base of seed rounded-acute, somewhat beaked; seed surface coarsely reticulate-foveate, with overlying, longitudinally oriented, shallow striations; margin slightly undulate.

Holotype. Palamarev (1971), pl. 22, figs. 5, 7; Palamarev et al. (1999), pl. 3, fig. 5; Fig. 4B, C. Held in the Paleobotanical Collection of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (IBER-PB), Sofia, Bulgaria (National Museum of Natural History, Bulgarian Academy of Sciences 2020)

Type locality and age. Middle Miocene brown coal, “Čukurovo-West” open-pit mine (Choukourovo), Bulgaria (Fig. 3C, D; Palamarev 1971; Palamarev et al. 2005).

Remarks. Passiflora bulgarica is from the middle Miocene of Bulgaria (Palamarev 1971; Palamarev et al. 2005). The emended diagnosis above is based on Palamarev’s (1971) diagnosis and published illustrations, as well as additional images of three seeds provided to me for this study. Palamarev (1971) figured two complete seeds with the

original description of *P. bulgarica*; the one designated as the holotype was also figured by Palamarev et al. (1999). Based on comparison between new images made in 2020 to Palamarev's (1971) original figures, the image designated as the holotype (Palamarev 1971: pl. 22, fig. 7; Palamarev et al. 1999: pl. 3, fig. 5) appears to be the same specimen and same surface shown here in Figure 4B. I believe that the other published image of a complete seed is the opposite side of the holotype rather than a second specimen (cf. Fig. 4C and pl. 22, fig. 5 in Palamarev 1971). Palamarev (1971) indicated that one illustration of the palisade seed coat (Palamarev 1971: pl. 24, fig. 17) also came from the holotype, although this is not possible if the holotype is still fully intact. Two other specimens clearly belong to *Passiflora bulgarica* based on shape and ornamentation pattern. A fourth seed (Fig. 4A) from the same locality is distinct in morphology and likely represents a different species with characteristics that link it to *Passifloroidesperma* (see above). New images of the seed cross sections and macerations illustrated by Palamarev (1971: pl. 24, figs. 16–18) were not obtained for this study, and they are here assumed to belong to *P. bulgarica*.

Palamarev (1971) originally described *Passiflora bulgarica* as a subspecies of *Passiflora kirchheimeri*. The holotype of *Passiflora bulgarica* is, however, distinct enough in form and ornamentation from *Passifloroidesperma kirchheimeri* to justify raising it to species rank. *Passifloroidesperma kirchheimeri* seeds are smaller than *Passiflora bulgarica* seeds, obovate rather than falcate in shape, have finer reticulations, and have an extended triangular apical appendage (see Mai 1960, 1967, 2000; Czeczott and Skirgiełło 1967). Palamarev (1971) highlighted the similarity of *Passiflora bulgarica* to seeds of modern *Passiflora suberosa* L. (subgenus *Decaloba*,

587 supersection *Cieca*: Porter-Utley 2014; see Fig. 4D), while comparing
588 *Passifloroidesperma kirchheimeri* to *Passiflora alba* Link & Otto (synonym of *Passiflora*
589 *subpeltata* Ortega*,* subgenus *Passiflora*, supersection *Stipulata*: Ulmer and MacDougal
590 2004) and "*Passiflora aurantiaca* Forst.,*"* apparently meaning the Australasian species
591 *Passiflora aurantia* G.Forst. (subgenus *Decaloba*, supersection *Disemma* (Labill.)
592 J.M.MacDougal & Feuillet: Ulmer and MacDougal 2004).
593 Although not noted by Palamarev (1971), the reticulations on the seed coat of
594 *Passiflora bulgarica* are overlain by shallow longitudinal striations, rendering the seeds
595 coarsely reticulate and striate (Fig. 4B, C). The shape and ornamentation of *Passiflora*
596 *bulgarica* are similar to seeds of members of *Passiflora* supersection *Cieca*. Seeds of
597 members of supersection *Cieca* are distinguished by their fusiform to slightly falcate
598 shape; they have coarsely reticulate sculpture with foveae, often with longitudinally
599 oriented, shallow striations (see fig. 3ñ of *Passiflora suberosa* in Pérez-Cortéz et al.
600 2002; see also published images of *Passiflora coriacea* Juss.*, Passiflora juliana*
601 J.M.MacDougal*, Passiflora obtusifolia* Sessé & Moc.*, Passiflora pallida* L.*, P. suberosa,*
602 *Passiflora viridiflora* Cav.*,* and *Passiflora xiikzodz* J.M.MacDougal: Mai 1960; Deginani
603 2001; Pérez-Cortéz et al. 2002; Vanderplank 2004; Pérez-Cortéz 2007; Mondin et al.
604 2011; USDA, NRCS 2019–2020). As originally noted by Palamarev (1971), *Passiflora*
605 *bulgarica* is especially similar in form and ornamentation to modern *Passiflora suberosa*
606 (Fig. 4D; see also the figures of *P. suberosa* seeds in references cited above), although
607 the fossil seeds are slightly larger (*Passiflora suberosa* = 2–4 mm long x 1.5–2.5 mm
608 wide: Deginani 2001; Porter-Utley 2014). Seeds produced by some members of
609 supersection *Bryonioides* (Harms) J.M.MacDougal & Feuillet also have coarsely

610 reticulate-foveate sculpture and a tapering (beaked) base (MacDougal 1994); however,
611 they tend to lack the distinctive curvature present in *P. bulgarica* and modern members
612 of *Cieca*, and also lack the striations overlying the reticulations (see published images of
613 *Passiflora dioscoreifolia* Killip, *Passiflora gracilis* J.Jacq. ex Link, *Passiflora lobata*
614 (Killip) Hutch. ex J.M.MacDougal, and *Passiflora morifolia* Mast.: MacDougal 1994;
615 Deginani 2001; Pérez-Cortéz et al. 2002; Vanderplank 2004; Pérez-Cortéz 2007;
616 Mondin et al. 2011; Gurski 2015).
617
618 *Subgenus*—Passiflora
619 *Supersection*—Passiflora*?*
620 *Series*—Passiflora*?*
621 *Species*—Passiflora appalachiana *Hermsen, sp. nov. (Fig. 5A–L)*
622
623 *Species diagnosis*. Seed obovate, slightly asymmetrical, 5.7–6.3 mm long, 3.9–
624 4.3 mm wide, and 2.6–2.9 mm thick; apical appendage conspicuous and triangular,
625 base of appendage encircled by a collar; base of seed truncate, oblique, unlobed, often
626 with central mucro; seed surface reticulate-foveolate; margin entire.
627 *Holotype*. ETMNH 22625 (Fig. 5A, B). Held at the East Tennessee State
628 University Museum of Natural History (ETMNH) collections, Gray Fossil Site, Gray,
629 Tennessee, U.S.A.
630 *Paratypes*. ETMNH 21283, 22626–22636 (Fig. 5C–L).
631 *Etymology*. The species epithet refers to the occurrence of this species in the
632 Appalachian region of the United States.

633 *Type locality and age.* Gray Fossil Site, Tennessee, U.S.A. (Fig. 3E); sinkhole
634 sediments, lower Pliocene (Samuels et al. 2018; Odom et al. 2019).
635 *Species description*. Seed compressed (Fig. 5A), obovate, slightly asymmetrical
636 (Fig. 5B–D), 5.7–6.3 mm long, 3.9–4.3 mm wide, 2.6–2.9 mm thick; length:width ratio
637 1.4:1–1.6:1. Apex with conspicuous, triangular apical appendage; slightly thickened
638 collar (rim) encircling the base of the apical appendage (Fig. 5B–E). Apical appendage
639 0.6–1.0 mm high from tip of appendage to top edge of collar. Base truncate and oblique,
640 often with central mucro (Fig. 5B–D, F). Seed margin entire, surface reticulate-
641 foveolate; foveolae on each seed face numerous (~45 or more, from 5 seeds) (Fig. 5B–
642 D, G). Seed coat with palisade structure made up of elongated, radially aligned cells,
643 270–580 µm thick, thickest in the region of the rim at the base of the apical appendage
644 and near the base of the seed (Fig. 5H–L). Canals through the seed coat traverse the
645 interior of the apical appendage and the base of the seed (Fig. 5H, I). Endosperm
646 reticulate, i.e., inner surface of the seed coat with projections (Fig. K, L).
647
648 *Remarks. Passiflora appalachiana* has the essential characteristics that support
649 placement in Passifloroideae; the seeds are obovate (Fig. 5B–D), compressed (Fig.
650 5A), and less than 10 mm long with a triangular apical appendage (Fig. 5B–E),
651 reticulate-foveolate ornamentation (Fig. 5B–D, G), reticulate endosperm (Fig. 5K, L),
652 and palisade seed coat (Fig. 5H–L). *Passiflora appalachiana* is larger than passifloroid
653 seeds from European deposits and additionally differs from *Passiflora bulgarica* in
654 shape and ornamentation (Table A2; cf. Fig. 4B, C and Fig. 5B–D). *Passifloroidesperma*
655 *sogamosense* (length:width ratio of about 1.7:1: Martínez 2017) is slightly more

elongated than *Passiflora appalachiana*. *Passifloroidesperma sogamosense* also differs in being centrally reticulate-foveolate with radiating costae (narrow ridges) toward the margin (see fig. 3 of Martínez 2017).

Although not conspicuously tridentate, *Passiflora appalachiana* seeds have a collar encircling the apex of the seed, which forms very short lateral projections (Fig. 5B–E). For this reason, it is my opinion that the species may belong to *Passiflora* subgenus *Passiflora*. *Passiflora appalachiana* is very similar in form and ornamentation to the extant species *Passiflora incarnata* (subgenus *Passiflora*, supersection *Passiflora*: Ulmer and MacDougal 2004; see Fig. 5M and images of *P. incarnata* in Pérez-Cortéz et al. 2002; Vanderplank 2004; Pérez-Cortéz et al. 2009; USDA, NRCS 2019–2020), which is native to and widespread in eastern North America today (Fig. 3E; Goldman and MacDougal 2015). Notably, the apex structure of *P. incarnata* is somewhat variable; the apical appendage may be inconspicuous (with the apex appearing truncate) or conspicuous, and may or may not be surrounded by a basal ridge (Fig. 5M; see also descriptions and/or images of *P. incarnata* in Pérez-Cortéz et al. 2002, 2009; Ulmer and MacDougal 2004; Vanderplank 2004; USDA, NRCS 2019–2020).

Discussion

This study confirms Martínez's (2017) conclusion that seed morphology is often not diagnostic at the genus level in Passifloroideae. There are important exceptions, however, including seeds of *Dilkea* and seeds of some groups within the well-studied

679 genus *Passiflora* (e.g., supersection *Decaloba*). Thus, most reports of fossil *Passiflora*
680 seeds are best referred to *Passifloroidesperma*, including *Passifloroidesperma*
681 *sogamosense* from South America and *Passifloroidesperma kirchheimeri*,
682 *Passifloroidesperma heizmannii*, and most other *Passiflora*-like seeds reported from
683 Europe. Two species, *Passiflora bulgarica* from the Miocene of Bulgaria and *Passiflora*
684 *appalachiana* from the Pliocene of eastern North America, can be assigned to
685 *Passiflora* based on their morphology. Because relatively little is known about the seed
686 morphology of most genera of Passifloroideae, further investigations may yield
687 additional differentiating characters that allow for more precise placement of seeds
688 currently referred to *Passifloroidesperma*.
689 Subfamily Passifloroideae is highly structured in its present geographic
690 distribution. A mostly New World or American clade including *Passiflora* and three other
691 genera—*Ancistrothyrsus*, *Dilkea*, and *Mitostemma* Mast.—is nested within the
692 paraphyletic Old World genera of Passifloroideae (Muschner et al. 2012; Tokuoka 2012;
693 Kozak 2015). The extant Old World genera of Passifloroideae (12 genera, over 150
694 species) occur in the paleotropics, with most of their diversity in continental Africa and
695 Madagascar; only about 15 species in two genera (*Adenia* and *Paropsia* Noronha ex
696 Thouars) occur in Asia and Oceania (Fig. 1; Sleumer 1970; de Wilde 1971, 1972;
697 Feuillet and MacDougal 2007; Martínez 2017). Within the American clade, only about
698 25 species in two groups of *Passiflora* (supersection *Disemma*, 22 species, Asia to
699 Oceania; subgenus *Tetrapathea*, 3 species, Oceania) are native to the Old World
700 (Krosnick and Freudenstein 2005; Wang et al. 2007; Krosnick et al. 2009, 2013b; Ma et
701 al. 2019). No members of Passifloroideae are native to Europe today.

The presence of *Passifloroidesperma sogamosense* in Colombia indicates that Passifloroideae were present in South America by the late Eocene (Martínez 2017); solely considering the biogeographic evidence (Fig. 1, 3A), *P. sogamosense* likely has affinities with the New World clade, and the fossil species resembles seeds of some species of *Passiflora* subgenus *Astrophea* in sculpture and form (e.g., *Passiflora macrophylla* Spruce ex Mast.: see images in Vanderplank 2004; Mezzonato-Pires et al. 2017). No unique diagnostic characters were identified for *Astrophea* seeds in this study, however, so the fossil species cannot be attributed to the subgenus. The affinities of the European *Passifloroidesperma* occurrences (Fig. 3A, B, D; Mai 1960, 1967, 2000; Czeczott & Skirgiełło 1967; Gregor 1978, 1982; Henniger et al. 2011) within Passifloroideae are unclear. They could plausibly have links to the African Passifloroideae or to the American genera, the latter via the North Atlantic Land Bridge (NALB) that once connected Europe to North America (McKenna 1975; Tiffney 1985; Tiffney and Manchester 2001; Milne 2006).

Passiflora bulgarica (Fig. 4B, C), from the Miocene of Bulgaria, is most similar to seeds of members of *Passiflora* supersection *Cieca* (Fig. 4D). All 19 species of *Cieca* are native to the Americas today, with the northernmost-ranging species occurring as far north as northern Mexico, Texas, Florida, and the West Indies (Fig. 3C; Porter-Utley 2014). Monophyly of *Cieca* is supported by molecular phylogenetic analyses as well as morphological data (Krosnick et al., 2013a; Porter-Utley 2014; Kozak 2015). *Cieca* is not closely related to either of the modern Old World *Passiflora* clades (Krosnick et al., 2013a), and the supersection has no other known fossil occurrences in Eurasia.

