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Morphological Studies of *Chamaecrista* sect. *Absus* ser. *Setosae* (Leguminosae) With Emphasis on the *Chamaecrista setosa* Complex, Including a New Species

Tatiane Santana Silva,[1] Matheus Martins Teixeira Cota,[2] Leonardo M. Borges,[3] Alexandre Gibau de Lima,[4] Mario Tomazello-Filho,[5] and Juliana Gastaldello Rando[1,6]

[1]Programa de Pós-graduação em Ciências Ambientais, Universidade Federal do Oeste da Bahia, Rua Bertioga, 892, Morada Nobre I, CEP: 47810-059, Barreiras, Bahia, Brazil; silv.thaty@gmail.com; juliana.rando@ufob.edu.br
[2]Programa de Pós-graduação em Botânica, Departamento de Ciências Biológicas, Universidade Estadual de Feira de Santana - UEFS, Av. Transnordestina, s/n, Bairro Novo Horizonte, CEP 44036-900, Feira de Santana, Bahia, Brazil; matheusmtc@hotmail.com
[3]Universidade Federal de São Carlos, Departamento de Botânica, Rodovia Washington Luís, Km 235, São Carlos, SP, 13565-905, Brazil; aquitemcaqui@gmail.com
[4]Programa de Pós-graduação em Botânica, Escola Nacional de Botânica Tropical, Jardim Botânico do Rio de Janeiro, Rua Pacheco Leão 2040, Jardim Botânico, CEP 22460-030, Rio de Janeiro, Rio de Janeiro, Brazil; alegibau@gmail.com
[5]Universidade de São Paulo, Escola Superior de Agricultura "Luiz de Queiroz", Av. Pádua Dias 11, CEP 13418-900, Piracicaba, São Paulo, Brazil; mtomazel@usp.br
[6]Author for correspondence (juliana.rando@ufob.edu.br)

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Abstract*—Chamaecrista* is one of the largest genera of Leguminosae, subfamily Caesalpinioideae. Traditionally, it has been divided into six sections, of which *Chamaecrista* sect. *Absus* is the largest, with 31 series. *Chamaecrista* sect. *Absus* ser. *Setosae* comprises nine species. *Chamaecrista setosa* is the most widely distributed species, comprising four varieties, distinguished by the type and distribution of glandular trichomes, and the leaflet venation. Given the importance of leaflet venation in the delimitation of the taxa, here we performed a study of leaflet architecture of all species of the series and a more detailed morphological study for the *Chamaecrista setosa* complex. For the study of leaf architecture, 2D images of the leaflets were made using the Faxitron x-ray technique. The morphological studies were based on herbarium specimens. We present the details of the leaflet architecture for the species of *Chamaecrista* sect. *Absus* ser. *Setosae,* and we propose nomenclatural changes for a variety of *Chamaecrista setosa* and some corrections to typifications. During our studies we also found a new species, ***Chamaecrista forzzae***, which is morphologically similar to *Chamaecrista setosa* and *Chamaecrista multiseta*. It is here described and illustrated.

***Keywords*—**Fabaceae, leaflet architecture, taxonomy, variety.

Resumo*—Chamaecrista* é um dos maiores gêneros da subfamília Caesalpinioideae em Leguminosae. Tradicionalmente é reconhecido seis seções, a maior destas é *Chamaecrista* sect. *Absus* com 31 séries. *Chamaecrista* sect. *Absus* ser. *Setosae* compreende nove espécies, sendo *Chamaecrista setosa* a espécie mais amplamente distribuída e com quatro variedades distintas basicamente pelo tipo e distribuição dos tricomas glandulares e pela venação dos folíolos. Considerando a importância dada à venação foliolar na delimitação dos táxons, realizamos aqui um estudo da arquitetura foliolar para todas as espécies da série e um estudo morfológico mais detalhado para o complexo *Chamaecrista setosa*. Para o estudo da arquitetura foliolar, foram feitas imagens 2D dos folíolos usando a técnica de raio-x Faxitron. Os estudos morfológicos foram feitos com base em espécimes de herbário. Como resultados, detalhamos a arquitetura do folíolo para as espécies de *Chamaecrista* sect. *Absus* ser. *Setosae*, propomos uma mudança nomenclatural para uma das variedades de *Chamaecrista setosa* e realizamos algumas correções nas tipificações. Durante nossos estudos, também encontramos uma nova espécie, ***Chamaecrista forzzae***, morfologicamente similar à *Chamaecrista setosa* e *Chamaecrista multiseta*, aqui descrita e ilustrada.

***Palavras-chave*—**Fabaceae, arquitetura foliolar, taxonomia, variedade.

Large genera commonly include complexes of closely similar species. Such complexes may be resolved by close examination of micromorphological characters (e.g. Conceição et al. 2008; Fortuna-Perez et al. 2012; Klimko et al. 2018; Cota et al. 2020), as these are rarely used in original species descriptions. With more than 360 species and being one of the largest Caesalpinioideae genera in the Leguminosae (Lewis 2005; LPWG 2021), *Chamaecrista* (L.) Moench comprises groups of taxa with hazy delimitation, particularly at the infraspecific level. Over the past decade, close inspection of such taxonomic issues using anatomical and other morphological data led to synonymization (Rando et al. 2013, 2020; Cota et al. 2020; Oliveira et al. 2021) or up-ranking of varieties to species level (Rando et al. 2013; Mendes et al. 2020). Despite these improvements, taxonomic complexes still abound in *Chamaecrista*, especially in its largest infrageneric assembly.

Chamaecrista sect. *Absus* (DC. ex Collad.) H.S.Irwin & Barneby includes more than 170 species, traditionally grouped into four subsections and 31 series (Irwin and Barneby 1978, 1982; but see a proposal for a new classification in Souza et al. 2021). Among the traditional series, *C.* sect. *Absus* ser. *Setosae* (H.S.Irwin & Barneby) H.S.Irwin & Barneby comprises nine species, after inclusion of one species [*C. multiseta* (Benth.) H.S.Irwin & Barneby] recently transferred from *C.* ser. *Absoideae*, and exclusion of *C. amphibola* (H.S.Irwin & Barneby) H.S.Irwin & Barneby (Irwin and Barneby 1978, 1982; Oliveira et al. 2021). Eight of these species occur in cerrado vegetation of the Cerrado domain (the Brazilian savanna), while *C. orenocensis* (Spruce ex Benth.) H.S.Irwin & Barneby occurs in Amazon savannas (Irwin and Barneby 1978; Oliveira et al. 2021). In addition to the glandular trichomes and the terminal compound racemes, typical of *C.* sect. *Absus*, these species share 1–2 (3) pairs of leaflets per leaf, revolute leaflet margins [except in *C. coradinii* H.S.Irwin & Barneby and *C. ochrosperma* (H.S.Irwin & Barneby) H.S.Irwin & Barneby], and prominent veins that form a strong alveo-reticulate pattern on the leaflets' abaxial surface (Irwin and Barneby 1978; Oliveira et al. 2021). The distinction among the species is primarily based on the number, texture, and

shape of leaflets. Another important character for species delimitation in the series is the presence and density of trichomes (Irwin and Barneby 1978; Oliveira et al. 2021).

Recent phylogenetic studies have improved the circumscription of *Chamaecrista* ser. *Setosae* (Souza et al. 2019, 2021; Oliveira et al. 2021). However, proper knowledge on species delimitation depends on extended morphological evaluation, in particular for *C. setosa*, a widespread and morphologically variable species with four varieties (Irwin and Barneby 1978, 1982). These varieties apparently form a clade with low support (Souza et al. 2021). Nevertheless, although the merging of *C. setosa* varieties was based on the supposed lack of macromorphological distinctiveness (Oliveira et al. 2021), there is doubt regarding what characters were considered as invariant and, consequently, as evidence for synonymization.

Considering the importance of the leaflet venation for taxa delimitation in *Chamaecrista* ser. *Setosae*, here we present a detailed study of leaflet architecture for all species in the series. We also gave special attention to indumentum and leaflet venation patterns, which are of particular taxonomic significance in the *C. setosa* complex (Irwin and Barneby 1978, 1982). Using these morphological data, we question past and current delimitation of the *C. setosa* complex. Our results show that a variety of *C. setosa* should be raised to species level and also support description of a novel related species.

Materials and Methods

Morphology and Geographical Distribution—Morphological analyses were based on field observations and collections or digital images from the following herbaria: BRBA, CEN, ESA, HUEFS, IBGE, K, MBM, MG, NY, P, RB, SPF and US (acronyms following Thiers 2021). We also examined all taxon protologues and images of types available from JSTOR Plants (https://plants.jstor.org), INCT (http://inct.florabrasil.net/herbario-virtual/), and Reflora (http://reflora.jbrj.gov.br). Morphological terminology follows Radford et al. (1974) for habit, shape of leaflets (except for apex and base), stems, and parts of the flower. For leaflet apex, base, and venation terminology we followed Hickey (1974) and Ellis et al. (2009). Finally we described indumentum and inflorescence following Payne (1978) and Weberling (1989), respectively.

Specimens used to document taxonomic updates presented here are fully cited. Geographical coordinates obtained from herbarium specimens or during field expeditions were used to build the distribution map using QGIS version 3.14 (QGIS Development Team 2020). For herbarium specimens lacking georeference, we calculated approximate coordinates based on the locality collection. For assessing the conservation status of the new species we used the GeoCAT tool (Bachman et al. 2011) with a recommended cell size of 2 km^2 (IUCN 2019).

Leaflet Architecture—We analyzed all recognized species of *Chamaecrista* sect. *Absus* ser. *Setosae* sensu Oliveira et al. (2021): *C. auris-zerdae* (H.S.Irwin & Barneby) H.S.Irwin & Barneby, *C. campicola* (Harms) H.S.Irwin & Barneby, *C. coradinii* H.S.Irwin & Barneby, *C. multiseta* (Benth.) H.S.Irwin & Barneby, *C. obtecta* (Benth.) H.S.Irwin & Barneby, *C. ochrosperma* (H.S.Irwin & Barneby) H.S.Irwin & Barneby, *C. orenocensis* (Spruce ex Benth.) H.S.Irwin & Barneby, *C. scabra* (Pohl ex Benth.) H.S.Irwin & Barneby, and *C. setosa* (Vogel) H.S.Irwin & Barneby. We also studied the new species presented here, *Chamaecrista forzzae*, and the varieties *C. setosa* var. *detonsa*, *C. setosa* var. *setosa*, and *C. setosa* var. *subsetosa*. The 2D images of the leaflets were made using the Faxitron x-ray technique (model LX-60, number 120807305). This technique is non-destructive and all leaflets were returned to their herbarium sheets after the images were taken. The exposure time used was 5.6 sec at a voltage of 29 kV (Schneider et al. 2018).

