



## Original Paper

# Taxonomic review of the species of *Parkinsonia* (Leguminosae, Caesalpinioideae) from the Americas

Marcos Vinicius Varjão Romão<sup>1,2,4</sup> & Vidal de Freitas Mansano<sup>2,3</sup>

### Abstract

The genus *Parkinsonia* has a pantropical distribution with 12 species globally, occurring mainly in arid and semi-arid climate environments. Many taxonomic studies have considered *Parkinsonia* as a distinct genus of *Cercidium*, but phylogenetic analyses do not support this distinction because, when together, they form a well-supported monophyletic group. The aim of this study was to review the taxonomy of *Parkinsonia* species from the Americas. We examined 400 specimens deposited in herbaria, original diagnoses, and types. We present here morphological descriptions, identification key, taxonomic notes and nomenclatural notes, ecology and conservation status, reproductive phenological states, distribution maps and drawings for each species in this treatment. Our study points out eight species of *Parkinsonia* for the Americas (*P. aculeata*, *P. andicola*, *P. florida*, *P. glauca*, *P. microphylla*, *P. peruviana*, *P. praecox*, and *P. texana*), three new synonyms of *Parkinsonia* (*Cercidium macrum*, *P. inermis*, and *P. texana* var. *macra*) and six new lectotypifications (*Cercidium plurifoliolatum*, *C. spinosum*, *P. inermis*, *P. microphylla*, *P. praecox*, *P. texana*). The main diagnostic characteristics are green or gray stem, branches generally with thorns, reduced leaves (pinnate appearance) or not reduced (bipinnate), hyphodromous venation, racemose inflorescences, yellow petals and moniliform or flat pod fruit.

**Key words:** *Cercidium*, lectotypifications, Neotropics, *Parkinsonia*, synonyms.

### Resumo

O gênero *Parkinsonia* tem distribuição pantropical com 12 espécies globalmente, que ocorrem em ambientes de clima árido e semiáridos. Muitos estudos taxonômicos consideraram *Parkinsonia* como gênero distinto de *Cercidium*, mas estudos filogenéticos não suportam essa distinção, pois quando juntos formam um grupo monofilético bem sustentado. Então o objetivo deste estudo é revisar a taxonomia das espécies de *Parkinsonia* das Américas. Para isso, foram examinados 400 espécimes depositados em herbários, diagnoses originais e tipos, também foram elaboradas descrições morfológicas, chave de identificação, notas taxonômicas e nomenclaturais, estado de conservação e ecologia, estágios fenológicos reprodutivos, mapas de distribuição e desenhos taxonômicos. Nosso estudo aponta oito espécies de *Parkinsonia* para América (*P. aculeata*, *P. andicola*, *P. florida*, *P. glauca*, *P. microphylla*, *P. peruviana*, *P. praecox* e *P. texana*), três novos sinônimos de *Parkinsonia* (*P. inermis*, *Cercidium macrum* e *P. texana* var. *macra*) e seis novas lectotipificações (*Cercidium plurifoliolatum*, *C. spinosum*, *P. inermis*, *P. microphylla*, *P. praecox*, *P. texana*). As principais características diagnósticas são caule verde ou cinza, ramos com espinhos (ou espinhos ausentes), folhas reduzidas (aparência pinada) ou não reduzidas (bipinadas), venação hifódroma, inflorescências racemosas, pétalas amarelas e fruto legume moniliforme ou plano.

**Palavras-chave:** *Cercidium*, lectotipificações, Neotrópicos, *Parkinsonia*, sinônimos.

<sup>1</sup> Universidade Estadual de Campinas, Inst. Biologia, Depto. Biologia Vegetal, Cidade Universitária Zeferino Vaz - Barão Geraldo, Campinas, SP, Brazil. ORCID: <<https://orcid.org/0000-0003-2361-7671>>.

<sup>2</sup> Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Jardim Botânico, Rio de Janeiro, RJ, Brazil.

<sup>3</sup> ORCID: <<https://orcid.org/0000-0002-7204-0744>>.

<sup>4</sup> Author for correspondence: biomarcosromao@gmail.com

## Introduction

*Parkinsonia* L. (1753) is pantropical and has 12 species globally (eight native species from the New World and four native species from the Old World), which occur naturally in dry forest, deserts, and semi-deserts habitats of arid and semi-arid climates. It is economically important for feeding small ruminants (Domínguez-Gómez *et al.* 2014), ecologically important in fixing nitrogen in the soil (Perroni-Ventura *et al.* 2010), medicinally important as a therapeutic agent against obesity-related complications (Araújo *et al.* 2016). It also has antidiabetic activity and other beneficial effects that ameliorate diabetes and associated complications (Leite *et al.* 2011).

*Parkinsonia*'s taxonomic history began with the simplified description of a single species attributed to the Americas, *Parkinsonia aculeata* L. (1753). Later, Watson (1876) proposed the recircumscription of the genus *Parkinsonia* lumping the genus *Cercidium* Tul. (1844) within its concept. His decision was supported by the morphology of the flowers articulated pedicels, glandular and pubescent claw on the adaxial petal, gibbous stamen, calyx with valvate aestivation (or slightly imbricate), straight or tortuous pod with a more or less leathery consistency.

The lumping of these two genera was widely accepted until 1889, when Sargent (1889) reestablished the genus *Cercidium* based on the calyx's valvate prefloration and the glandular claw of the adaxial petal. According to the author, these characteristics were not evident in the species of *Parkinsonia*. This conception was followed by the taxonomic studies of Johnston (1924) and Carter (1974).

Taxonomic problems involving the genera *Cercidium* and *Parkinsonia* were only elucidated with the phylogenetic study by Haston *et al.* (2005), who used chloroplasts sequences in their molecular phylogeny. This research concluded that *Parkinsonia* and *Cercidium* are paraphyletic when recognized as distinct genera and when considered together form a well-sustained monophyletic group.

Many nomenclatural combinations resulting from the circumscriptions of *Parkinsonia* with the inclusion of *Cercidium* had already been proposed in studies by Watson (1876) and Hawkins *et al.* (1999). These studies predated the molecular phylogeny of Haston *et al.* (2005) and served as the basis for several authors, such as Felger *et al.*

(2017) and Romão & Mansano (2018, 2020), to make the new combinations for *Cercidium* species to be transferred to *Parkinsonia*.

The gaps with synonyms, typifications and morphological delimitations are still persistent in species of *Parkinsonia*; therefore, the goal of this work was to review the taxonomy of the species of *Parkinsonia* in the Americas.

## Material and Methods

We examined 400 specimens deposited in the following herbaria: A (photo), ALCB, ARIZ, ASU (photo), BHCB, BHZB, BM, CGMS, CTES, EAC, ESA, GH (photo), HUICS, HUEFS, HRB, HST, HTSA, IAC, IBGE, ICN, IPA, IMA, K (photo), LL, MA (photo), MAC, MBM, NY, MB (photo), MO (photo), P (photo), PEUFR, R, RB, RSA-POM (photo), SI (photo), SP, SPF, TCD (photo), TEX, UEC, UCR (photo), UFP, UPCB (acronyms according to Thiers, continuously updated).

The descriptions of the species of *Parkinsonia* were based on the original diagnoses, types, specimens of herbaria and field observations in Caatinga and Chaco of Brazil. For the morphological and morphometric analyses, a stereomicroscope (Zeiss) and digital caliper were used, or ImageJ (Rasband 1997) for the images of exsiccates. The characterizations of the morphological structures were based on the terminologies Harris & Harris (2001) and venation of Hickey (1973).

From geographic data present in the exsiccates, Reflora, Species link and GBIF, maps of geographic distribution were prepared with QGIS version 3.14.1 and the conservation status of the species of *Parkinsonia* according to the GeoCAT tool (Bachman *et al.* 2011) and the criteria of IUCN (2012).

## Results and Discussion

According to our study, eight species of *Parkinsonia* are recognized for the Americas: *P. aculeata*, *P. andicola*, *P. florida*, *P. glauca*, *P. microphylla*, *P. peruviana*, *P. praecox*, and *P. texana* (Tab. 1); three new synonyms for *Parkinsonia*: *Cercidium macrum*, *P. inermis*, and *P. texana* var. *macra*; and six new lectotypifications: *Cercidium plurifoliolatum* GH00053333, *C. spinosum* P03327366, *P. inermis* P03113850, *P. microphylla* NY00004549, *P. praecox* MA812236, and *P. texana* GH00053328.

**Table 1** – Taxonomic treatments of the species of *Parkinsonia* from the Americas.

Species this work/ taxonomic studies	Watson (1876)	Sargent (1889)	Johnston (1924)	Carter (1974)	Felger <i>et al.</i> (2017)
<i>Parkinsonia aculeata</i>	-	-	<i>Parkinsonia aculeata</i>	<i>Parkinsonia aculeata</i>	<i>Parkinsonia aculeata</i>
<i>Parkinsonia andicola</i>	-	-	<i>Cercidium andicola</i>	-	-
<i>Parkinsonia florida</i>	<i>Parkinsonia florida</i> , <i>Parkinsonia torreyana</i>	<i>Cercidium floridum</i> , <i>Cercidium torreyanum</i>	<i>Cercidium floridum</i> , <i>Cercidium peninsulare</i> , <i>Cercidium macrum</i>	<i>Cercidium floridum</i>	<i>Parkinsonia florida</i>
<i>Parkinsonia glauca</i>	-	-	<i>Cercidium australe</i>	-	-
<i>Parkinsonia microphylla</i>	<i>Parkinsonia microphylla</i>	-	<i>Cercidium microphyllum</i>	<i>Cercidium microphyllum</i>	<i>Parkinsonia microphylla</i>
<i>Parkinsonia peruviana</i>	-	-	-	-	-
<i>Parkinsonia praecox</i>	-	-	<i>Cercidium praecox</i>	<i>Cercidium praecox</i>	<i>Parkinsonia praecox</i>
<i>Parkinsonia texana</i>	<i>Parkinsonia texana</i>	<i>Parkinsonia texana</i>	<i>Cercidium texanum</i>	-	-

#### Taxonomic treatment

***Parkinsonia*** L., Species Plantarum 1: 375, 1753.

TYPE: *Parkinsonia aculeata* L., Species Plantarum 1: 375.1753.

*Cercidium* Tul., Arch. Mus. Hist. Nat. 4: 133, 1844. TYPE: *Cercidium spinosum* Tul., Arch. Mus. Hist. Nat. 4: 134, 1844. [*Parkinsonia praecox* (Ruiz & Pav.) Hawkins].

*Rhetinophloeum* H.Karst., Fl. Columb. 2: 25, 1862. TYPE: *Rhetinophloeum viride* H.Karst., Fl. Columb. 2: 25, t. 113, 1862. [*Parkinsonia praecox* (Ruiz & Pav.) Hawkins].

*Peltophoropsis* Chiov., Ann. Bot. 13: 385, 1915. TYPE: *Peltophoropsis scioana* Chiov. Ann. Bot. 13: 386, 1915. [*Parkinsonia scioana* (Chiov.) Brenan].

*Cercidiopsis* Britton & Rose, N. Amer. Fl. 23(5): 306, 1930. TYPE: *Cercidiopsis microphylla* (Torr.) Britton & Rose, N. Amer. Fl. 23(5): 306, 1930. [*Parkinsonia microphylla* Torr.].