724 The presence of *Passiflora bulgarica* in Europe is plausibly explained by an
725 ancient connection through the NALB, which operated as a link between eastern North
726 America and Europe in the Paleogene (McKenna 1975; Tiffney 1985; Tiffney and
727 Manchester 2001; Milne 2006), with some arguing for at least an intermittent connection
728 into the Miocene for temperate taxa (Tiffney and Manchester 2001; Grímsson and Denk
729 2007; Tiffney 2008; Denk et al. 2010). Long-distance dispersal is, of course, another
730 possibility. The complete absence of *Passiflora* in Europe today is not entirely surprising
731 given the Cenozoic history of the European flora. Many warm temperate to subtropical
732 plant genera found in the European fossil record disappeared from Europe in the later
733 Neogene to the Pleistocene but are still present elsewhere today, perhaps best
734 represented in the modern floras of North America and especially Asia (Manchester
735 1999; Manchester et al. 2009; Martinetto et al. 2017, 2020).
736 *Passiflora appalachiana*, from Gray Fossil Site, Tennessee, U.S.A., is the first
737 credible report of a fossil *Passiflora* from eastern North America. The GFS macroflora is
738 best known for yielding genera that have northern hemisphere distributions; these
739 genera typically have connections to modern genera or species found today primarily in
740 eastern North America and/or eastern Asia, and fossil records that are Laurasian in
741 distribution (Gong et al. 2010; Liu and Jacques 2010; Brandon 2013; Noll 2013; Huang
742 et al. 2014, 2015; Quirk and Hermsen 2020). Most genera so far described from the
743 GFS fruit and seed flora are extant and presently occur in eastern North America (Gong
744 et al. 2010; Brandon 2013; Noll 2013; Baumgartner 2014; Huang et al. 2014, 2015).
745 Several GFS macrofossil plant genera, like *Corylopsis* Siebold & Zucc. and *Sinomenium*
746 Diels, are currently endemic to Asia but have more widespread northern hemisphere

747 fossil records (Liu and Jacques 2010; Jacques et al. 2011; Quirk and Hermsen 2020);
748 one genus, *Cavilignum* Siegert & Hermsen, is entirely extinct (Siegert and Hermsen
749 2020). The fauna shows at least some parallels to the flora; the herptiles are largely
750 from groups found in southeastern North America today, whereas the mammals include
751 some taxa with connections to present-day eastern Asia and Eurasia (Bourque and
752 Schubert 2015; see also Wallace and Wang 2004; Mead et al. 2012). Thus far, extinct
753 groups—e.g., saber-toothed cats (cf. *Machairodus* Kaup), North American rhinos
754 (*Teleoceras aepysoma* Short et al.)—are a more significant element of the fauna than
755 the flora (Bourque and Schubert 2015; Short et al. 2019).
756 *Passiflora* includes a small number of extant species native to eastern Asia and
757 to the Americas north of the Neotropics. All Asian species of *Passiflora* belong to
758 section *Octandranthus* Harms*,* which includes about 18 of the 22 species in
759 supersection *Disemma* (Krosnick and Freudenstein 2005; Krosnick et al. 2013a, b; Ma
760 et al. 2019). For *Octandranthus*, only a photo of a *Passiflora menghaiensis* X.D.Ma et
761 al. seed was located for this study (fig. 1F in Ma et al. 2019). The seed of *P.*
762 *menghaiensis* is dissimilar from *Passiflora appalachiana*; it is small (4 mm long x 3 mm
763 wide) and broadly obovate, with a tapering, beaked base and 25–35 foveolae on each
764 side (Ma et al. 2019). Based on the limited evidence available, seed morphology does
765 not support a close relationship between *P. appalachiana* and the modern Asian
766 passifloras.
767 About 18 species of *Passiflora* occur in the continental United States today, 13 of
768 which are native (Goldman and MacDougal 2015). Of the native species, most reach
769 the northern limits of their ranges in Arizona, Florida, or Texas; only two, *Passiflora*

incarnata and *Passiflora lutea* L., are currently widespread in the eastern United States (Goldman and MacDougal 2015). *Passiflora appalachiana* seeds are dissimilar from seeds of *P. lutea,* which have the sulcate seed coat typical for members of supersection *Decaloba* (Ulmer and MacDougal 2004; see also images of *P. lutea* in Vanderplank 2004; USDA-NRCS 2019–2020). As noted above, *P. appalachiana* is similar in morphology to *P. incarnata* (cf. Fig. 5B–D to Fig. 5M), and Gray Fossil Site is within the native range of the modern species (Fig. 3E; Goldman and MacDougal 2015). *Passiflora incarnata* is in subgenus *Passiflora* (250 species), series *Passiflora* (14 species) (Ulmer and MacDougal 2004; Krosnick et al. 2013a; Bernacci and Souza 2012). Other members of series *Passiflora* and subgenus *Passiflora* are native to the Americas, with the greatest number of species in subgenus *Passiflora* occurring in northern South America (Ulmer and MacDougal 2004). Thus, it is reasonable to conclude that *P. appalachiana* represents the first Neotropical connection identified from the Gray Fossil Site macroflora. Notably, Neotropical connections are also rare in the fauna; one Neotropical animal genus, *Heloderma* (Wiegmann) (beaded lizard), has been described from the site (Mead et al. 2012; Noll 2013). It is possible that *Passiflora* may have dispersed to GFS from south to north, as hypothesized for *Heloderma* (Mead et al. 2012).

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Figure legends

Figure 1. Approximate distribution of modern Passifloroideae, based on the distributions of the two largest genera, *Adenia* and *Passiflora* (these genera encompass most or all of the native range of the subfamily); some outlying islands have been circled to provide a sense of the complete range of the subfamily. Of the three major regions of distribution, no genera are shared between the Americas and Africa/Madagascar. Three genera are found in Asia and Oceania: *Passiflora* (ca. 25 species: Krosnick and Freudenstein 2005; Wang et al. 2007; Krosnick et al. 2009, 2013b; Ma et al. 2019) from the New World group and *Adenia* (ca. 14 species: de Wilde 1971, 1972) and *Paropsia* (1 species: Sleumer 1970) from the Africa/Madagascar group. Sources: Reiche (1898), de Wilde (1971, 1972), Deginani (2001), Stevens (2001 onwards), Ocampo-Pérez (2007), Krosnick et al. (2009, 2013b), Milward-de-Azevedo et al. (2012), Porter-Utley (2014), Goldman and MacDougal (2015), Boza Espinoza et al. (2018), GBIF.org (2020a, b, c). GBIF occurrence datasets were checked against other sources to exclude occurrences outside of the documented native range for a given taxon or group of taxa.

Figure 2. Fossil and modern leaves. A. Holotype of *Passiflora antiqua* (YPM PB 011087, Late Cretaceous, Woodbridge, New Jersey, U.S.A.), previously figured by Newberry (1895), Berry (1911), and Kozak (2015). B. Leaf of *Passiflora biflora* Lam. (US 01245631, *Ortiz, O.O. 503,* Panama); scale bar = 2 cm. C. *Bauhinia cretacea* (YPM PB 011289, Late Cretaceous, Woodbridge, New Jersey, U.S.A.), previously figured by

Newberry (1895). D. Leaf of *Liriodendrites bradacii* Johnson (YPM PB 006361, Late Cretaceous, North Dakota, U.S.A.), previously figured by Johnson (1996). Image credits: A, C, D. Photos by Division of Paleobotany (YPM PB), courtesy of the Peabody Museum of Natural History, Yale University, New Haven, Connecticut, U.S.A. (Gall 2020a–c). B. Photo by I. Lin, courtesy of United States National Herbarium (US) (Orrell 2020).

Figure 3. Distribution of fossil *Passifloroidesperma* and *Passiflora* seed species. A–B, D. Distribution of *Passifloroidesperma* as recognized in this study (for references, see Tables A1, A5). Worldwide distribution (A), distribution in Central Europe (B), and distribution in Bulgaria (D). 1. *Passifloroidesperma sogamosense* (Eocene, Santander, Colombia). 2. *Passifloroidesperma*? sp. (Eocene, Saxony-Anhalt, Germany). 3. *Passifloroidesperma* sp. (Miocene, Bavaria, Germany). 4. *Passifloroidesperma heizmannii* (Miocene, Baden-Württemberg, Germany). 5. *Passifloroidesperma kirchheimeri* (Miocene: 5a = Saxony, Germany; 5b = Lower Silesia Vovoideship, Poland; 5c = Bavaria, Germany). 6. *Passifloroidesperma* sp. (Miocene, Sofia, Bulgaria). C–D. Distribution of modern and fossil members of *Passiflora* supersection *Cieca*. C. *Passiflora bulgarica* (Miocene, Sofia, Bulgaria: Palamarev 1971; Palamarev et al. 1999, 2005) and modern distribution of *Passiflora* supersection *Cieca* (after maps in Porter-Utley 2014). D. Approximate location of Čukurovo open-pit mine (6), type locality of *Passiflora bulgarica*. E. *Passiflora appalachiana* (Pliocene, Tennessee, U.S.A.: this paper) and distribution of extant *Passiflora incarnata* (after Goldman and MacDougal 2015; GBIF.org 2020c). Note: Ranges for extant taxa (*Cieca*, *P. incarnata*) include only

their native distributions. Maps created with Simplemappr (Shorthouse 2010), modified in Photoshop. Scale bars: A, C = 3300 km; B, D = 222 km; E = 870 km.

Figure 4. A–C. Fossil seeds from Čukurovo open-pit mine, Miocene, Bulgaria. A. Seed here attributed to *Passifloroidesperma*. B–C. *Passiflora bulgarica* (Palam.) Hermsen, stat. nov. B. Holotype (cf. Palamarev 1971: pl. 22, fig. 7; Palamarev et al. 1999: pl. 3, fig. 5). C. Opposite surface of holotype (cf. Palamarev 1971: pl. 22, fig. 5). D. Modern seeds of *Passiflora suberosa*. Scale bars: A–C = approximately 1 mm (estimated from rulers in background); D = 1 mm. Image credits: A–C. Photos of specimens held at IBER-PB by Dr. Mila Andonova. D. Photo by Steve Hurst, hosted by USDA-NRCS PLANTS Database (USDA, NRCS 2019–2020).

Figure 5. A–L. *Passiflora appalachiana* Hermsen, sp. nov. A. Edge of seed showing compression. ETMNH 22625 (holotype). B–D. Lateral views of complete seeds showing overall form, apical appendage, base, and sculpture. B. ETMNH 22625 (holotype). C. ETMNH 22627. D. ETMNH 22626. E. Detail of apical appendage. ETMNH 22631. F. Detail of base with mucro. ETMNH 22635. G. Detail of outer surface with foveolae. ETMNH 22631. H. Inner surface of apical appendage with canal and radiating palisade cells. ETMNH 22632. I. Inner surface of base with canal and radiating palisade cells. ETMNH 22632. J. Detail of seed coat showing radiating palisade cells. ETMNH 22633. K–L. Details of inner surface showing rounded projections (= ruminate endosperm). J. ETMNH 22633. L. ETMNH 22635. M. *Passiflora incarnata* (extant). Scale bars: A–D, K–M = 1 mm; E, G, H = 0.5 mm; F, I = 0.2 mm; J = 0.1 mm.

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Description of Supplementary Tables A3–A7

Tables A3–A5. Summary of the fossil record of Passifloroideae. All tables are organized first by age (oldest to youngest by period and epoch), then alphabetically, first by generic name, then by species epithet.

Table A3. Fossil pollen reports of *Passiflora* and Passifloroideae, with assessments of their reliability.

Table A4. Fossil leaf reports of *Passiflora* and Passifloroideae, with notes.

Table A5. Fossil seed reports of *Passiflora* and *Passifloroidesperma*, with assessments of their reliability.

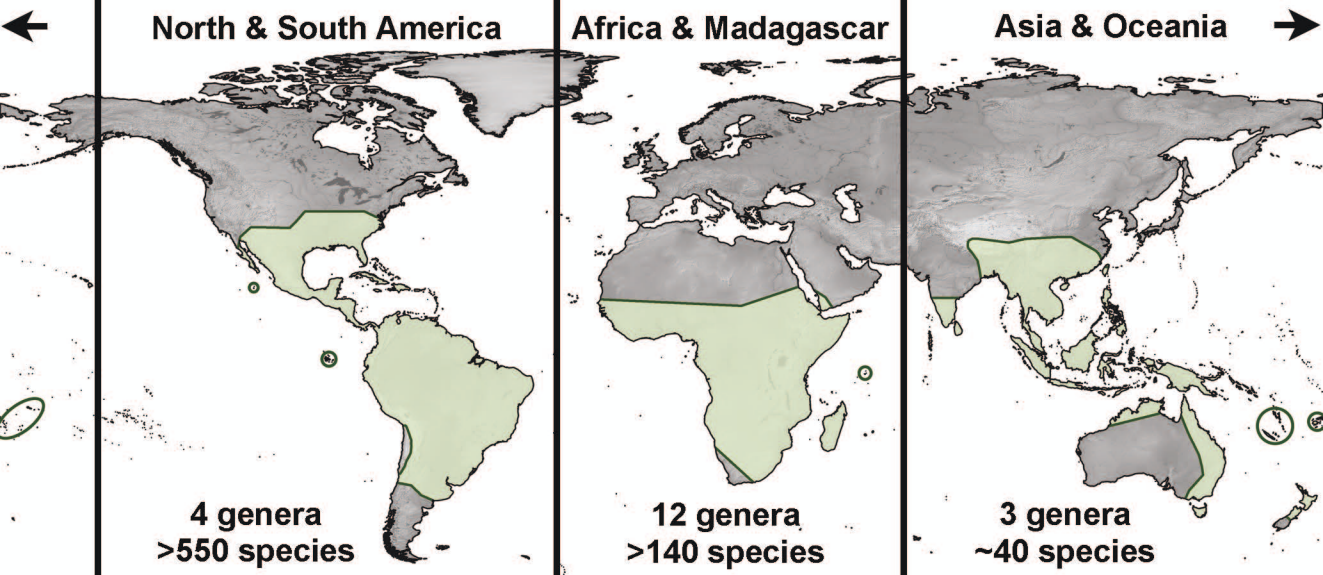
References, Tables A3–A5. Reference list for Tables A1–A3.

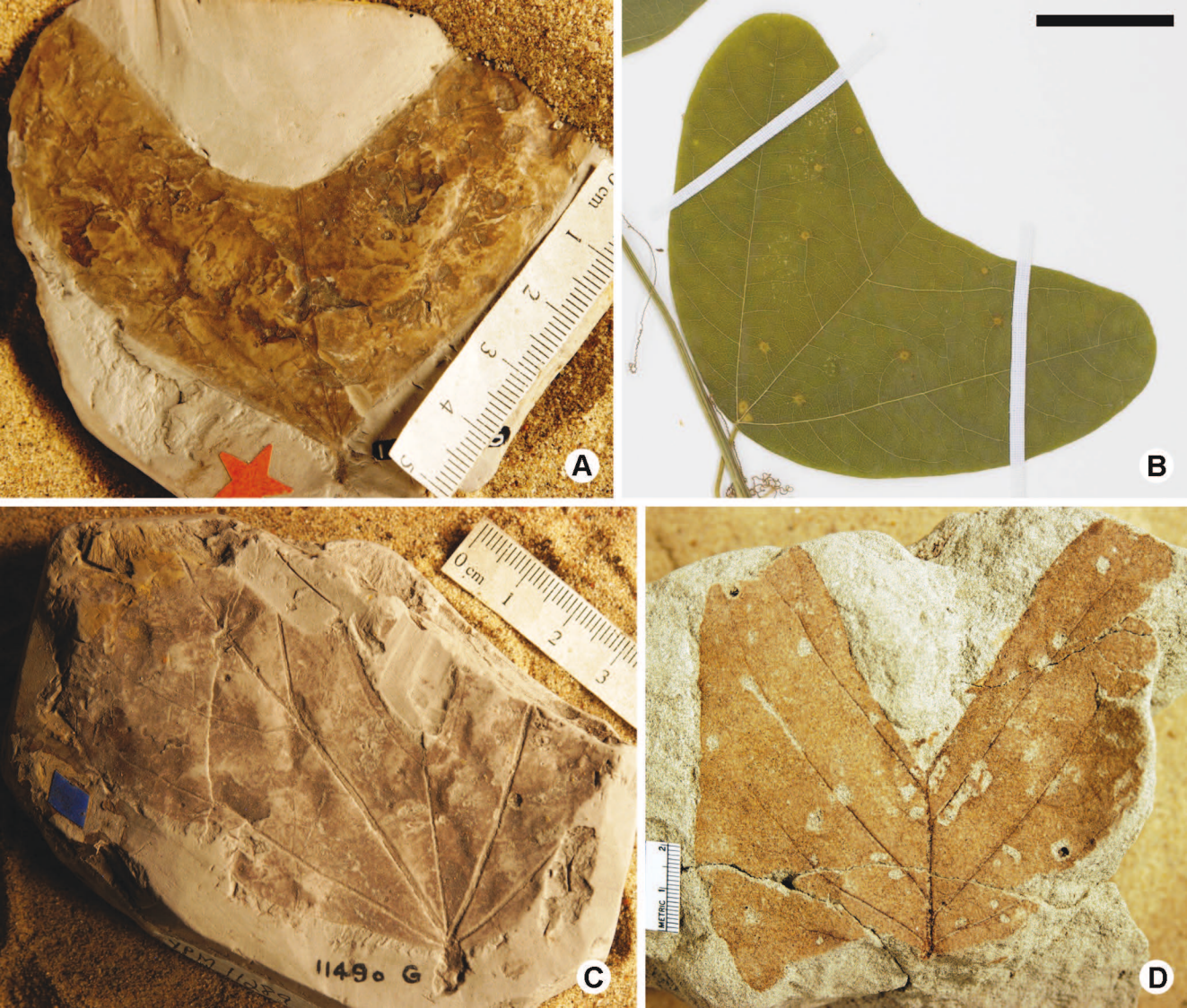
Tables A6, A7. Morphology of modern seeds of Passifloroideae.

Table A6. Summary of figured seeds of Passifloroideae (only photographic figures or SEM photomicrographs included).

Table A7. Summary of differentiating seed characteristics of groups within Passifloroideae.

References, Tables A6, A7. Reference list for Tables A4–A5.


