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TAXONOMIC REVISION OF THE GENUS CHAMAECRISTA (FABACEAE) IN ECUADOR



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Bilden på framsidan föreställer: *Chamaecrista nictitans*

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ABSTRACT

A revision of the genus *Chamaecrista* (Leguminosae) in Ecuador is presented. The work is based on morphometric studies of herbarium material and information from the literature and the Internet. The purpose of the study was to get a better knowledge of the distribution, taxonomic status and conservation of *Chamaecrista* in Ecuador. The study recognizes in all six species and several varieties, viz. *Ch. nictitans* with var. *jaliscensis*, var. *disandea*, var. *pilosa*, var. *paraguariensis* and var. *glabrata*, *Ch. glandulosa* with var. *flavicomma* and var. *andicola*, *Ch. absus* and *Ch. rotundifolia*.

Keys, descriptions and illustrations are provided for all taxa.

INTRODUCTION

Background

Chamaecrista is a genus within the legume family (Leguminosae). Species of this genus were previously included in the genus *Cassia*, but were placed in a separate genus by Irwin & Barneby (1976, 1982). The most distinctive character with which to distinguish *Chamaecrista* from *Cassia* is the kind of arrangement of the stamens. *Cassia* flowers have dimorphic stamens, the filaments of three stamens being sigmoidally curved and several times longer than their respective anthers and the rest of the stamens have filaments shorter than the anthers. In *Chamaecrista* flowers the stamens are monomorphic or slightly dimorphic, the filaments being straight and shorter to less than twice as long as the anthers (Irwin & Barneby 1982). There are about 330 species of *Chamaecrista*, the majority of which are distributed in the New World and about 30 species are Asian (Lewis et al. 2005).

According to the Tropicos database (Tropicos 2014), six species of *Chamaecrista* have been recorded from Ecuador. However, the genus has been poorly studied in Ecuador and no separate work focusing on the genus in this part of South America has ever been published. As many new species of flowering plants are discovered from Ecuador each year, it was considered a possibility that there would be more *Chamaecrista* species present than earlier noted. In addition, many species not recorded from Ecuador have been reported from the neighboring countries Peru and Colombia (Tropicos 2014) and since no large geographical barriers exist between Ecuador and these countries it was considered possible that unrecorded species could be recovered among extant herbarium collections.

According to the Tropicos database (Tropicos 2014), there are six species of *Chamaecrista* reported from Peru, whence three of them not reported from Ecuador, and there are 24 species reported from Colombia, 19 of which have not been reported from Ecuador. Although Colombia usually is richer in species than Ecuador, it is difficult to understand why there should be four times more species of *Chamaecrista* in Colombia than in Ecuador, both countries having more or less the same climate and variation in habitats.

The herbariums listed after the type-material of taxa are the following; Natural History Museum, London (BM); Gray Herbarium, Boston (GH); Missouri Botanical Garden, St. Louis (MO); New York Botanical Garden, New York (NY); Smithsonian Institution, Washington DC (US); Geneva Herbarium, Geneve (G); Firenze Herbarium, Firenze (FI); Comarov Institute, Leningrad (LE); Linnean Society, London (LINN) and Herbarium de Humboldt et Bonpland, Museum Historie Natural, Paris (P-HBK).

Aim of study

Using morphological characters obtained from herbarium material a taxonomic revision was carried out on the genus *Chamaecrista* as it occurs in Ecuador. The purpose was to get a wider understanding of the circumscription of the species that occur in the country and record their distributions. The main question was if there are more species in the country than those already recorded, and if so, if they had been referred to the right taxon or not.

Thus, by analyzing new, previously not examined specimens the circumscriptions of current taxonomic units were tested.

The discussion part of the report is included in the results and consequently not presented under a separate heading, since morphological analyses are directly linked to the taxonomic conclusions.

MATERIALS AND METHODS

This study is based on material from the herbaria of the Swedish Museum of Natural History (S), Göteborg University (GB) and Århus University (AAU). In addition, specimen images online were consulted when available.

The herbarium material was first sorted into potential taxonomic units based on visual similarities, followed by more detailed studies of the variation in several morphological parameters. Observations were made using a dissecting microscope and illustrations were prepared with the help of a drawing tube.

After the preliminary classification using easily observed features, observations focused on selection of morphological characters, such as the variation in size, shape, hairiness, venation and colour in selected organs, e.g., pods, stipules and leaflets. The observed data were then analyzed and differences and cohesive similarities were used to group specimens into taxa.

All gathered data were inserted into a matrix, which was used to produce formal taxonomic descriptions. These were then compared with information on extant taxa in the literature, in order to apply the correct names. Keys to species and subspecific taxa were prepared primarily using easily assessed characters.

Collections for which collection localities were available were inserted into the GIS application DIVA-GIS (DIVA-GIS 2014), creating distribution maps of the species areal varieties.

RESULTS AND DISCUSSION

Four species were recognized in the extant herbarium material, all of which identifiable as previously reported taxa. In addition, for two of the species, *Ch. nictitans* and *Ch. glandulosa*, five and two varieties, respectively, were identifiable using the classification of Irwin & Barneby (1982). Two additional species reported from Ecuador in the Tropicos database (Tropicos 2014), *Ch. flexuosa* and *Ch. pilosa*, were not represented in the studied material. These two species are presently known from a single collection each, and their identifications thus still remain uncertain.