Shrub or tree with green or gray stem. Pubescent indument generally on thorns, stipules, rachis, leaflets, axis of inflorescence, bracts, claw

of petals, filament, style, stigma and pod. Thorn 1, leaf base or absent. Stipules 1–2, spinescent or not spinescent. Bipinnate or reduced leaves (petioles, thorn base) with pinnate appearance; pinnae 1–10 pairs; winged or cylindrical rachis; leaflets 1–80 (or more) pairs, oblong, orbicular, elliptic or ovate; oblique, rounded, aequilateral or attenuate leaflet bases; acute or mucronate leaflet apex; hypodromous venation. Inflorescence axillary; racemose or isolated flowers; green or yellow axis; deltoid to lanceolate bracts, deciduous. Flowers with 5-sepals green; a yellow adaxial petal, with red or orange macula, claws in some species, auriculate, ovate to orbicular; the other yellow petals (two lateral and two abaxial), claws present in some species, without macula, auriculate or not auriculate, elliptic, obovate or orbicular. Stamens 10; cylindrical filament; anthers dorsifixed oblong to elliptic. Green pistil; linear ovary, glabrous, pubescent or villous, ovules 5–12; cylindrical style; stigma truncate. Linear or oblong pod; dehiscent; moniliform or flat. Seeds 1–8 per fruit, oblong to globose.

Etymology: Homage to the botanist John Parkinson (1567–1650).

Vernacular names: *Parkinsonia aculeata* - “Araroba”, “Cedro”, “Cedro do ceará”, “Chifre de touro”, “Chile”, “Chorão brasileiro”, “Cina cina”, “Espinheiro turco”, “Espinho de Jerusalém”, “Retama”, “Rosa da turquia”, “Turco”; *Parkinsonia florida* - “Blue palo verde”; *Parkinsonia praecox* - “Palo brea”; *Parkinsonia peruviana* - “Goma de canaquil”, “Pastilla”.

This genus is characterized by shrub or arboreal habit, green or gray stem, branches with or without thorns, reduced leaves (pinnate appearance) or not reduced (bipinnate), hyphodromous venation, inflorescence racemose, yellow petals, moniliform or flat pod fruit. Among the synonyms, *Cercidium* is the most recently used in scientific publications in the areas of agriculture (Sampietro *et al.* 2020),

chemistry (Gomez *et al.* 2020; Sznaider *et al.* 2020), ecology (Glatzle *et al.* 2020; Loto & Bravo 2020) and forestry science (Jaureguiberry *et al.* 2020).

In America, species of *Parkinsonia* are distributed from the United States to Argentina, three species are endemic to North America (*P. florida*, *P. microphylla* and *P. texana*), three species are endemic to South America (*P. andicola*, *P. glauca* and *P. peruviana*) and two species (*P. aculeata* and *P. praecox*) are widely distributed. They are usually present in xerophilous vegetation, such as Caatinga, Chaco, Deserts, Semi-deserts and Dry Woods. In these environments the conservation status is critical for the species of *P. glauca*, *P. peruviana* and *P. texana*.

The flowering species of *Parkinsonia* occurs mainly between September to May and fruiting from November to May.

### Key to the species of *Parkinsonia* from the Americas

1. Branches without thorns.
  2. Pinnae 0.5–3 cm long, leaflets 3–7 pairs per pinna, 1–2 mm long; axis of inflorescence 0.6–2 cm long; native to the United States and Mexico ..... 5. *Parkinsonia microphylla*
  - 2'. Pinnae 14–33 cm long, leaflets 30–78 pairs per pinna, 7–14 mm long; axis of inflorescence 10–19 cm long; native to Peru ..... 6. *Parkinsonia peruviana*
- 1'. Branches with thorns.
  3. Reduced leaves (petioles), with pinnate appearance.
    4. Pinnae 1–3 cm long, rachis cylindrical, leaflets 5–14 pairs per pinna; axis of inflorescence 0.3–1 cm long; pod flat ..... 2. *Parkinsonia andicola*
    - 4'. Pinnae 12–42 cm long, rachis winged, leaflets 16–80 (or more) pairs per pinna; axis of inflorescence 3–27 cm long; pod moniliform ..... 1. *Parkinsonia aculeata*
  - 3'. Unreduced leaves, bipinnate.
    5. Spinescent stipules; pinnae 1–4 pairs, leaflets 4–10 pairs per pinna; native to South America, except *Parkinsonia praecox*, occurring from Brazil to the United States of America.
      6. Pinnae 1(–2) pair, leaflets 4–7 pairs per pinna, 1–3(–4) mm long; ovary 3–5 mm long, villous, ovules 6–8, pubescent style ..... 4. *Parkinsonia glauca*
      - 6'. Pinnae 1–3 pairs, leaflets 5–10 pairs per pinna, 3–9 mm long; ovary 5–12 mm long, glabrous, ovules 10–12, glabrous style ..... 7. *Parkinsonia praecox*
    - 5'. Stipules not spinescent; pinna 1 pair, leaflets 1–3(–4) pairs per pinna; native to North America.
      7. Leaflets 1–2 pairs per pinna; adaxial petal 7–9 mm long; villous ovary, ovules 5–6 ..... 8. *Parkinsonia texana*
      - 7'. Leaflets 2–3(–4) pairs per pinna; adaxial petal 5–6 mm long; glabrous or pubescent ovary, ovules 7–8 ..... 3. *Parkinsonia florida*

**1. *Parkinsonia aculeata*** L., Species Plantarum 1: 375. 1753. TYPE: AMÉRICA (lectotype [figure!]) Hortus Cliffortianus 1738: 157, t. 13, designated by Stearn 1957: 47).  
=*Parkinsonia spinosa* Kunth, Nov. Gen. Sp. [H.B.K.] 6: 335, 1823. TYPE: VENEZUELA.

SUCRE: Cumaná, A.J.A. Bonpland & F.W.H.A. von Humboldt 106 (holotype P00679214 [photo!]). =*Parkinsonia inermis* Spreng., Syst. Veg., 16 (2): 345, 1825. TYPE: URUGUAI. MONTEVIDEO (lectotype here designated P03113850 [photo!]). New synonym.

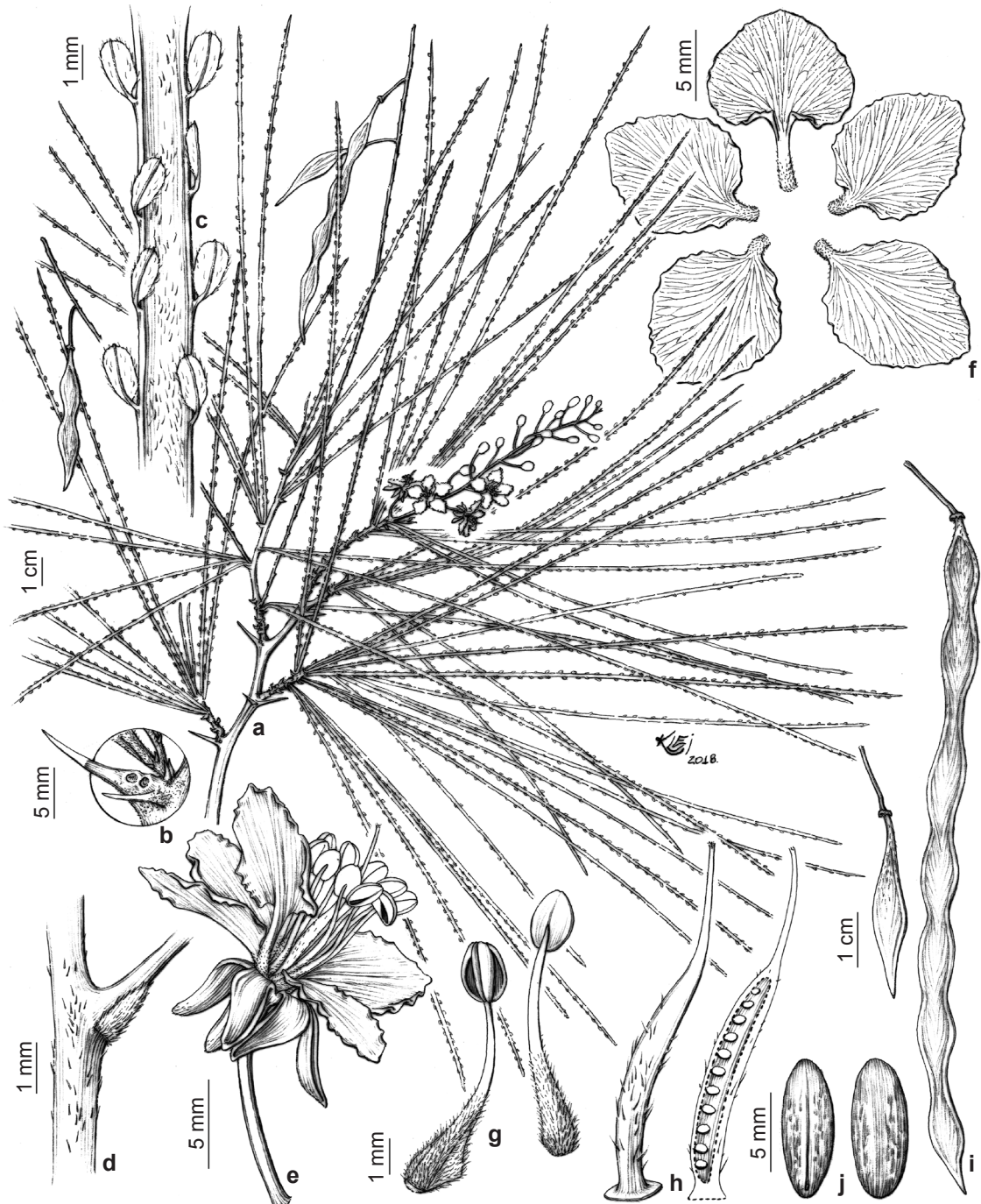
=*Parkinsonia thornberi* M.E.Jones, Contr. W. Bot. 12: 12, 1908. TYPE: USA. ARIZONA: Tucson, *M.E.Jones* (holotype RSA-POM0053587 [photo!]).

Fig. 1

Shrub or tree 2–8 m tall. Pubescent indument on thorns, petiolules, rachis, leaflets, axis of inflorescence, bracts, pedicels, sepals, petal claw, filaments, ovary, style, stigma and pod. Thorn 1–22 mm long. Stipules 2, 1–8 mm long, spinescent, deciduous. Reduced leaves (petioles), with pinnate appearance; pinnae 1–4 pairs, 12–42 cm long; petiolules 1–10 mm long; winged rachis, 6–41 cm long; leaflets 16–80 (or more) pairs per pinna, oblong, elliptic to obovate, 2–9 × 1–3 mm, rounded to oblique base, mucronate apex. Inflorescence axillary, racemose; axis 3–27 cm long; bracts 1–2 × 0.5–1 mm, lanceolate, deciduous; pedicels 0.6–2 cm long. Flowers 8–16 mm long; sepals 4–8 × 2–3 mm, deltoid to lanceolate; adaxial petal 5–10 × 5–10 mm, auriculate, orbicular, glabrous, claw 3–5 mm long; the other petals (two lateral and two abaxial) 5–12 × 5–10 mm, not auriculate, obovate, claw 1–2 mm long. Stamens 6–12 mm long; filaments 5–10 mm long; anthers 1–2 mm long, glabrous. Pistil 7–12 mm long; ovary 4–7 × 1 mm, ovules 8–11; style 3–5 mm long; stigma truncate. Pod 3–14 × 0.2–1 cm, linear to oblong, moniliform; seeds 1–8 per fruit, 8–11 × 3–5 mm, oblong to elliptic.