Species Concept, Delimitation, and Nomenclature—We adopted the morphological species concept to evaluate and define species limits (Du Rietz 1930; Bisby and Coddington 1995). Thus, species are defined here as "the smallest natural populations permanently separated from each other by a distinct discontinuity in the series of biotypes" (Bisby and Coddington 1995). Following this concept, we analyzed the characters currently used to diagnose the taxa in the series. Characters such as indumentum, leaflet shape, and number of veins per leaflet were observed in more detail.

Results and Discussion

The Leaflet Architecture of Chamaecrista sect. Absus ser. Setosae—Leaflet shape—Almost all taxa analyzed (Table 1) have elliptical leaflets (*C. orenocensis*, *C. obtecta*, *C. setosa* var. *subsetosa*, *C. setosa* var. *detonsa*, *C. campicola*, *C. ochrosperma*, *C. scabra*, and *C. coradinii*; Fig. 1A, B, E, G, I, J–L), two species

Table 1. Comparative table of leaflet morphology of the *Chamaecrista* sect. *Absus* ser. *Setosae* species based on 2D images, following Hickey (1974), Ellis et al. (2009), and Radford et al. (1974). * Taxa with nomenclatural changes proposed here, and the new species.

Species	Lamina shape	Base symmetry	Apex shape	Terminal features of apex	Venation
C. auris-zerdae (H.S.Irwin & Barneby) H.S.Irwin & Barneby	Oblong	Asymmetrical	Truncate	Spinose	Brochidodromous
C. campicola (Harms) H.S.Irwin & Barneby	Elliptic	Asymmetrical	Emarginate	Mucronate	Eucamptodromous /brochidodromous
C. coradinii H.S.Irwin & Barneby	Elliptic	Asymmetrical	Rounded	Mucronate	Craspedodromous /presence of perimarginal vein
C. multiseta (Benth.) H.S.Irwin & Barneby	Ovate	Asymmetrical	Acuminate	Absent	Brochidodromous
* *C. forzzae* T.S.Silva, M.Cota & Rando	Oblong	Asymmetrical	Emarginate	Mucronate	Brochidodromous
C. obtecta (Benth.) H.S.Irwin & Barneby	Elliptic	Asymmetrical	Rounded	Mucronate	Brochidodromous
C. ochrosperma (H.S.Irwin & Barneby) H.S.Irwin & Barneby	Elliptic	Asymmetrical	Rounded	Mucronate	Eucamptodromous /brochidodromous /presence of perimarginal vein
C. orenocensis (Spruce ex Benth.) H.S.Irwin & Barneby	Elliptic	Slightly asymmetrical	Rounded	Mucronate	Brochidodromous
C. scabra (Pohl ex Benth.) H.S.Irwin & Barneby	Elliptic	Asymmetrical	Acuminate	Mucronate	Eucamptodromous /brochidodromous /presence of perimarginal vein
* *C. setosa* var. *detonsa* = *C. detonsa* (Benth.) T.S.Silva, M.Cota & Rando	Elliptic	Asymmetrical	Acuminate	Absent	Brochidodromous
C. setosa (Vogel) H.S.Irwin & Barneby var. *setosa*	Ovate	Asymmetrical	Rounded	Absent	Brochidodromous
C. setosa var. *subsetosa* = *C. setosa*	Elliptic	Asymmetrical	Rounded	Mucronate	Brochidodromous

have oblong leaflets (*C. forzzae* and *C. auris-zerdae*; Fig. 1C, H), and two taxa have ovate leaflets (*C. setosa* var. *setosa* and *C. multiseta*; Fig. 1D, F). All species have leaflets with an asymmetrical base, except for *C. orenocensis* (Fig. 1A), which has slightly asymmetrical leaflet bases. Leaflets of five taxa have a rounded mucronate apex (*C. orenocensis*, *C. obtecta*, *C. setosa* var. *subsetosa*, *C. ochrosperma,* and *C. coradinii*; Fig. 1A, B, E, J, L), except for *C. setosa* var. *setosa* (Fig. 1D), which is not mucronate. *Chamaecrista auris-zerdae* has a truncate and spinose apex (Fig. 1H), two taxa have leaflets emarginate with a mucronate apex (*C. forzzae* and *C. campicola*; Fig. 1C, I), and three taxa have an acuminate apex (*C. multiseta*, *C. setosa* var. *detonsa,* and *C. scabra*; Fig. 1F, G, K), one of which is mucronate (*C. scabra*; Fig. 1K).

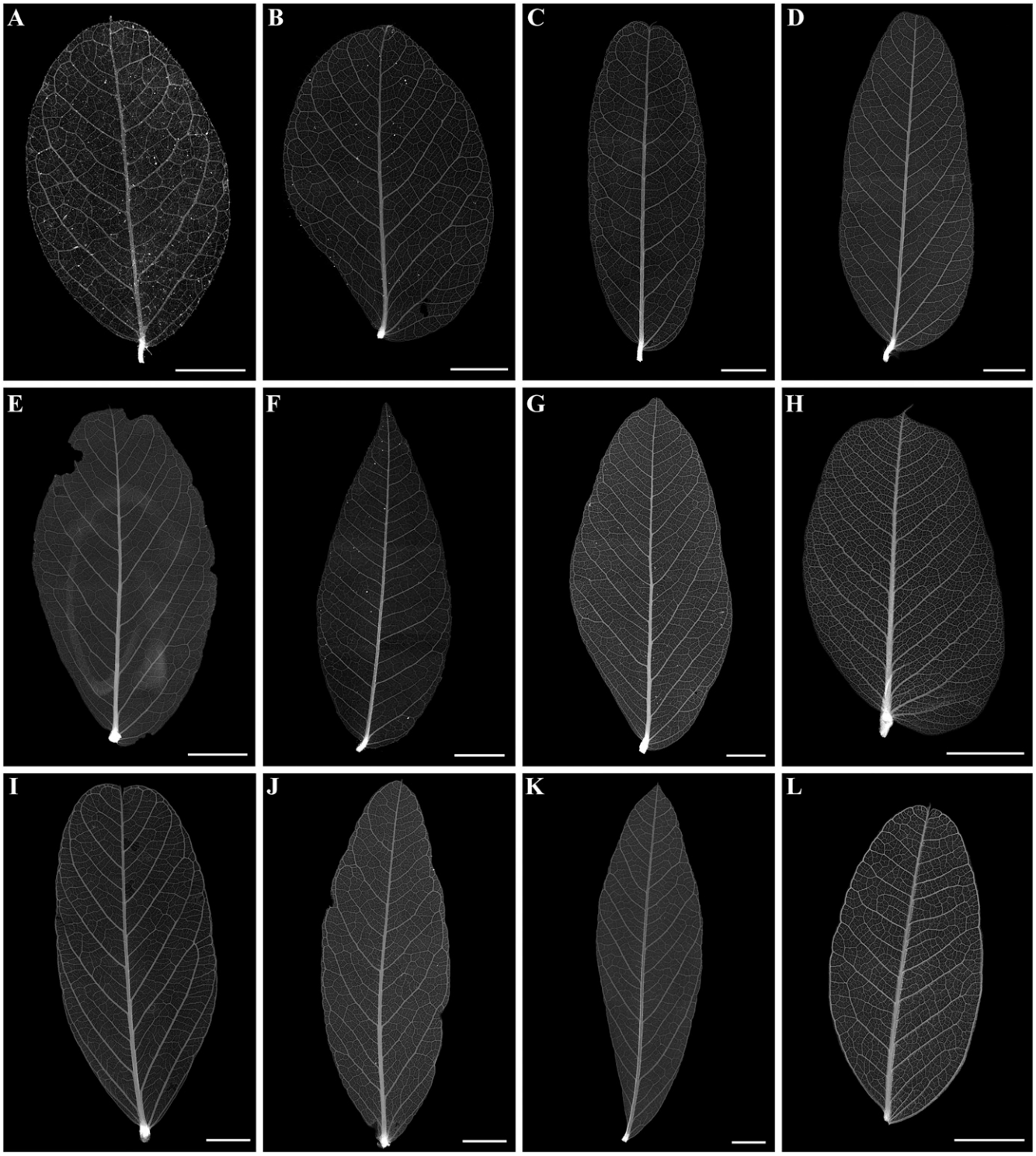

FIG. 1. Leaflet venation. A. *Chamaecrista orenocensis* (*Rojas 1980*). B. *C. obtecta* (*Pereira-Silva 6266*). C. *C. forzzae* (*Verdi 7216*). D. *C. setosa* var. *setosa* (*Assis 100*). E. *C. setosa* var. *subsetosa* (*Queiroz 10460*). F. *C. multiseta* (*Queiroz 14276*). G. *C. setosa* var. *detonsa* (*Pereira-Silva 11818*). H. *C. auris-zerdae* (*Souza 2250*). I. *C. campicola* (*Duarte 8309*). J. *C. ochrosperma* (*Simon 3035*). K. *C. scabra* (*Hatschbach 70461*). L. *C. coradinii* (*Silva et al. 32*). Scale = 1 cm.

VEIN CHARACTERS—All species have pinnate leaflet venation (with a single primary vein). Most taxa have brochidodromous secondary venation (*C. orenocensis*, *C. obtecta*, *C. forzzae*, *C. setosa* var. *setosa*, *C. setosa* var. *subsetosa*, *C. multiseta,* and *C. setosa* var. *detonsa*; Fig. 1A–H), while three species (*C. campicola*, *C. ochrosperma*, and *C. scabra*; Fig. 1I–K) have eucamptodromous secondary venation which becomes brochidodromous distally, and one species, *C. coradinii* (Fig. 1L), has craspedodromous venation. An interesting character observed in these latter four species is the presence of a perimarginal vein (*C. campicola*, *C. ochrosperma*, *C. scabra* and *C. coradinii*; Fig. 1I–L).