Generic description: *Chamaecrista*

Subshrubs or shrublets, i.e., plants often woody at base and herbaceous at top. Leaves with stipules, alternate, glandular or eglandular, paripinnate, the leaflet venation pinnate, the petiole canaliculate, sometimes pulvinate. Flowers slightly zygomorphic, hermaphroditic. Sepals free, lanceolate to narrowly elliptic, often hairy. Corolla yellow or yellowish. Stamens monomorphic, anthers linear, tetradynamous, opening with apical pores or longitudinal slits, filaments shorter than the anthers to twice as long. The ovary hairy, style glabrous, stigma often ciliate-margined. Pod linear, thin and often slightly curved, opening with twisting valves.

Species and sub specific taxa

Key to species and varieties of *Chamaecrista* in Ecuador

- 1a. Stems 4-angulate. 2. *Ch. flexuosa*
- 1b. Stems terete.
- 2b. More than 5 leaflet pairs.
- 3a. Erect, tall subshrubs, unbranched to branched.
- 4a. Pedicel as long as or shorter than the flower. 3. *Ch. nictitans* var. *jalisensis*,
disadena, *paraguariensis* & *glabrata*
- 4b. Pedicel longer than the flower. 4a. *Ch. glandulosa* var. *flavicomma*
- 3b. Richly branched subshrub or prostrate shrublet.
- 5a. Pedicel shorter, up to 6 mm long. 3c. *Ch. nictitans* var. *pilosa*
- 5b. Pedicel long, up to 17 mm long. 4b. *Ch. glandulosa* var. *andicola*
- 2a. Leaves with up to 5 leaflet pairs.
- 6a. Leaves with up to 5 leaflets, the petioles glandular, herb. 1. *Ch. pilosa*
- 6b. Leaves with 1 or 2 pairs of leaflets, the petioles eglandular, subshrub.
- 7a. Leaflets in two pairs, inflorescence a raceme, stamens 5. 5. *Ch. absus*
- 7b. Leaflets in one pair, inflorescence as single flower on a very long pedicel, stamens 7 or 8. 6. *Ch. rotundifolia*

1. *Ch. pilosa* (L.) Greene, Pittonia 4: 28 (1899). --- Fig. 1.

Cassia pilosa L., Syst. ed. 10, 1017 (1759). --- Lectotype: Browne, Jamaica (LINN 538/18. selected by Fawcett & Rendle in Fl. Jamaica 4: 111 (1920).

Chamaecrista pilosa is a poorly known species collected in the Greater Antilles and in northern South America. In Ecuador it has been collected only once, being recorded from the agricultural areas on the lower, western slopes of the Andes (prov. Bolívar).

No collections of this species have been available for this study.

Discussion

The plant is probably not established in Ecuador and probably not native, then it might just be an anthropogenic contamination. Weeds are easily spread with fodder-seeds over far distances.

2. *Ch. flexuosa* (L.) Greene, Pittonia 4: 27 (1899). --- Fig. 1.

Cassia flexuosa L., Sp. Pl. 379 (1753). --- Lectotype: Tab. 23 in Breyn, Exot. Pl. Cent., 64 (1678), selected by Greene in Pittonia 4: 27 (1899).

Chamaecrista flexuosa is distributed in Central America, the West Indies and in the eastern and southern parts of tropical South America (Tropicos 2014). Like *Ch. pilosa* it is known from a single collection made in the southern part of the country (prov. Loja). This is indeed an isolated occurrence since no records of this species are known from Peru and in Colombia it is only known from areas in the northern part of the country, near the Caribbean. The Ecuadorian collections have not been available for this study and its identity is then somewhat uncertain.

As indicated by the specific epithet, *Ch. flexuosa* is recognized by its flexuous branches producing a more or less well developed “zig-zag” growth pattern. In addition, the number of leaflets per leaf is larger than in all other *Chamaecrista* species in Ecuador, and the petiolar glands are sessile.

Discussion

The occurrence of this species in Ecuador might also be a result of contaminated fodder-seeds.



Fig. 1. Herbarium specimen at the Swedish Museum of Natural History of *Chamaecrista flexuosa* (left; Malmé s.n., Brazil) and *Chamaecrista pilosa* (right; Billberg 155a, Panama).

3. *Ch. nictitans* (L.) Moench, Meth. Pl. Hort. Bot. Marburg. 272 (1794). --- Figs. 3-8.

Cassia nictitans L., Sp. Pl. 380 (1753). --- Lectotype: U.S.A., “Habitat in Virginia”, 1737, Hortus Cliffortianus t. 36 (BM, selected by Pennell, Bull Torrey Bot. Club 44: 356 (1917); a sterile branch preserved in Hortus Cliffortianus (BM), marked as “Cassia No. 1”, should perhaps be regarded as belonging to the original material.

Subshrub with pilose stems. Stipules triangular to narrow triangular, oblique and rounded at base, with parallel venation. Leaves narrowly oblong or lanceolate. Petiole mostly with a single gland between petiole base and proximal pair of leaflets. Gland varying in shape and size, from concave to convex, stalked or unstalked. Leaflets slightly angled forward, narrowly oblong, the ultimate pair obovate, aristate at apex, oblique and distinctly pulvinate at base, ciliate-margined to obscurely ciliate-margined, pinnate-veined, with colaters present in the leaflet axils. Inflorescences seemingly emerging from the internodes. Pedicels pilose to villous. Bracts and bracteoles in pairs, narrow triangular to deltoid, parallel-veined, ciliate-margined, with colaters on inside at base. Calyx pilose to villous, margin ciliate or glabrous lobes lanceolate to narrowly elliptic with parallel-venation, often with colaters on inside at base. Corolla yellow, petals parallel-veined, sometimes with colaters on the inside at base. Stamens 5-10, filaments short. Anthers linear, straight or slightly to strongly curved. Pistil light green to black, ovary densely villous to pilose, style curved, stigma with or without prominent ring and often ciliate-margined. Pod pilose, with prominent edge, straight to slightly curved, the style and stigma persistent, often curved downwards. Seeds about 3 mm wide, brown or black.