**Specimens examined:** ARGENTINA. CORDOBA: Rio Segundo, 23.XI.1975, fl., *R. Subils 2081* (MBM). CORRIENTES: Departamento Capital, Molina Punta, 15.XII.1968, fr., *A. Krapovickas & C. Cristóbal 14.497* (MBM). Departamento Mercedes, 2.XII.1998, fl., *M.M. Arbo et al.* (ALCB, CTES, UPCB). Departamento Monte Caseros, 12.I.2007, fl. and fr., *J. Paula-Souza et al. 7039* (ESA). Departamento San Martín, 1.XI.1971, fl., *A. Krapovichas et al.* (MBM). BRAZIL. ALAGOAS: Água Branca, Morro do Padre, 24.VII.2014, fl., *M.W. Tavares-Silva et al. 117* (MAC). Arapiraca, 22.II.2008, fl. and fr., *D.T. Souza 393* (BHCB). Batalha, 21.II.2009, fl. and fr., *R.P. Lyra-Lemos et al. 11800* (MAC). Dois Riachos, 10.III.2001, fl., *R.P. Lyra-Lemos* (MAC). Maceió, 15.II.1982, fl. and fr., *T.S.M. Grandi* (BHCB); Olho d' do Casado, 27.VIII.2002, fl., *A.L.S. Santos 60* (SP, MAC). Pariconha, 4.X.2009, fl., *D. Coelho & B. Cabral 1047* (MAC). Santana do Ipanema, Maniçoba, 27.VII.2008, fl. and fr., *Chagas-Mota 919* (MAC). BAHIA: Araci, 15.VI.2011, fl., *V.F. Mansano et al. 854* (SPF, RB). Barra, 14.II.1977, fl. and fr., *G. Hatschbach 39511* (MBM, SPF, UEC, UPCB). Brumado, 26.III.2000, fl. and fr., *M.D. Moraes & L.Y.S. Aona 524* (UEC). Casa Nova, 1.VII.2001, fl. and fr., *D.M. Loureiro et al. 383* (ALCB). Chorrochó, 11.X.2009, fl. and fr., *E. Melo et al. 6614* (HUEFS). Curaça, São Bento, 4.VI.2011, fl., *C.J. Gonzaga & F. França 21* (HUEFS). Estação Ecológica

do Raso da Catarina, 9.X.1980, fr., *P. Souza* (ALCB). Euclides da Cunha, 9.X.2009, fl., *C.T. Lima & S.G.Lima 255* (HUEFS). Feira de Santana, 5.IX.1983, fl., *M.J.S. Lemos 032* (ALCB, HUEFS). Glória, 27.VIII.1995, fl., *F.P. Bandeira 259* (HUEFS). Iaçú, 6.VII.2009, fl., *J.E. Meireles et al. 662* (HUEFS, RB, SPF). Iraquara, 13.X.1981, fl., *G. Hatschbach 44228* (MBM). Irecê, Ibipeba, Mirorós, 27.IX.2000, fl. and fr., *D.S. Almeida 02* (ALCB). Ibaiana, 26.XI.1971, fl., *D. Andrade-Lima et al.* (IPA, MAC). Itatim, Rio Ribeirão, 7.IX.2012, fl., *E. Melo et al. 11466* (HUEFS). Itiuba, 19.IV.2004, fl. and fr., *T.S. Nunes et al. 1126* (ESA, HUEFS). Jaguarari, 25.VI.1983, fl., *L. Coradin et al. 5994* (SP). Jeremoabo, Canché, 21.V.1978, fl., *J.S. Silva 602* (SP, SPF). Juazeiro, 17.XI.1963, fl., *A.L. Costa* (ALCB). Livramento do Brumado, 19.III.1984, fl. and fr., *J.C.A. Lima & L.C.O. Filho 58* (ALCB, HRB). Macaúbas, Serra de Poções, 27.XI.2004, fr., *G. Hatschbach 2005* (MBM). Manoel Vitorino, 11.IX.1991, fl. and fr., *F. Navarro* (ALCB, MBM). Maracás, 28.IX.2003, fl., *M.M. Silva-Castro & G.C. Moreira 749* (HUEFS). Miguel Calmon, 6.IV.2001, fl., *T. Ribeiro et al. 14* (ALCB, HRB, HUEFS). Moro do Chapéu, 4.V.2007, fl., *D. Cardoso & R.M. Santos 1843* (HUEFS, UPCB). Nova Fátima, Paraguaçu, 22.VI.2014, fl. and fr., *M.L. Guedes 22809* (ALCB). Cocos, 18.VII.2007, fl. and fr., *M.L. Guedes & M.L. Valadão 13653* (ALCB). Paulo Afonso, 19.XII.1993, fr., *L.P. Queiroz & N.S. Nascimento* (HUEFS, MBM). Remanso, 16.VI.2001, fl. and fr., *T.S. Nunes et al. 497* (ALCB, HUEFS, UPCB). Retirolândia, 16.IX.1999, fl., *R.P. Oliveira 264* (HUEFS). Rodelas, 25.II.1987, fl. and fr., *L.B. Silva & G.O.M. Silva 90* (ALCB, HRB, HUEFS). Salvador, 1956, fl. and fr., *A. Oliveira* (ALCB). Santa Bárbara, 20.XI.2006, fl., *A.M. Lucchese & C.E.O. Cordeiro 5* (ESA, HUEFS). Santa Luz, 1.XII.1992, fl., *M.M. Arbo et al. 5500* (HUEFS, SPF). Santa Luzia, 20.IX.1937, fl., *P. Silva 19* (SP). Santa Terezinha, 18.X.2013, fl. and fr., *M.L. Guedes et al. 21018* (ALCB). Sento Sé, 7.IX.2016, fl., *L.P. Queiroz et al. 16223* (HUEFS). Sobradinho, 22.IX.2009, fl. and fr., *E. Melo et al. 6492* (ALCB, HUEFS). Tucano, 23.III.1993, fl. and fr., *L.P. Queiroz & T.S.N. Sena 3113* (HUEFS, MBM). Uauá, 29.III.2000, fl., *N.G. Jesus et al. 901* (ALCB, SPF). Xique-Xique, 5.VI.2000, fl., *S.S. Lima et al. 65* (ALCB). CEARÁ: Aquiraz, 15.X.1935, fl. and fr., *F. Drouetex H. Gray* (SP). Fortaleza, Conjunto Palmares, 20.V.1996, fl., *A. Marta* (EAC, HUEFS). Cedro, 24.II.1910, fr., *A. Lofgren 21* (R). Itapipoca, 3.III.1998, fl., *V.P. Pinto* (EAC, HUEFS). Missão Velha, APA Cachoeira da Missão Velha, 18.VIII.2011, fl., *E. Melo et al. 10237* (HUEFS). Quixadá, 15.VIII.2014, fl., *M.L. Guedes & T.F. Costa 22278* (ALCB, HUEFS). Santa Quitéria, 1.VI.2011, fl., *M.E.F. Rodrigues & B.P. De Carli 734* (ESA). MATO GROSSO DO SUL: Corumbá, 15.II.2006, fl. and fr., *M.S. Werneck & M. Vasconcelos* (BHCB, CGMS). MINAS GERAIS: Belo Horizonte, 26.VI.1986, fl. and fr., *E. Guimarães* (BHCB). Itinga, 1.VII.2003, fr., *I.R. Andrade* (BHCB). Jaíba, 23.IX.1999, fl., *S.A. Santos* (BHCB). Januária,



**Figure 1** – a-j. *Parkinsonia aculeata* – a. branches with leaves and inflorescence; b. thorn and stipules; c. rachis and leaflets; d. bracts; e. flower; f. petals; g. gibbous stamens; h. ovary and ovules; i. moniliform pod; j. seeds. (a-c. *M.V.V.Romão 1000* (UEC); d-j. *M.V.V.Romão 1003* (UEC)). Drawn by Klei Rodrigo Sousa.

Brejo Mata Fome, IV.2000, fl., C.C. Soares (BHCB). Salto da Divisa, 22.VIII.2003, fl., J.A. Lombardi *et al.* 5351 (BHCB, SPF). PARAÍBA: Belém, 18.IX.1979, fl., F.A. Matos (EAC, HUEFS). Camalau, 15.VI.1984, fl., J.E.R. Collares & J. A. Silva 203 (ALCB, HRB, HUEFS, IPA, MBM). Patos, IX.1939, fr., J. Deslandes 73 (SP, SPF). PERNAMBUCO: Bodocó, 18.X.1984, fl. and fr., G. Fortius & I.B. Sá 3901 (HUEFS, HTSA). Caruaru, 25.IX.1976, fl. and fr., P.H. Davis & D. Andre-Lima, 61143 (UEC, MBM). Floresta, 8.XI.2003, fl. and fr., J. Ferraz 23 (ALCB, HUEFS, HST, MAC). Mirandiba, Salinas, 5.X.2006, fl., E. Córdula *et al.* 191 (HUEFS, UFP). Petrolina, Projeto Senador Nilo Coelho, 5.IV.1991, fl., A.L. Brochado & P.E.N. Silva (HUEFS, IBGE). Salgueiro, BR-232, 31.V.1984, fl., E.F. Almeida & M.C. Ferreira 305 (ALCB, HRB). Serra Talhada, BR-232, 24.XI.2007, fl. and fr., A.M. Miranda & J. Ferraz 5573 (HUEFS, HST). RIO DE JANEIRO: Rio de Janeiro, Campo Grande, VIII.1934, fl., A.S. Freire *et al.* (R). RIO GRANDE DO NORTE: Apodi, 18.VIII.2014, fl. and fr., M.L. Guedes & T.F. Costa 22376 (ALCB, HUEFS). RIO GRANDE DO SUL: Alegrete, 20.XII.1967, fr., P. Occhioni 3605 (MBM). Caçapava do Sul, RS-357, 9.XII.2008, fl., L.C.P. Lima *et al.* 456 (HUEFS). Porto Alegre, 18.II.1939, fl., A.R. Schultz 127 (HUCS, ICN). Quaraí, 3.XII.1994, fr., J.R. Stehmann *et al.* 1564 (BHCB, SPF, UEC). Santa Cruz do Sul, 23.XII.1953, fl., A. Sehnem (MBM). Santa Vitória do Palmar, Cural do Arroio, 25.V.1989, fr., J.A. Jarenkow & J.L. Waechter 1285 (UEC, ESA). São Gabriel, 14.XII.2010, fl., M. Grings 1161 (MBM, UFRGS). Uruguaiana, Vila Imbaá, 15.XI. 2009, fl., E. Barbosa *et al.* 2576 (ALCB, MBM). SÃO PAULO: Campinas, IAC, 17.X.2002, fl., J.E.A. Bertoni & A. Geremias 828 (IAC, UEC). Ilha Solteira, 25.X.1984, fl., O. Cesar *et al.* 330 (MBM). Penápolis, 14.IX.1980, fl., J.R. Pirani 10-80 (MBM, UEC). Piracicaba, 5.VII.1930, fr., P.M.O. Santos (ESA). SERGIPE: Canindé do São Francisco, 16.IV.2002, fl., A.L.S. Santos 01 (MAC). CHILE. ARAUCANÍA: Pucon, 10.XII.2000, fl., S. Dietrich (SP). COLOMBIA. ATLANTICO: Barranquilla, fr., B. Elias 1381 (IAC). VALLE DO CAUCA: Santiago de Cali, 26.XI.1985, fl., N. Paz 098 (MBM). MEXICO. MORELOS: Crucero de Alpuyecá, 16.VIII.1986, fl. and fr., G.F. Flores 49 (MBM). NUEVO LEON: Las Adjuntas, 5.IV.1984, fl., R. Sánchez *et al.* 463 (MBM). PARAGUAY. PRESIDENTE HAYES: Villa Hayes, 5.III.1984, fl. and fr., W. Hahn 2175 (MBM, SP). UNITED STATES. ARIZONA: Maricopa, 17.VII.1999, fl., A. Salywon 918 (HUCS, ARIZ). NEW YORK: Bronx, 7.VI.1993, fl., M. Nee 43537 (MBM). TEXAS: Brazos, 4.V.1954, fl., G.E. Lord (LL, TEX). Calhoun, 19.VII.1973, fl., R.L. Hartman & J. Smith 3655 (LL, TEX). Coryell, 26.V.2009, fl., L.L. Hansen 6569 (LL, TEX). Houston, 16.IX.1911, fl. and fr., R.A. Studhalter 4102 (LL, TEX). Kleberg, 15.VI.2006, fl., W.R. Carr 24656 (LL, TEX). Webb, 20.IV.1962, fl., L. Rodriguez (LL, TEX). VENEZUELA. GUARICO: San Fernando de Apure, 10.XI.1973, fl. and fr., G. Davidse 3939 (MBM, MO).