North & South America
Africa & Madagascar
Asia & Oceania
4 genera
>550 species
12 genera
>140 species
3 genera
~40 species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C
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0 cm 1 2 3
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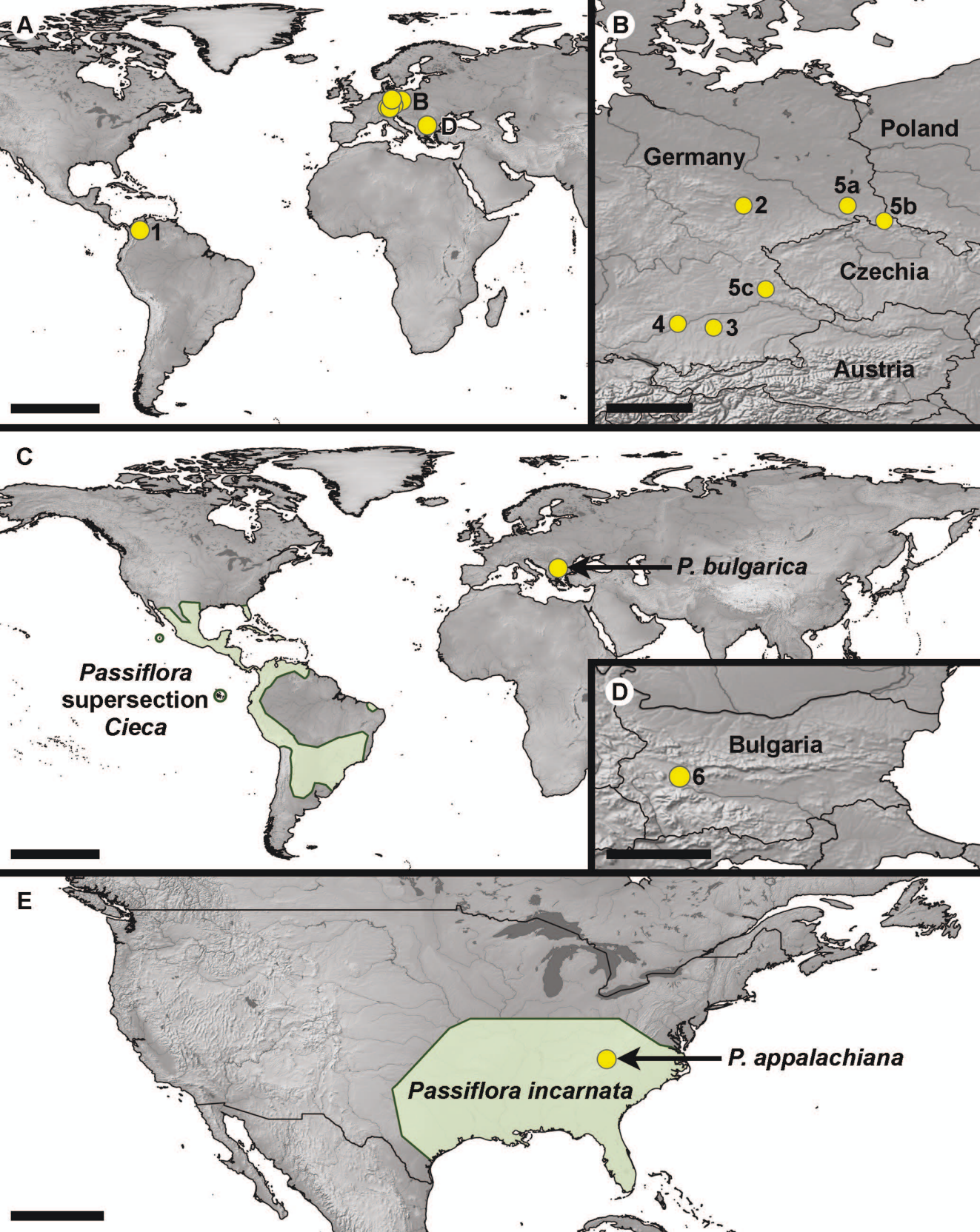
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D
1
B
Poland
Germany
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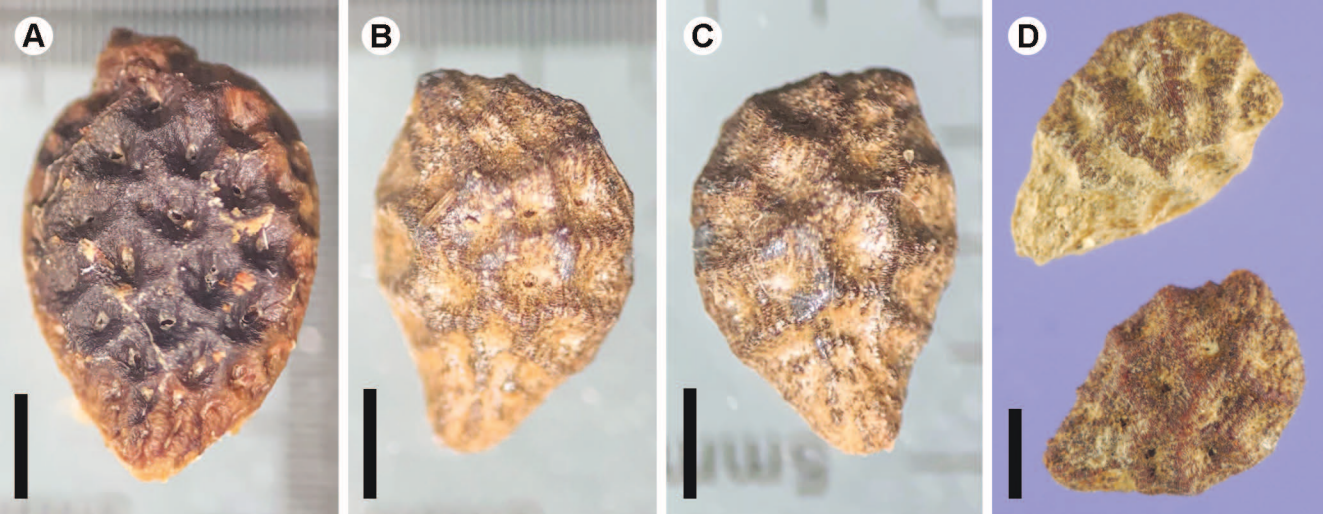
5a
5b
Czechia
5c
4
3
Austria
C
P. bulgarica
Passiflora
supersection
Cieca
D
Bulgaria
6
E
P. appalachiana
Passiflora incarnata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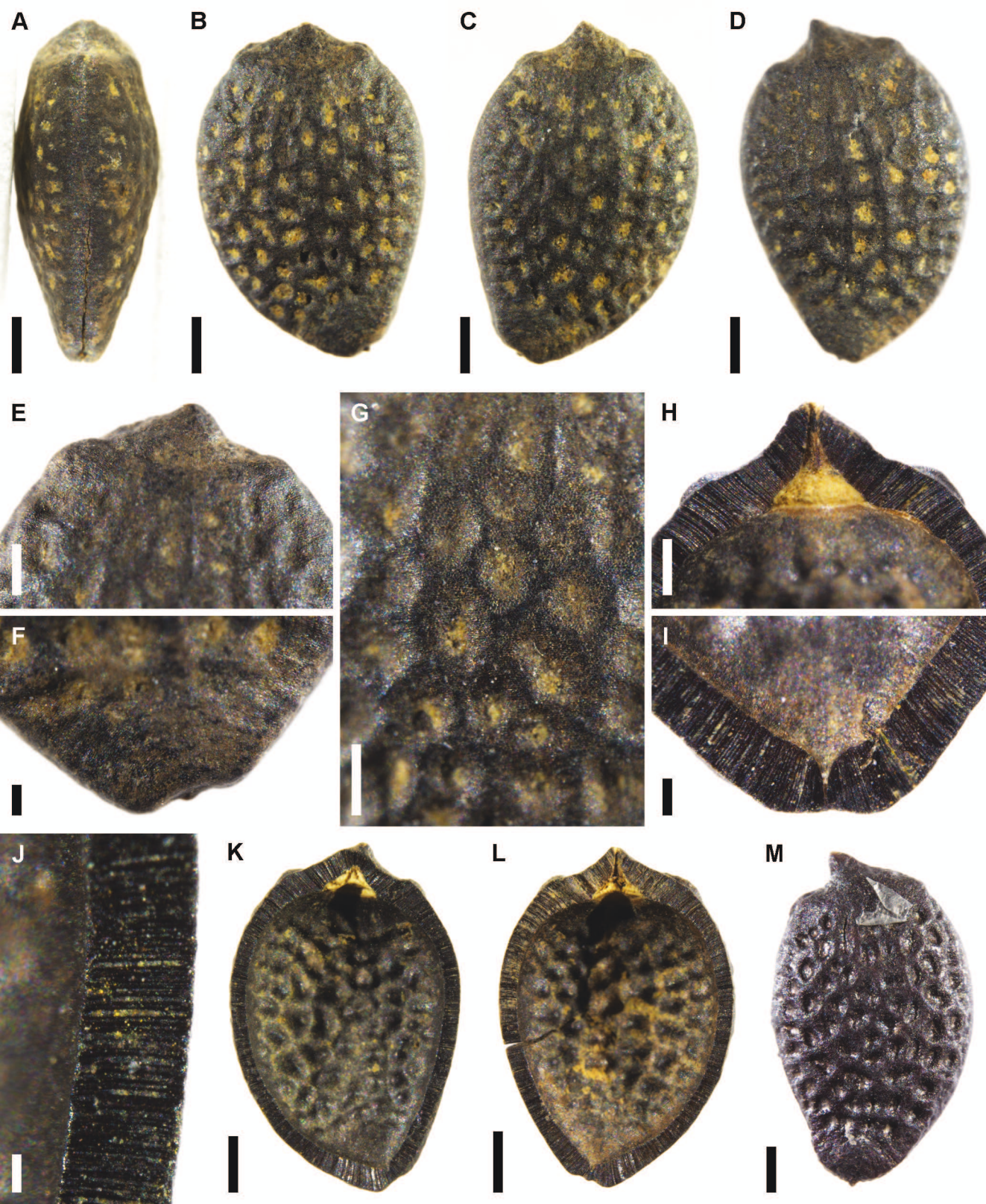
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Table A1.

Fossil Record of Seeds Attributed to Passifloroideae

Original name	Age	Location[1]	References	Revised status
Passifloroidesperma sogamosense Martínez-A.	Eocene	Colombia	Martínez (2017)	Unchanged
Passiflora cf. *kirchheimeri* Mai	Eocene	Germany	Henninger et al. (2011)	*Passifloroidesperma*? sp.
Passiflora spec.	Miocene	Germany	Gregor (1982)	*Passifloroidesperma* sp.
Passiflora heizmannii H.-J. Gregor	Miocene	Germany	Gregor (1982)	*Passifloroidesperma heizmannii* (H.-J. Gregor) Hermsen, comb. nov.
Passiflora kirchheimeri Mai	Miocene	Germany, Poland	Mai (1960, 1967, 2000), Czeczott & Skirgiełło (1967), Gregor (1978)	*Passifloroidesperma kirchheimeri* (Mai) Hermsen, comb. nov.

Passiflora kirchheimeri Mai subspecies *bulgarica* Palam.	Miocene	Bulgaria	Palamarev (1971), Palamarev et al. (1999, 2005), this study	*Passiflora bulgarica* (Palam.) Hermsen, stat. nov., and *Passifloroidesperma* sp.
Passiflora appalachiana Hermsen, sp. nov.	Pliocene	U.S.A.	This study	Not applicable

[1] Localities are mapped in Fig. 3.

Table A2.

Comparison of fossil passifloroid seed species[1]

Taxon	Shape	Length (mm)	Width (mm)	Thickness (mm)	Seed coat thickness (μm)	Surface sculpture	Apical appendage
Passiflora appalachiana	Obovate	5.7–6.3	3.9–4.3	2.6–2.9	270–580	Reticulate-foveolate	Triangular with basal collar
Passiflora bulgarica	Slightly falcate	4.5	3–3.5	1.5	150–200	Coarsely reticulate-foveate with shallow longitudinal striations	None to very short triangular
Passifloroidesperma heizmannii	Elliptical to obovate	1.7–2.3	1.1–1.6	–	200	Reticulate-foveolate	Short triangular

Passifloroidesperma kirchheimeri	Obovate	3–4	1.5–3	0.5–1	200–400	Reticulate-foveolate	Triangular
Passifloroidesperma sogamosense	Obovate	4–9	2.5–4.5	–	300	Reticulate-foveolate, radiating marginal costae	Triangular

[1] Sources: *Passiflora appalachiana* (this study), *Passiflora bulgarica* (Palamarev 1971, this study), *Passifloroidesperma heizmannii* (Gregor 1982), *Passifloroidesperma kirchheimeri* (Mai 1960, 1967, 2000; Czeczott and Skirgiełło 1967; Gregor 1978), *Passifloroidesperma sogamosense* (Martínez 2017). Descriptive terminology standardized for this study.

Taxon	Proposed affinities in original study	Figures	Period	Epoch	State/province
Spirosyncolpites spiralis González-Guzmán	Passifloraceae (probably equivalent to Passifloroideae of this study)	None	Paleogene	Paleocene–Eocene	Norte de Santander Department (Colombia), Zulia (Venezuela)
Passiflora	*Passiflora*	Graham (1976), figs. 177, 178	Neogene	Miocene	Veracruz
Retistephanocolpites "passionis" D'Apolito, ined. (thesis name)	Bignoniaceae?, *Passiflora*	D'Apolito (2016), pl. 23, figs. 7–9	Neogene	Miocene	
Stephanocolpites sp. Hammen	Passifloraceae? (probably equivalent to Passifloroideae of this study)	Hoorn (1994), pl. 1, fig. 4	Neogene	Miocene	
Syncolpites sp. Hammen	*Passiflora*-type, *Passiflora* spp.	Palazzesi et al. (2014), suppl. fig. 3C, F	Neogene	Miocene	Chubut, Rio Negro

Taxon	**Country/continent/region**	**Key references (descriptions, figures)**	**Additional references (supplementary information on status of name, synonyms, age, locality, etc.)**	**Kozak (2015, table 3.1).** Assessment of fossil Passifloraceae (equivalent to Passifloroideae + Turneroideae of this study). Reliability ratings = low, high.	**Martínez (2017, table 1).** Assessment of fossil Passifloroideae. Reliability ratings = low, medium, high.
Spirosyncolpites spiralis González-Guzmán	Colombia, Venezuela	Jaramillo et al. (2010b)		Not treated	"Not Passifloraceae"
Passiflora	Mexico	Graham (1976)		Low	Low
Retistephanocolpites "passionis" D'Apolito, ined. (thesis name)	Brazil	D'Apolito (2016)		Not treated	Not treated
Stephanocolpites sp. Hammen	NW Amazon region (Brazil-Colombia-Peru)	Hoorn (1994)	Jaramillo et al. (2010a)	Low (citing only Jaramillo et al. 2010a)	Not treated
Syncolpites sp. Hammen	Argentina	Palazzesi et al. (2014)		Not treated	Medium

Taxon	**This study.** Assessment of fossil Passiflora and Passifloroideae. Reasoning provided based on figures and descriptions in published sources.
Spirosyncolpites spiralis González-Guzmán	Ambiguous. Not figured, assignment to Passifloraceae not discussed in Jaramillo et al. (2010b, see esp. supporting online material). Martínez (2017) provided no discussion for unambiguously concluding that this report is not Passifloraceae.
Passiflora	Ambiguous. Assignment to *Passiflora* not discussed in Graham (1976). Muller (1981) considered figures inadequate.
Retistephanocolpites "passionis" D'Apolito, ined. (thesis name)	Ambiguous. Possible assignment to *Passiflora* not discussed in D'Apolito (2016). A comparison of images of *Retistephanocolpites* "*passionis*" (D'Apolito 2016) to images of *Passiflora* pollen (Amela García et al. 2002; Roubik and Moreno Patiño 2003; Milward-de-Azevedo et al. 2004; Mezzonato-Pires et al. 2015) and Bignonaceae Juss. pollen (Roubik and Moreno Patiño 2003; Souza et al. 2019) for this study shows that the fossil pollen has similarities to at least some modern pollen forms in both groups (e.g., *Passiflora misera* Kunth, *Passiflora suberosa* L., *Anemopaegma chamberlaynii* (Sims) Bureau & K.Schum.).
Stephanocolpites sp. Hammen	Ambiguous. Assignment to Passifloraceae not discussed in Hoorn (1994) or Jaramillo et al. (2010a).
Syncolpites sp. Hammen	Dubious. Palazzesi et al. (2014, see their supplementary information) compared this pollen to pollen of extant *Passiflora caerulea* L. (as "*Passiflora coerulea*") in size, wall characteristics, and aperture type. The illustrated *Syncolpites* grain (see supp. fig. 3C, F in Palazzesi et al. 2014) has, in my interpretation, ca. seven holes (fenestrae), whereas a similarly preserved *P. caerulea* grain would have three (see fig. 35 in Amela García et al. 2002). Furthermore, in the *Syncolpites* grain, the holes occur all over the grain, whereas they would be equatorial in *P. caerulea* (see fig. 35 in Amela García et al. 2002 and discussion in main text).