Chamaecrista nictitans is a variable species with a loose altitudinal range (Fig. 2). It is distributed in eastern U.S.A. and throughout the Neotropics. It was divided into four subspecies (not treated here) and 12 varieties by Irwin & Barneby (1982), whose classification has been used as a point of departure from the outlier of the species in Ecuador. Extant material from Ecuador has been divided in five varieties, of which only one occurs exclusively in the Andes at 1700--2200 m alt. and the remaining grow from the lowlands to higher altitudes.

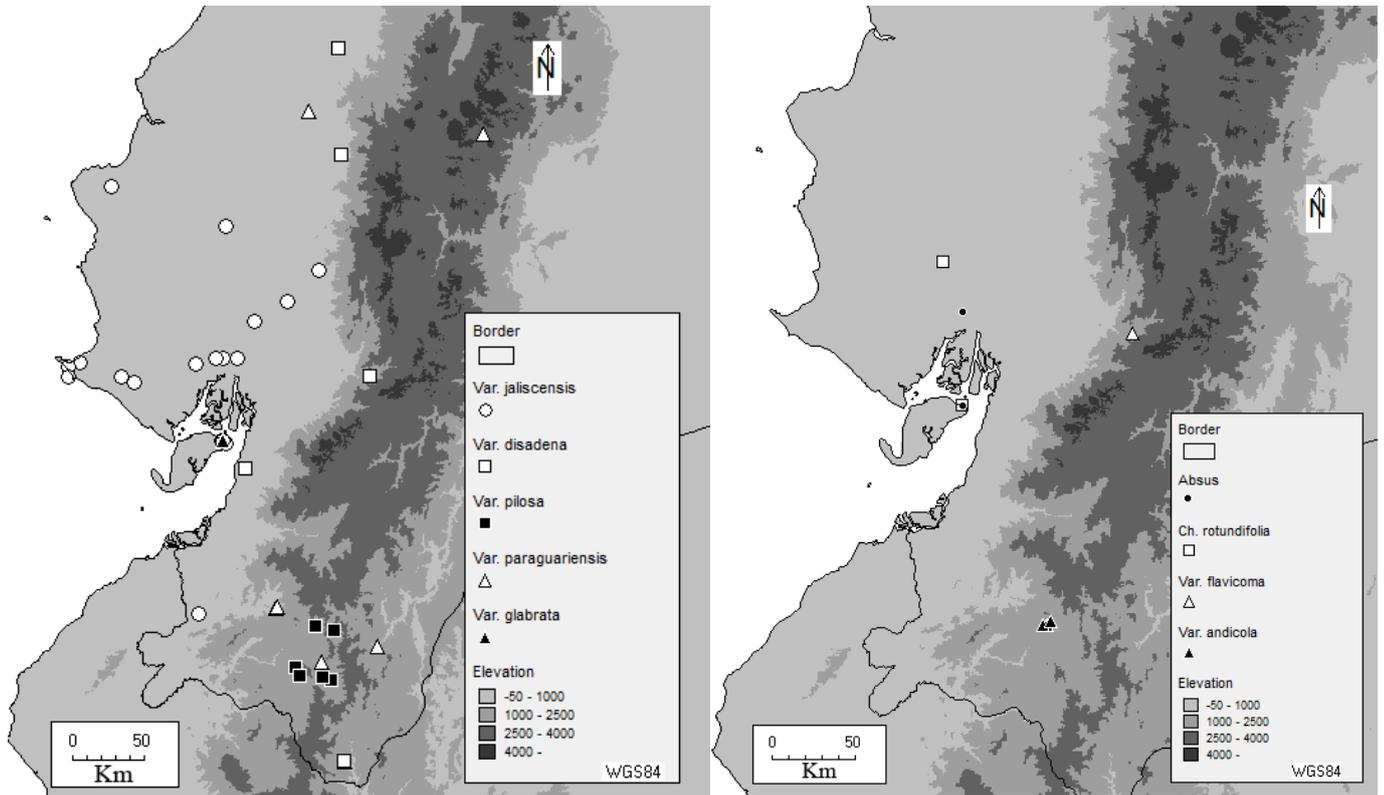


Fig. 2. The distribution of the *Chamaecrista* in Ecuador. To the left *Ch. nictitans* with its varieties, to the right *Ch. glandulosa*, *absus* and *rotundifolia*.

Within *Ch. nictitans* the flower size can vary within and between varieties. Where the two varieties *disadena* and *paraguariensis* coexist at one locality, *disadena* has a single well-developed pod and a larger flower with longer pedicel than has *paraguariensis*, the material of which has only two very small pods despite being a larger and more branched plant.

The characters used to distinguish the varieties of *Ch. nictitans* overlap, as do the number of leaflets per leaf. This makes it sometimes difficult to refer specimens to the correct variety, and a good taxonomic reason to treat these entities as varieties rather than separate species. The only exception is var. *glabrata*, which is easily distinguished in having glabrous parts.

Leaves of individual plants generally have a single gland, but an exception is shown in Fig. 3. This plant grew in a sandy and dry habitat, which is a rather typical environment for *Ch. nictitans*.