*Parkinsonia aculeata* (Fig. 1) is a polymorphic species easily identified by its reduced leaves (petioles) with pinnate appearance, winged rachis, leaflets 16–80 (or more) pairs per pinna and moniliform pod. A new synonym, *P. inermis* is included within the concept of *P. aculeata*; since the morphology of the pinnae and leaflets described for *P. inermis* are identical to *P. aculeata*, we also selected a lectotype for *P. inermis* based on material collected in Montevideo, probably from Sprengel (P03113850), and according to information from the original diagnosis (pinnae 2 pairs, leaflets oblong and mucronate apex).

The species occurs in all continents except Antarctica (Hawkins *et al.* 2007); in the Americas it is present mainly in Argentina, Brazil, Chile, Ecuador, Mexico, Paraguay, Peru, the United States and Uruguay (Fig. 2). A biogeographic study will be developed to determine the center of origin of *P. aculeata* in the Americas. The species occupies seasonally dry tropical forests (Andes, Caatinga and Chaco), deserts, cultivated and anthropized environments with large populations. Its state of conservation is assessed as Least Concern (LC), its extent of occurrence (EOO) is estimated at 15,896,890.157 km<sup>2</sup>, and area of occupation (AOO) is estimated at 2,632 km<sup>2</sup>.

Flowering throughout the year, especially from September to December. Fruiting with predominance from December to March.

**2. *Parkinsonia andicola*** (Griseb.) Varjão & Mansano, *Phytotaxa* 344(3): 295, 2018. TYPE: ARGENTINA. JUJUY: Maimará, P.G. Lorentz & G. Hieronymus 746 (holotype GOET008878 [photo!], isotype SI001985 [photo!]).

≡ *Cercidium andicola* Griseb., *Abh. Königl. Ges. Wiss. Göttingen* 24: 114, 1879.

≡ *Caesalpinia praecox* Ruiz & Pav. *ex Hook. & Arn.* var. *andicola* Hosseus, *Bol. Acad. Nac. Ci.* 26: 145, 1921.

Fig. 3

Shrub 0.8–1 m tall. Pubescent indument on thorns, stipules, petiolules, rachis, leaflets, axis of inflorescence, pedicels, petal claw, filament and stigma. Thorn 1, 5–37 mm long. Stipules 2, 2 mm long, not spinescent, deciduous. Reduced leaves (petioles), with pinnate appearance; Pinnae 2–10 pairs, 1–3 cm long; petiolules 1–3 mm long; cylindrical rachis, 1–2 cm long; leaflets 5–14 pairs per pinna, oblong to elliptic, 1–2 × 0.5–1 mm, rounded base, acute or mucronate apex. Inflorescence axillary, racemose; axis 0.3–1 cm long; bracts deciduous; pedicels 0.8–2

cm long. Flowers 8–11 mm long; sepals 5–7 × 1 mm, lanceolate, glabrous; adaxial petal 7 × 7 mm, auriculate, orbicular, glabrous, claw 6 mm long; the other petals (two lateral and two abaxial) 8–10 × 4–5 mm, not auriculate, elliptic, glabrous, claw 1 mm long. Stamens 7–10 mm long; filament 7–8 mm long; anthers 2 mm long, glabrous. Pistil 8 mm long; ovary 4 × 1 mm, glabrous, ovules 5; style 4 mm long, glabrous; stigma truncate. Pod 3–4 × 1–2 cm, oblong, flat. Seeds not seen.

**Specimens examined:** ARGENTINA. PROVINCIA JUJUY: Tumbaya, Ruta 9, 21.I.2007, fl., *J.Paula-Souza et al.* (ESA); Quebrada de Humahuaca, 10.XII.2001, fl., *R. Mello-Silva et al.* 1895 (SPF). Tilcara, Maimará, 8.II.1971, fl., *A. Krapovickas & C.L. Cristóbal* (IAC). BOLIVIA. CHUQUISACA: Camargo, 26 km hacia Villa Abecia, 24.III.1979, fr., *S.G. Beck 693* (US). POTOSÍ: Nor Chichas, Canton Calcha, camino a Pacapampa, 12.X.1987, fl., *M. Schulte 15* (US).

*Parkinsonia andicola* (Fig. 3) is characterized by its reduced leaves with pinnate appearance, leaflets 1–2 mm long, oblong to elliptic, flat pod. This species has leaves similar to *P. microphylla*, but *P. microphylla* has no thorns, its ovary is pubescent and it is found exclusively in North America (where as *P. andicola* has thorns, a

glabrous ovary and grows exclusively in South America).

The species is present only in South America, precisely in the Andes of Argentina and Bolivia (Fig. 4), with a preference for arid, semi-arid habitats and altitudes above 2,000 m. Its state of conservation is assessed as Near Threatened (NT) [EOO is estimated at 39,465.462 km<sup>2</sup> and AOO of 108 km<sup>2</sup>], with fragmented populations in the Andean habitat.

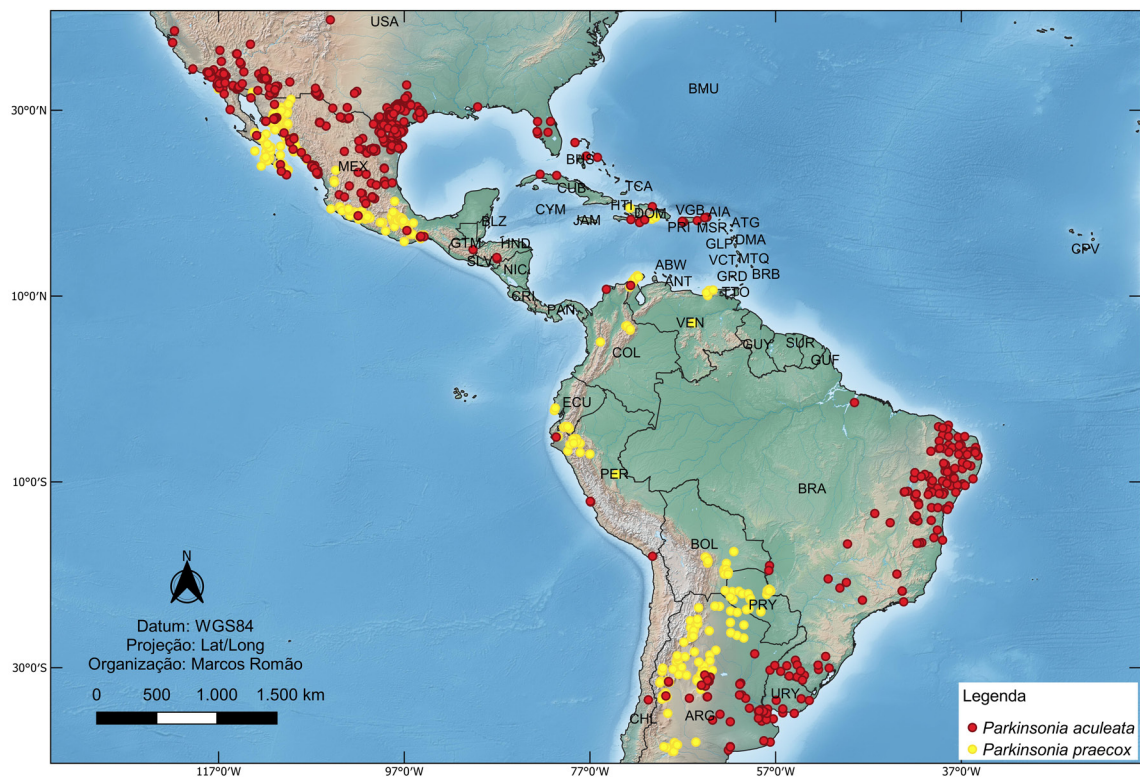
Flowering from October to January and fruiting from January to March.

**3. *Parkinsonia florida*** (Benth. ex A.Gray) S.Watson, Proc. Amer. Acad. Arts 11: 135, 1876. TYPE: MEXICO. SONORA: Sonora Alta, *T. Coulter 489* (lectotype TCD0018337 [flowering branch of the lower right, photo!], designated by Carter [1957: 333]).

≡ *Cercidium floridum* Benth. ex A.Gray, Smithsonian Contr. Knowl, 3(5): 58, 1852.

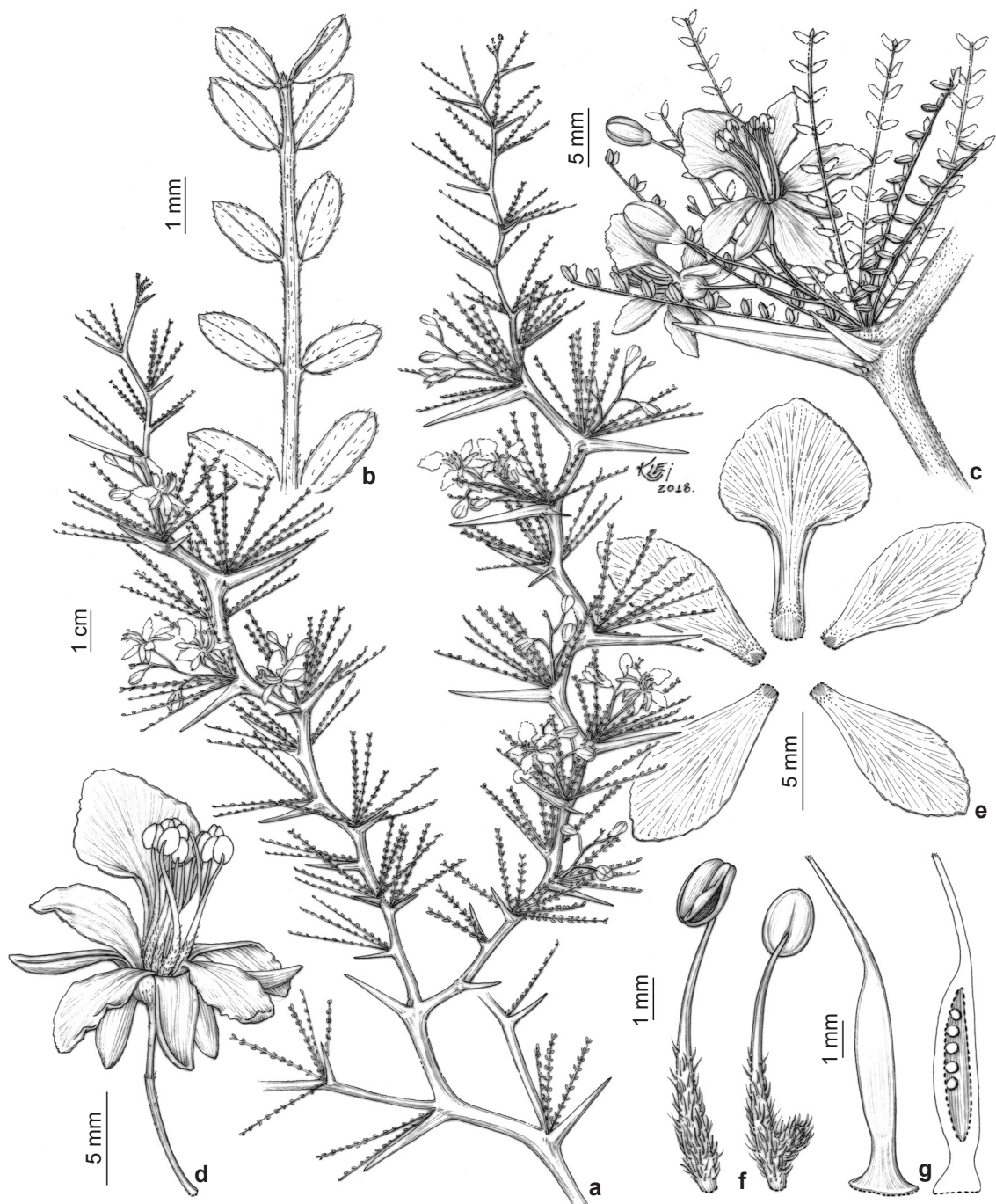
≡ *Parkinsonia torreyana* S. Watson, Proc. Amer. Acad., 11: 135, 1876.