Taxon	Synonyms	Figures	Period	Epoch	State/province
Passiflora antiqua Newb.		Newberry (1895), pl. 23, fig. 7; Berry (1911), pl. 23, fig. 5; Kozak (2015), fig. 3.1; this study, Fig. 2A [Note: Figures in Berry (1911) and Kozak (2015) are reprints of the illustration in Newberry (1895).]	Cretaceous	Late Cretaceous	New Jersey
Passiflora feuilletii Torres, nom. nud.		Torres (2003), fig. 24.4	Paleogene	Paleocene-Eocene	King George Island
Passiflora nikolaevii Budantsev		Budantsev (2012), pl. 16, figs. 2–9	Paleogene	Paleocene-Eocene	King George Island
Parataxon TARA-6 (?Proteaceae, ?Passifloraceae)		Pole (1994), fig. 25	Paleogene	Eocene	North Otago
Passiflora sp.		Hunger (1939), pl. 4, fig. 57	Paleogene	Eocene	Saxony-Anhalt
Passiflora spec.?		Fischer (1950), pl. 8, fig. 3	Paleogene	Eocene	Saxony
Passiflora hauchecornei Friedrich		Friedrich (1883b), pl. 31, figs. 1, 2	Paleogene	Oligocene	Saxony-Anhalt
Passiflora tenuiloba Friedrich, non Engelm.		Friedrich (1883b), pl. 25, fig. 20	Paleogene	Oligocene	Saxony-Anhalt
Passifloraephyllum kraeuselii Rásky, originally '*kraeuseli*'		Rásky (1960), pl. 4, fig. 16	Paleogene	Oligocene	Budapest
Passiflora basiloba Smiley		Smiley (1963), pl.15, figs. 1, 6	Neogene	Miocene	Washington
Passiflora braunii R.Ludw., originally '*brauni*' [name published 1860]	*Calycanthus braunii* Brongn., nom. nud.	Ludwig (1859–1860), pl. 48, figs. 1–10 (leaves) & figs. 11–16 (fruits & seeds)	Neogene	Miocene	Hesse
Passiflora canadensis Hollick		Hollick (1927), pl. 37, fig. 2	Neogene	Miocene	British Columbia
Passiflora canfieldii Britton, originally '*canfieldi*'	*Passiflora* (?) *canfieldii* Britton, originally '*canfieldi*'	Britton (1893), figs. 12, 13; Berry (1919), pl. 18, figs. 4, 5	Neogene	Miocene	Potosi Department

Taxon	Country/continent	Key references (descriptions, figures)	Additional references (supplementary information on status of name, synonyms, age, locality, etc.)
Passiflora antiqua Newb.	USA	Newberry (1895), Berry (1911)	Newberry (1886), Herendeen et al. (1992), Wang et al. (2014), Kozak (2015), Martínez (2017), Gall (2020a, b), GBIF.org (2020)
Passiflora feuilletii Torres, nom. nud.	Antarctica	Torres (2003)	GBIF.org (2020)
Passiflora nikolaevii Budantsev	Antarctica	Budantsev (2012)	
Parataxon TARA-6 (?Proteaceae, ?Passifloraceae)	New Zealand	Pole (1994)	Kozak (2015)
Passiflora sp.	Germany	Hunger (1939)	
Passiflora spec.?	Germany	Fischer (1950)	
Passiflora hauchecornei Friedrich	Germany	Friedrich (1883a, b)	IFPNI International Editorial Board (2014–2020), GBIF.org (2020)
Passiflora tenuiloba Friedrich, non Engelm.	Germany	Friedrich (1883a, b)	IFPNI International Editorial Board (2014–2020)
Passifloraephyllum kraeuselii Rásky, originally '*kraeuseli*'	Hungary	Rásky (1960)	Hably & Fernandez Marron (1998), Krosnick et al. (2013), Kozak (2015), Martínez (2017)
Passiflora basiloba Smiley	USA	Smiley (1963)	GBIF.org (2020)
Passiflora braunii R.Ludw., originally '*brauni*' [name published 1860]	Germany	Brongniart (1849), Ludwig (1859–1860)	Kirchheimer (1957), Koch & Friedrich (1971), IFPNI International Editorial Board (2014–2020), GBIF.org (2020)
Passiflora canadensis Hollick	Canada	Hollick (1927)	LaMotte (1952), Clague (1974)
Passiflora canfieldii Britton, originally '*canfieldi*'	Bolivia	Britton (1893), Berry (1919)	Berry (1939), Gregory-Wodzicki et al. (1998), Gall (2020c, d), GBIF.org (2020)

Taxon	Notes	Species discussed in main text of this paper?
Passiflora antiqua Newb.	Bilobed leaf, 1 figured specimen (Newberry 1895; Berry 1911; Kozak 2015); 2 specimens held at Yale Peabody Museum (YPM PB 011087, 152005), New Haven, Connecticut, USA (GBIF.org 2020). Images of one specimen available online (Gall 2020a). Considered a low-reliability record by Kozak (2015) and Martínez (2017). Probably the same species as *Bauhinia cretacea* Newb. (1886, 1895; see Gall 2020b and main text for images of a comparable *B. cretacea* specimen from the same locality), which may belong to *Liriophyllum* Lesq. or *Liriodendrites* Johnson (Herendeen et al. 1992; Wang et al. 2014).	Yes
Passiflora feuilletii Torres, nom. nud.	Obdeltoid leaf, 1 figured specimen (Torres 2013). Nomen nudum, specimen figured with no diagnosis or description. Probably a specimen of *Passiflora nikolaevii*.	Yes (with *P. nikolaevii*)
Passiflora nikolaevii Budantsev	Bilobed, roughly obdeltoid leaves, about 10 specimens (Budantsev 2012).	Yes
Parataxon TARA-6 (?Proteaceae, ?Passifloraceae)	One partial lobed leaf (Pole 1994). Kozak (2015) considered it a low-reliability report of Passifloraceae.	Yes
Passiflora sp.	One partial trilobed leaf (Hunger 1939).	No
Passiflora spec.?	One unlobed leaf (Fischer 1950). Fischer (1950) compared this leaf to two species of *Passiflora* and to *Miquelia cumingii* Baill. (Icacinaceae).	No
Passiflora hauchecornei Friedrich	Unlobed and trilobed leaves, 2 specimens figured (Friedrich 1883a, b).	No
Passiflora tenuiloba Friedrich, non Engelm.	Trilobed leaf, 1 specimen figured (Friedrich 1883a, b). Nomen illegitimum, later homonym of *Passiflora tenuiloba* Engelm. (IFPNI International Editorial Board, 2014–2020).	No
Passifloraephyllum kraeuselii Rásky, originally '*kraeuseli*'	One partial leaf (Rásky 1960). Accepted as a record of Passifloraceae by Kozak (2015), but considered dubious by Krosnick et al. (2013, as *Passiflora*) and Martínez (2017).	Yes
Passiflora basiloba Smiley	15 total specimens, two specimens figured; 3–5-lobed leaves with no teeth (Smiley 1963).	Yes
Passiflora braunii R.Ludw., originally '*brauni*' [name published 1860]	This taxon includes leaves, fruits, and seeds. The basionym for this species (*Calycanthus braunii*) is a nomen nudum (IFPNI International Editorial Board, 2014–2020, and confirmed for this study by examining Brongniart 1849). The leaves appear to be simple dicot leaves, apparently at least 10 specimens (see plate 48 in Ludwig 1859–1860). Associated fruits and seeds of *Passiflora braunii* have been referred to *Spirematospermum wetzleri* (Heer) M.Chandler (Kirchheimer 1957; Koch & Friedrich 1971). The holotype is unclear, although Ludwig (1859–1860) indicated that Brongniart based the species on fruit. This was confirmed in Brongniart (1849). Kirchheimer (1957) indicated that the relationship of *P. braunii* leaves to *Passiflora* was equivocal.	Yes
Passiflora canadensis Hollick	One partial trilobed leaf (Hollick 1927).	No
Passiflora canfieldii Britton, originally '*canfieldi*'	Trilobed leaves, 2 figured specimens (Britton 1893); 4 specimens total (YPM PB 027922, 028175, 152698, 152699), held at Yale Peabody Museum (YPM), New Haven, Connecticut, USA (GBIF.org 2020). Images of two specimens available online (Gall 2020c, d).	No

Taxon (this study)	Original name (if name revised)	Figure	Period	Epoch	Locality	Latitude	Longitude
***Passiflora* L.**							
Passiflora bulgarica (Palam.) Hermsen	*Passiflora kirchheimeri* Mai subsp. *bulgarica* Palam.	Palamarev (1971), pl. 22, fig. 5, 7; pl. 24, figs. 16–18; Palamarev et al. (1999), pl. 3, fig. 5; this study, Fig. 4B, C	Neogene	Miocene	Tagebau "Čukurovo-West"	42.53	23.61
Passiflora appalachiana Hermsen		This study, Fig. 5A–L	Neogene	Pliocene	Gray Fossil Site	36.39	-82.50
***Passifloroidesperma* Martínez-A.**							
Passifloroidesperma? sp.	*Passiflora* cf. *kirchheimeri* Mai	Henniger et al. (2011), pl. 2, figs. 11, 17	Paleogene	Eocene	Karsdorf	51.27	11.66
Passifloroidesperma sogamosense Martínez-A.		Martínez (2017), figs. 3A–D	Paleogene	Eocene	Topocoro Dam	7.11	-73.42
Passifloroidesperma sp.	*Passiflora* spec.	Gregor (1982) pl. 7, fig. 15	Neogene	Miocene	Derching (near Augsburg)	48.41	10.96
Passifloroidesperma sp.	*Passiflora kirchheimeri* Mai subsp. *bulgarica* Palam.? (inferred, specimen not figured in previous publications)	This study, Fig. 4A	Neogene	Miocene	Tagebau "Čukurovo-West"	42.53	23.61
Passifloroidesperma heizmannii (H.-J.Gregor) Hermsen	*Passiflora heizmannii* H.-J.Gregor	Gregor (1982), pl. 11, figs. 24–26	Neogene	Miocene	Langenau (near Ulm)	48.50	10.12
Passifloroidesperma kirchheimeri (Mai) Hermsen	*Passiflora kirchheimeri* Mai	Mai (1960), pl. 5, figs. 5–8; Mai (1967), pl. 2, fig. 16; Mai (2000), pl. 10, figs. 21, 22 [Note: Figures in Mai (1967, 2000) appear to be reprints of figures from Mai (1960).]	Neogene	Miocene	Wiesa (near Kamenz)	51.27	14.10
Passifloroidesperma kirchheimeri (Mai) Hermsen	*Passiflora kirchheimeri* Mai	Czeczott & Skirgiełło (1967), pl. 7, figs. 4, 5	Neogene	Miocene	Turów (near Bogatynia)	50.91	14.96
Passifloroidesperma kirchheimeri (Mai) Hermsen	*Passiflora kirchheimeri* Mai	Gregor (1978), pl. 12, figs. 4, 5	Neogene	Miocene	Oder II	49.31	12.18

Taxon (this study)	Distribution map (this paper)	Coordinate Source	State/province	Country/continent	Main references	**Kozak (2015, table 3.1).** Assessment of fossil Passifloraceae (equivalent to Passifloroideae + Turneroideae of this study). Reliability ratings = low, high.
***Passiflora* L.**						
Passiflora bulgarica (Palam.) Hermsen	Fig. 3C, D (6)	Estimated	Sofia	Bulgaria	Palamarev (1971), Palamarev et al. (1999, 2005)	Low (listed as *Passiflora kirchheimeri*, with organ type listed as "pollen (?)")
Passiflora appalachiana Hermsen	Fig. 3E	Estimated	Tennessee	USA	This paper	Not treated
***Passifloroidesperma* Martínez-A.**						
Passifloroidesperma? sp.	Fig. 3A, B (2)	Estimated	Saxony-Anhalt	Germany	Henniger et al. (2011)	Not treated
Passifloroidesperma sogamosense Martínez-A.	Fig. 3A (1)	Converted from coordinates reported in Martínez (2017).	Santander	Colombia	Martínez (2017)	Not treated
Passifloroidesperma sp.	Fig. 3A, B (3)	Estimated	Bavaria	Germany	Gregor (1982)	Not treated
Passifloroidesperma sp.	Fig. 3A, D (6)	Estimated	Sofia	Bulgaria	Palamarev (1971), Palamarev et al. (2005)	Not treated
Passifloroidesperma heizmannii (H.-J.Gregor) Hermsen	Fig. 3A, B (4)	Estimated	Baden-Württemberg	Germany	Gregor (1982)	Low (organ type listed as "?")
Passifloroidesperma kirchheimeri (Mai) Hermsen	Fig. 3A, 3B (5a)	Estimated	Saxony	Germany	Mai (1960, 1967, 2000), GBIF.org (2020)	High (listed as "*Passiflora* OR *Turnera*"; only Mai 1967 reference cited)
Passifloroidesperma kirchheimeri (Mai) Hermsen	Fig. 3A, 3B (5b)	Estimated	Lower Silesia Vovoideship	Poland	Czeczott & Skirgiełło (1967), Czeczott (1970)-age	Low (listed as *Passiflora* sp.; organ type listed as "?")
Passifloroidesperma kirchheimeri (Mai) Hermsen	Fig. 3A, 3B (5c)	Estimated	Bavaria	Germany	Gregor (1978)	High (organ type listed as "fruit and seed")

Taxon (this study)	**Martínez (2017, table 1).** Assessment of fossil Passifloroideae. Reliability ratings = low, medium, high.	**This study.** Assessment of fossil *Passiflora* and Passifloroideae. Reasoning provided based on figures and descriptions in original sources and/or personal observations, where applicable.
***Passiflora* L.**		
Passiflora bulgarica (Palam.) Hermsen	High	Reliable. Three seeds consistent with *Passiflora* supersection *Cieca* in shape and ornamentation (see Palamarev 1971; this study, Fig. 4B, C). Palamarev (1971, plate 24, figs. 17, 18) shows palisade seed coat structure. Ruminate endosperm not documented.
Passiflora appalachiana Hermsen	Not treated	Reliable. Seeds similar to *Passiflora incarnata* in shape and ornamentation. Compression, palisade seed coat, and ruminate endosperm documented (this study).
***Passifloroidesperma* Martínez-A.**		
Passifloroidesperma? sp.	Not treated	Ambiguous. Two partial seeds figured. Seed coat structure and ruminate endosperm not documented.
Passifloroidesperma sogamosense Martínez-A.	High (not in table, rating inferred)	Reliable. Size, shape, and ornamentation consistent with Passifloroideae. Martínez (2017) described and illustrated the palisade seed coat (Martínez 2017, fig. 3C) and ruminate endosperm (Martínez 2017, fig. 3A).
Passifloroidesperma sp.	Not treated	Somewhat ambiguous. Low quality image. Described as having palisade seed coat (Gregor 1982, pg. 116), but no figure of seed coat structure provided.
Passifloroidesperma sp.	Not treated	Probably reliable. This seed was not figured by Palamarev (1971, 1999), but it was on a slide with three *Passiflora bulgarica* seeds. Size, shape, and ornamentation are consistent with Passifloroideae. Seed coat structure and ruminate endosperm not documented.
Passifloroidesperma heizmannii (H.-J.Gregor) Hermsen	Medium	Somewhat ambiguous. Seeds small, shape and ornamentation consistent with Passifloroideae. Described as having palisade seed coat (Gregor 1982, pg. 115), but no figure of seed coat structure provided. Ruminate endosperm not documented.
Passifloroidesperma kirchheimeri (Mai) Hermsen	High (only Mai 1960 and Mai 2000 references cited)	Reliable. Size, shape, ornamentation, and palisade seed coat consistent with subfamily. Palisade seed coat figured (Mai 1960, pl. 5, figs. 6, 8; Mai 2000, pl. 10, fig. 22). Figure showing inner seed surface indicates ruminate endosperm (Mai 1960, pl. 5, fig. 6; Mai 2000, pl. 10, fig. 22).
Passifloroidesperma kirchheimeri (Mai) Hermsen	Not treated	Probably reliable. Images show that it is similar to German material figured by Mai (1960, 1967, 2000). Seed coat structure and ruminate endosperm not documented.
Passifloroidesperma kirchheimeri (Mai) Hermsen	High	Probably reliable. Seeds appear similar to material figured by Mai (1960, 1967, 2000), but preservation is not as good and apical appendage in small and blunt rather than extended and triangular. Seed coat structure and ruminate endosperm not documented.