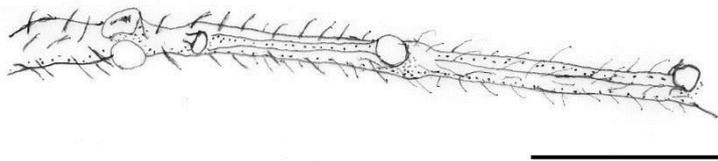


Fig. 3. Petiole of *Chamaecrista nictitans* showing three glands below proximal leaflets, two tack-like in pair and followed by a trumpet-like, and then one gland each at the two proximal leaflets. Holm-Nielsen 22815 (AAU). Scale bar = 5 mm.

Key to the varieties of *Chamaecrista nictitans* in Ecuador

- 1a. Erect subshrub.
 - 2a. Petiole gland stalked and trumpet-like, longer than wide. 3a. var. *jaliscensis*
 - 2b. Petiole gland short, stalked or sessile, about as wide as long.
 - 3a. Pod evenly pilose
 - 4a. Leaves with up to 25 leaflet pairs, each leaflet up to 15 mm long; pedicel up to 12 mm long. 3b. var. *disadena*.
 - 4b. Leaves with up to 36 leaflet pairs, each leaflet up to 12 mm long; pedicel up to 4 mm long. 3d. var. *paraguariensis*
 - 3b. Pod with glabrous valves, the edges ciliate. 3e. var. *glabrata*
- 1b. Prostrate shrublet. 3c. var. *pilosa*

3a. *Ch. nictitans* var. *jaliscensis* (Greenm.) Irwin & Barneby, Mem. New York Bot. Gard. 35: 834 (1982). --- Figs. 4a, 5b, 6b, 7a.

Cassia leptadenia (Greenm.) Cockrell var. *jaliscensis* Greenman, Proc. Amer. Acad. Sci. 41: 239 (1905). --- Lectotype: designated by Irwin & Barneby, Mem. New York Bot. Gard. 35: 834 (1982). Mexico, Jalisco, Guadalajara, Sep 1886, Palmer 23 (GH; isolecotypes MO, NY, US).

For taxonomic synonyms, see Irwin & Barneby, Mem. New York Bot. Gard. 35: 834 (1982)

Subshrub up to 1 m high, erect, unbranched to richly branched. Stipules up to 1.5 cm long, ciliate-margined. Leaves up to 9 cm long. Petiole pilose to villous. Gland stalked, mostly trumpet-like. Leaflets up to 26 pairs in tall plants, proximal pair sometimes pilose, middle pairs 1.2--2.5 cm long, ultimate pair obovate to obscurely obovate. Inflorescences of solitary flowers, sometimes with new flowers emerging from the old pedicel axils, or appearing as compressed racemes. Pedicel 3--7 mm long, pilose to villous. Bracteols opposite or alternate, narrowly triangular to triangular. Calyx margin glabrous, lobes longer than corolla, mostly lanceolate and pilose to villous. Stamens 5--10, with two of the anthers often at least 1.5 times longer than the others. Ovary densely villous, style curved inwards, stigma with or without a prominent margin, this often ciliate-margined. Pod 3.5--5 cm long, up to 1 mm wide. Seeds about 3 mm wide, black, dotted, with emerging root-tip.

Manabí: Montecristo, 150--200 m alt., 80°39'W, 01°04'S, B. Sparre 19872 (S). **Santa Elena:** Santa Elena, 80°51'W, 02°13'S, E. Asplund 5601 (S). E of Punta Carnero, 80°55'W, 02°15'S, L. Holm-Nielsen et al. 2056 (AAU, GB, S). Between Zapotal and Santa Elena, 70 m alt., 80°35'W, 02°19'S, L. Holm-Nielsen et al. 2288 (AAU). Hills NE of Chanduy, 70--200 m alt., 80°30'W, 02°21'S, L. Holm-Nielsen et al. 2162 (AAU, S). Ancón, Río Tambo, 80°55'W, 02°19'S, D. M. Pearsall 1240 (AAU). **Guayas:** Hda Piedad, 5 km N of Balzar, 25 m alt., 79°54'W, 01°20'S, L. Holm-Nielsen & S. Jeppesen 40 (AAU, S). Puná, path from Puná Nueva to Las Pozas, 79°54'W, 02°45'S, J. E. Madsen 63435 (AAU); between Puná Nueva and Zapote, 79°56'W, 02°44'S, J. E. Madsen 63215 (AAU); between Puná Nueva to Estero de Pozo, 79°55'W, 02°44'S, J. E. Madsen 63109

(AAU). Puná, 79°55'W, 02°44'S, N. J. Andersson 189 (S). Guayaquil, 79°55'W, 02°12'S, E. Asplund 5244, 15906 (S). Samborondón, 79°43'W, 01°57'S, K. Mathewson 237A (AAU). Durán, 79°50'W, 02°12'S, E. Asplund 5790 (S, AAU). Cerro Azul, W of Guayaquil, 79°58'W, 02°12'S, Harling 4856 (S). Near Embalse de Chongón, 80°06'W, 02°14'S, B. Ståhl 7566 (S). **Los Ríos:** Río Prieto, 4 km E of Babahoyo, 100 m alt., 79°30'W, 01°49'S, L. Holm-Nielsen et al. 22957 (AAU). Caluma, 250 m alt., 79°18'W, 01°37'S, L. Holm-Nielsen 22893 (AAU). **El Oro:** Puyango petrified forest, 450 m alt., 80°05'W, 03°52'S, B. B. Klitgaard et al. 510 (AAU).

Discussion

This taxon is recognized by its long-stalked foliar glands, as well as by having calyx lobes somewhat longer than the corolla and longer leaflets than the other varieties.