≡ *Cercidium torreyanum* (S.Watson) Sarg., Garden & Forest, 2: 388, 1889.



**Figure 2** – Distribution map of *Parkinsonia aculeata* and *Parkinsonia praecox* in the Americas.





**Figure 3** – a-g. *Parkinsonia andicola* – a. branches with leaves, thorns and flowers; b. rachis and leaflets; c. inflorescence; d. flower; e. petals; f. gibbous stamens; g. ovary and ovules. (a-g. R. Mello-Silva et al. 1895 (UEC)). Drawn by Klei Rodrigo Sousa.

=*Cercidium peninsulare* Rose, Contr. U.S. Natl. Herb. 8: 301, 1905. TYPE: MEXICO [BAJA CALIFORNIA SUR]. LOWER CALIFORNIA: La Paz, *E.A. Goldman 388* (holotype US00002535 [photo!]; isotype US00376058).

=*Cercidium macrum* I.M.Johnst., Contr. Gray Herb. 70: 64, 1924. TYPE: MEXICO. NUEVO LEON: Monterey, *C.P. Pringle 2537* (holotype GH00053330 [photo!]). New synonym.

≡*Cercidium floridum* Benth. ex A.Gray subsp. *floridum* A.M.Carter, Proc. Calif. Acad. Sci. ser. 4, 40 (2): 33, 1974.

=*Cercidium floridum* Benth. ex A.Gray subsp. *peninsulare* (Rose) A.M.Carter, Proc. Calif. Acad. Sci. ser. 4, 40(2): 35, 1974. TYPE: MEXICO [BAJA CALIFORNIA SUR]. LOWER CALIFORNIA: La Paz, *E. Palmer 112* (holotype US00376058 [photo!]).

=*Parkinsonia texana* (A.Gray) S.Watson var. *macra* (I.M. Johnst.) Isely, Mem. New York Bot. Gard. 25(2): 218, 1975. New synonym. Fig. 5

Shrub or tree 2–5 m tall. Pubescent indument on thorns, stipules, petioles, petiolules, rachis, leaflets, axis of inflorescence, bracts, pedicels,

petal claw, filament and stigma. Thorn 1, 1–7 mm long. Stipules not spinescent, deciduous. Not reduced leaves, bipinnate; petioles 0.1–1 cm long; pinna 1 pair, 0.5–3 cm long; petiolules 1–4 mm long; cylindrical rachis, 0.2–1 cm long; leaflets 2–3(–4) pairs per pinna, oblong to obovate, 2–13 × 1–10 mm, rounded base, rounded, oblique or mucronate apex. Inflorescence axillary, racemose; axis 0.2–4 cm long; bracts 0.5 × 0.5 mm, deltoid, deciduous; pedicels 0.3–2 cm long. Flowers 8–13 mm long; sepals 5–7 × 2 mm, lanceolate, glabrous; adaxial petal 5–6 × 6–8 mm, auriculate, orbicular, glabrous, claw 4–5 mm long; the other petals (two lateral and two abaxial) 6–10 × 5–6 mm, not auriculate, elliptic to obovate, glabrous, claw 1–3 mm long. Stamens 7–10 mm long; filament 6–9 mm long; anthers 1.5 mm long, glabrous. Pistil 7–11 mm long; ovary 4–5 × 1 mm, glabrous or pubescent, ovules 7–8; style 3–6 mm compr., glabrous; stigma truncate. Pod 3–7 × 1–2 cm, oblong, flat, glabrous; seeds 1–3 per fruit, 8–11 × 4–9 mm, oblong to elliptic.

**Specimens examined:** MEXICO. BAJA CALIFORNIA SUR: La Paz, 16.IV.1899, fl., *E.A. Goldman 388* (US);



**Figure 4** – Distribution map of *Parkinsonia andicola*, *Parkinsonia microphylla* and *Parkinsonia peruviana* in the Americas.



**Figure 5** – a-k. *Parkinsonia florida* – a. branches with inflorescences; b. branches with leaves and pod; c. pinnae and leaflets; d. thorn; e. bracts; f. flower; g. petals; h. gibbous stamens; i. ovary and ovules; j. flat pod; k. frontal (right) and side (left) views of the seed. (a, e-i. *J. Verrier* 623 (ARIZ); b-d, j-k. *J.A. Soule* 8967 (ARIZ)). Drawn by Klei Rodrigo Sousa.

20.I.1890, fl., *E. Palmer 112* (US); 14.VI.1897, fl., *J.N. Rose 1330* (US). San José del Cabo, III.1897, fl., *A.W. Anthony 363* (US). SONORA: Nogales, 21.IV.2004, fl., *A.L. Reina et al.* (ASU). Sonora Alta, 1830, fl., *T.Coulter489* (TCD). Vidrios, 22.III.1969, fr., *K. Pinkava 15477* (ASU). UNITED STATES. ARIZONA: Gila, 25.III.2007, fr., *T. Price 916* (MBM, ASU). Pima Country, Ajo, 2.XI.2014, fr., *J.A. Soule 8967* (ARIZ); Pima Country, 6.IV.2005, fl., *M.B. Johnson* (ASU). Maricopa County, Tonto National Forest, 22.V.2001, fl., *S. Doan 744* (MBM); Maricopa County, 22.IV.1999, fl., *L.R. Landrum 9421* (MBM). San Bernardino County, 4.IV.2000, fl., *J. Stone & S. Bodine 2854* (MBM). Santa Cruz County, 5.X.2016, fl., *J. Verriers* (ARIZ).

*Parkinsonia florida* subsp. *florida* (Fig. 5) is recognized by leaflets (2–)3(–4) pairs per pinna, 2–8 mm long. Mean while, *P. florida* subsp. *peninsulare* has 2(–3) leaflets per pinna, 4–13 mm long. *Cercidium macrum* is the new synonym for *P. florida* since Johnston (1924) based the description of *C. macrum* on collections of Coulter, which is the type of *P. florida*; also the synonym has a morphological circumscription and geographical distribution in *P. florida*. Another new synonym is *P. texana* var. *macra*, which is a combination and change of status of *C. macrum*.

The species occurs in deserts in the United States and Mexico, while *P. florida* subsp. *peninsulare* has distribution in coastal and island ecosystems in Mexico (Fig. 6). The species is evaluated as Least Concern (LC) [EEO is estimated at 632,166.906 km<sup>2</sup> and AOO of 2,236 km<sup>2</sup>].

Flowering and fruiting from March to November.

**4. *Parkinsonia glauca*** (Cav.) Varjão & Mansano, Phytotaxa 435(3): 248, 2020. TYPE: SPAIN. MADRID: [Horto Regio Matritense] Royal Botanical Garden (holotype MA655813 [photo!]). = *Cercidium australe* I.M. Johnst., Contr. Gray Herb. 70: 67, 1924. TYPE: ARGENTINA. GENERAL ROCA: Rio Negro, *W. Fischer 20* (holotype GH00053334 [photo!]; isotypes K000264617 [photo!], NY000040111!).

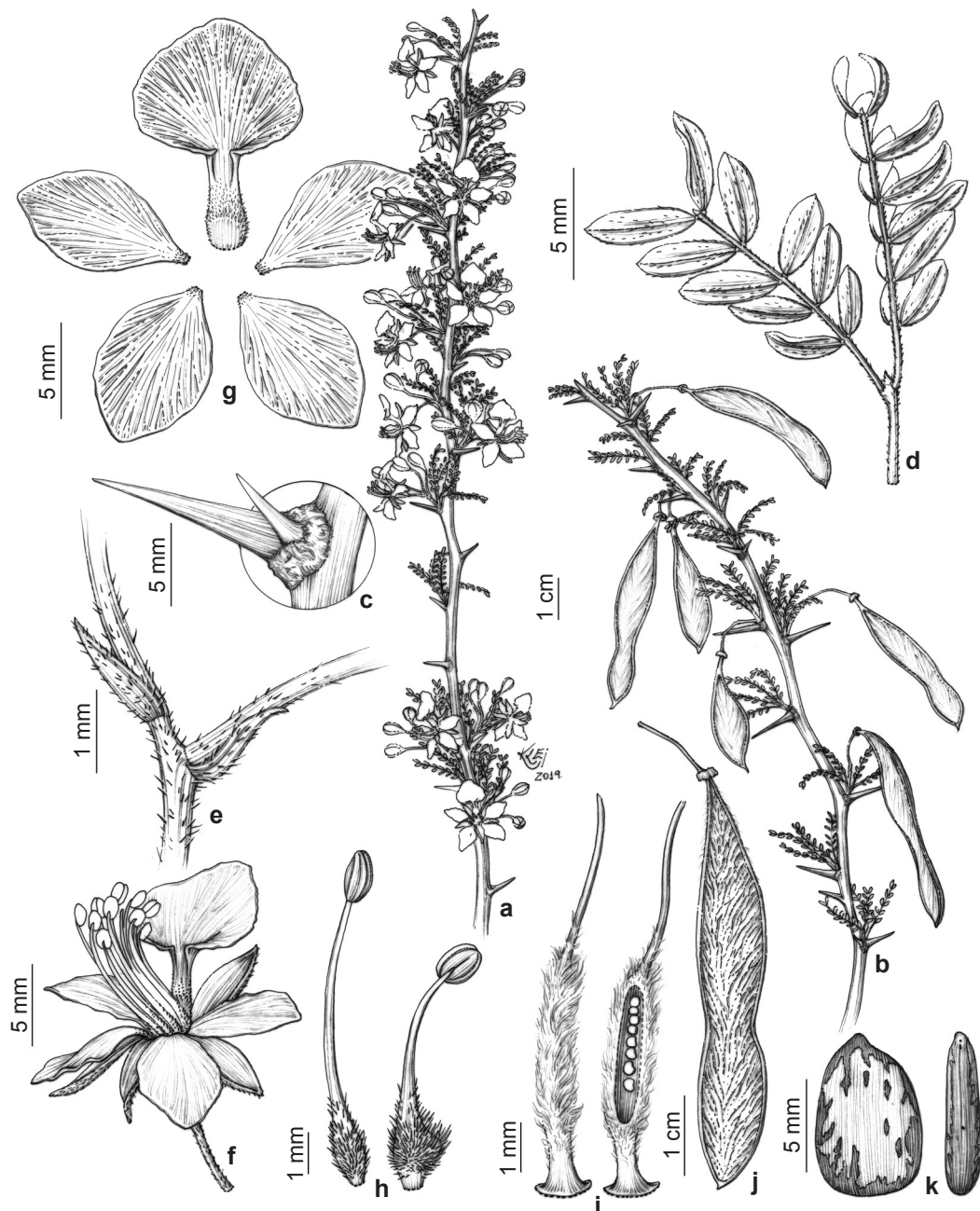
≡ *Cercidium praecox* subsp. *glaucum* (Cav.) Burkart & A.M. Carter, Darwiniana 20(4): 309, 1976.