We also counted the number of secondary vein pairs for the varieties of *C. setosa* (Fig. 1D, E, G) which have similar leaflet shape and venation. We did so for all *C. setosa* specimens analyzed (not only the x-ray sampled) and observed the following variation: 11–22 pairs in *C. setosa* var. *setosa*, 8–11 pairs in *C. setosa* var. *subsetosa*, 8–14 pairs in *C. setosa* var. *paucivenia*, 9–16 pairs in *C. setosa* var. *detonsa* (summarized in Fig. 2). We analyzed the margin of leaflets of all specimens in order to define if the margin is plane or revolute, and we observed that this feature can vary within the same populations in *C. setosa*.

Although recognition of *Chamaecrista setosa* varieties is in part based on the number of secondary veins (Irwin and Barneby 1978), we found overlap in the number of veins among the varieties and conclude that this character is not taxonomically useful to delimit varieties within *C. setosa*. On the other hand, the perimarginal vein, already used by Irwin and Barneby (1978) and Barneby (1992) in the delimitation of *C. campicola* and *C. coradinii* (Fig. 1I and L, respectively), is also taxonomically useful for recognition of *C. ochrosperma* and *C. scabra* (Fig. 1J, K). The truncate and spinose leaflet apex is diagnostic for *Chamaecrista auris-zerdae* (Fig. 1H). Most species have leaflets with an asymmetrical base, but this feature is especially pronounced in the sessile leaves of *C. auris-zerdae* (Fig. 1H) and *C. obtecta* (Fig. 1B). Finally, while most of the features studied here are constant within any given taxon, leaflet lamina and apex shape are generally more variable within and among populations.

Trichomes and Indumentum—In our analyses we observed four types of trichomes in *Chamaecrista setosa* and its varieties (summarized in Fig. 2). These are divided into glandular and non-glandular trichomes. The glandular indumentum comprises 1) stalked bulbous hairs branched at the base with tiny tector rays (bulbous-stellular) (Fig. 2A, also see Fig. 3C, F, I); 2) obclavate trichomes with a large base and narrow at the tip (Fig. 2B, also see Fig. 3L); and 3) stalked stiff long hairs branched at the base with tiny tector rays (setiform-stellular; the "setae" of Vogel (1837), and of Irwin and Barneby (1978)) (Fig 2C, also see Fig. 3D, G, J). This last type of trichome forms a glandular-hispid indumentum. The only non-glandular trichomes observed were filiform ones (Fig 2D, also see Fig. 3B, E, H, K), which, depending on their density, form puberulent, or pubescent to villous indumenta.

Almost all varieties have setiform-stellular trichomes, a remarkable characteristic of *Chamaecrista setosa.* However, these trichomes are completely absent in *C. setosa* var. *detonsa* (Figs. 2, 3A–C). *Chamaecrista setosa* var. *subsetosa* is the only variety without bulbous-stellular hairs on the petiole and leaflets (Figs. 2, 3D–F), which makes its indumentum less dense than other varieties. *Chamaecrista setosa* var. *setosa* and *C. setosa* var. *paucivenia* bear the same trichomes, even though they vary in indumentum distribution and density (Figs. 2, 3G–L).

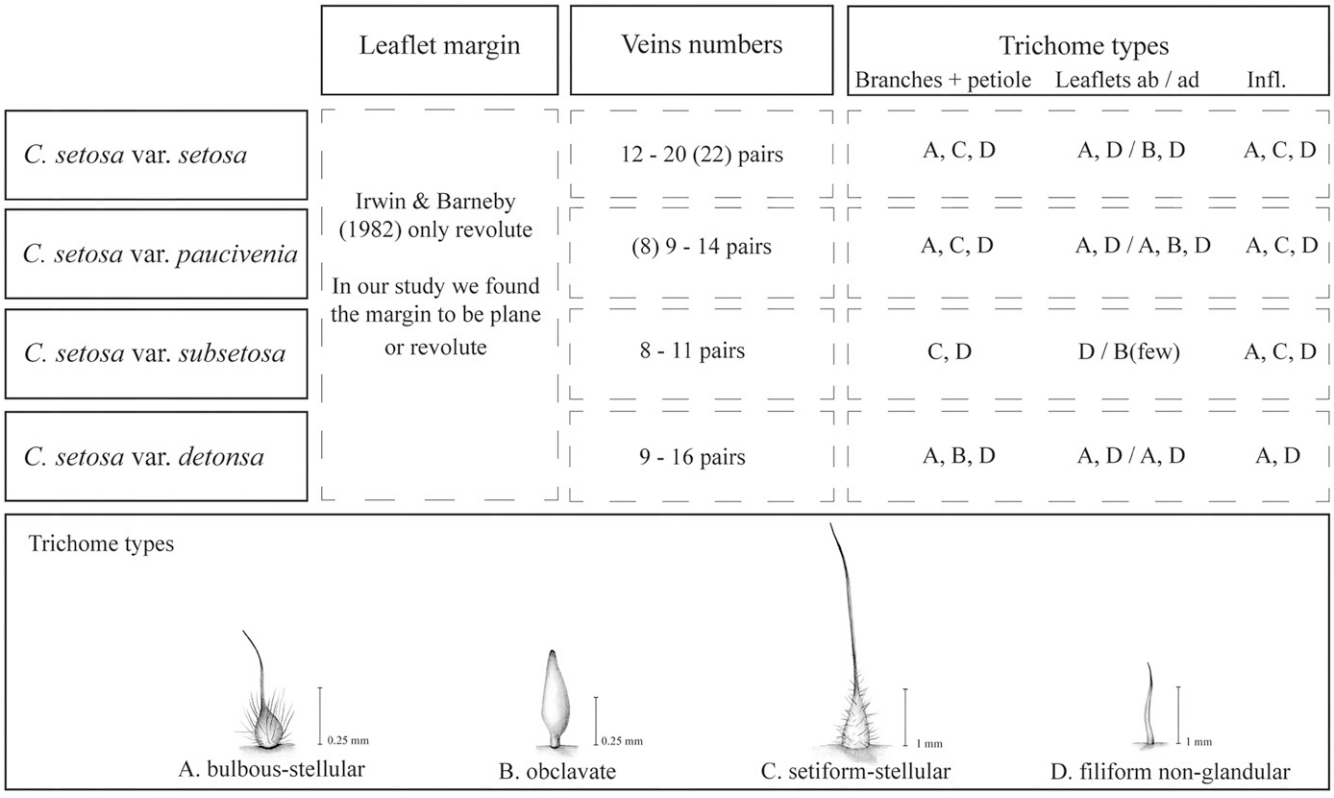

FIG. 2. The characters used by Bentham (1870) and by Irwin and Barneby (1982) to recognize varieties of *Chamaecrista setosa*.

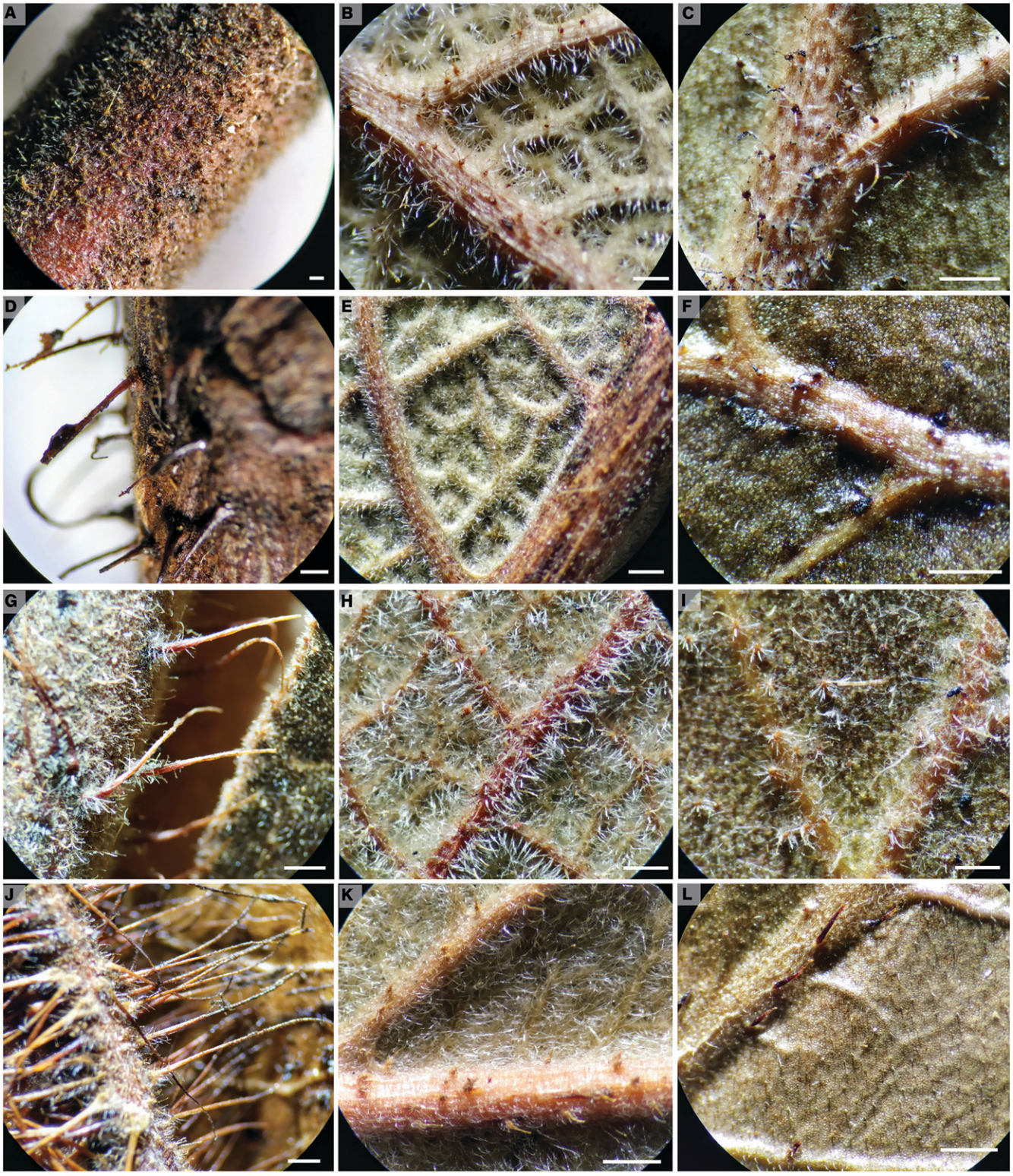

FIG. 3. Stereomicroscope images of trichome details. A–C. *C. detonsa.* Branch, abaxial and adaxial surface of the leaflet, respectively (*Hatschbach 38740*). D–F. *C. setosa* var. *subsetosa.* Branch, abaxial and adaxial surface of the leaflet, respectively (*Queiroz 10460*). G–I. *C. setosa* var. *paucivenia.* Branch, abaxial and adaxial surface of the leaflet, respectively (*Brade 13416*). J–L. *C. setosa* var. *setosa.* Branch, abaxial and adaxial surface of the leaflet, respectively (*Assis 100*). A–C, E, H, I, K showing the glandular indumentum formed by bulbous hairs branched at the base, and also filiform trichomes present; D, G, J showing the glandular-hispid indumentum; F, L showing the glandular indumentum formed by obclavate trichomes. Scale = 1 mm.