Author(s)	Year	Title	Book/journal, volume, pages, etc.	DOI or URL
Amela García MT, BG Galati, AM Anton	2002	Microsporogenesis, microgametogenesis and pollen morphology of *Passiflora* spp. (Passifloraceae)	*Botanical Journal of the Linnean Society* 139: 383–394.	https://doi.org/10.1046/j.1095-8339.2002.00072.x
Berry EW	1911	The flora of the Raritan Formation	Geological Survey of New Jersey Bulletin 3. MacCrellish & Quigley, State Printers, Trenton, New Jersey.	https://doi.org/10.5962/bhl.title.7725
Berry EW	1919	Fossil plants from Bolivia and their bearing upon the age of uplift of the eastern Andes	*Proceedings of the United States National Museum* 54: 103–164.	https://doi.org/10.5479/si.00963801.54-2229.103
Berry EW	1939	The fossil flora of Potosi, Boliva	*The Johns Hopkins University Studies in Geology* 13: 9–67.	
Britton NL	1893	Note on a collection of Tertiary fossil plants from Potosí, Bolivia	*Transactions of the American Institute of Mining Engineers* 21: 250–259.	https://books.google.com/books?id=DcxMAAAAYAAJ&printsec=frontcover#v=onepage&q&f=false
Brongniart AT	1849	Végétaux fossiles	Pages 52–173 in C. D'Orbigny, ed. Dictionnaire universel d'histoire naturelle. Tome Treizième. MM. Renard, Martinet et C, Paris.	https://doi.org/10.5962/bhl.title.23115
Budantsev LYu	2012	Tertiary flora of the King George Island (Antarctica)	Tovarishchestvo nauchnykh izdaniĭ KMK, St. Petersburg, Moscow. [In Russian with English summary, e-book published 2018]	
Clague JJ	1974	The St. Eugene Formation and the development of the southern Rocky Mountain Trench	*Canadian Journal of Earth Sciences* 11: 916–938.	https://doi.org/10.1139/e74-091
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D'Apolito C	2016	Landscape evolution in western Amazonia: Palynostratigraphy, palaeoenvironments and diversity of the Miocene Solimões Formation, Brazil	Ph.D. thesis. University of Birmingham, Birmingham, U.K.	http://etheses.bham.ac.uk/id/eprint/6781
Fischer E	1950	Pflanzenabdrücke aus dem Alttertiär von Mosel bei Zwickau in Sachsen	*Abhandlungen des Geologischen Dienstes Berlin, Neue Folge* 221: 1–28.	https://books.google.com/books?id=IlJeDwAAQBAJ&lpg=PP1&pg=PP1#v=onepage&q&f=false
Friedrich P	1883a	Beiträge zur Kenntniss der Tertiärflora der Provinz Sachsen	*Abhandlungen zur geologischen Specialkarte von Preussen und den Thüringischen Staaten* 4: 1–305 [159–463].	https://www.biodiversitylibrary.org/page/35796233
Friedrich P	1883b	Atlas von einunddreissig Lichtdrucktafeln zu der Abhandlung: Beiträge zur Kenntniss der Tertiärflora der Provinz Sachsen	*Abhandlungen zur geologischen Specialkarte von Preussen und den Thüringischen Staaten* 4 (Atlas): plates 1–31.	https://www.biodiversitylibrary.org/page/57917841
GBIF.org	2020	GBIF Occurrence Download (8 September 2020). https://doi.org/10.15468/dl.juzerk		https://doi.org/10.15468/dl.juzerk
Gall L	2020a	*Passiflora antiqua* Newberry, GBIF occurrence 1039330373	Paleobotany Division, Yale Peabody Museum. https://doi.org/10.15468/hpasyo	https://www.gbif.org/occurrence/1039330373
Gall L	2020b	*Bauhinia cretacea* Newberry, GBIF occurrence 1039291629	Paleobotany Division, Yale Peabody Museum. https://doi.org/10.15468/hpasyo	https://www.gbif.org/occurrence/1039291629
Gall L	2020c	*Passiflora canfieldi*, GBIF occurrence 1039292037	Paleobotany Division, Yale Peabody Museum. https://doi.org/10.15468/hpasyo	https://www.gbif.org/occurrence/1039292037
Gall L	2020d	*Passiflora canfieldi*, GBIF occurrence 1039371229	Paleobotany Division, Yale Peabody Museum. https://doi.org/10.15468/hpasyo	https://www.gbif.org/occurrence/1039371229
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Hollick A	1927	The flora of the Saint Eugene Silts, Kootenay Valley, British Columbia	*Memoirs of the New York Botanical Garden* 7: 389–465.	https://www.biodiversitylibrary.org/page/44065993
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Number, Feuillet & MacDougal	Genus	Subgenus	Supersection	Section	Series	Species in published photos	Species author (ref: Feuillet & MacDougal 2002 and/or IPNI 2020)	Reference for figure (light photograph, light photomicrograph, or SEM photomicrograph)	Reference for classification within *Passiflora* (if applicable)
NA	***Ancistrothyrsus***								
	Ancistrothyrsus					*A. scopae*	Feuillet	Feuillet (2020)	
NA	***Adenia***								
	Adenia					*Adenia* sp.		Martínez (2017)	
	Adenia					*A. angulosa*	G.W.Hu & Q.F.Wang	Ngumbau et al. (2017)	
	Adenia					*A. gummifera*	Harms	Ngumbau et al. (2017)	
	Adenia					*A. huillensis*	(Welw.) A.Fern & R.Fern	Kirkbride et al. (2006)	
NA	***Androsiphonia***								
	Androsiphonia					None found			
NA	***Barteria***								
	Barteria					None found			
NA	***Basananthe***								
	Basananthe					None found			
NA	***Crossostemma***								
	Crossostemma					None found			
NA	***Deidamia***								
	Deidamia					None found			
NA	***Dilkea***								
	Dilkea					*D. ovalis*	Feuillet	Feuillet (2009)	
NA	***Efulensia***								
	Efulensia					None found			
NA	***Mitostemma***								
	Mitostemma					None found			
NA	***Paropsia***								
	Paropsia					None found			
NA	***Paropsiopsis***								
	Paropsiopsis					None found			
NA	***Schlechterina***								
	Schlechterina					None found			
NA	***Smeathmannia***								
	Smeathmannia					None found			
NA	***Viridivia***								
	Viridivia					None found			
	Passiflora								
	Passiflora	?	?	?	?	*Passiflora* sp.		Czeczott & Skirgiello (1967)	
	Passiflora	?	?	?	?	*P. brevifila*	Killip	Vanderplank (2004)	
	Passiflora	?	?	?	?	*P. comte*	ined.	Vanderplank (2004)	
	Passiflora	?	?	?	?	*P. cyanea*	Mast.	Pérez-Cortéz (2007)	
	Passiflora	?	?	?	?	*P. luismanvlii*	ined.	Vanderplank (2004)	
	Passiflora	?	?	?	?	*P. spectabilis*	Killip	Pérez-Cortéz et al. (2002, 2009). One of these is mislabeled (mixed up with *P. sidifolia*).	
	Passiflora	?	?	?	?	*P. tikilli*	ined.	Vanderplank (2004)	
1	***Passiflora***	***Astrophea***							
1.1	***Passiflora***	***Astrophea***	***Astrophea***						
1.1.1	***Passiflora***	***Astrophea***	***Astrophea***	***Astrophea***					
	Passiflora	*Astrophea*	*Astrophea*	*Astrophea*	NA	*P. araguensis*	L.K. Escobar	Pérez-Cortéz (2007)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Astrophea*	*Astrophea*	NA	*P. engleriana*	Harms	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Astrophea*	*Astrophea*	NA	*P. lindeniana*	Planch. ex Triana & Planch.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Astrophea*	*Astrophea*	NA	*P. macrophylla*	Spruce ex Mast.	Vanderplank (2004), Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Astrophea*	*Astrophea*	NA	*P. sphaerocarpa*	Triana & Planch.	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Astrophea*	*Astrophea*	NA	*P. tica*	Gómez-Laur. & L.D. Gómez	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
1.1.2	***Passiflora***	***Astrophea***	***Astrophea***	***Capreolata***					
	Passiflora	*Astrophea*	*Astrophea*	*Capreolata*	NA	*P. ceratocarpa*	F.Silveira	Vanderplank (2004), Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Astrophea*	*Capreolata*	NA	*P. faroana*	Harms	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Astrophea*	*Capreolata*	NA	*P. hexagonocarpa*	Barb.Rodr.	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Astrophea*	*Capreolata*	NA	*P. maguirei*	Killip	Pérez-Cortéz (2007)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Astrophea*	*Capreolata*	NA	*P. pittieri*	Mast.	Vanderplank (2004)	Hilgenhof (2013)
1.1.3	***Passiflora***	***Astrophea***	***Astrophea***	***Leptopoda***					
	Passiflora	*Astrophea*	*Astrophea*	*Leptopoda*	NA	None found			
1.2	***Passiflora***	***Astrophea***	***Pseudoastrophea***						
1.2.1	***Passiflora***	***Astrophea***	***Pseudoastrophea***	***Pseudoastrophea***					
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*	NA	*P. candida*	(Poepp. & Endl.) Mast.	Vanderplank (2004), Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*	NA	*P. costata*	Mast.	Pérez-Cortéz et al. (2002), Pérez-Cortéz (2007), Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*	NA	*P. elliptica*	Gardner	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*	NA	*P. haematostigma*	Mart. ex. Mast.	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*	NA	*P. mansoi*	Mast.	Pérez-Cortéz et al. (2002) as "*P. mansii*", Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*	NA	*P. ovata*	Jos.Martin ex DC.	Vanderplank (2004), Mezzonato-Pires et al. (2017)	Hilgenhof (2013)

	Passiflora	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*	NA	*P. pentagona*	Mast.	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*	NA	*P. rhamnifolia*	Mast.	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*	NA	*P. sclerophylla*	Harms	Pérez-Cortéz (2007)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*	NA	*P. skiantha*	Huber	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*	NA	*P. tessmannii*	Harms	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*	NA	*P. venosa*	Rusby	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
1.2.2	***Passiflora***	***Astrophea***	***Pseudoastrophea***	***Botryastrophea***					
1.2.2.1	***Passiflora***	***Astrophea***	***Pseudoastrophea***	***Botryastrophea***	***Botryastrophea***				
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Botryastrophea*	*Botryastrophea*	*P. pyrrhantha*	Harms	Pérez-Cortéz (2007), Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Botryastrophea*	*Botryastrophea*	*P. rusbyi*	Mast.	Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Botryastrophea*	*Botryastrophea*	*P. securiclata*	Mast.	Pérez-Cortéz (2007), Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Botryastrophea*	*Botryastrophea*	*P. spinosa*	Mast.	Pérez-Cortéz et al. (2002), Pérez-Cortéz (2007), Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
1.2.2.2	***Passiflora***	***Astrophea***	***Pseudoastrophea***	***Botryastrophea***	***Carnae***				
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Botryastrophea*	*Carnae*	*P. amoena*	L.K.Escobar	Vanderplank (2004)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Botryastrophea*	*Carnae*	*P. fuchsiiflora*	Hemsl.	Pérez-Cortéz (2007)	Hilgenhof (2013)
	Passiflora	*Astrophea*	*Pseudoastrophea*	*Botryastrophea*	*Carnae*	*P. longiracemosa*	Ducke	Pérez-Cortéz (2007), Mezzonato-Pires et al. (2017)	Hilgenhof (2013)
2	***Passiflora***	***Deidamioides***							
2.1	***Passiflora***	***Deidamioides***	NA	***Polyanthea***					
	Passiflora	*Deidamioides*	NA	*Polyanthea*	NA	*P. cirrhiflora*	Juss.	Vanderplank (2004)	Ulmer & MacDougal (2004)
2.2	***Passiflora***	***Deidamioides***	NA	***Deidamioides***					
	Passiflora	*Deidamioides*	NA	*Deidamioides*	NA	None found			
2.3	***Passiflora***	***Deidamioides***	NA	***Tetrastylis***					
	Passiflora	*Deidamioides*	NA	*Tetrastylis*	NA	*P. ovalis*	Vell.	Vanderplank (2004)	Ulmer & MacDougal (2004)
2.4	***Passiflora***	***Deidamioides***	NA	***Mayapathanthus***					
	Passiflora	*Deidamioides*	NA	*Mayapathanthus*	NA	None found			
2.5	***Passiflora***	***Deidamioides***	NA	***Tryphostemmatoides***					
	Passiflora	*Deidamioides*	NA	*Tryphostemmatoides*	NA	*P. discophora*	P.Jørg. & Lawesson	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Deidamioides*	NA	*Tryphostemmatoides*	NA	*P. gracillima*	Killip	Vanderplank (2004)	Ulmer & MacDougal (2004)
3	***Passiflora***	***Decaloba***							
3.1	***Passiflora***	***Decaloba***	***Pterosperma***						
	Passiflora	*Decaloba*	*Pterosperma*	NA	NA	*P. lancetillensis*	J.M.MacDougal	Vanderplank (2004) as "*P. lancetellsis*"	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Pterosperma*	NA	NA	*P. microstipula*	L.E.Gilbert & J.M.MacDougal	Gilbert & MacDougal (2000), Vanderplank (2004)	Ulmer & MacDougal (2004)
3.2	***Passiflora***	***Decaloba***	***Hahniopathanthus***						
	Passiflora	*Decaloba*	*Hahniopathanthus*	NA	NA	*P. guatemalensis*	S.Watson	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Hahniopathanthus*	NA	NA	*P. hahnii*	Mast.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007)	Ulmer & MacDougal (2004)
3.3	***Passiflora***	***Decaloba***	***Disemma***						
3.3.1	***Passiflora***	***Decaloba***	***Disemma***	***Octandranthus***					
	Passiflora	*Decaloba*	*Disemma*	*Octandranthus*	NA	*P. menghaiensis*	X.D.Ma, L.C.Yan & J.Y.Shen	Ma et al. (2019)	Ma et al. (2019)
3.3.2	***Passiflora***	***Decaloba***	***Disemma***	***Disemma***					
	Passiflora	*Decaloba*	*Disemma*	*Disemma*	NA	*P. aurantia*	G.Forst.	Czeczott & Skirgiello (1967) as "*P. aurantiaca*", Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Disemma*	*Disemma*	NA	*P. cinnabarina*	Lindl.	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Disemma*	*Disemma*	NA	*P. herbertiana*	Ker Gawl.	Vanderplank (2004)	Ulmer & MacDougal (2004)
3.3.3	***Passiflora***	***Decaloba***	***Disemma***	***Hollrungiella***					
	Passiflora	*Decaloba*	*Disemma*	*Hollrungiella*	NA	None found			
3.4	***Passiflora***	***Decaloba***	***Multiflora***						
	Passiflora	*Decaloba*	*Multiflora*	NA	NA	*P. holosericea*	L.	Pérez-Cortéz et al. (2002), Pérez-Cortéz (2007)	Ulmer & MacDougal (2004)
3.5	***Passiflora***	***Decaloba***	***Auriculata***						
	Passiflora	*Decaloba*	*Auriculata*	NA	NA	*P. auriculata*	Kunth	Pérez-Cortéz et al. (2002), Pérez-Cortéz (2007), Silva et al. (2020)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Auriculata*	NA	NA	*P. fanchonae*	Feuillet	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Auriculata*	NA	NA	*P. rufa*	Feuillet & J.M.MacDougal	Vanderplank (2004)	Feuillet & MacDougal (2008)
3.6	***Passiflora***	***Decaloba***	***Cieca***						
	Passiflora	*Decaloba*	*Cieca*	NA	NA	*P. coriacea*	Juss.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007)	Porter-Utley (2014)
	Passiflora	*Decaloba*	*Cieca*	NA	NA	*P. juliana*	J.M.MacDougal	Vanderplank (2004)	Porter-Utley (2014)
	Passiflora	*Decaloba*	*Cieca*	NA	NA	*P. obtusifolia*	Sessé & Moc.	Vanderplank (2004)	Porter-Utley (2014)
	Passiflora	*Decaloba*	*Cieca*	NA	NA	*P. pallida*	L.	USDA, NRCS (2019–2020)	Porter-Utley (2014)
	Passiflora	*Decaloba*	*Cieca*	NA	NA	*P. suberosa* (incl. subspp.)	L.	Mai (1960), Deginani (2001), Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007), Mondin et al. (2011), USDA, NRCS (2019–2020)	Porter-Utley (2014)
	Passiflora	*Decaloba*	*Cieca*	NA	NA	*P. viridiflora*	Cav.	Vanderplank (2004) as "*P. viridifolia*"	Porter-Utley (2014)
	Passiflora	*Decaloba*	*Cieca*	NA	NA	*P. xiikzodz*	J.M.MacDougal	Vanderplank (2004) as "*P. xiikdodz*"	Porter-Utley (2014)
3.7	***Passiflora***	***Decaloba***	***Bryonioides***						
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. adenopoda*	DC.	MacDougal (1994), Vanderplank (2004), Pérez-Cortéz (2007)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. bryonioides*	Kunth	MacDougal (1994), Vanderplank (2004) as "*P. bryonoides*"	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. colimensis*	Mast. & Rose	MacDougal (1994)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. dioscoreifolia*	Killip	MacDougal (1994)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. dolichocarpa*	Killip	MacDougal (1994)	Krosnick et al. (2013a)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. exsudans*	Zucc.	MacDougal (1994)	Jørgensen (no date)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. gracilis*	J.Jacq. ex Link	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. karwinskii*	Mast.	MacDougal (1994), Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. lobata*	(Killip) Hutch. ex J.M.MacDougal	MacDougal (1994), Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. morifolia*	Mast.	MacDougal (1994), Deginani (2001), Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007), Mondin et al. (2011), Gurski (2015)	Ulmer & MacDougal (2004)