Fig. 7

Shrub 2–3 m tall. Pubescent indument on petioles, petiolules, rachis, leaflets, axis of inflorescence, bracts, pedicels, sepals, petal claw, filament, style, stigma and pod. Thorn 1, 5–33 mm



**Figure 6** – Distribution map of *Parkinsonia florida*, *Parkinsonia glauca* and *Parkinsonia texana* in the Americas.



**Figure 7** – a-k. *Parkinsonia glauca* – a. branches with leaves and inflorescence; b. branches with leaves and pod; c. thorn indument and stipules; d. pinnae; e. bracts; f. flower; g. petals; h. gibbous stamens; i. ovary and ovules; j. flat pod; k. side (left) and frontal (right) views of the seed. (a-i. *T.M. Pedersen 13958* (MBM); j-k. *W. Fischer 20* (NY)). Drawn by Klei Rodrigo Sousa.

long, glabrous. Stipules 3–8 mm long, spinescent, deciduous, glabrous. Not reduced leaves, bipinnate; petioles 0.2–0.4 cm long; pinnae 1(–2) pairs, 0.5–2 cm long; petiolules 1–3 mm long; cylindrical rachis, 0.5–1 cm long; leaflets 4–7 pairs per pinna, oblong, 1–3(–4) × 0.5–1 mm, rounded base, acute or mucronate apex. Inflorescence axillary, racemose; axis 0.2–1 cm long; bracts 1.5–2 × 0.5 mm, lanceolate, deciduous; pedicels 0.3–1 cm long. Flowers 7–18 mm long; sepals 5–8 × 2–3 mm, lanceolate; adaxial petal 5–8 × 6–10 mm, auriculate, orbicular, glabrous, claw 3–5 mm long; the other petals (two lateral and two abaxial) 7–11 × 4–5 mm, not auriculate, elliptic to obovate, glabrous, claw 1–2 mm long. Stamens 6–12 mm long; filament 5–10 mm long; anthers 1–2 mm long, glabrous. Pistil 6–11 mm long; ovary 3–5 × 1 mm, villous, ovules 6–8; style 3–6 mm long; stigma truncate. Pod 2–5 × 1–2 cm, oblong to elliptic, flat; seeds 1–2 per fruit, 6–9 × 2–5 mm, oblong.

**Specimens examined:** ARGENTINA. LA RIOJA: Quebrada de Ischichuca, Río Guandacal, XI.1967, fl., *R. Herbst 1093* (MBM). RIO NEGRO: General Roca, IX.1914–XI.1915, fl. and fr., *W. Fischer 20* (NY). SALTA: La Viña, 5.XI.1984, fl., *T.M. Pedersen 13958* (MBM). Cafayeta, Ruta 40, 26.I.2007, fr., *J. Paula-Souza et al. 7937* (ESA). SAN JUAN: Jáchal, 18.III.1989, fl., *T.M. Pedersen 15273* (MBM). Calingasta, 16.I.2009, fr., *J. Chiapella & E. Vitek 09-0311* (NY). TUCUMÁN: Tafí, 2.II.1933, fl., *A. Burkart* (SP). Tafídel Valle, 27.XII.1987, fl., *L.R. Landrum 5798* (MBM).

*Parkinsonia glauca* (Fig. 7) is distinguished from *P. praecox* by the pinnae with 1(–2) pairs, leaflets 4–7 pairs per pinna, 1–3(–4) mm long, ovary 3–5 mm long, villous, ovules 6–8 (vs. *P. praecox* pinnae with 1–3(–4) pairs, leaflets 5–10 pairs per pinna, 3–9 mm long, ovary 5–12 mm long, glabrous, ovules 10–12).

The species occurs exclusively in Argentina in the Andes, dry chaco or riverbanks (Fig. 6). The species is assessed as Endangered (EN) [EEO is estimated at 54,881.076 km<sup>2</sup> and AOO of 28 km<sup>2</sup>], with fragmented populations in the Andes.

Flowering from November to March and fruiting from January to March.

**5. *Parkinsonia microphylla*** Torr., Pacif. Railr. Rep. 4: 82, 1857. TYPE: UNITED STATES. ARIZONA: Yuma, Diluvial Banks of the Colorado, *A.C.V. Schott et al. 299* (lectotype here designated NY00004549 [photo!]; isolectotype NY00004550 [photo!], FV0057885 [photo!]).

≡ *Cercidium microphyllum* (Torr.) Rose & I.M. Johnston., Contr. Gray Herb. 70: 66, 1924.

≡ *Cercidiopsis microphylla* (Torr.) Britton & Rose, N. Amer. Fl. 23(5): 306, 1930. Fig. 8

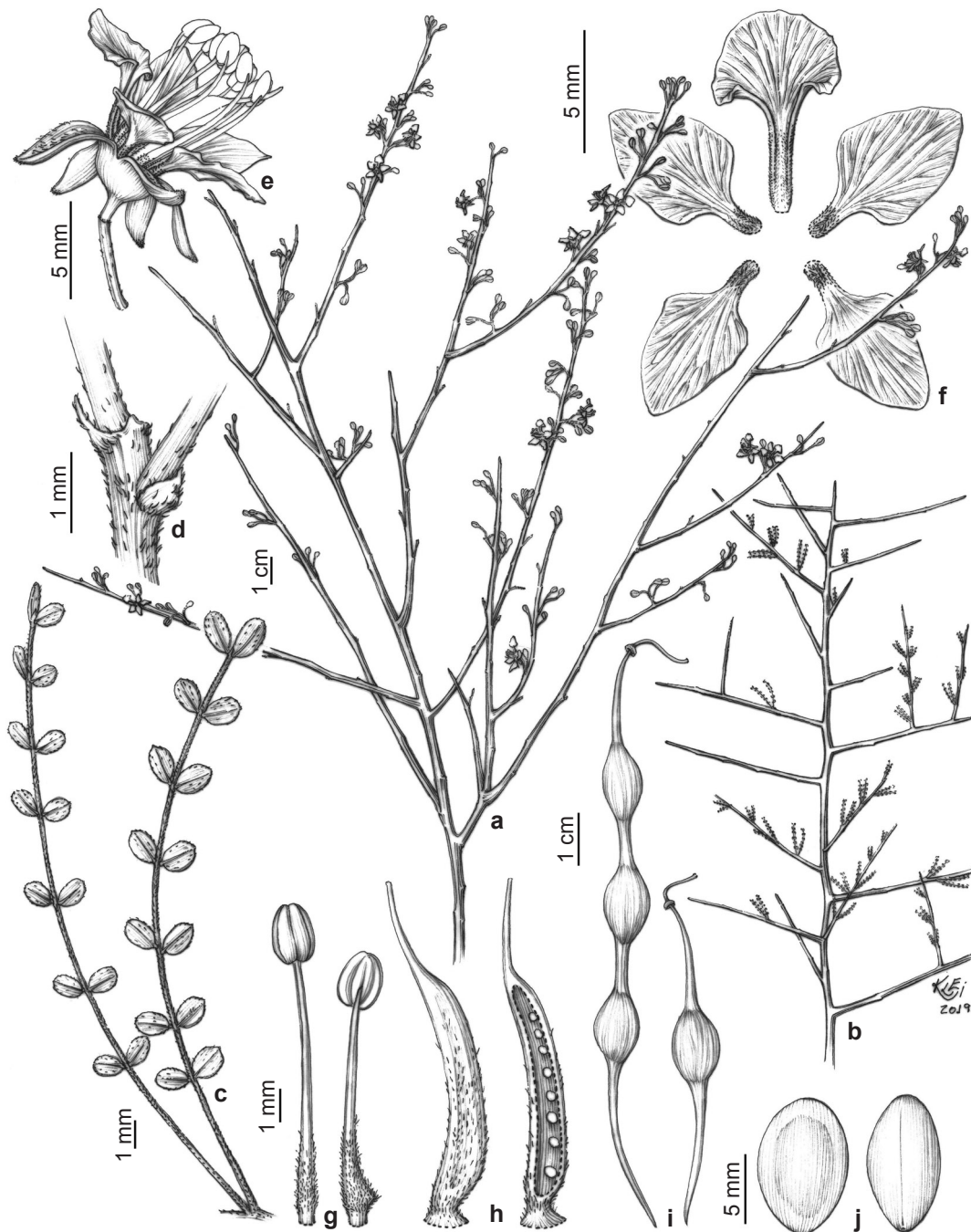
Tree 2–6 m tall. Pubescent indument on petiolules, rachis, leaflets, axis of inflorescence, bracts, pedicels, petal claw, filament, ovary and stigma. Thorn absent. Stipules not seen. Reduced leaves (petioles), with pinnate appearance; pinnae 1–2 pairs, 0.5–3 cm long; petiolules 2–7 mm long; cylindrical rachis, 0.4–2 cm long; leaflets 3–7 pairs per pinna, orbicular, 1–2 × 1 mm, rounded base, mucronate apex. Inflorescence axillary, racemose; axis 0.6–2 cm long; bracts 0.5–1 × 0.3–0.5 mm, lanceolate, deciduous; pedicels 0.6–1 cm long. Flowers 8–13 mm long; sepals 6–7 × 2–3 mm, lanceolate, glabrous; adaxial petal 4–5 × 4–5 mm, auriculate, orbicular, glabrous, claw 4–5 mm long; the other petals (two lateral and two abaxial) 4–6 × 3–5 mm, not auriculate, ovate, glabrous, claw 2–3 mm long. Stamens 8–13 mm long; filament 7–11 mm long; anthers 1–2 mm long, glabrous. Pistil 9–14 mm long; ovary 4–7 × 1 mm, ovules 8–10; style 5–7 mm long, glabrous; stigma truncate. Pod 4–18 × 1–2 cm, linear, moniliform, glabrous or pubescent; seeds 1–4 per fruit, 8–10 × 5–9 mm, oblong.

**Specimens examined:** MEXICO. BAJA CALIFORNIA: Sierra Mayor, 14.II.1977, fr., *J.P. Rebman 2080* (ASU). BAJA CALIFORNIA SUR: Loreto, 29.VI.2007, fr., *G.I. Manríquez 5419* (ASU). UNITED STATES. ARIZONA: Gila, 4.V.2000, fl., *N.D. Atwood & S.L. Welsh* (HUCS). Maricopa County, 17.IV.1985, fl., *T.F. Daniel 4279* (ASU). Pima County, Rincon Peak, 2.V.2007, fl., *M.A. Baker 16544* (ARIZ). Pinal County, 1.VII.2008, fr., *M.B. Johnson* (ARIZ).

*Parkinsonia microphylla* is characterized by its branches without thorns, pinnae 0.5–3 cm long, leaflets 3–7 pairs per pinna and moniliform pod (Fig. 8). The form of the moniliform pod is also shared with *P. aculeata* and *P. peruviana*, which have pinnae 12–42 cm long and leaflets (14–)30–78 (or more) pairs per pinna. Countless materials are cited as type *P. microphylla* (Carter 1974), but Torrey (1857) did not assign any type to the species, so we established a lectotype (NY00004549) and isolectotypes (NY00004550, FV0057885) for *P. microphylla* with support in the original diagnosis (minute roundish leaflets), collection site (Banks of the Colorado and Williams rivers) and specimen collectors (*A.C.V. Schott et al. 299*).

The species occurs in the United States and Mexico (Fig. 4), mainly in deserts. The species is evaluated as Least Concern (LC) [EEO is estimated at 739,265.975 km<sup>2</sup> and AOO of 1,936 km<sup>2</sup>].

Flowering from March to May and fruiting from June to July.



**Figure 8** – a-j. *Parkinsonia microphylla* – a. branches with inflorescence; b. branches with leaves; c. leaflets; d. bracts; e. flower; f. petals; g. stamens; h. ovary and ovules; i. moniliform pod; j. seeds. (a, d-h. *M.A. Baker 16544* (ARIZ); b-c. *G.W.A. Fernandes* (BHCB); i-j. *M.B. Johnson* (ARIZ)). Drawn by Klei Rodrigo Sousa.