Our analysis indicates that trichome morphology is not taxonomically informative to distinguish *C. setosa* var. *setosa* and *C. setosa* var. *paucivenia*, as they have essentially the same indumentum. *Chamaecrista setosa* var. *subsetosa* would also fit this scenario, if not for the consistent lack of bulbous-stellular trichomes on its leaves. In this context, *C. setosa* var. *detonsa* is the only taxon with an indumentum of different nature, lacking setiform-stellular trichomes.

Taxonomic History of Chamaecrista setosa and Morphological Variation Within the Species—*Chamaecrista setosa* was first described within the genus *Cassia* L., based on a collection (likely destroyed in Berlin during World War II) made by Sellow in Brazil ("Hbt. In Brasilia: leg. Sellow"; Vogel 1837). Vogel described the species as having long and stiff trichomes ("setis longis hispidis"), bifoliolate leaves, oval-elliptical to oblong leaflets, densely tomentose on the abaxial face. The etymology of the name refers to the glandular-hispid indumentum, composed of stiff long hairs (setas). Bentham (1870) named specimens similar to *Cassia setosa*, but lacking its distinctive hispid indumentum, as *C. setosa* var. *detonsa.* A third variety, *Cassia setosa* var. *paucivenia*, was added by Irwin and Barneby (1978) to circumscribe specimens with a smaller number of secondary veins, shorter and larger leaflets, and the presence of a velutinous indumentum on the leaflet adaxial face. Irwin and Barneby (1978) also combined *Cassia subsetosa* Malme (1931) as *Cassia setosa* var. *subsetosa*, as, except for variations in indumentum, it resembled *C. setosa* var. *detonsa*. Irwin and Barneby (1982) combined these *Cassia* names in *Chamaecrista*. More recently, all *C. setosa* varieties were synonymized based on the overlap of morphological variation and geographical distribution (Oliveira et al. 2021). However, this last work does not clearly state which characters are overlapping.

Our observations indicate that while some characters previously thought to be taxonomically informative indeed do not vary among the varieties, others do. At the same time a few features are more variable within each taxon than previously known. Characters varying within and among varieties: The margin of the leaflets is either plane or revolute; although Irwin and Barneby (1978) used this character to distinguish between *Chamaecrista setosa* (revolute margin) and *C. multiseta* (plane margin), it varies even within a single population of *C. setosa* var. *setosa*. The number of secondary veins pairs is another variable character, and there is great variation in leaflet shape and size. Characters constant within and among varieties: The trichome type is consistent with the limits of *C. setosa* varieties, even though some share the same type of indumentum (see above). The uniform and unique absence of setiform-stellular (Figs. 3A, 4A, B) in all parts of the plant clearly sets *C. setosa* var. *detonsa* apart from other *C. setosa* varieties.

In face of the morphological variation presented above and also considering that glandular setiform-stellular trichomes are the main diagnostic feature of *Chamaecrista setosa*, we propose to raise *C. setosa* var. *detonsa* to species level. As the other varieties differ only in indumentum density, we agree that they should be treated as synonyms of *C. setosa*, as proposed by Oliveira et al. (2021). Although this proposal renders *C. setosa* paraphyletic, species need not be monophyletic (Hennig 1968; Crisp and Chandler 1996). In fact, paraphyletic species are expected under vicariant speciation, which was apparently common in the Cerrado (Nogueira et al. 2011). Hence, recognition of *C. setosa* var. *detonsa* as a distinct species and *C. setosa* paraphyly support the idea that widespread species from the Cerrado may not be monophyletic (Pennington and Lavin 2016). Our morphological studies also revealed that a population thought to belong to *C. setosa* differs from it in leaflet shape, and the type of trichomes and indumentum of leaves, sepals, ovaries, and fruits. Based on that, we describe this population as a new species, *C. forzzae*.

A Key to *C. detonsa*, *C. forzzae* and Related Species

1. Setiform-stellular (glandular-hispid) indumentum absent from branches, petioles, leaflets, and inflorescences. . . . . *Chamaecrista detonsa*
1. Setiform-stellular (glandular-hispid) indumentum present on branches, petioles, leaflets, and inflorescences. 2
   2. Glandular indumentum composed of bulbous-stellular and setiform-stellular trichomes, these are golden to reddish in fresh plants. This glandular-hispid indument is present on almost all structures, except for the ovary and fruits. . . . . *Chamaecrista setosa*
   2. Glandular indumentum composed by bulbous and setiform trichomes, which are blackened in fresh plants. This glandular-hispid indument is also present on all structures, including the ovary and fruits. 3
      3. Shrubs 1–2 m tall; leaflets oblong, apex emarginate or retuse, apiculate (mucronate), coriaceous, abaxial surface densely pubescent, discolor; sepals with setiform and filiform trichomes; fruit glandular-hispid on the sutures and margin; restricted to Cristália, Minas Gerais. . . . . *Chamaecrista forzzae*
      3. Shrubs to small trees, 2–5 m tall; leaflets ovate or elliptic, apex acute, apiculate, membranaceous, abaxial surface sparsely pubescent, not discolor; sepals with bulbous and filiform trichomes; fruit with glandular-hispid indumentum throughout its surface or concentrated at the base; widely distributed in Distrito Federal, Goiás, Minas Gerais, Pará, and Piauí. . . . . *Chamaecrista multiseta*

1. *Chamaecrista detonsa* (Benth.) T.Silva, M.Cota & Rando, comb. nov. & stat. nov. *Cassia setosa* var. *detonsa* Benth., Fl. Bras. (Martius) 15(2): 141 (1870). Type: Brazil. Goiás, 1839, *Gardner 3127* (Lectotype: K-000555484!, isolectotypes: BM-00793259!, G-00370963!, K-000555485!, P-00836115!).

Chamaecrista setosa var. *detonsa* (Benth.) H.S. Irwin & Barneby, Mem. New York Bot. Gard. 35(2): 651 (1982).

Cassia setosa var. *angusta* Benth., Fl. Bras. (Martius) 15 (2): 141 (1870). Type: Brazil. Goiás, Cavalcante, "in prov. Goyaz" *Burchell 7588* (Holotype: K-000555486!).

Cassia chrysotingens Hoehne, Relat. Commiss. Linhas Telegr. Estratég. Mato Grosso Amazonas 5, Bot. pt. 8: 44, pl. 143 (1919). Type: Brazil. "Colhida no Lambary além de Campos Novos da Serra do Norte", November 1914, *Hoehne 5413* (Lectotype inadvertely designated by Oliveira et al. 2021: R-13998!).

Cassia chrysotingens var. *obtusata* Hoehne, Relat. Commiss. Linhas Telegr. Estratég. Mato Grosso Amazonas 5, Bot. pt. 8: 45 (1919). Type: Brazil. "Colhida nas margens do Bananalzinho, afluente do rio Paranatinga", November 1914, *Kuhlmann 411* (Lectotype designated here: R-64229!).

Shrubs or subshrubs, 0.5–2.5 m tall, branches puberulent, with filiform non-glandular and short glandular bulbous-stellular trichomes. **Stipules** triangular subulate, 1–3 × 0.6 mm, caducous, with filiform non-glandular and bulbous-stellular trichomes. **Leaves** with petiole 1.7–7.1 cm long, with filiform non-glandular and glandular bulbous-stellular trichomes; 2 pairs of leaflets, the proximal pair relatively smaller than the distal pair, 5.3–13.0 × 2.3–7.0 cm, elliptic, oval or ovate, apex acuminate, emarginate, or retuse, apiculate, base asymmetrical, margin entire, coriaceous, abaxial surface pilose with filiform non-glandular and glandular bulbous-stellular trichomes present along the veins, adaxial surface pubescent with bulbous-stellular and a few filiform non-glandular trichomes, obclavate glandular trichomes sometimes present mainly between the leaflet pairs; secondary veins 9–16 pairs.

FIG. 4. A–B. *Chamaecrista detonsa*. A. Habit. B. Part of inflorescence showing the absence of glandular hispid trichomes. C–D. *Chamaecrista setosa*. C. Habit. D. Part of inflorescence showing the glandular hispid trichomes. Photos A and B by M. F. Simon, and C and D by M. M. T. Cota.

Inflorescence a heterothetic double-raceme, 10–46 flowers per raceme; pedicel 0.8–2.5 cm long with filiform non-glandular and glandular bulbous-stellular trichomes; bracts triangular-subulate, 1–6 × 0.4–1 mm, persistent, with filiform non-glandular and glandular bulbous-stellular trichomes; bracteoles triangular-subulate, ca. 1–2 × 1 mm, persistent, with filiform non-glandular and glandular bulbous-stellular trichomes; sepals elliptical with acute apex, reddish, 0.9–2.0 × 0.2–0.7 cm, with filiform non-glandular and glandular bulbous-stellular trichomes; five petals, obovate, yellow, 0.8–2.0 × 0.4–1.4 cm; stamens 10, anthers 5–7 mm long, with filiform non-glandular trichomes in the sutures, filaments 0.5–1 mm long; ovary ca. 4 mm long, with filiform non-glandular and glandular bulbous-stellular trichomes, style 11 mm long, glabrous or with a few filiform non-glandular trichomes. **Fruits** oblong, 1.4–6.0 × 0.2–0.9 cm, velutinous with filiform non-glandular and glandular bulbous-stellular trichomes; seeds not observed. Figures 1G, 3A–C, 4, 5.