Ecology and distribution

A widely distributed plant, common and widespread in Central America (Irwin & Barneby 1982). In Ecuador, it is common in, and possibly confined to, the lowlands west of the Andes at altitudes of 0–450 m. It grows in dry and light-exposed collections such as roadsides and other disturbed types of vegetation, but has also been recorded from semi-deciduous forests, sandy expenses, stony ravines and secondary forest.

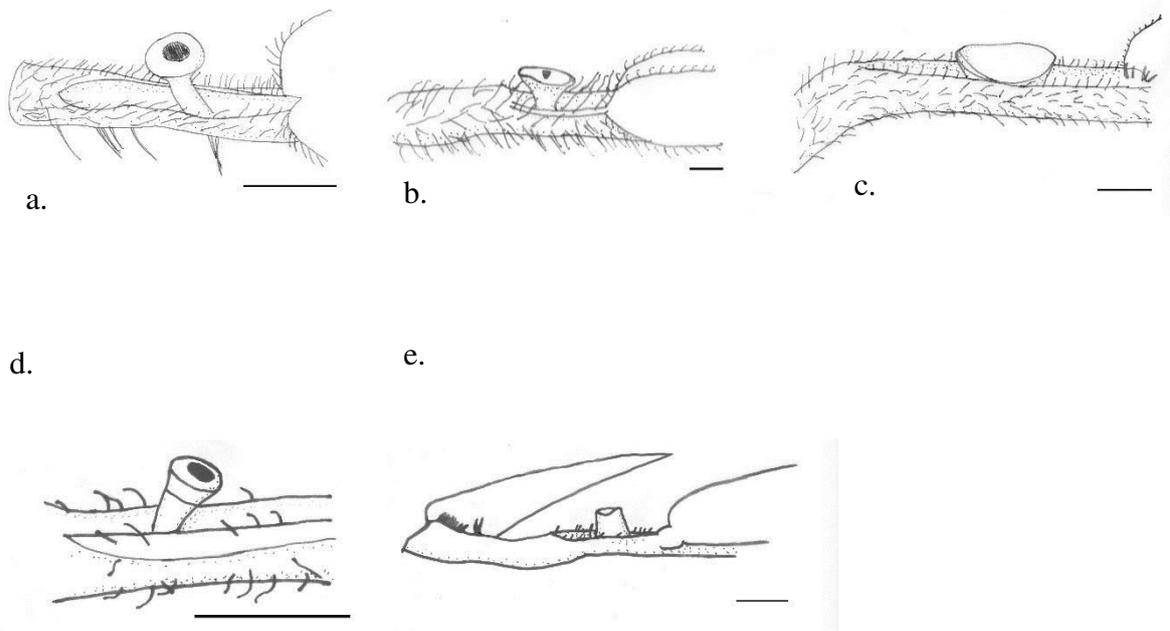


Fig. 4. Gland types on petioles of different varieties of *Chamaecrista nictitans*, (a) the stalked, trumpet-like gland of var. *jaliscensis* (Ståhl 7566), (b) the parasol-like gland of var. *disadena* (Heilborn 20), (c) the tub-like gland of var. *paraguariensis* (Harling 5915), (d) the cone-like gland of var. *pilosa* (Lewis & Huges 3765) and (e) the cylinder-like gland of var. *glabrata* (Andersson s.n.). Scale bars = 1 mm.

3b. *Ch. nictitans* var. *disadena* (Steudel) Irwin & Barneby, Mem. New York Bot. Gard. 35: 826 (1982). --- Figs. 4b, 5a.

Cassia disadena Steudel, Fl. Regensb. 26: 760 (1843). --- Type: Suriname, Hostmann 1179 (G, GH, FI, LE, NY). For taxonomic synonyms, see Irwin & Barneby, Mem. New York Bot. Gard. 35: 826 (1982).

Subshrub up to almost 1 m high, erect and branched. Stems pilose. Stipules triangular, up to 1.7 cm long, ciliate-margined. Leaves narrowly oblong, up to 10 cm long. Gland stalked, about as wide as long, parasol- to trumpet-like. Up to 25 leaflet pairs, middle pairs up to 1.5 cm long, proximal leaflets obovate. Inflorescences emerging from the internode, of solitary flowers, with new flowers emerging from the pedicel axils or as compressed racemes. Pedicel 5--12 mm long, pilose to villous. Bracts and bracteols triangular to narrowly triangular. Calyx green, lobes often shorter than corolla, sometimes slightly longer to longer, lanceolate to narrowly elliptic, irregularly pilose to pilose in the middle, sometimes ciliate-margined. Petals sometimes with colaters at base on inside. Petals may have colaters at base. Stamens 10. Anthers linear, straight or curved, sometimes yellow at base. Pistil brownish to light yellow. Ovary densely pilose, style curved inwards. Stigma ciliate-margined. Pod 4.5--6 cm long, up to 1 mm wide, pilose, dark brown, straight to slightly curved. Seeds 11--17, up to 3 mm wide, brownish.

Guayas: Tenguel, Río Gata, 79°46'W, 02°55'S, O. Heliborn 20 (S). **Pichincha:** Road from San Miquel de los Bancos to La Abundancia, km 39, 500--600 m alt., 79°10'W, 00°10'S, B. B. Klitgaard et al. 654 (AAU).