	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. oaxacensis*	J.M.MacDougal	MacDougal (1994)	Jørgensen (no date)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. pendens*	J.M.MacDougal	MacDougal (1994)	Krosnick et al. (2013a)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. pilosa* subsp. *dimidiata*	Ruiz & Pav. Ex DC.	MacDougal (1994)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. podadenia*	Killip	MacDougal (1994)	Jørgensen (no date)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. pterocarpa*	J.M.MacDougal	MacDougal (1994)	Jørgensen (no date)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. quercetorum*	Killip	MacDougal (1994)	Jørgensen (no date)
	Passiflora	*Decaloba*	*Bryonioides*	NA	NA	*P. sicyoides*	Cham. & Schltdl.	MacDougal (1994)	Krosnick et al. (2013a)
3.8	***Passiflora***	***Decaloba***	***Decaloba***						
	Passiflora	*Decaloba*	*Decaloba*	?	NA	*P. lyra* (misidentified?)	Planch. & Linden ex Killip	Pérez-Cortéz (2007)	Jørgensen (no date); imaged seed not consistent with supersection.
3.8.1	***Passiflora***	***Decaloba***	***Decaloba***	***Decaloba***					
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. affinis*	Engelm.	Vanderplank (2004), USDA, NRCS (2019–2020)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. allantophylla*	Mast.	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. alnifolia*	Kunth	Vanderplank (2004), Pérez-Cortéz (2007) as *P*. cf. *alnifolia* and *P. bauhinifolia*	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. amalocarpa*	Barb.Rodr.	Vanderplank (2004)	Vanderplank (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. andicola*	Esquerre	Esquerre-Ibañez (2019)	Esquerre-Ibañez (2019)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. apetala*	Killip	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. bicornis*	Mill.	Pérez-Cortéz et al. (2002), Pérez-Cortéz (2007) as *P. pulchella*. Image in Pérez-Cortéz (2007) probably incorrect (same image as *P.* aff. *tiliaefolia* in same publication).	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. biflora*	Lam.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007), USDA, NRCS (2019–2020)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. boenderi*	J.M.MacDougal	Vanderplank (2004) as "*P. boenderii*"	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. candollei*	Triana & Planch.	Pérez-Cortéz et al. (2002), Vanderplank (2004)	Vanderplank (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. colinvauxii*	Wiggins	Vanderplank (2004)	Vanderplank (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. cuneata*	Willd.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. filipes*	Benth.	Pérez-Cortéz (2007)	Krosnick et al. (2013a)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. gilbertiana*	J.M.MacDougal	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. helleri*	Peyr.	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. jorullensis*	Kunth	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. lancearia*	Mast.	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. lutea*	L.	Vanderplank (2004), USDA, NRCS (2019–2020)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. misera*	Kunth	Deginani (2001), Pérez-Cortéz et al. (2002), Pérez-Cortéz (2007), Mondin et al. (2011)	Krosnick et al. (2013a)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. mollis*	Kunth	Pérez-Cortéz (2007)	Supersection: Jørgensen (no date). Section: this study, based on seed sculpture.
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. murucuja* (misidenitified?)	L.	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. organensis*	Gardn.	Mondin et al. (2011)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. ornithoura*	Mast.	Vanderplank (2004)	Krosnick et al. (2013a)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. pardifolia*	Vanderpl.	Vanderplank (2004)	Krosnick et al. (2013a)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. punctata*	L.	Pérez-Cortéz et al. (2002), Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. quimbayensis*	Ocampo & Forero	Ocampo Pérez et al. (2018)	Ocampo Pérez et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. sexflora*	Juss.	Pérez-Cortéz et al. (2002)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. standleyi*	Killip	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. tricuspis*	Mast.	Vanderplank (2004)	Krosnick et al. (2013a)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. tuberosa*	Jacq.	Pérez-Cortéz et al. (2002) as *P*. aff. *tuberosa*, Pérez-Cortéz (2007)	Krosnick et al. (2013a)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. tulae*	Urb.	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. urnaefolia*	Rusby	Deginani (2001), Mondin et al. (2011) as "*P. urnifolia*"	Supersection: Jørgensen (no date). Section: this study, based on seed sculpture.
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. vespertilio*	L.	Vanderplank (2004), Pérez-Cortéz (2007)	Ulmer & MacDougal (2004)
	Passiflora	*Decaloba*	*Decaloba*	*Decaloba*	NA	*P. yucatanensis*	Killip ex Standl.	Vanderplank (2004)	Ulmer & MacDougal (2004)
3.8.2	***Passiflora***	***Decaloba***	***Decaloba***	***Xerogona***					
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. capsularis*	L.	Deginani (2001), Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007), Modin et al. (2011), Milani (2014), Boza Espinoza et al. (2018)	Boza Espinoza et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. cisnana*	Harms	Boza Espinoza et al. (2018), Silva et al. (2020)	Boza Espinoza et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. citrina*	J.M.MacDougal	Vanderplank (2004), Milani (2014), Boza Espinoza et al. (2018)	Boza Espinoza et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. cobanensis* subsp.	Killip	Vanderplank (2004) as *P. brevipes*, Boza Espinoza et al. (2018)	Boza Espinoza et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. conzattiana*	Killip	Vanderplank (2004), Boza Espinoza et al. (2018)	Boza Espinoza et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. costaricensis*	Killip	Pérez-Cortéz et al. (2002), Vanderplank (2004), Boza Espinoza et al. (2018)	Boza Espinoza et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. goniosperma*	Killip	Boza Espinoza et al. (2018)	Boza Espinoza et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. pusilla*	J.M.MacDougal	Boza Espinoza et al. (2018)	Boza Espinoza et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. quinquangularis*	S.Calderón ex J.M.MacDougal	Boza Espinoza et al. (2018)	Boza Espinoza et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. rovirosae*	Killip	Boza Espinoza et al. (2018)	Boza Espinoza et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. rubra*	L.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007), Milani (2014), Boza Espinoza et al. (2018)	Boza Espinoza et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. sanguinolenta*	Mast. & Linden	Vanderplank (2004), Boza Espinoza et al. (2018)	Boza Espinoza et al. (2018)
	Passiflora	*Decaloba*	*Decaloba*	*Xerogona*	NA	*P. tenella*	Killip	Boza Espinoza et al. (2018)	Boza Espinoza et al. (2018)
4	***Passiflora***	***Passiflora***							
	Passiflora	*Passiflora*	?	?	?	*P. guazumaefolia*	Juss.	Pérez-Cortez (2007)	Rome & Coppens d'Eeckenbrugge (2017)
	Passiflora	*Passiflora*	?	?	?	*P. maliformis*	L.	Vanderplank (2004)	Rome & Coppens d'Eeckenbrugge (2017)
	Passiflora	*Passiflora*	?	?	?	*P. nephrodes*	Mast.	Vanderplank (2004)	Vanderplank (2004)
	Passiflora	*Passiflora*	?	?	?	*P. pallens*	Poepp. ex Mast.	Pérez-Cortéz et al. (2002, 2009), Vanderplank (2004)	Hansen et al. (2006)
	Passiflora	*Passiflora*	?	?	?	*P.* cf. *picturata*	Ker Gawl.	Pérez-Cortéz (2007)	Silva et al. (2018)
	Passiflora	*Passiflora*	?	?	?	*P. stipulata*	Aubl.	Vanderplank (2004)	Vanderplank (2004)
4.1	***Passiflora***	***Passiflora***	***Passiflora***						
4.1.1	***Passiflora***	***Passiflora***	***Passiflora***	NA	***Passiflora***				
	Passiflora	*Passiflora*	*Passiflora*	NA	*Passiflora*	*P. cacao*	Bernacci & M.M.Souza	Bernacci & Souza (2012)	Bernacci & Souza (2012)

	Passiflora	*Passiflora*	*Passiflora*	NA	*Passiflora*	*P. cincinnata*	Mast.	Deginani (2001), Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007), Gurski (2015)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Passiflora*	NA	*Passiflora*	*P. edulis* (incl. forms)	Sims	Deginani (2001), Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007), Mondin et al. (2011), USDA, NRCS (2019–2020)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Passiflora*	NA	*Passiflora*	*P. incarnata*	L.	Pérez-Cortéz et al. (2002, 2009), Vanderplank (2004), USDA, NRCS (2019–2020), this study	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Passiflora*	NA	*Passiflora*	*P. mayarum*	J.M.MacDougal	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Passiflora*	NA	*Passiflora*	*P. serratifolia*	L.	Vanderplank (2004)	Ulmer & MacDougal (2004)
4.1.2	***Passiflora***	***Passiflora***	***Passiflora***	**NA**	***Palmatisectae***				
	Passiflora	*Passiflora*	*Passiflora*	NA	*Palmatisectae*	*P. palmatisecta*	Mast.	Deginani (2001)-only apex figured	Feuillet & MacDougal (2003)
4.1.3	***Passiflora***	***Passiflora***	***Passiflora***	**NA**	***Pedatae***				
	Passiflora	*Passiflora*	*Passiflora*	NA	*Pedatae*	*P. pedata*	L.	Pérez-Cortéz et al. (2002), Pérez-Cortéz (2007), Silva et al. (2016)	Feuillet & MacDougal (2003)
4.1.4	***Passiflora***	***Passiflora***	***Passiflora***	**NA**	***Setaceae***				
	Passiflora	*Passiflora*	*Passiflora*	NA	*Setaceae*	None found			
4.2	***Passiflora***	***Passiflora***	***Stipulata***						
4.2.1	***Passiflora***	***Passiflora***	***Stipulata***	***Granadillastrum***					
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. actinia*	Hook.	Vanderplank (2004), Mondin et al. (2011)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. amethystina*	J.C.Mikan	Deginani (2001), Vanderplank (2004), Mondin et al. (2011)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. caerulea*	L.	Deginani (2001), Vanderplank (2004), Mondin et al. (2011)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. danielii*	Killip	Ocampo et al. (2015)	Ocampo et al. (2015)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. eichleriana*	Mast.	Gurski (2015), Mondin et al. (2011). Images in these two sources are dissimilar (different species?).	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. elegans*	Mast.	Deginani (2001), Vanderplank (2004), Mondin et al. (2011)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. exura*	Feuillet	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. garckei*	Mast.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. gibertii*	N.E.Br.	Deginani (2001) as "*P. gibertii*", Vanderplank (2004), Gurski (2015). Vanderplank (2004) may be misidentified (seed very different in morphology from other sources).	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. gritensis*	H.Karst.	Pérez-Cortéz et al. (2002, 2009), Vanderplank (2004), Pérez-Cortéz (2007)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. menispermifolia*	Kunth	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. mooreana*	Hook.f.	Deginani (2001), Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. mucronata*	Lam.	Vanderplank (2004), Gurski (2015)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. oerstedii* (incl. varieties)	Mast.	Vanderplank (2004), Pérez-Cortéz (2007)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. resticulata*	Mast. & André	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. retipetala*	Mast.	Vanderplank (2004), Pérez-Cortéz (2007)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	Stipulata	*Granadillastrum*	NA	*P. sidifolia*	M.Roem.	Pérez-Cortéz et al. (2002) as "*P. sidaefolia*", Pérez-Cortéz et al. (2009) as "*P. sidiifolia*". One of these is mislabeled (mixed up with *P. spectabilis*).	Nardin et al. (2015)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. sprucei*	Mast.	Vanderplank (2004) as "*P. spruceii*"	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. subpeltata*	Ortega	Mai (1960) as *P. alba*, Vanderplank (2004), Pérez-Cortéz (2007), Pérez-Cortéz et al. (2009). Seed in Pérez-Cortéz (2007) and Pérez-Cortéz et al. (2009) is different than those in other sources.	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. tenuifila*	Killip	Deginani (2001), Vanderplank (2004) as "*P. tenufila*", Mondin et al. (2011)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. tucumanensis*	Hook.	Deginani (2001), Vanderplank (2004) as *P. naviculata*	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Granadillastrum*	NA	*P. urubiciensis*	Cervi	Mondin et al. (2011)	Cervi (2003)
4.2.2	***Passiflora***	***Passiflora***	***Stipulata***	***Calopathanthus***					
	Passiflora	*Passiflora*	*Stipulata*	*Calopathanthus*	NA	*P. racemosa*	Brot.	Vanderplank (2004)	Ulmer & MacDougal (2004)
4.2.3	***Passiflora***	***Passiflora***	***Stipulata***	***Tacsonioides***					
	Passiflora	*Passiflora*	*Stipulata*	*Tacsonioides*	NA	*P. reflexiflora*	Cav.	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Tacsonioides*	NA	*P. tarapotina*	Harms	Pérez-Cortéz et al. (2002)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Stipulata*	*Tacsonioides*	NA	*P. umbilicata*	Harms	Deginani (2001)-only apex figured, Vanderplank (2004)	Ulmer & MacDougal (2004)
4.2.4	***Passiflora***	***Passiflora***	***Stipulata***	***Kermesinae***					
	Passiflora	Passiflora	*Stipulata*	*Kermesinae*	NA	*P. kermesina*	Link & Otto	Vanderplank (2004)	Ulmer & MacDougal (2004)
4.2.5	***Passiflora***	***Passiflora***	***Stipulata***	***Dysosmia***					
	Passiflora	*Passiflora*	*Stipulata*	*Dysosmia*	NA	*P. ciliata* (incl. varieties)	Aiton	Vanderplank (2004) as *P. foetida* var. *hirsutissima*, *P. foetida* var. *lanuginosa*, *P. foetida* var. *maxonii*, *P. foetida* var. *orinocensis*, *P. foetida* var. *parvifolia*	Vanderplank (2013)
	Passiflora	*Passiflora*	*Stipulata*	*Dysosmia*	NA	*P. chrysophylla*	Chodat.	Deginani (2001)	Vanderplank (2013)
	Passiflora	*Passiflora*	*Stipulata*	*Dysosmia*	NA	*P. foetida* (incl. varieties)	L.	Deginani (2001), Pérez-Cortéz et al. (2002, 2009), Vanderplank (2004), Pérez-Cortéz (2007), Mondin et al. (2011), Gurski (2015), USDA, NRCS (2019–2020)	Vanderplank (2013)
	Passiflora	*Passiflora*	*Stipulata*	*Dysosmia*	NA	*P. pentaschista*	(Killip) H.T.Svoboda	Vanderplank (2004) as *P. arida* var. "*pentachista*"	Svoboda & Harris (2018)
	Passiflora	*Passiflora*	*Stipulata*	*Dysosmia*	NA	*P. sublanceolata*	(Killip) J.M.MacDougal	Vanderplank (2004) as *P. palmeria* var. "*sublanceolate*"	Vanderplank (2013)
	Passiflora	*Passiflora*	*Stipulata*	*Dysosmia*	NA	*P. urbaniana*	Killip	Vanderplank (2004)	Vanderplank (2013)
	Passiflora	*Passiflora*	*Stipulata*	*Dysosmia*	NA	*P. vesicaria* var.	L.	Vanderplank (2004) as *P. foetida* var. *galapagensis*	Vanderplank (2013)
4.3	***Passiflora***	***Passiflora***	***Laurifolia***						
4.3.1	***Passiflora***	***Passiflora***	***Laurifolia***	NA	***Laurifoliae***				
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. acuminata*	DC.	Vanderplank (2004)	Rome & Coppens d'Eeckenbrugge (2017)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. ambigua*	Hemsl.	Vanderplank (2004), Pérez-Cortéz (2007)	Rome & Coppens d'Eeckenbrugge (2017)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. capparidifolia*	Killip	Pérez-Cortéz (2007)	Rome & Coppens d'Eeckenbrugge (2017)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. cerasina*	Annonay & Feuillet	Vanderplank (2004)	Rome & Coppens d'Eeckenbrugge (2017)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. crenata*	Feuillet & Cremers	Vanderplank (2004)	Rome & Coppens d'Eeckenbrugge (2017)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. gabrielliana*	Vanderpl.	Vanderplank (2004)	Rome & Coppens d'Eeckenbrugge (2017)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. gleasonii*	Killip	Pérez-Cortéz (2007) as "*P. gleasoni*"	Rome & Coppens d'Eeckenbrugge (2017)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. gustaviana*	Ocampo & Molinari	Ocampo Pérez & Molinari (2017)	Ocampo Pérez & Molinari (2017)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. laurifolia*	L.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007), USDA, NRCS (2019–2020)	Rome & Coppens d'Eeckenbrugge (2017)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. nigradenia*	Rusby	Vanderplank (2004)	Rome & Coppens d'Eeckenbrugge (2017)