Distribution, Habitat, and Phenology—*Chamaecrista detonsa* is widely distributed in the Brazilian Central plateau, with most collections coming from the Distrito Federal and Goiás state. The species is less frequent in other states including western Bahia, Tocantins, and Mato Grosso (Fig. 5). It occurs in areas of Cerrado at elevations between (300–)350–1000 m. It has been collected with flowers and fruits from April to November, and with only flowers in January and from May to November.

Notes—*Chamaecrista detonsa* can be recognized by its two pairs of leaflets with a pubescent indumentum on their adaxial face, which includes bulbous-stellular glandular trichomes, but not setiform-stellular glandular ones on all structures, and for its large coriaceous elliptic or ovate leaflets, with an acute, acuminate, retuse, or rarely emarginate apex.

The protologues of the synonyms *Cassia chrysotingens* and *C. chrysotingens* var. *obtusata* included a list of syntypes: *Hoehne 5413* and *5414* for *Cassia chrysotingens*, and *Kuhlmann 411* and *412* for *Cassia chrysotingens* var. *obtusata* (Hoehne 1919). Oliveira et al. (2021) listed *Hoehne 5413* as the holotype of *Cassia chrysotingens*, and, thus, inadvertently lectotypified it. Here we make clear that *Hoehne 5413* is a lectotype. Additionally, we designate the specimen *Kuhlmann 411* as the lectotype of *Cassia chrysotingens* var. *obtusata*. This chosen specimen is well preserved with available images in virtual herbaria.

Additional Specimens Examined—**Brazil.** —Bahia: Barreiras, subida para Serra do aeroporto [-45047778, -12099722], 31 Aug 2017, *Rando 1322* (BRBA); —Distrito Federal: Brasília, Bacia do Rio São Bartolomeu [-47707222, -15861944], 04 Jun 1980, *Heringer 4999* (IBGE, NY, US-online image); 09 Jun 1980, *Heringer 5050* (IBGE, NY-online image); 22 Apr 1981, *Heringer, 6819* (IBGE-online image, NY); 19 May 1981, *Heringer 6953* (IBGE, K, MG, MO, US-online image); Brasília, região de Sobradinho dos Melos, 06 Aug 2013, *Giroldo 86* (CEN, HUEFS); Brasília, Sobradinho, 23 Jul 1964, *Duarte 8329* (BRBA, RB); Brasília, ca. 30 km N. E. of Brasília, 14 May

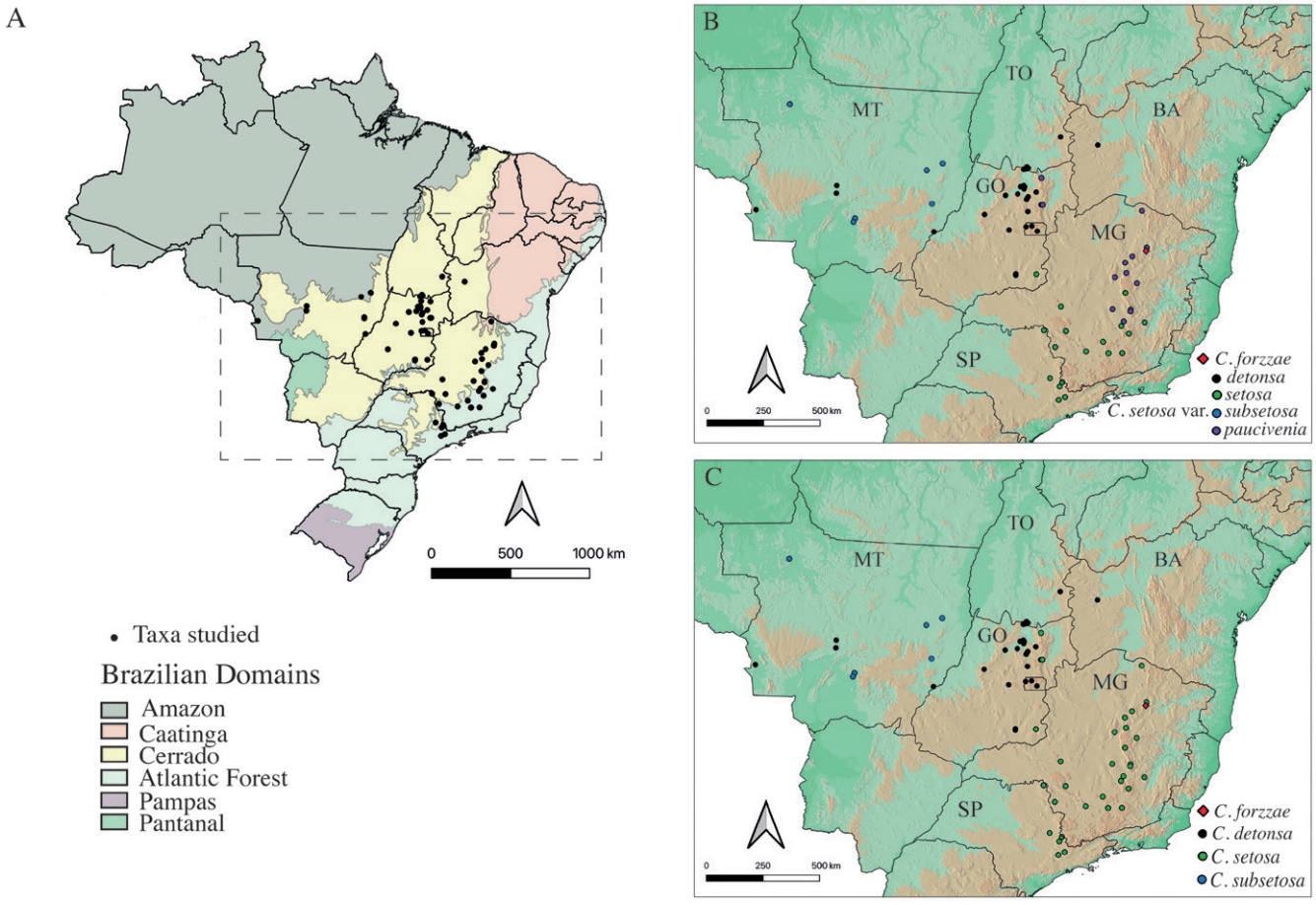

FIG. 5. Distribution of the taxa of series *Setosae* treated in this study. A. Map of Brazil with delimitation of states, phytogeographic domains, and the general distribution of the *C. setosa* species complex together with *C. forzzae*. B. Detailed distribution of *C. forzzae*, together with *C. setosa* and its varieties proposed by Bentham (1870) and Irwin and Barneby (1978). C. Detailed distribution of the newly proposed classification, recognizing *C. forzzae*, *C. detonsa*, *C. subsetosa*, and *C. setosa*. BA = Bahia; GO = Goiás; MG = Minas Gerais; MT = Mato Grosso; MS = Mato Grosso do Sul; SP = São Paulo; TO = Tocantins. On maps B and C, green corresponds to elevations below 600 m and brown to elevations above 600 m.