**6. *Parkinsonia peruviana*** C.E.Hughes, Daza & Hawkins, Kew Bull 58(2): 467, 2003. TYPE: PERU. AMAZONAS: Chachapoyas, 5 km ENE of Balsas, Marañón Valley, *Hughes 2213* (holotype MOL; isotypes FHO98148, K000264611 [photo!], K000264612 [photo!], K000264613 [photo!], K000264614 [photo!]).

Tree 3–5 m tall. Pubescent indument on filament, ovary and stigma. Thorn absent. Stipules not seen. Not reduced leaves, bipinnate; petioles 3–8 cm long; pinnae (2–)3–4 pairs, 14–40 cm long; petiolules 0.5 mm long; cylindrical rachis, 14–38 cm long; leaflets 30–78 pairs per pinna, elliptic, 7–14 × 3–4 mm, oblique base, mucronate apex, glabrous. Inflorescence axillary, racemose; axis 10–19 cm long; bracts not seen; pedicels 2–3 cm long. Flowers 14–18 mm long; sepals 9–10 × 2–3 mm, oblong; adaxial petal 7–10 × 9–12 mm, auriculate, orbicular, glabrous, claw 6–7 mm long; the other petals (two lateral and two abaxial) 12–15 × 6–8 mm, not auriculate, oblong to obovate, glabrous, claw 3 mm long; Stamens 17–18 mm long; filament 15–16 mm compr.; anthers 2 mm long. Pistil 20 mm long; ovary 12 × 1 mm, ovules not seen; style 8 mm long, glabrous; stigma truncate. Pod 10–26 × 6–8 cm, linear, moniliform, glabrous; seeds 2–12 per fruit, 4 × 8 mm, oblong to elliptic.

**Specimens examined:** PERU. AMAZONAS: Chachapoyas, 5 km ENE of Balsas, Marañón Valley, 22.IV.2002, fl. and fr., *Hughes 2213* (K).

*Parkinsonia peruviana* (Figure Hughes *et al.* 2003: 469) is a species close to *P. aculeata* because they share general characteristics of the moniliform pod; however, the first one does not present reduced leaves (bipinnate) nor thorns (*vs.* reduced leaves with pinnate appearance and presence of thorns in *P. aculeata*).

The species is endemic to Peru (Fig. 4) from the dry forests of Marañón. Its conservation status is assessed as Critically Endangered (CR) [EOO is estimated at 175.354 km<sup>2</sup> and AOO of 16 km<sup>2</sup>], with fragmented populations and few individuals.

Flowering in April and fruiting from May to June.

**7. *Parkinsonia praecox*** (Ruiz & Pav.) Hawkins, Pl. Syst. Evol. 216: 63, 1999. TYPE: PERU (lectotype here designated MA812236 [photo!]; isolectotypes MA812235 [photo!], isolectotypes MA812237 [photo!]).

≡ *Caesalpinia praecox* Ruiz & Pav., Fl. Peruv. 4: t. 376, 1830.

≡ *Caesalpinia praecox* Ruiz & Pav. *ex* Hook. & Arn., Bot. Misc. 3: 208, 1833.

= *Cercidium spinosum* Tul., Arch. Mus. Hist. Nat. 4: 134, 1844. TYPE: MEXICO. OAXACA: Cordillera, *H. Galeotti 3212* (lectotype here designated P03327366 [photo!]).

= *Rhedinophloeum viride* H.Karst., Fl. Columb. 2(1): 25, t. 113. 1862, nom. inval.

= *Cercidium viride* H.Karst., Bot. Jahrb. Syst. 8 (5): 346. 1887, nom. inval.

= *Cercidium plurifoliolatum* Micheli, Mém. Soc. Phys. Genève 34(3): 269, t. 18, 1903. TYPE: MEXICO. MICHOACÁN: San Luis, *E. Langlassé 933* (lectotype here designated GH00053333 [photo!]; isolectotype MPU023368 [photo!]).

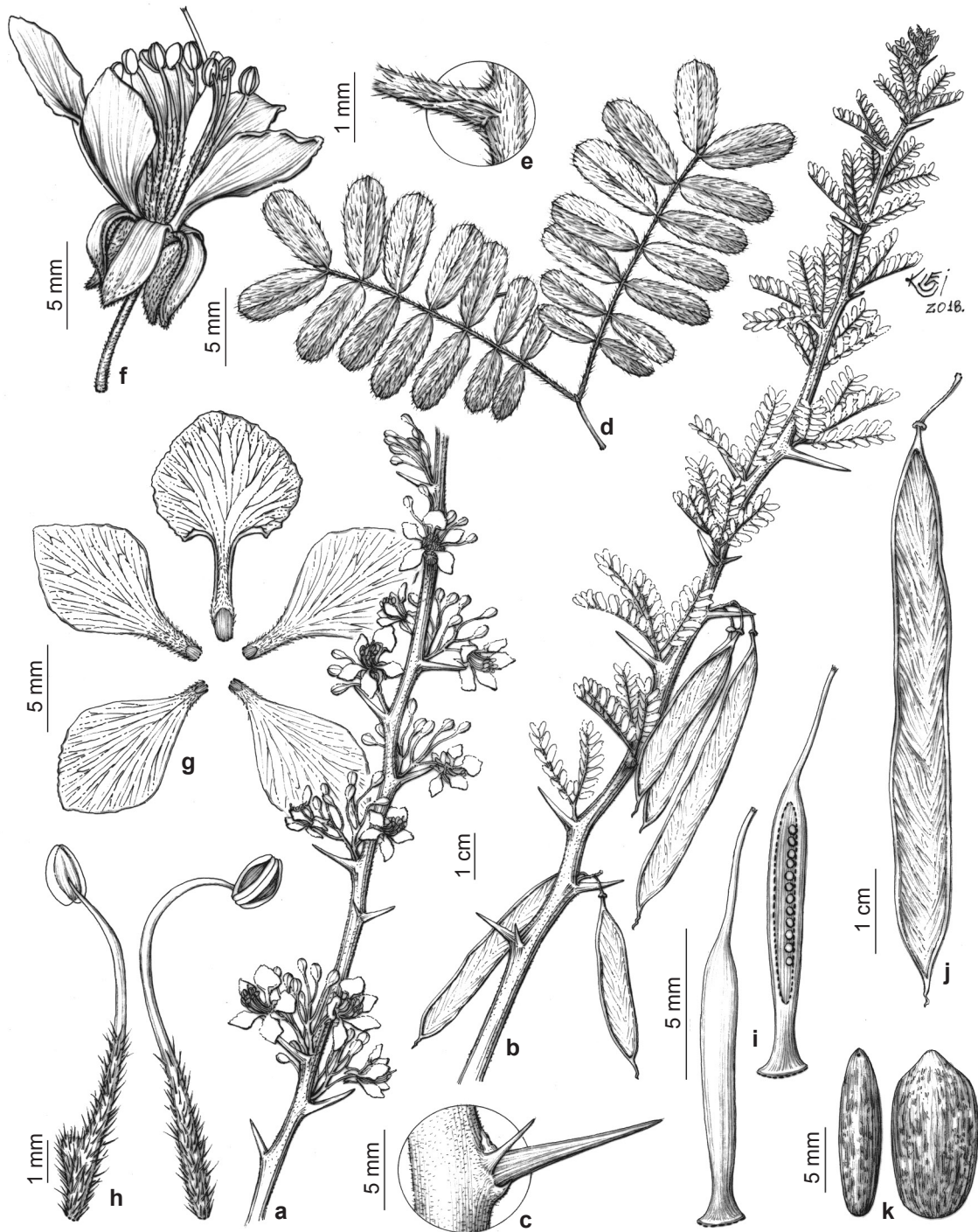
= *Cercidium goldmani* Rose, Contr. U.S. Natl. Herb. 8: 301, 1905. TYPE: MEXICO. OAXACA: San Geronimo, *E.A. Goldman 735* (holotype US00002538 [photo!]).

= *Cercidium unijuga* Rose, Contr. U.S. Natl. Herb. 8: 301, 1905. TYPE: MEXICO. OAXACA: Cuicatlan, *E.W. Nelson 1696* (holotype US00002532 [photo!]).  
≡ *Cercidium praecox* (Ruiz et Pav.) Harms, Bot. Jahrb. Syst. 42(1): 91, 1909. Fig. 9

Shrub or tree 2–8 m tall. Pubescent indument on thorns, stipules, petioles, petiolules, rachis, leaflets, axis of inflorescence, bracts, pedicels, sepals, petal claw, filament and stigma. Thorn 1, 3–16 mm long. Stipules 1, 1–5 mm long, spinescent, deciduous. Not reduced leaves, bipinnate; petioles 0.2–2 cm long; pinnae 1–3 pairs, 0.7–3 cm long; petiolules 1–3 mm long; cylindrical rachis, 0.6–2 cm long; leaflets 5–10 pairs per pinna, oblong to elliptic, 3–9 × 1–4 mm, rounded to oblique base, mucronate apex. Inflorescence axillary, racemose; axis 0.2–2 cm long; bracts 1–1.5 × 0.5 mm, lanceolate, deciduous; pedicels 0.4–1.5 cm long. Flowers 8–14 mm long; sepals 4–8 × 2–4 mm, lanceolate to deltoid; adaxial petal 6–8 × 7–8 mm, auriculate, orbicular, glabrous, claw 4–5 mm long; the other petals (two lateral and two abaxial) 6–10 × 4–5 mm, not auriculate, elliptic to obovate, glabrous, claw 1–2 mm long. Stamens 8–11 mm long; filament 7–10 mm long; anthers 1.5 mm long, glabrous. Pistil 8–13 mm long; ovary 5–12 × 1 mm, glabrous, ovules 10–12; style 4 mm compr., glabrous; stigma truncate. Pod 3–7 × 0.4–1 cm, linear to oblong, flat, glabrous; seeds 1–3 per fruit, 7–11 × 3–4 mm, oblong to elliptic.

**Specimens examined:** ARGENTINA. CATAMARCA: Fray Mamerto Esquiú, 4.X.1973, fl., *A.T. Hunziker* (MBM). La Paz, 9.XI.2013, fl., *P. Demaio 369* (UEC). FORMOSA: Bermejo, 29.IX.1998, fl., *R. Vanni 4267* (MBM). MENDOZA: Las Heras, 29.I.2010, fl., *M.S. Ferrucci et al.* (UEC). SANTIAGO DEL ESTERO: Copo, Pampa de los Guanacos, 1.XI.1974, fl. and fr.,





**Figure 9** – a-k. *Parkinsonia praecox* – a. branches with inflorescence; b. branches with leaves and pod; c. thorns; d. pinnae and leaflets; e. bracts; f. flower; g. petals; h. stamens; i. ovary and ovules; j. flat pod; k. seeds. (a, e-i. *P. Demaio* 369 (UEC); b-d, j-k. *A. Krapovickas & C.L. Cristóbal* 14505 (MBM)). Drawn by Klei Rodrigo Sousa.

*T.M. Pedersen 10727* (MBM). Pellegrini, 15.XI.1993, fr., *T.M. Pedersen 15836* (MBM). Sarmiento, 27.XII.1968, fr., *A. Krapovickas & C.L. Cristóbal 14505* (MBM). SALTA: Hickmann, 9.XII.2007, fr., *E.L. Cabral et al. 845* (HUEFS, CTES). Pluma del Pato, 16.IX.2009, fr., *A. Schinini & E. Flaschland* (CTES, HUEFS, UEC). TUCUMÁN: Capital, Ruta Nacional 9, 18.IX.1997, fl., *G. Seijo & M. Dematteis 1091* (MBM, SP, SPF). BRAZIL. MATO GROSSO DO SUL: Porto Murinho, 27.VIII.2004, fl. and fr., *G.P.L. Nunes et al. 285* (CGMS, MBM); 24.X.1987, fl. and fr., *G. Hatschbach 51642* (MBM); 11.VIII.2001, fl. and fr., *V.C. Souza et al. 26792* (ESA, MBM). HAITI. ARTIBONITE: Gonaives, 20.XI.1982, fr., *T. Zanoni et al.* (NY). MEXICO. OAXACA: Cuicatlán, 20.II.1995, fl., *J.I. Calzada 19795* (MBM). SONORA: Soyopa, 24.V.1998, fr., *A.L. Reina et al. 98-538* (ASU). Villa Juarez, 13.III.1994, fl., *S.L. Friedman 006-94* (ASU).