Cotopaxi: Quevedo-Latacunga road along Río Pílaló, 1200--1300 m alt., 79°09'W, 00°52'S, L. Holm-Nielsen et al. 3163 (S, AAU). **Chimborazo:** Huigra, 78°58'W, 02°19'S, E. Asplund 15453 (S). **Zamora-Chinchipec:** Isimanchi, ca 6 km N of Zumba, 1000--1100 m alt., 79°08'W, 04°50'S, G. Harling & E. Madsen 25227 (AAU).

Discussion

This variety has few, if any, specific characters to distinguish it from the other varieties of *Ch. nictitans*. It is seemingly always branched, unlike var. *jaliscensis* and *paraguariensis*, which are the varieties most similar to var. *disadena* of those present in Ecuador. It is distinguished by having short, stalked glands as broad as high and much longer pedicels than the other varieties.

Ecology and distribution

Present from southern Mexico to eastern Brazil (Irwin & Barneby 1982). It is common and weedy and grows both in shady places, and in roadsides and in dry, open shrub forest at 500--1300 m altitude.



Fig. 5. *Chamaecrista nictitans*. a) Ciliate-margined stigma of var. *disadena* (Asplund 15453) and b) the villous pistil of var. *jaliscensis* (Ståhl 7566). Scale bars = 1 mm.

3c. *Ch. nictitans* var. *pilosa* (Benth.) Irwin & Barneby, Mem. New York Bot. Gard. 35: 829 (1982). --- Fig. 4d.

Cassia riparia Kunth var. *pilosa* Benth. in Mart., Fl. Bras. 15(2): 174 (1870). --- Type: Brazil, Minas Gerais, Lagoa Santa, Warming 207 (NY). For taxonomic synonyms, see Irwin & Barneby, Mem. New York Bot. Gard. 35: 829 (1982).

Short, richly branched, prostrate shrublet. Stems pubescent. Stipules triangular, about 6--7 mm long, ciliate-margined. Leaves narrowly oblong, from 2--3.5 cm long, sometimes glossy green above and dull green below. Petiole pilose. Gland stalked, trumpet- to cone-like. Longest leaves with 15--17 leaflet pairs, proximal leaflet pairs pilose underneath, middle leaflets up to 5 (7.5) mm long, ultimate pairs obovate. Inflorescences of solitary flowers emerging from the internode with new flowers emerging from the pedicel axils. Pedicel 3--6 mm long. Bracts and bracteoles narrowly triangular to triangular. Calyx longer than corolla, pale green, lobes lanceolate to narrowly elliptic, pilose to vaguely pilose along the middle, with colaters inside at base. Corolla yellow, petals with colaters at base on inside. Stamens 9 or 10. Anthers linear. Pistil variable, light yellow to brownish. Ovary densely pilose, style strongly to slightly curved, stigma thin or wide, margin ciliate, sometimes prominent. Pod 1--3.5 cm long, about 0.5 cm wide, brownish with a pale edge, pilose. Seeds 3--12, brownish with darker dots, up to 3 mm wide with emerging root tip.

Loja: El Arenal, ca 4 km W of Gonzanamá on road to Cariamanga, 2000 m alt., 79°27'W, 04°13'S, B. Sparre 16174 (S). Loja, 2200 m alt., 79°12'W, 03°59'S, G. Harling 1527 (S). Vilcabamba--Yangana road, km 7, 2000 m alt., 79°13'W, 04°18'S, G. P. Lewis & C. E. Hughes 3765 (AAU). Gonzanamá--Quilanga road, km 11, 1900 m alt., 79°25'W, 04°16'S, B.B. Klitgaard et al. 460 (AAU). Old road Loja to La Toma, 2 km from junction with new road, ca. 1700 m alt., 79°19'W, 03°57'S, B.B. Klitgaard et al. 118 (AAU). Cerro Campana, 1900 m alt., 79°16'W, 04°17'S, B. Løjtnant et al. 14991 (AAU).

Discussion

This variety is distinguished by its richly branched, prostrate habit, evidently an adaptation to the habitat, growing in arid areas and at rather high altitudes. In addition, it has the smallest leaves of all the varieties of *Ch. nictitans* in Ecuador.

The studied material exhibits some interesting variation in fruit size. Pods are usually 3--3.5 cm long, but early developed pods are about 1 cm long and somewhat later developed pods from 2--3.5 cm long.

Ecology and distribution

The variety is widespread throughout tropical America (Irwin & Barneby 1982). In Ecuador it has only been recorded from the southernmost province of Loja, although similar habitats occur further north. In Loja, it is commonly growing in roadside scrub, grassy hills, deciduous scrub and ravines, at altitudes of 1700--2200 m.

3d. *Ch. nictitans* var. *paraguariensis* (Chodat & Hassler) Irwin & Barneby, Mem. New York Bot. Gard. 35: 815 (1982). --- Fig. 4c, 6a, 7b.

Cassia flavicoma Kunth var. *paraguariensis* Chodat & Hassler, Bull. Herb. Boiss. II, 4: 827 (1904). --- Type: Paraguay, Igatimí, Hassler 5420 (G, NY). For taxonomic synonyms, see Irwin & Barneby, Mem. New York Bot. Gard. 35: 815 (1982).