1966, *Irwin 15842* (MO, NY-online image); Brasilândia, entrada da faz. Alegre [-48.200000, -15.666667], 09 Jul 1991, *Vieira 825* (CEN); Chapada da Contagem, ca. 25 km NE of Brasília [-47941667, -15636944], elev. 1000 m, *Irwin 8042* (NY-online image); —Goiás: Alto Paraíso de Goiás, Chapada dos Veadeiros, 05 Sep 1994, *Mendonça 2103* (IBGE-online image, RB); Alto Paraíso de Goiás, Rodovia GO-239 ca. 6,5 km de São Jorge [-47.758611, -14.152778], elev. 1130 m, 16 Aug 2017, *Bringel 1335* (CEN); 28 Jul 1987, *Neto 319* (NY-online image); Caldas Novas, Parque Estadual da Serra de Caldas Novas [-48.656944, -17.730833], elev. 765 m, 30 Jul 2008, *Moura 284* (CEN); [-48.657222, -17.730833], elev. 768 m, 30 Jul 2008, *Moura 286* (CEN); [-48.662222, -17.795000], 14 Jun 2009, *Moura 586* (CEN); 18 May 2007, *Iglesias s.n.* (CEN); 11 May 2008, *Iglesias 26* (CEN); 30 Jul 2008, *Iglesias 43* (CEN); 30 May 2009, *Iglesias 208* (CEN); Caldas Novas, Rio Piracanjuba, 08 Jul 1976, *Hatschbach* 38740 (MBM); Campinaçu [-48.450000, -13.916667], elev. 480 m, 08 Oct 1995, *Walter 2758* (CEN); Campinorte [-49.104167, -14.295278], elev. 490 m, 23 Jun 1998, *Fonseca 1916* (RB); Colinas do Sul, a margem do Rio Tocantizinho [-48.262500, -13.925556], elev. 470 m, 22 Jun 1999, *Pereira-Silva 4163* (BRBA); Mimoso de Goiás, estrada de terra para Mato Seco [-48.121389, -15.007500], elev. 760 m, 13 Jun 2002, *Fonseca 3493* (EAC-online image, IBGE); Niquelândia, 31 Km da cidade em direção ao povoado de Muquém [-48.178333, -14.475556], elev. 470 m, 08 May 1998, *Silva 3813* (IBGE, NY-online image); Niquelândia, 52 Km do trevo Niquelândia [-48.106944, -14.355556], elev. 469 m, 22 Jul 2007, *Forzza, 4608* (HUEFS); ca. 15 km S. of Niquelândia [elev. 1000m], 21 Jan 1972, *Irwin 34639* (MO, NY-online image); ca. 15 km S. of Niquelândia [elev. 750 m], 23 Jan 1972, *Irwin 34849* (MO, NY-online image, RB); Niquelândia, estrada para Colinas do Sul, [-48.154444, -14.432222], elev. 490 m, 07 May 1998, *Fonseca 1792* (IBGE-online image, RB); Niquelândia, estrada de acesso a barra do rio Bagagem [-48.283333, -14016667], 20 Jul 1995, *Cavalcanti 1473* (CEN, HUEFS); Niquelândia, Fazenda Engenho ca. 11 km de Niquelândia, 27 Jan 1997, *Fonseca 1472* (IBGE-online image, RB); Niquelândia, margem esquerda do Rio Traíras [-48.566667, -14.233333], elev. 470 m, 09 Jun 1992, *Walter 1533* (CEN, RB); Pirenópolis, Morro do Frota [-48.949444, -15.807778], elev. 1090, 13 Jul 2012, *Silva 969* (HUEFS); São João d'Aliança, Fazenda Barra Mata Serena [-47.544167, -14.711389], 18 Sep 1990, *Vaz 782* (IBGE); Serra Dourada, ca. 16 km (straight line) S of Goiás Velho [elev. 950m], 11 May 1973, *Anderson 10108* (MO, NY-online imagens, RB, SP); *Anderson 10080* (NY-online image); Serra Dourada, reserva biológica Serra Dourada [-50033333, -15133333], elev. 500m, 22 Nov 1987, *Skorupa 133* (CEN); Goiás, unspecified municipality, *Burchell s.n.* (K-online image); *Gardner 3127* (K-online image); 27 May 1895, *Glaziou 21001* (P-online image); ca. 83 km. S. E. of Aragarças [-52248611, -15891389] elev. 700 m, 21 Jun 1966, *Irwin 17524* (MO, NY-online image); Estrada que liga Serra da Mesa/Colinas [-48.300000, -13.866667], elev. 510 m, 21 Nov 1991, *Walter 806* (CEN, HUEFS, NY-online image); [-49.104167, -14.295278], elev. 490, 23 Jun 1998, *Fonseca 1916* (NY-online image, RB); —Mato Grosso: São José do Rio Claro [-56516667, -13866667], 14 Jun 1997, *Souza 18195* (ESA); entrada para São José do Rio Claro [-56533333, -14200000] elev. 530 m, 03 Jul 1979, *Becker s.n.* (RB, V-online image); Vila Bela da Santíssima Trindade, Serra do Ricardo Franco [-60071306, -14926694] elev. 668 m, 19 Jun 2012, *Borges 774* (NY-online image, RB); Xavantina, 21 Aug 1967, *Ratter R432* (NY-online image); Xavantina, on road to Caveira de Índio,. 6 km W of Xavantina [-52.333333, -14.750000], 30 Aug 1982, *Ratter R4754* (NY-online image); Xavantina, Pedra Preta, Rod. BR-364, Serra da Petrovina, 16 May 1995, *Hatschbach 62844* (MBM); Xavantina, Rio das Mortes [-52.350000, -14.700000], elev. 450 m, 26 Aug 1968, *Eiten 8361* (NY-online image); *Eiten, 8384* (NY-online image); *Eiten, 8404* (NY-online image); 27 Aug 1968, *Eiten 8429* (NY-online image) Xavantina, Serra Azul, ca. 75 km. S. of Xavantina, 16 Jun 1966, *Irwin 17252* (MO, NY-online image); 17 Jun 1966, *Irwin 17297* (MO, NY-online image) Xavantina, Serra do Roncador [elev. 550 m], 02 Jun 1966, Irwin 16476 (MBM, MO-online image); —Tocantins: Dianópolis, [-46.682500, -11.740556], elev. 621 m, 30 Sep 2003, *Cavalcanti 3443* (CEN); Palmeirópolis, [-48.164167, -13.046389], elev. 206 m, 09 May 2007, *Pereira-Silva 11710* (CEN); [-48.145556, -13.133056], elev. 330 m, 10 May 2007, *Pereira-Silva 11732* (CEN); Palmeirópolis, estrada vicinal em direção ao Rio Tocantins [-48.302222, -13.164722], elev. 360 m, 11 Jul 2007, *Pereira-Silva 11914* (BRBA, CEN); [-48.220833, -13.141389], elev. 370 m. 14 Jun 2008, *Pereira-Silva 13468* (BRBA, CEN); Paraná, Faz. Alegre [-48.099722, -13.104167], elev. 350 m, 15 May 2007, *Pereira-Silva 11818* (BRBA); Unspecified locality. *Burchell 6909* (P-online image); *Burchell 6943* (P-online image).

2. Chamaecrista setosa (Vogel) H.S.Irwin & Barneby. *Cassia setosa* Vogel, Syn. Gen. Cassiae 51. (1837). Type: Brasil. "Brasilia", *Sellow, s.n.* (neotype designated by Irwin and Barneby 1978: K-000555488!).

Chamaecrista setosa var. *paucivenia* (H.S.Irwin & Barneby) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 651 (1982). Type: Brazil. Minas Gerais, Serra do Cipó, 15 June 1962, *Duarte 6547* (holotype: RB-00539496!, isotypes: RB-00168982!, NY-00003940!).

Chamaecrista setosa var. *subsetosa* (Malme) H.S.Irwin & Barneby (1982: 561). ≡ *Cassia setosa* var. *subsetosa* Malme, Ark. Bot. 23A (13): 62, (1931). Type: Brazil. Mato Grosso: Santa Anna da Chapada in "cerrado arenoso", 13 May 1903, *Malme 3321* (holotype: S-10–9066!, isotypes: R-000023122!, S-SR8866!).

Shrubs or subshrubs, 0.5–4 m tall, branches puberulent to villous, glandular-hispid, with filiform non-glandular, glandular bulbous-stellular, and glandular setiform-stellular trichomes, setiform-stellular trichomes golden to reddish in fresh plants. **Stipules** triangular subulate, 1–4 × 0.6–2 mm, persistent or caducous, with filiform non-glandular trichomes and glandular bulbous-stellular. **Leaves** with petiole 2.1–6.5(–8.2) cm length, with filiform non-glandular, setiform-stellular, and glandular bulbous-stellular trichomes; two pairs of leaflets, 2.8–11.5 × 1.6–6.1 cm, lance-ovate to ovate, elliptic, or oblong-ovate, apex acute, obtuse, acuminate, or retuse, emarginate, mucronate, base oblique, asymmetrical, margin entire, revolute or plane with glandular bulbous-stellular trichomes, membranaceous to coriaceous, abaxial surface puberulent, pilose to villous, with non-glandular trichomes, glandular bulbous-stellular trichomes sometimes present along the veins, adaxial surface of leaflets glabrous, puberulent, sparsely pubescent to pubescent or villose, obclavate glandular trichomes sometimes present mainly at the base of the leaflets on the adaxial surface and between leaflet pairs; 8–22 pairs of secondary veins. **Inflorescence** a heterothetic double-raceme, (9–)11–54(–70) flowers per raceme; pedicel 1.0–3.5 cm long, with filiform non-glandular trichomes, setiform-stellular, and glandular bulbous-stellular trichomes; bracts triangular-subulate, 1–7 × 0.5–1 mm, persistent, with non-glandular trichomes and glandular bulbous hairs branched at the base; bracteoles triangular-subulate, ca. 1–2 × 0.5–1 mm, persistent, with filiform non-glandular trichomes and glandular bulbous hairs branched at the base; sepals elliptical with an acute apex, 0.9–2.5 × 0.2–1.0 cm, with filiform non-glandular trichomes, setiform-stellular, and glandular bulbous-stellular trichomes; the five petals obovate, yellow, 1.4–2.0 × 0.3–1.2 cm; stamens 10, anthers 5–7.8 mm long, with filiform non-glandular trichomes in the sutures, filaments 0.5–1.7 mm long; ovary 5–7.5 mm long, with filiform non-glandular trichomes, style 8.3–11 mm long, glabrous. **Fruits** linear-oblong, 2.8–7.5 × 0.4–1.0 cm, velutinous with non-glandular and glandular bulbous-stellular trichomes; seeds 4–10 per fruit, depressed-obovate to depressed-oblong, dark-brown to black. Figures 1D, E, 3D–F, J–L, 4, 5.

Distribution, Habitat, and Phenology—*Chamaecrista setosa* occurs in the states of Goiás, Minas Gerais, and São Paulo (Fig. 5). It grows in areas of Cerrado and campos rupestres vegetation, and in transition areas between the two. Some collections are from the margin of gallery forest. The species occurs at elevations between 600–1420 m and has been collected with flowers throughout most of the year, and in fruit between January and April, and from June to November.

Notes—*Chamaecrista setosa* can be recognized by its two pairs of leaflets and by the glandular-hispid indumentum present on almost all parts of the plant, including branches, petioles, and inflorescences. The glandular-hispid indumentum

is composed of golden to reddish setiform-stellular trichomes (Figs. 2, 3G, J, 4C). The presence or absence of other trichome types on some parts of the plant can vary, as does leaflet shape. These variations were used by Irwin and Barneby (1978) to delimit the varieties *C. setosa* var. *setosa*, *C. setosa* var. *subsetosa*, and *C. setosa* var. *paucivenia*. Here we showed that leaflet shape overlaps in the three varieties. Also, *C. setosa* var. *setosa* and *C. setosa* var. *paucivenia* differ only in indumentum density at the leaflets' adaxial face (puberulent or sparsely pubescent on *C. setosa* var. *setosa*, and pubescent to villous on *C. setosa* var. *paucivenia*). While *C. setosa* var. *subsetosa* differs from the other varieties in the presence of relatively short setiform-stellular trichomes on the branches, petioles, and the inflorescence axis, and the absence of bulbous-stellular trichomes on almost all parts of the plant, it is still not clear if these differences are of taxonomic significance. We therefore agree with the synonymization of *C. setosa* var. *paucivenia* and *C. setosa* var. *subsetosa* under *C. setosa* (Oliveira et al. 2021). Despite this, we reinforce the need for more studies in populations of these varieties, mainly in *C. setosa* var. *subsetosa*, which is known by few collections from a small cerrado area in the Mato Grosso state.

As the holotype of *Chamaecrista setosa* was destroyed at B, Irwin and Barneby (1978) designated a specimen from K as a "neoholotype," terminology not accepted by the ICBN (Turland et al. 2018). If the specimen from K was indeed a duplicate of the holotype, it should be designated a lectotype (Turland et al. 2018). However, it is not possible to be sure of that; almost all of Sellow's specimens have no collection number or any other information but a label simply stating: "Brasilia leg. Sellow." Here, we ratify the specimen selected by Irwin and Barneby (1978) as a neotype (rather than a neoholotype). A Sellow collection at P (specimen 836111) could be an isoneotype, but that cannot be certified, as just discussed.