*Parkinsonia praecox* (Fig. 9) is morphologically close to *P. andicola* and *P. glauca*, but the first one has not reduced leaves (bipinnate), pinnae with 1–3 pairs, pubescent ovary and 10–12 ovules (*P. andicola* has reduced leaves with pinnate appearance, pinnae with 2–10 pairs, glabrous ovary and 5 ovules vs. *P. glauca* has not reduced leaves, bipinnate, pinnae 1 (–2) pairs, villous ovary and 6–8 ovules). In this study we propose the lectotypification *P. praecox* (MA812236) based on the collection of Ruiz and Pavón deposited in the herbarium Royal Botanical Garden of Madrid (MA) and the original diagnosis of these authors. We also recommend the lectotypifications of the synonyms *Cercidium plurifoliolatum* (GH00053333), and *Cercidium spinosum* (P03327366), with support in the diagnosis of species (*C. plurifoliolatum* - leaves bipinnate, pinnae with 2 pairs and racemes fasciculate in us above the thorn; *C. spinosum* - leaves bipinnate, pinnae with 1–2 pairs, ovary glabrous, ovules 8–10) collection sites (*C. plurifoliolatum* - Rio San Luis, Mexico; *C. spinosum* - Oaxaca, Mexico) and collectors (*C. plurifoliolatum* - *E. Langlassé 933*; *C. spinosum* - *H. Galeotti 3212*). In addition, supposed hybridizations are registered between *P. praecox* and *P. aculeata* in a sympatry area of Mexico; the hybrid was described and named *Parkinsonia × carterae* Hawkins (1999: 63); another supposed hybridization between *P. praecox* and *P. microphylla* occurs in the Sonora Desert and in Baja California Sur; the hybrid was registered as *Parkinsonia × sonorae* (Rose & I.M. Johnst.) J.E. Hawkins & Felger (2017: 3). These supposed hybrids need further studies in controlled environments and with the use of integrative tools for cytogenetics, morphometry, species

distribution modeling, phenology, pollinations and germinations to understand the process of hybridizing of *P. praecox* with other species of the genus.

*Parkinsonia praecox* has a wide distribution from the Sonora Desert (Mexico and the United States) to the Chaco (Bolivia, Argentina, Paraguay and Brazil) (Fig. 1). Biogeographic study will be developed to determine the center of origin of *P. praecox* in the Americas. Its conservation status is assessed as Least Concern (LC) [EOO is estimated at 10,471,079.150 km<sup>2</sup> and AOO of 2,224km<sup>2</sup>].

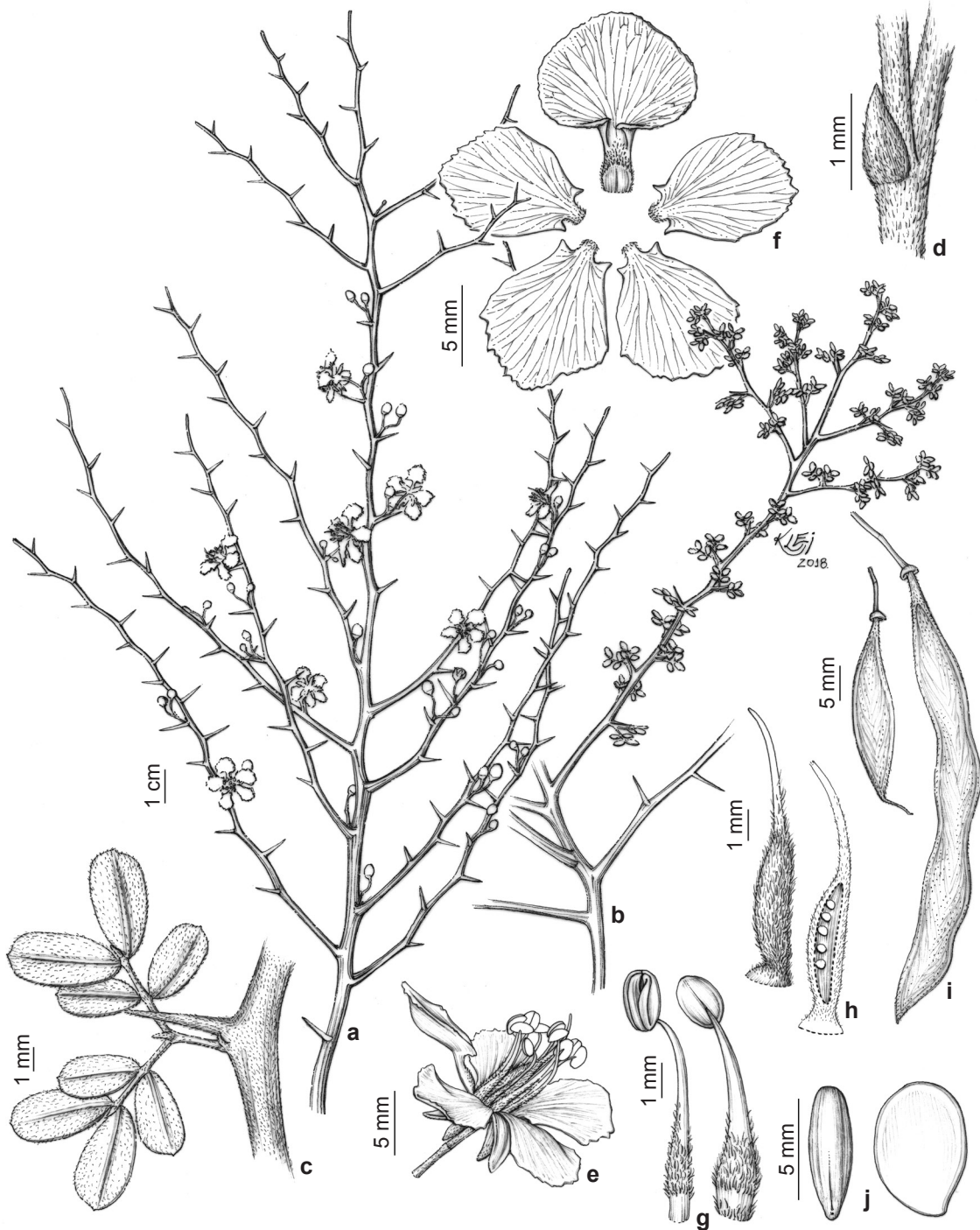
Flowering and fruiting occur throughout the year, mainly from September to May.

**8. *Parkinsonia texana*** (A.Gray) S. Watson, Proc. Amer. Acad. Arts 11: 136, 1876. TYPE: ESTADOS UNIDOS. TEXAS: Rio Grande, *C. Wright* (lectotype here designated GH00053328 [photo!]; isolectotypes GH00053327 [photo!], GH00053329 [photo!], GH01873941 [photo!], K000756950 [photo!], K000756952 [photo!], K000756953 [photo!]).

≡ *Cercidium texanum* A.Gray, Smithsonian Contr. Knowl. 3(5): 58, 1852. Fig. 10

Shrub or tree 2–3 m tall. Pubescent indument on thorns, stipules, petioles, petiolules, rachis, leaflets, axis of inflorescence, bracts, pedicels, sepals, petal claw, filament, style, stigma and pod. Thorn 1, 2–7 mm long. Stipules 1, 0.5–1 mm long, not spinescent. Not reduced leaves, bipinnate; petioles 0.1–0.5 cm long; pinna 1 pair, 0.2–2 cm long; petiolules 1–3 mm long; cylindrical rachis, 0.1–0.3 mm long; leaflets 1–2 pairs per pinna, oblong to obovate, 3–9 × 1–4 mm, oblique base, mucronate apex. Inflorescence axillary, racemose or isolated flowers; axis 0.2–1 cm long; bracts 1–1.2 × 0.5 mm, deltoid to lanceolate, deciduous; pedicels 0.2–0.7 mm long. Flowers 8–14 mm long; sepals 4–7 × 2–3 mm, deltoid to lanceolate; adaxial petal 7–9 × 7–11 mm, auriculate, orbicular, glabrous, claw 3–5 mm long; the other petals (two lateral and two abaxial) 7–10 × 5–9 mm, auriculate, elliptic to obovate, glabrous, claw 1–2 mm long. Stamens 6–15 mm long; filament 5–13 mm long; anthers 1–2 long, glabrous. Pistil 9–13 mm long; ovary 4–7 × 1–2 mm, villous, ovules 4–6; style 4–5 mm long; stigma truncate. Pod 3–8 × 0.5–1 cm, oblong; flat; seeds 1–5 per fruit, 6–9 × 3–5 mm, oblong to orbicular.

**Specimens examined:** MEXICO. COAHUILA: Piedras Negros, 12.V.1977, fl., *J. Henrickson et al. 16051* (ARIZ). UNITED STATES. TEXAS: Dimmit,



**Figure 10** – a-j. *Parkinsonia texana* – a. branches with inflorescence; b. branches with leaves; c. thorn, pinnae and leaflets; d. bracts; e. flower; f. petals; g. stamens; h. ovary and ovules; i. flat pod; j. seeds. (a, d-h. *B.B. Simpson 4-V-00-1* (LL, TEX); b-c. *Sullivan & Turner 26* (LL, TEX); i-j. *E.J. Palmer 12303* (LL, TEX)). Drawn by Klei Rodrigo Sousa.

22.V.2001, fl., *D.S. Seigler & J.E. Ebinger 14907* (LL, TEX). Duval, 10.III.1962, fl., *Roel Bustamante 76* (LL, TEX). Frio, 21.VI.1958, fl. and fr., *Sullivan & Turner 26* (LL, TEX). Kinney, 21.VII.1995, fl. and fr., *G. Turner 95-186* (LL, TEX). Kinney, 9.VI.1955, fr., *B.L. Turner* (LL, TEX). Mc Mullen, 19.V.2006, fl., *W.R. Carr 24527* (LL, TEX). Roma, 4.VI.1975, fr., *R. Runyon* (LL, TEX). Val Verde, 17.V.1984, fl. and fr., *B. Ertter 5388* (LL, TEX). Val Verde, 3.IV.1953, fl., *B.H. Warnock* (LL, TEX). Webb, 1.IV.1962, fl., *R.M. Rodriguez 121* (LL, TEX). Webb, 30.IV.1949, fl., *B.C. Tharp & C.L. York* (LL, TEX). Webb, 4.V.2000, fl., *B.B. Simpson* (LL, TEX). Zapata, 11.IV.1965, fl., *X.M. Hernandez 35* (LL, TEX). Zapata, 14.IV.1962, fl., *M.E. Uribe 97* (LL, TEX).

*Parkinsonia texana* (Fig. 10) is identified by the leaflets with 1–2 pairs per pinna and the villous ovary with 4–6 ovules. The lectotypification of *P. texana* (GH 00053328) is supported by the original diagnosis (pinna 1 pair, leaflets oblong to obovate, ovary villous), which indicates the collection site (Rio Grande, Texas, United States) and the collector (*Charles Wright*).

The species occurs in the southern United States, specifically in Texas, and northern Mexico (Fig. 6). The conservation status is assessed as Vulnerable (VU) [EOO is estimated at 94,554.273 km<sup>2</sup> and AOO of 88 km<sup>2</sup>], the distribution of populations is fragmented, and the species is not protected by conservation units in the United States and Mexico.

Flowering from April to July and fruiting from May to July.

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