Subshrub up to 1 m tall, erect, branched or unbranched. Stems very sparsely pubescent at base and pubescent at top. Stipules triangular to narrow triangular, up to 2 cm long, ciliate-margined. Leaves lanceolate, up to 9 cm long. Gland unstalked, wide tub-like or shortly flat, concave or convex. Leaflet pairs 26--36 in long leaves, narrowly obovate, middle pair usually 0.5 cm long, longest middle pairs leaflets up to 1.2 cm long, proximal leaflets obovate. Inflorescences emerging from internodes as solitary flowers with new flowers emerging from

the pedicel axils, or in compressed racemes with 3 or 4 flowers. Pedicel pilose to villous. Bract and bracteols triangular to deltoid. Calyx shorter than corolla, lobes lanceolate to narrowly elliptic, pilose throughout or pilose in the middle only, ciliate-margined or margin glabrous, sometimes with colaters inside at base. Petals with colaters at base on inside. Stamens 10, anthers vaguely to strongly curved, at least 2 of the anthers 1.5 times longer than the others. Pistil brownish to light yellow, ovary densely villous, style sometimes thin, curved inwards. Stigma with or without prominent margin, ciliate-margined or glabrous. First developed pods sometimes about 1 cm long, later pods 3.5--4 cm long, 0.5 mm wide, pilose, slightly curved. Small pods with 1--3 seeds, later pods with 12--15 seeds, brown, sometimes with palid edge. Seeds up to 2.5 mm wide, brown to black, dotted, with emerging root tip.

Los Ríos: Río Palenque, km 56 on road Quevedo--Santo Domingo, 150--220 m alt., 79°22'W, 00°35'S, C. H. Dodson 7137 (AAU). **Imbabura:** Between Guayupe and Peñas Negras, 1050 m alt., 78°14'W, 00°44'N, L. Holm-Nielsen & J. Jaramillo 28964 (AAU). **Loja:** NE of Recinto El Prado on road Portovelo to Loja, 800--1000 m alt., 79°35'W, 03°50'S, G. Harling 27106 (S). Road Malacatos to El Tambo, km 8, 1500 m alt., 79°17'W, 04°11'S, L. Holm-Nielsen 22786 (AAU). Loja--Zamora road, above Guayquichuma, 1300 m alt., 79°34'W, 03°49'S, L. Holm-Nielsen 22815 (AAU). **Zamora-Chinchipec:** Zamora, 1000 m alt., 78°55'W, 04°05'S, G. Harling 5915 (S). Isimanchi, ca 6 km N of Zumba, 1000--1100 m alt., 79°08'W, 04°50'S, G. Harling & E. Madsen 25227 (AAU).

Discussion

Var. *paraguariensis* is most easily recognized by its leaves, which have a broad unstalked gland and many, short leaflets.

Ecology and distribution

It occurs in Central America, and is widespread both north and south of the Amazon basin (Irwin & Barneby 1982). In Ecuador it grows along roadsides, dry open scrub forests, deciduous forests in mountains and steep slopes, and dry scrub at an altitude of 150--1300 m.

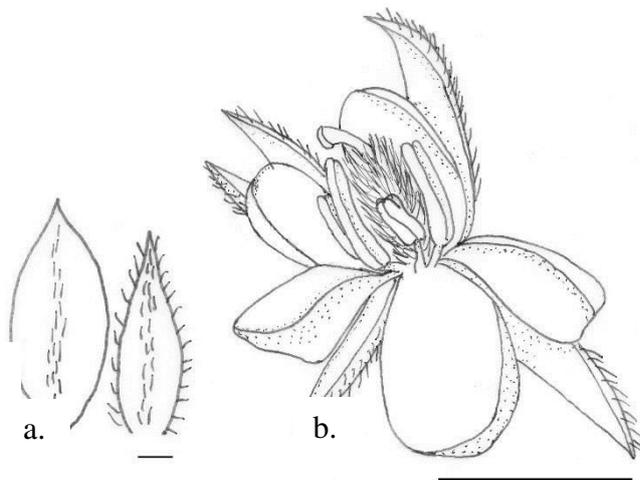
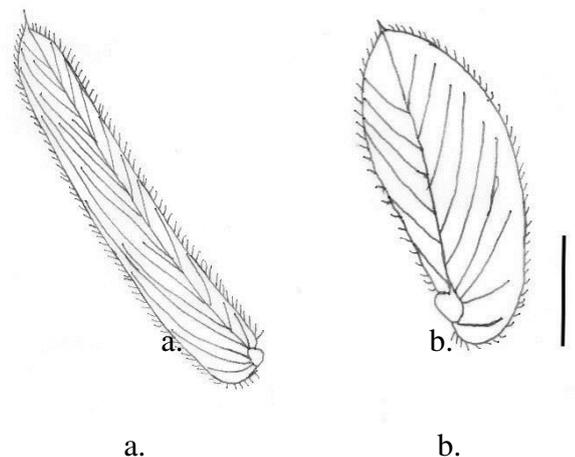


Fig. 6. *Chamaecrista nictitans*, showing a) two sepal morphs of the same flower of var. *paraguariensis* (Harling 5915), and b) flower of var. *jaliscensis* (Ståhl 7566). Scale bars = 1 mm (left) and 5 mm (right).

Fig. 7. *Chamaecrista nictitans*, showing

- a) one of the middle leaflets of var. *jaliscensis* (Ståhl 7566) and
 b) of the ultimate leaflets of var. *paraguariensis* (Harling 5915).
 Scale bars = 1 mm.



3e. *Ch. nictitans* var. *glabrata* (Vogel) Irwin & Barneby, Mem. New York Bot. Gard. 35: 822 (1982). --- Fig. 4e, 8.

Cassia patellaria (Collad.) Irwin & Barneby var. *glabrata* Vogel, Syn. Gen. Cass. 66 (1837). --- Type: Brazil, Para, Siber 8001 (W, B-WILLD; marked as “*Cassia aristata*”). For taxonomic synonyms, see Irwin & Barneby, Mem. New York Bot. Gard. 35: 822 (1982).