***Specimens Examined*—Brazil.** —Goiás: Água Fria, Subida para a torre Embratel, 07 Nov 1991, *Hatschbach et. Hatschbach 55901* (MBM); Alto Paraíso, 19 Feb 1975, *Anderson* 11468 (MBM); Cavalcante, Serra do Tombador [-47.529722, -13.539444], elev. 1128 m, 19 Apr 2013, *Cordeiro 4961* (MBM); São João da Aliança [-47.473889, -14.711944], *Hatschbach 60242* (K-online image, MBM, NY-online image); Serra do Facão, ca. 50 km N.E. of Catalão [-47.750000, -17.749722], elev. 900 m, 25 Jan 1970, *Irwin 25363* (NY-online image); Goiás unspecified municipality, 04 Aug 1894, *Glaziou 21002* (P-online image); —Mato Grosso: Aripuanã, arredores do campo de aviação [-58.586111, -10.306389], 15 Jun 1979, *Silva 5000* (NY-online image); Água Boa - Cachimbo road, 85 km from Xavantina, *Hunt 5692* (NY-online image); Chapada dos Guimarães, estrada para água fria [-55.723889, -15.298611], elev. 532 m, 19 Apr 2005, *Queiroz 10460* (HUEFS); Garapu, 10 km. S. of Garapú [-52.566667, -13.200000], elev. 300–400 m, 03 Oct 1964, *Irwin 6631* (MO, NY-online image); Ca. 50 km. S. of Garapu [-52.566667, -13.200000], 29 Sep 1964, *Irwin 6416* (NY-online image); Santa Anna da Chapada (Chapada dos Guimarães), Xavantina, ca. 2 km S of Xavantina [-52.333333, -14.666667], elev. 300–400 m, 25 Sep 1964, *Irwin 6311* (NY-online image); [-51.866667, -12.900000], 26 Jun 1968, *Ratter R1986* (NY-online image); Xavantina, ca. 270 km N of Xavantina [-51.866667, -12.900000], Oct 1967, *Ramos 59* (K, MO-online image, NY-online image, P-online image, RB); Mato Grosso unspecified municipality, 03 Feb 1979, *Silva 4422* (MG-online image); Minas Gerais: Barroso, Mata do Baú [-43974444, -21187778], 30 Apr 2001, *Assis 100* (MBM); Belo Horizonte, Rod. Fernão Dias, 04 Sep 1971, *Hatschbach 26970* (MBM, NY-online image); Belo Horizonte, Serra do Taquaril, 02 Aug 1942, *Magalhães 3242* (US-online image); 22 Jul 1933, *Barreto 6020* (V-online image); 29 Jun 1933, *Barreto 6018* (SP, V-online image); Boa Esperança, Buraco do Monge [-45.560000, -21.116667], 13 May 1989, *Figuereido s.n.* (ESAL 9450); Bocaiúva, Rodovia Bocaiúva [-43.845833, -17.242778], 23 Jul 1998, *Hatschbach 68106* (MBM); Buenópolis, upper slopes of Serra do Cabral [-44.298611, -17.877222], 09 Mar 1970, *Irwin 27238* (NY-online image); Cachoeira do Campo [-43.686667, -20.343611], *Claussen 82* (P-online image); *Clausen 872* (NY-online image); Gouveia [-43.838889, -18.561111], elev. 1416 m, 13 Apr 1963, *Costa 1307* (SPF-online image); Grão Mongol, estrada Porto Mandacaru-Grão Mongol [-42895833, -16.578889], 20 Jul 1985, *Martinelli 11211* (NY-online image, RB); Ibirité, subida da serra Ibirité [-44.017500, -20.008889], 09 Jun 1963, *Magalhães 19254* (NY-image online); Itamirim [-42.886111, -14.772778], 15 Aug 1985, *Gavilanes 1413* (ESAL); Itacambira-Juramento, ca. 9 km de Itacambira [-43.534444, -16.968611], 23 Nov 2002, *Souza 28233* (RB); 08 Jul 1983, *Gavilanes s.n.* (ESAL 00921); Itumirim, 08 Jul 1983, *Gavilanes s.n* (ESAL 00921), 05 Jun 1987, *Carvalho s.n.* (ESAL 7381); Lavras, Jun 1992, *Frieiro s.n.* (ESAL13300); Lavras, 29 Jun 1996, *Martins s.n.* (ESAL14713); Lavras, Parque Quedas do Rio Bonito [-44.585700, -21.195500], 22 Aug 2007, *Domingos 958* (ESAL); 11 Sep 2008, *Domingos 959* (ESAL); *Domingos 960* (ESAL); *Domingos 961* (ESAL); Lavras, Reserva Poço Bonito. 28 Oct 1990, *Gavilanes s.n* (ESAL11213); 14 Sep 1985, *Gavilanes 1454* (ESAL); *Gavilanes 2128* (ESAL); 08 Jun 1991, *Gavilanes 5191* (ESAL); 01 Sep 1989, *Almeida, s.n.* (ESAL09597); 04 Nov 1989, *Almeida 161* (ESAL); Oliveira [-44.820556, -20.701667], 24 Jun 1989, *Gavilanes 4229* (ESAL); Olaria, próximo de Patos, 24 Oct 1950, *Duarte 2962* (BRBA, RB); Paraopeba [-44.403611, -19.272222], 12 Jul 1956, *Heringer 5232* (NY-online image); Santa Luzia [-43.907500, -19.802778], 06 Aug 1936, *Archer 5001* (US-online image); Santana do Riacho, Serra do Cipó [-43.601944, -19.295556], 11 Jan 2008, *Rando 530* (SPF-online image); São Domingos [-42.991667, -19.851389], 19 Sep 1827, *s.c.* (P03084013-online image); São Roque de Minas. Parque Nacional da Serra da Canastra [-46.449722, -20.230833], 27 Jun 1997, *Romero 4312* (HUFU- online image); São Sebastião do Paraíso. Baú de Santa Cruz [-46.921111, -20.928611], 10 May 1945, *Teodoro et Edésio 5129* (ICN-online image); Serra do Salitre, Próximo ao distrito de Catiara, BR-146 [-46.666944, -19.159722], 27 Apr 2017, *Cota 909* (HUEFS); Serra do Cipó, próximo ao Chapéu do Sol, 24 May 1993, *Lombardi 256* (NY-online image); Cardeal Mota, *Sobral* 6262 (RB); Serra do Cipó, ca. 1–2 km acima do Córrego Chapéu de Sol, 03 Jul 1996, *Souza 11592* (ESAL, MBM); 02 Mar 1980, *Furlan CFSC6018* (SP-online image); Estrada para Santana do Riacho, 22 Jun 2009, *Francino 21* (HUEFS, VIC-online image); 07 Jun 1980, *Menezes et al. CFSC6184* (SP-online image); Serra do Cipó, estrada da usina, 01 May 2012, *Kubo 51* (SPF-online image); Serra do Cipó, Jaboticatubas [-43617778, -19367222], 02 Jan 1975, *Hatschbach 29874* (MBM, NY-online image); 26 Jul 1979, *Mantovani 88* (SP-online image); Serra do Cipó, Riacho da Serra, 04 Aug 1956, *Heringer 5267* (NY-online image); São Gonçalo do Rio Preto, Parque Estadual do Rio Preto [-43.334444, -18.133889], elev. 805 m, 28 Mar 2014, *Cota 702* (SPF-online image); Serra do Espinhaço, ca. 17 km SW of Gouveia [-43.797500, -17.691389], elev. 1000–1050 m, 07 Feb 1972, *Anderson 35607* (NY-online image); Minas Gerais, unspecified municipality, 01 Jan 1838, *Claussen 812* (P-online image); *Claussen 872* (P-online image); Jun 1934, *Trade 13416* (RB); 31 Aug 2001, *Souza 26964* (RB); Fazenda do Mato Grande, 26 Apr 1892, *Glaziou 19074* (NY, P-online image); *Damasio 8602* (RB); —São Paulo: Atibaia [-46.489444, -23.120000], 07 Jun 1988, *Meira Neto s.n.* (ESA); Lindóia, Pico do Morro Pelado [-46.610556, -22.457778], 04 Jun 1927, *Hoehne 20680* (SP, US-online image); Mogi-Guaçu, Fazenda Campininha [-47.151944, -22.286389], elev. 600 m, 12 Nov 1959, *Eiten 1480* (US-online image); Pedregulho, Parque Estadual das Furnas do Bom Jesus [-47.419444, -20.197222], elev. 900 m, 24 May 2003, *Sasaki 498* (SPF-online image); Monte Alegre - Amparo, Alto do Morro da Capela, Serra Negra [-46.724722, -22.652778], 07 Apr 1943, *Kuhlmann 633* (K, P-online image); Pedregulho, Parque Estadual das Furnas do Bom Jesus [-47.419444, -20.197222], elev. 900 m, 09 Jul 2003, *Sasaki 629* (SPF, UEC-online image); Perto de Pádua Sales, Reserva Florestal da Fazenda Campininha, 04 Apr 1966, *Mattos 13675* (NY, US-online image); Jundiahy [-46.766944, -23.244722], 04 Apr 1915, *Brade 6316* (NY-online image); Itu, Mar 1834, *Riedel 2182* (NY-online image); São Paulo, unspecified municipality, 05 May 1848, *Regnell 482* (US-online image); 01 Jan 1833, *Gaudichaud 894* (P- online image); Unspecified locality, *Regnell s.n.* (K000835553-online image); *Sellow s.n.* (P00836111-online image, K000555488); *Vauthier* 138 (P-online image); *Weddell 1994* (P-online image); 27 Jul 1905, *Damazio 1793* (RB); *Vauthier 174* (P-online image).

3. *Chamaecrista forzzae* T.Silva, M.Cota & Rando, sp. nov. Type: Brazil. Minas Gerais, Cristália, Morro do Chapéu, base do morro, -42.922500°, -16.722222°, elev. 1240 m, 25 Jun 2014, (fl, fr), *Verdi et al. 7216* (holotype: RB-605524!, isotypes: BRBA-8267!, HUEFS-223650!, SPF-224754!).

Chamaecrista forzzae mostly resembles *Chamaecrista setosa* but differs in the leaflet shape (oblong versus in general ovate in *C. setosa*), and in the apex of leaflets (emarginate versus acute in *C. setosa*). It also differs in the presence of blackened setiform trichomes not stellular at the base, while *C. setosa* bears golden to reddish setiform-stellular trichomes.