	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. nitida*	Kunth	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007)	Rome & Coppens d'Eeckenbrugge (2017)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. pergrandis*	Holm-Nielsen & Lawesson	Vanderplank (2004)	Rome & Coppens d'Eeckenbrugge (2017)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Laurifoliae*	*P. riparia*	Mart. ex Mast.	Pérez-Cortéz et al. (2002), Pérez-Cortéz (2007)	Rome & Coppens d'Eeckenbrugge (2017)
4.3.2	***Passiflora***	***Passiflora***	***Laurifolia***	NA	***Quadrangulares***				
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Quadrangulares*	*P. alata*	Curtis	Deginani (2001), Pérez-Cortéz et al. (2002), Vanderplank (2004), Mondin et al. (2011), Gurski (2015). Seed in Gurski (2015) misidentified? (does not match images in other sources).	Koch et al. (2013)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Quadrangulares*	*P. phoenicea*	Lindl.	Vanderplank (2004) as "*P. pheonicia*"	Koch et al. (2013)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Quadrangulares*	*P. quadrangularis*	L.	Pérez-Cortéz et al. (1995, 2002), Vanderplank (2004), Pérez-Cortéz (2007)	Koch et al. (2013)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Quadrangulares*	*P. trialata*	Feuillet & J.M.MacDougal	Vanderplank (2004)	Koch et al. (2013)
4.3.3	***Passiflora***	***Passiflora***	***Laurifolia***	NA	***Tiliifolia***				
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Tiliifolia*	*P. ligularis*	Juss.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Kirkbride et al. (2006), Pérez-Cortéz (2007), Cárdenas-Hernández et al. (2011), USDA, NRCS (2019–2020)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Tiliifolia*	*P. magnifica*	L.K.Escobar	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Tiliifolia*	*P. multiformis*	Jacq.	Pérez-Cortéz (2007)	Yockteng et al. (2011)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Tiliifolia*	*P. platyloba*	Killip	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Tiliifolia*	*P. seemannii*	Griseb.	Vanderplank (2004) as "*P. seemanii*", Pérez-Cortéz (2007) as "*P. seemanni*"	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Tiliifolia*	*P. serratodigitata*	L.	Vanderplank (2004)	Ulmer & MacDougal (2004)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Tiliifolia*	*P. serrulata*	Jacq.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007)	Yockteng et al. (2011)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Tiliifolia*	*P.* aff. *tiliifolia*	L.	Pérez-Cortéz et al. (2002) as "*P.* sp. n. aff. *tilifolia*", Pérez-Cortéz (2007) as "*P.* aff. *tiliaefolia*"	Feuillet & MacDougal (2003)
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Tiliifolia*	*P. triloba*	Ruiz & Pav. ex DC.	Vanderplank (2004)	Ulmer & MacDougal (2004)
4.3.4	***Passiflora***	***Passiflora***	***Laurifolia***	NA	***Marginatae***				
	Passiflora	*Passiflora*	*Laurifolia*	NA	*Marginatae*	None found			
4.4	***Passiflora***	***Passiflora***	***Coccinea***	NA	NA				
	Passiflora	*Passiflora*	*Coccinea*	NA	NA	*P. aimae*	Annonay & Feuillet	Vanderplank (2004) as "*P. aimea*"	Feuillet (2007)
	Passiflora	*Passiflora*	*Coccinea*	NA	NA	*P. coccinea* (incl. subspp.)	Aubl.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007), Vanderplank & Zappi (2011), Gurski (2015)	Feuillet (2007)
	Passiflora	*Passiflora*	*Coccinea*	NA	NA	*P. quadrifaria*	Vanderpl.	Vanderplank (2004)	Feuillet (2007)
	Passiflora	*Passiflora*	*Coccinea*	NA	NA	*P. quadriglandulosa*	Rodschied	Pérez-Cortéz (2007)	Feuillet (2007)
	Passiflora	*Passiflora*	*Coccinea*	NA	NA	*P. vitifolia*	Kunth	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007)	Feuillet (2007)
4.5	***Passiflora***	***Passiflora***	***Distephana***						
	Passiflora	*Passiflora*	*Distephana*	NA	NA	*P. amicorum*	Wurdack	Pérez-Cortéz (2007)	Vanderplank & Zappi (2011)
	Passiflora	*Passiflora*	*Distephana*	NA	NA	*P. cristalina*	Vanderpl. & Zappi	Vanderplank & Zappi (2011), Silveira et al. (2019)	Vanderplank & Zappi (2011)
	Passiflora	*Passiflora*	*Distephana*	NA	NA	*P. glandulosa*	Cav.	Vanderplank (2004), Pérez-Cortéz (2007), Vanderplank & Zappi (2011)	Vanderplank & Zappi (2011)
	Passiflora	*Passiflora*	*Distephana*	NA	NA	*P. variolata*	Poepp. & Endl.	Vanderplank (2004), Pérez-Cortéz (2007)	Vanderplank & Zappi (2011)
4.6	***Passiflora***	***Passiflora***	***Tacsonia***						
4.6.1	***Passiflora***	***Passiflora***	***Tacsonia***	***Rathea***					
	Passiflora	*Passiflora*	*Tacsonia*	*Rathea*	NA	None found			
4.6.2	***Passiflora***	***Passiflora***	***Tacsonia***	***Insignes***					
	Passiflora	*Passiflora*	*Tacsonia*	*Insignes*	NA	*P. pilosocorona*	Sacco	Vanderplank (2004) as "*P. pilosicorona*"	Jørgensen & Vásquez (2009)
	Passiflora	*Passiflora*	*Tacsonia*	*Insignes*	NA	*P. pinnatistipula*	Cav.	Vanderplank (2004), González-Benito et al. (2009)	Jørgensen & Vásquez (2009)
4.6.3	***Passiflora***	***Passiflora***	***Tacsonia***	***Colombiana***					
4.6.3.1	***Passiflora***	***Passiflora***	***Tacsonia***	***Colombiana***	***Colombianae***				
	Passiflora	*Passiflora*	*Tacsonia*	*Colombiana*	*Colombianae*	*P. rugosa*	Planch. & Triana	Pérez-Cortéz et al. (2002), Pérez-Cortéz (2007)	Bonilla Morales (2014)
	Passiflora	*Passiflora*	*Tacsonia*	*Colombiana*	*Colombianae*	*P. truxillensis*	Planch. & Lind. ex Triana & Planch.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007)	Bonilla Morales (2014)
4.6.3.2	***Passiflora***	***Passiflora***	***Tacsonia***	***Colombiana***	***Leptomischae***				
	Passiflora	*Passiflora*	*Tacsonia*	*Colombiana*	*Leptomischae*	*P. antioquiensis*	H.Karst.	Vanderplank (2004)	Bonilla Morales (2014)
4.6.3.3	***Passiflora***	***Passiflora***	***Tacsonia***	***Colombiana***	***Quindiensae***				
	Passiflora	*Passiflora*	*Tacsonia*	*Colombiana*	*Quindiensae*	None found			
4.6.4	***Passiflora***	***Passiflora***	***Tacsonia***	***Parritana***					
	Passiflora	*Passiflora*	*Tacsonia*	*Parritana*	NA	None found			
4.6.5	***Passiflora***	***Passiflora***	***Tacsonia***	***Fimbriatistipula***					
	Passiflora	*Passiflora*	*Tacsonia*	*Fimbriatistipula*	NA	None found			
4.6.6	***Passiflora***	***Passiflora***	***Tacsonia***	***Tacsoniopsis***					
	Passiflora	*Passiflora*	*Tacsonia*	*Tacsoniopsis*	NA	None found			
4.6.7	***Passiflora***	***Passiflora***	***Tacsonia***	***Elkea***					
	Passiflora	*Passiflora*	*Tacsonia*	*Elkea*	NA	*P. tarminiana*	Coppens & V.E.Barney	Vanderplank (2004), González-Benito et al. (2009)	Bonilla Morales (2014)
	Passiflora	*Passiflora*	*Tacsonia*	*Elkea*	NA	*P. tripartita*	Breiter	Pérez-Cortez et al. (2002) as *P. mollissima*, Pérez-Cortéz (2007) as *P. mollissima*, González-Benito et al. (2009) as *P. mollissima*, Martínez (2017), USDA, NRCS (2019–2020)	Ulmer & MacDougal (2004), Bonilla Morales (2014)
4.6.8	***Passiflora***	***Passiflora***	***Tacsonia***	***Tacsonia***					
	Passiflora	*Passiflora*	*Tacsonia*	*Tacsonia*	NA	*P. matthewsii*	(Mast.) Killip	Vanderplank (2004)	Bonilla Morales (2014)
	Passiflora	*Passiflora*	*Tacsonia*	*Tacsonia*	NA	*P. mixta* (incl. varieties)	L.f.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007)	Bonilla Morales (2014)
4.6.9	***Passiflora***	***Passiflora***	***Tacsonia***	***Boliviana***					
	Passiflora	*Passiflora*	*Tacsonia*	*Boliviana*	NA	None found			
4.6.10	***Passiflora***	***Passiflora***	***Tacsonia***	***Trifoliata***					
	Passiflora	*Passiflora*	*Tacsonia*	*Trifoliata*	NA	None found			
4.6.11	***Passiflora***	***Passiflora***	***Tacsonia***	***Manicata***					
	Passiflora	*Passiflora*	*Tacsonia*	*Manicata*	NA	*P. manicata*	Pers.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007)	Bonilla Morales (2014)

NA	***Passiflora***	**Tetrapathea**							
	Passiflora	Tetrapathea	NA	NA	NA	*P. tetrandra*	Banks ex DC.	Vanderplank (2004)	Krosnick et al. (2009)

Number, Feuillet & MacDougal (2003)	Genus	Subgenus	Supersection	Section	Series	Estimated number of species	Citation for number of species	Number of species with figured seeds (from Table S4)	Possible differentiating (unique or rare) seed features (vs. other Passifloroideae)	References consulted (only listed when features suggested; also see Table S4)	Notes
NA	*Ancistrothyrsus*					3	Feuillet (2020)	1	Seeds relatively large (12–14 mm in length).	Gentry (1992), Martínez (2017), Feuillet (2020)	
NA	*Adenia*					100	Feuillet & MacDougal (2007), Hearn (2006)	3–4			
NA	*Androsiphonia*					1	Feuillet & MacDougal (2007)	0			
NA	*Barteria*					4	Feuillet & MacDougal (2007)	0			
NA	*Basananthe*					30	Feuillet & MacDougal (2007)	0			
NA	*Crossostemma*					1	Feuillet & MacDougal (2007)	0			
NA	*Deidamia*					5	Feuillet & MacDougal (2007)	0			
NA	*Dilkea*					12	Feuillet (2011)	1	Seeds relatively large (13–20 mm long), not compressed to slightly compressed; shape ovate, elongate, or centrally constricted; surface smooth to pustulate.	Feuillet (2009, 2010, 2011), MacDougal (2011)	These characteristics differ from those reported by Martínez (2017) for *Dilkea*. See text for details.
NA	*Efulensia*					2	Feuillet & MacDougal (2007)	0			
NA	*Mitostemma*					3	Feuillet & MacDougal (2007)	0			
NA	*Paropsia*					12	de Vos & Breteler (2009)	0			
NA	*Paropsiopsis*					2	de Vos & Breteler (2009)	0			
NA	*Schlechterina*					1	Feuillet & MacDougal (2007)	0			
NA	*Smeathmannia*					2	de Vos & Breteler (2009)	0			
NA	*Viridivia*					1	Feuillet & MacDougal (2007)	0			
	Passiflora					562	Sum of subgenus estimates	218	None for the genus as a whole. Some subgroups have distinctive features (discussed below).		
	Passiflora	Unknown				NA		6			Number of species could be 7 (one seed not identified to species).
1	*Passiflora*	*Astrophea*				66	Hilgenhof (2013)	30			Subgenus *Astrophea* is monophyletic (Hansen et al. 2006; Muscher et al. 2012; Krosnick et al. 2013a).
1.1	*Passiflora*	*Astrophea*	*Astrophea*			33	Hilgenhof (2013)	11			
1.1.1	*Passiflora*	*Astrophea*	*Astrophea*	*Astrophea*		15	Hilgenhof (2013)	6			
1.1.2	*Passiflora*	*Astrophea*	*Astrophea*	*Capreolata*		16	Hilgenhof (2013)	5			
1.1.3	*Passiflora*	*Astrophea*	*Astrophea*	*Leptopoda*		2	Hilgenhof (2013)	0			
1.2	*Passiflora*	*Astrophea*	*Pseudoastrophea*			33	Hilgenhof (2013)	19			
1.2.1	*Passiflora*	*Astrophea*	*Pseudoastrophea*	*Pseudoastrophea*		20	Hilgenhof (2013)	12			
1.2.2	*Passiflora*	*Astrophea*	*Pseudoastrophea*	*Botryastrophea*		13	Hilgenhof (2013)	7			
1.2.2.1	*Passiflora*	*Astrophea*	*Pseudoastrophea*	*Botryastrophea*	*Botryastrophea*	6	Hilgenhof (2013)	4			
1.2.2.2	*Passiflora*	*Astrophea*	*Pseudoastrophea*	*Botryastrophea*	*Carnae*	7	Hilgenhof (2013)	3			
2	*Passiflora*	*Deidamioides*				13	MacDougal & Feuillet (2004)	4			Subgenus *Deidamioides* is polyphyetic. The sections are in three separate clades: 1) *Polyantha* + *Deidamioides* + *Tetrastylis*; 2) *Mayapathanthus*; 3) *Tryphostemmatoides* (Krosnick et al. 2013a).
2.1	*Passiflora*	*Deidamioides*	NA	*Polyanthea*		1	Krosnick et al. (2013a)	1	*P. cirrhiflora* has transversely sulcate seed sculpture similar to section *Xerogona*; image in Vanderplank (2004) shows that central sulcus is x-shaped.	Ulmer & MacDougal (2004), Vanderplank (2004)	The *Polyanthea* + *Deidamioides* + *Tetrastylis* clade is monophyletic (Hansen et al. 2006; Muscher et al. 2012; Krosnick et al. 2013a).
2.2	*Passiflora*	*Deidamioides*	NA	*Deidamioides*		1	Krosnick et al. (2013a)	0			The *Polyanthea* + *Deidamioides* + *Tetrastylis* clade is monophyletic (Hansen et al. 2006; Muscher et al. 2012; Krosnick et al. 2013a).
2.3	*Passiflora*	*Deidamioides*	NA	*Tetrastylis*		2	Krosnick et al. (2013a)	1			The *Polyanthea* + *Deidamioides* + *Tetrastylis* clade is monophyletic (Hansen et al. 2006; Muscher et al. 2012; Krosnick et al. 2013a).
2.4	*Passiflora*	*Deidamioides*	NA	*Mayapathanthus*		2	MacDougal & Feuillet (2004)	0	Scupture of *P. obovata* Killip "irregularly deeply rugose with 5–7 radial and transverse ridges."	Ulmer & MacDougal (2004, pg. 103)	This section is within subgenus *Decaloba* (Krosnick et al. 2013a).
2.5	*Passiflora*	*Deidamioides*	NA	*Tryphostemmatoides*		7	MacDougal & Feuillet (2004)	2	Sculpture sometimes sulcate (*P. arbelaezii* Uribe).	Ulmer & MacDougal (2004)	This section is sister to subgenus *Astrophea* (Muschner et al. 2012; Krosnick et al. 2013a).
3	*Passiflora*	*Decaloba*				230	Krosnick et al. (2013a)	84	None consistent for entire subgenus; however, some subgroups have distinctive features (discussed below).	See references for supersections and sections.	Subgenus *Decaloba* is likely monophyletic (Hansen et al. 2006; Muscher et al. 2012; Krosnick et al. 2013a; Sader et al. 2019). However, see notes for supersection *Pterosperma* below.
3.1	*Passiflora*	*Decaloba*	*Pterosperma*			4	Krosnick et al. (2013a)	2	Seeds relatively large (ca. 7.5–12 mm long x 7–11 mm wide), overall shape bilobed, having lateral striate wings with irregular margins.	Gilbert & MacDougal (2000), MacDougal & Hansen (2003), Ulmer & MacDougal (2004), Vanderplank (2004), Krosnick et al. (2013a)	Krosnick et al. (2013a) found supersection *Pterosperma* to be monophyletic, whereas Sader et al. (2019) found supersection *Pterosperma* to be polyphyletic.
3.2	*Passiflora*	*Decaloba*	*Hahniopathanthus*			5	Krosnick et al. (2013a)	2			Supersection *Hahniopathanthus* is monophyletic (Krosnick et al. 2013a).
3.3	*Passiflora*	*Decaloba*	*Disemma*			22	Krosnick et al. (2013b), Ma et al. (2019)	4			Supersection *Disemma* is monphyletic (Krosnick et al. 2013a, b).
3.3.1	*Passiflora*	*Decaloba*	*Disemma*	*Octandranthus*		18	Krosnick et al. (2013b), Ma et al. (2019)	1			Section *Octandranthus* is monophyletic (Krosnick et al. 2013a, b).
3.3.2	*Passiflora*	*Decaloba*	*Disemma*	*Disemma*		3	Krosnick et al. (2013b)	3			Section *Disemma* is monophyletic (Krosnick et al. 2013a, b).
3.3.3	*Passiflora*	*Decaloba*	*Disemma*	*Hollrungiella*		1	Krosnick et al. (2013b)	0			

3.4	*Passiflora*	*Decaloba*	***Multiflora***			22	Krosnick et al. (2013a)	1			*P. multiflora* L. is not closely related to the remainder of supersection *Multiflora*. Supersection *Multiflora* is paraphyletic, with supersection *Auriculata* embedded within it (Krosnick et al. 2013a).
3.5	*Passiflora*	*Decaloba*	***Auriculata***			8	Krosnick et al. (2013a)	3	Sculpture transversely sulcate with rugulose ridges.	Pérez-Cortéz et al. (2002), Ulmer & MacDougal (2004), Vanderplank (2004), Pérez-Cortéz (2007), Silva et al. (2020)	Supersection *Auriculata* is not monophyletic, and it forms a clade with most species in supersection *Multiflora* (Krosnick et al. 2013a). Ornamentation similar to seeds of section *Decaloba*.
3.6	*Passiflora*	*Decaloba*	***Cieca***			19	Krosnick et al. (2013a), Porter-Utley (2014)	7	Seeds often fusiform to falcate, ornamentation coarsely reticulate-foveate, often with shallow longitudinal striations overlying reticulations.	Mai (1960), Deginani (2001), Pérez-Cortéz et al. (2002), Vanderplank (2004), Pérez-Cortéz (2007), Mondin et al. (2011), USDA, NRCS (2019–2020)	Supersection *Cieca* is monophyletic (Krosick et al. 2013a).
3.7	*Passiflora*	*Decaloba*	***Bryonioides***			22	Krosnick et al. (2013a)	17			Supersection *Bryonioides* is monophyletic (Krosnick et al. 2013a).
3.8	*Passiflora*	*Decaloba*	***Decaloba***			130	Krosnick et al. (2013a)	48	Sculpture transversely sulcate.	In addition to the references for sections *Decaloba* and *Xerogona* below, see MacDougal (1994), Krosnick et al. (2013a).	Supersection *Decaloba* is monophyletic (Krosnick et al. 2013a).
NA	*Passiflora*	*Decaloba*	***Decaloba***	**Unknown**				1			
3.8.1	*Passiflora*	*Decaloba*	***Decaloba***	***Decaloba***		115	Krosnick et al. (2013a)	34	Sculpture transversely sulcate with rugulose ridges.	Deginani (2001), Pérez-Cortéz et al. (2002), Ulmer & MacDougal (2004), Vanderplank (2004), Pérez-Cortéz (2007), Mondin et al. (2011), Ocampo Pérez et al. (2018), Esquerre-Ibañez (2019), USDA, NRCS (2019–2020)	Section *Decaloba* is paraphyletic, with section *Xerogona* embedded within in (Krosnick et al. 2013a).
3.8.2	*Passiflora*	*Decaloba*	***Decaloba***	***Xerogona***		15	Krosnick et al. (2013a), Boza Espinoza (2018)	13	Sculpture transversely sulcate, typically with smooth ridges (ridges sometimes rugulose). Notable exception: *P. goniosperma*, which has toothed longitudinal ridges (see Boza Espinoza et al. 2018.)	Deginani (2001), Pérez-Cortéz et al. (2002), Ulmer & MacDougal (2004), Vanderplank (2004), Pérez-Cortéz (2007), Mondin et al. (2011), Milani (2014), Krosnick et al. (2013a), Boza Espinoza et al. (2018), Silva et al. (2020)	Section *Xerogona* is monophyletic (Krosnick et al. 2013a)
4	*Passiflora*	*Passiflora*				**250**	Krosnick et al. (2013a)	**93**	None consistent for entire subgenus; however, seed apex sometimes tridentate or shallowly tridentate in supersections *Laurifolia*, *Passiflora*, and *Stipulata*.	See references for sections and series.	Subgenus *Passiflora* is monophyletic (Hansen et al. 2006; Muscher et al. 2012; Krosnick et al. 2013a; Sader et al. 2019).
NA	*Passiflora*	*Passiflora*	**Unknown**			NA		6			
4.1	*Passiflora*	*Passiflora*	***Passiflora***			20	Sum of series values (below)	8	Apex sometimes tridentate.	See references for series.	
4.1.1	*Passiflora*	*Passiflora*	***Passiflora***	NA	***Passiflora***	14	Bernacci & Souza (2012)	6	Apex sometimes tridentate.	Deginani (2001), Pérez-Cortéz et al. (2002, 2009), Ulmer & MacDougal (2004), Vanderplank (2004), Pérez-Cortéz (2007), Mondin et al. (2011), Bernacci & Souza (2012), Gurski (2015), USDA, NRCS (2019–2020), this study	Seeds of *P. cacao* are distinct in having a striate and winged margin, similar to series *Quadrangulares* (Bernacci & Souza 2012).
4.1.2	*Passiflora*	*Passiflora*	***Passiflora***	NA	***Palmatisectae***	1	MacDougal & Feuillet (2004)	1	Apex tridentate.	Deginani (2001)	
4.1.3	*Passiflora*	*Passiflora*	***Passiflora***	NA	***Pedatae***	1	MacDougal & Feuillet (2004)	1			
4.1.4	*Passiflora*	*Passiflora*	***Passiflora***	NA	***Setaceae***	4	MacDougal & Feuillet (2004)	0			
4.2	*Passiflora*	*Passiflora*	***Stipulata***			98	Sum of section values (below)	34	Apex sometimes tridentate (esp. section *Dysosmia*).	See references for sections.	
4.2.1	*Passiflora*	*Passiflora*	***Stipulata***	***Granadillastrum***		66	MacDougal & Feuillet (2004)	22	Apex sometimes tridentate? Unambiguously tridentate forms—*P. gibertii* in Vanderplank (2004), *P. eichleriana* in Gurski (2015), and *P. subpeltata* in Pérez-Cortéz (2007) and Pérez-Cortéz et al. (2009)—do not match images of seeds of the same species in other sources.	Mai (1960), Deginani (2001), Pérez-Cortéz et al. (2002, 2009), Vanderplank (2004), Pérez-Cortéz (2007), Mondin et al. (2011), Gurski (2015), Ocampo et al. (2015)	
4.2.2	*Passiflora*	*Passiflora*	***Stipulata***	***Calopathanthus***		1	MacDougal & Feuillet (2004)	1			
4.2.3	*Passiflora*	*Passiflora*	***Stipulata***	***Tacsonioides***		4	MacDougal & Feuillet (2004)	3	Apex sometimes tridentate? Ulmer and MacDougal (2004) reported tridentate seeds in *P. reflexiflora* and *P. umbilicata*, but published images do not support this. Similarly, Pérez-Cortéz et al. (2002) described *P. tarapotina* as tridentate, but published image is open to interpretation.	Deginani (2001), Pérez-Cortéz et al. (2002), Ulmer & MacDougal (2004), Vanderplank (2004)	
4.2.4	*Passiflora*	*Passiflora*	***Stipulata***	***Kermesinae***		4	MacDougal & Feuillet (2004)	1			
4.2.5	*Passiflora*	*Passiflora*	***Stipulata***	***Dysosmia***		23	Vanderplank (2013), Svoboda & Harris (2018), Svoboda (2019)	7	Seed shape cuneate, oblong, rectangular, or scutiform; apex often tridentate (prominence of lateral appendages variable); base sometimes bilobed (winged).	Deginani (2001), Pérez-Cortéz et al. (2002, 2009), Vanderplank (2004, 2013), Pérez-Cortéz (2007), Ulmer & MacDougal (2004), Mondin et al. (2011), Gurski (2015), Svoboda & Harris (2018), USDA, NRCS (2019–2020)	Seeds in this group tend toward being notably angular/rectangular or scutiform when compared to seeds of most other passifloras. However, seeds from other sections may look similar (e.g., *P. ligularis* in series *Tiliifolia*).
4.3	*Passiflora*	*Passiflora*	***Laurifolia***			44	Sum of series values (below)	26	Apex sometimes tridentate.	See references for series.	
4.3.1	*Passiflora*	*Passiflora*	***Laurifolia***	NA	***Laurifoliae***	24	Rome & Coppens d'Eeckenbrugge (2017)	13	Apex sometimes tridentate.	Pérez-Cortéz et al. (2002), Ulmer & MacDougal (2004), Vanderplank (2004), Pérez-Cortéz (2007), Ocampo Pérez & Molinari (2017), USDA, NRCS (2019–2020)	

4.3.2	*Passiflora*	*Passiflora*	*Laurifolia*	NA	*Quadrangulares*	5	Koch et al. (2013)	4	Seeds relatively large (5–10 mm long x 4–8 mm wide), apex often tridentate, margin striate; base sometimes bilobed.	Deginani (2001), Pérez-Cortéz et al. (1995, 2002), Ulmer & MacDougal (2004), Vanderplank (2004), Pérez-Cortéz (2007), Mondin et al. (2011), Gurski (2015)	Some (e.g., *P. quadrangularis*) have seeds very similar to seeds of supersection *Pterosperma* (see Vanderplank 2004, pl. 33).
4.3.3	*Passiflora*	*Passiflora*	*Laurifolia*	NA	*Tiliifolia*	14	MacDougal & Feuillet (2004)	9	Apex sometimes tridentate.	Pérez-Cortéz et al. (2002), Vanderplank (2004), Kirkbride et al. (2006), Pérez-Cortéz (2007), Cárdenas-Hernández et al. (2011), USDA, NRCS (2019–2020)	
4.3.4	*Passiflora*	*Passiflora*	*Laurifolia*	NA	*Marginatae*	1	MacDougal & Feuillet (2004)	0			
4.4	*Passiflora*	*Passiflora*	*Coccinea*			18	Feuillet (2007)	5			
4.5	*Passiflora*	*Passiflora*	*Distephana*			6	Vanderplank & Zappi (2011)	4			
4.6	*Passiflora*	*Passiflora*	*Tacsonia*			65	Ocampo et al. (2017)	10			Supersection *Tacsonia* is monophyletic (Abrahamczyk et al. 2014).
4.6.1	*Passiflora*	*Passiflora*	*Tacsonia*	*Rathea*		4	Bonilla Morales (2014)	0			
4.6.2	*Passiflora*	*Passiflora*	*Tacsonia*	*Insignes*		6	Jørgensen & Vásquez (2009)	2			
4.6.3	*Passiflora*	*Passiflora*	*Tacsonia*	*Colombiana*		19	MacDougal & Feuillet (2004)	3			
4.6.3.1	*Passiflora*	*Passiflora*	*Tacsonia*	*Colombiana*	*Colombianae*	9	MacDougal & Feuillet (2004)	2			
4.6.3.2	*Passiflora*	*Passiflora*	*Tacsonia*	*Colombiana*	*Leptomischae*	8	MacDougal & Feuillet (2004)	1			
4.6.3.3	*Passiflora*	*Passiflora*	*Tacsonia*	*Colombiana*	*Quindiensae*	2	MacDougal & Feuillet (2004)	0			
4.6.4	*Passiflora*	*Passiflora*	*Tacsonia*	*Parritana*		2	MacDougal & Feuillet (2004)	0			
4.6.5	*Passiflora*	*Passiflora*	*Tacsonia*	*Fimbriatistipula*		2	MacDougal & Feuillet (2004)	0			
4.6.6	*Passiflora*	*Passiflora*	*Tacsonia*	*Tacsoniopsis*		2	MacDougal & Feuillet (2004)	0			
4.6.7	*Passiflora*	*Passiflora*	*Tacsonia*	*Elkea*		15	MacDougal & Feuillet (2004)	2			
4.6.8	*Passiflora*	*Passiflora*	*Tacsonia*	*Tacsonia*		6	Bonilla Morales (2014)	2			
4.6.9	*Passiflora*	*Passiflora*	*Tacsonia*	*Boliviana*		2	MacDougal & Feuillet (2004)	0			
4.6.10	*Passiflora*	*Passiflora*	*Tacsonia*	*Trifoliata*		1	MacDougal & Feuillet (2004)	0			
4.6.11	*Passiflora*	*Passiflora*	*Tacsonia*	*Manicata*		5	MacDougal & Feuillet (2004)	1			
NA	*Passiflora*	*Tetrapathea*				**3**	Krosnick et al. (2009)	**1**	Sculpture rugose in *P. kuranda* and *P. tetrandra.* (Note: Seeds not transversely sulcate as in supersection *Decaloba* .) Seeds winged in *P. kuranda* .	Vanderplank (2004), Krosnick et al. (2009)	Subgenus *Tetrapathea* is monophyletic (Krosnick et al. 2013a). Includes the formerly independent genera *Hollrungia* and *Tetrapathea* (Krosnick et al, 2009).

Author(s)	Year	Title	Book/journal, volume, pages, etc.	DOI or URL
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Bonilla Morales MM	2014	Biogeografía y morfología de las Passifloraceae (subg. *Tacsonia*, *Rathea* y *Manicata*) del trópico andino como estrategia de conservación.	Magister en Ciencias Biológicas thesis. Universidad Nacional de Colombia, Palmira, Colombia.	http://www.bdigital.unal.edu.co/47460/
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Cárdenas-Hernández J, D Miranda L., S Magnitskiy, C Carranza	2011	Morphological and anatomical analyses of the seed coats of sweet granadilla (*Passiflora ligularis* Juss.) seeds	*Agronomía Colombiana* 29: 377–385.	https://revistas.unal.edu.co/index.php/agrocol/article/view/21650
Cervi AC	2003	Estudo das *Passifloraceae* brasileiras. Uma nova espécie de *Passiflora* L. para Santa Catarina	*Sellowia* 53–55: 9–14.	
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de Vos JM, FJ Breteler	2009	A revision of the African genera *Paropsiopsis* and *Smeathmannia* (*Passifloraceae-Paropsieae*), including a new species of *Paropsiopsis* from Cameroon	*Edinburgh Journal of Botany* 66: 27–49.	https://doi.org/10.1017/S0960428609005174
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Feuillet C	2009	Folia taxonomica 16. *Dilkea* (Passifloraceae) 1. *Epkia*, a new subgenus and five new species from western Amazonia and the Guianas	*Journal of the Botanical Research Institute of Texas* 3: 593–604.	https://www.biodiversitylibrary.org/page/41536929
Feuillet C	2010	Folia taxonomica 17. *Dilkea* (Passifloraceae) 2. Conspectus of the species of the Guianas with three new species	*Journal of the Botanical Research Institute of Texas* 4: 55–62.	https://www.biodiversitylibrary.org/page/48586057
Feuillet C	2011	Two new species of *Dilkea* subgenus *Dilkea* (Passifloraceae) from Loreto, Peru	*PhytoKeys* 2: 1–8.	https://doi.org/10.3897/phytokeys.2.722
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