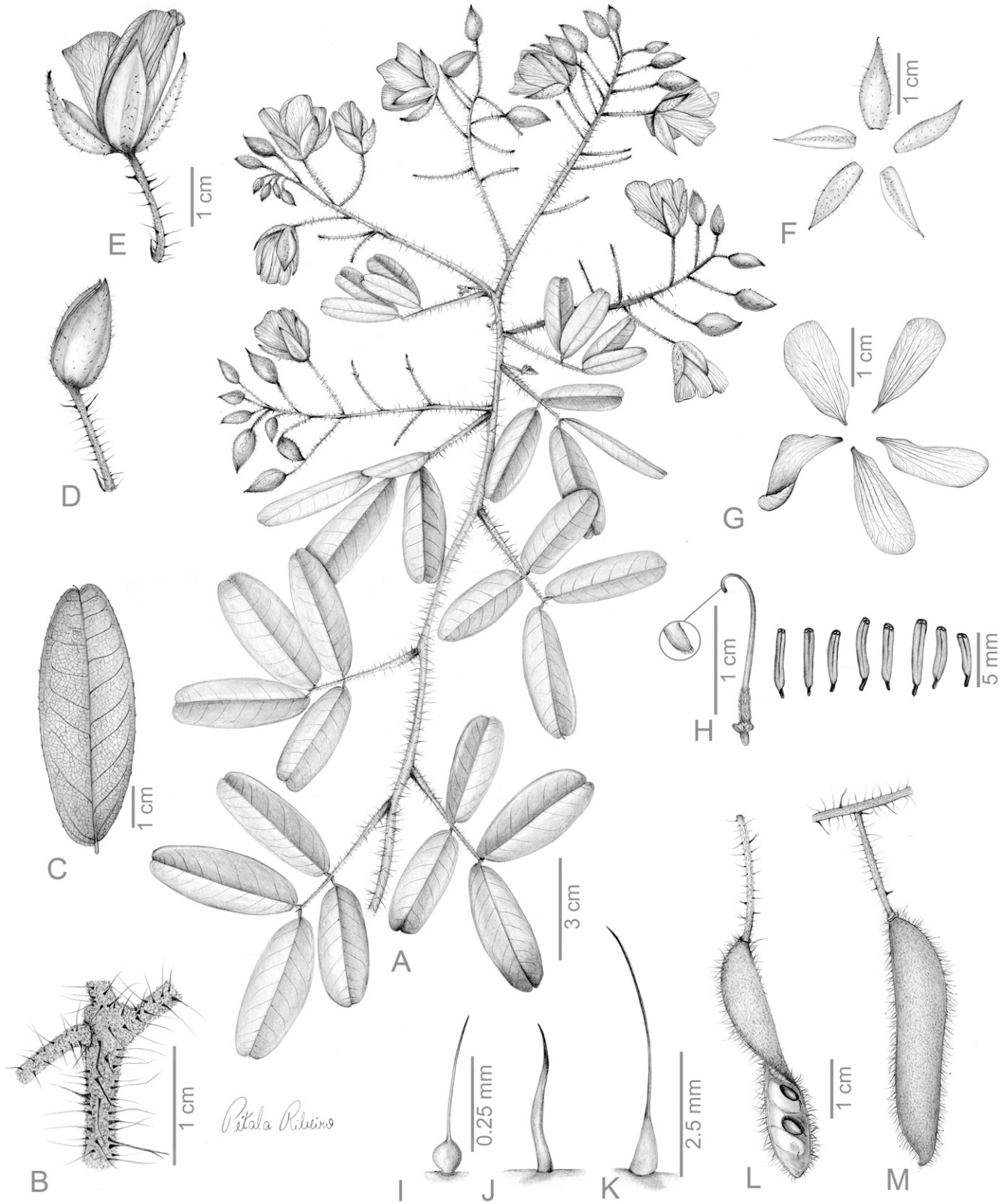

FIG. 6. *Chamaecrista forzzae*. A. Flowering branch. B. Detail of trichomes on the branch. C. Leaflet. D. Flower bud. E. Flower. F. Abaxial face of sepals. G. Petals. H. Stamens and gynoecium with detail of stigma. I–K. Bulbous glandular trichome, filiform non-glandular trichome, and hispid-setose glandular trichome, respectively. L. Valve of fruit showing seeds. M. Fruit. Drawing by Pétala Ribeiro. Habit drawn from *R. de Mello-Silva et al. 490* (SPF). Details of flowers and fruits drawn from *Verdi et al. 7216* (BRBA, RB).

FIG. 7. *Chamaecrista forzzae.* A. Flowering branch. B. Detail of the flower. Photo by J. G. Rando.

A glandular-hispid indumentum also occurs on the sepals, ovary, and fruits of *C. forzzae*, but is absent from these organs in *C. setosa*.

Shrubs, 1–2 m tall, branches pubescent, with filiform non-glandular trichomes, glandular bulbous trichomes, and glandular-hispid with setiform trichomes, setiform trichomes blackened in fresh plants. **Stipules** triangular-subulate, 1.7 × 0.6 mm, with filiform non-glandular and glandular setiform trichomes, caducous. **Leaves** with petiole 2.5–3.5 cm long, with filiform non-glandular, glandular bulbous, and setiform trichomes; 2 pairs of leaflets, the proximal pair smaller than the distal pair; 3.2–6.7 × 1.5–2.5 cm, oblong, apex emarginate, mucronate, or retuse, apiculate, base oblique, asymmetrical, margin entire, revolute, discolorous, coriaceous, adaxial face lustrous, abaxial surface tomentose with filiform non-glandular trichomes, glandular bulbous trichomes present on the main vein and secondary veins, adaxial surface almost glabrous with a few obclavate glandular and filiform trichomes concentrated in the middle of the leaflet, mainly at the base; 9–11 pairs of secondary veins. **Inflorescence** a heterothetic double-raceme, ca. 14 flowers per raceme; pedicel 1.2–1.9 cm long; bracts triangular–subulate, 1–2 × 0.5–1 mm, persistent, with filiform non-glandular and glandular setiform trichomes; bracteoles triangular, ca. 1 × 1 mm, persistent, with filiform non-glandular and glandular setiform trichomes; sepals elliptical with acute apex, abaxial surface reddish, adaxial surface yellowish, 1.0–1.5 × 0.3–0.6 cm, with filiform non-glandular and glandular setiform trichomes; the five petals obovate, yellow, 13–18 × 5–12 mm; stamens 10, anthers 4–7 mm long, with filiform non-glandular trichomes in the sutures, filaments 0.5–1 mm long, glabrous; ovary 4 mm long, with filiform non-glandular and small setiform trichomes, style 13 mm long, glabrous. **Fruits** oblong, 4.0–5.5 × 0.7–1.1 cm, velutinous, with filiform non-glandular and glandular setiform trichomes on the sutures and margins; seeds 4–8 per fruit, depressed-obovoid, brown to dark-brown. Figures 1C, 5, 6, 7.

Distribution, Habitat, and Phenology—Probably endemic to Cristália near Morro do Chapéu, in areas of Cerrado transitioning to campo rupestre vegetation (Fig. 5). It occurs in sandy-rocky soil or among rocks. The species has been collected with flowers and fruits in January and June, and with flowers only in November and June.

Preliminary Conservation Status—*Chamaecrista forzzae* is known from only seven collections in the Morro do Chápeu region, municipality of Cristália, few of which were georeferenced. Based on georeferenced specimens, the extent of occurrence (EOO) was estimated as 9.829 km^2. The estimated occupancy area (AOO) is 12.000 km^2. Thus, this species would be classified as a Critically Endangered (CR) species according to IUCN (2019) criteria B2, biii; C2, ai; and D.

Etymology—*Chamaecrista forzzae* is named in honor of Rafaela Campostrini Forzza, a researcher at the Rio de Janeiro Botanical Garden (JBRJ), curator of the RB herbarium, and coordinator of major initiatives to improve the knowledge of the Brazilian Flora, in particular the List of Flora of Brazil (BFG 2015) and the Brazilian Flora 2020 (Flora e Funga do Brasil 2021).

Notes—*Chamaecrista forzzae* can be recognized by its habit (a shrub, up to 2 m tall), leaves with two pairs of oblong leaflets, which have revolute margin and apex emarginate and mucronate, or retuse and apiculate (the leaflets are also relatively small compared with the other species of *C.* sect. *Absus* ser. *Setosae*). The indumentum of the branches and axis of the inflorescence is similar to that of *C. setosa* and *C. multiseta*, however it can be differentiated from *C. setosa* by its type of glandular trichome: setiform-stellular in *C. setosa*, but not stellular in *C. forzzae*; golden to reddish trichomes in *C. setosa* and blackened in *C. forzzae*, as well as by the fruit indumentum: glandular-hispid in *C. forzzae*, while it is velutinous in *C. setosa*. From *C. multiseta* the new species can be differentiated by the habit, morphology, texture, and color of the leaflets, and absence of trichomes on sepals (see the key above). The fruit of both species have glandular-hispid trichomes, but in *C. forzzae*, the trichomes are concentrated at the margin of the fruit whereas in *C. multiseta* the trichomes occur throughout the fruit or are concentrated at its base.

***Additional Specimens Examined*—Brazil.** —Minas Gerais: Cristália. Morro do Chapéu, [-42.8619°, -16.8006°], 6 Jan 1986, *Mello-Silva* CFCR8931 (K -online image, NY-online image, SPF); [elev. about 1400 m], 14 Jun 1991, *Mello-Silva* 490 (NY-online image, SPF); 13 Sep 1991, MGC 528 (RB); Cristália, estrada para Morro do Chapéu, [-42.925000°, -16.721944°], elev. 1178 m, 13 Apr 2011, *Rando* 983 (SPF); ca. 5 km W em direção ao Morro do Chapéu [-42.862201°, -16.800300°], 02 Nov 1988, *Wanderley* 1448 (NY-online image); [elev. 700–750 m], 02 Nov 1988, *Kral* 75453 (NY-online image).

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Author Contributions

TSS and JGR discovered the new species in herbarium collections; JGR collected it in the field. TSS, JGR, and MMTC chose the name of the new species and made the nomenclatural decisions. AGL and MTF performed the 2D images of the leaflets. TSS and JGR prepared the morphological description, figures, and wrote the first draft of the manuscript. MMTC, LMB, AGL, and MTF revised the manuscript prior to submission.

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