Erect, unbranched subshrub. Stems glabrous at base and irregularly and unilaterally pilose at top. Stipules triangular, glabrous. Leaves narrowly oblong. Gland unstalked, cylinder-like. Petiole pilose on channel-margins, otherwise glabrous or the leaf base pilose and flocks of hairs on the lower side near to the leaf base and in the proximal leaflets pairs. Leaflets faintly and minutely ciliate-margined. Petiole unilaterally pubescent and receptacle unevenly pubescent. Bracts and bracteols not ciliate-margined, triangular to deltoid. Calyx as long as or shorter than corolla with colaters inside at base, lobes lanceolate, glabrous, or pilose at the base, and sometimes vaguely pilose in the middle, with no colaters at base, margin glabrous. Petals with colaters inside at base. Stamens 10. Pistil black, ovary flat, puckered, pilose at edges, and as a whorl at base. Anthers vaguely curved. Style thin, straight to slightly curved. Stigma without prominent ring, ciliate-margined. Pod about 3.5 cm long, 0.5 mm wide, black, valves glabrous, edges puckered and pilose, straight to slightly bended with the style persistent. Seeds black, up to 3 mm wide, dotted, with an emerging root tip.

Guayas: Isla Puná, 79°55'W, 02°44'S, N. J. Andersson (S, 2 sheets).

Discussion

Var. *glabrata* differs from the other varieties of *Chamaecrista nictitans* in several distinctive characters, especially the one-sided pubescens present along the stems and pedicels, the glabrous stipule margin, the unevenly pubescent floral axis, and the flattened, wrinkled pistil with pubescent margins.

The above description is based on two small and unbranched specimens and are likely to have the same branching tendency as var. *jaliscensis*. The two taxa have been collected in the same areas; here var. *glabrata* develops less pods per individual and has slightly larger flowers than var. *jaliscensis*. They have about the same size judged from the collections.

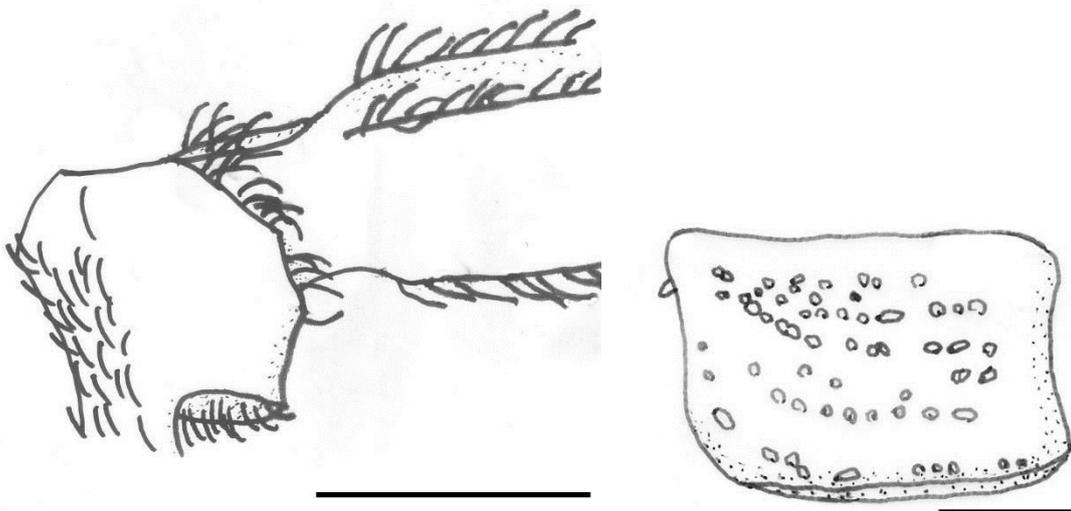


Fig. 8. *Chamaecrista nictitans* var. *glabrata* (Andersson s.n.), showing unitarily pubescent pedicel, the unevenly pubescent receptacle and the flat and puckered ovary with its pilose base and edges (left) and a dotted seed (right). Scale bars = 1 mm.

4. *Ch. glandulosa* (L.) Greene, Pittona 4: 286 (1866).

Cassia glandulosa L., Syst. Nat. ed. 10, 1017 (1759). --- Type: Jamaica, Browne, marked as “*Dialanthera glandulosa*”, 528/32 (LINN).

Tall subshrub or shrublet. Stipules ciliate-margined, parallel-veined, sometimes oblique at base. Petiole pilose canaliculate and glandular. Leaflets oblong to narrowly oblong with an oblique base on a distinct pulvinus, ciliate-margined and pinnate veined, aristate, slightly angled forward, colaters present at base. Pedicel longer than flower, pubescent. Bracts and bracteoles ciliate-margined, parallel-veined, with colaters at base on inside. Sepals lanceolate, parallel-veined, with colaters at base, margin glabrous. Stamens 10, filaments short, anthers linear, two or three at least 1.5 times longer than the others. Pod pubescent.

Discussion

Chamaecrista glandulosa is distinguished by its twin-glands on the petiole between the base and the first leaflet pairs. The two varieties present in Ecuador, var. *flavicom*a and var. *andicola*, differ in many characters and could easily be distinguish at the species level. Before such action is taken a larger material should be studied from the whole distribution area of the species, preferably accompanied by field observation of several populations and genetic analysis.

Distribution

There are four varieties of *Chamaecrista glandulosa* in India and nine in the New World (Irwin & Barneby 1982); two varieties occur in Ecuador.

Key to the varieties of *Chamaecrista glandulosa* in Ecuador

- 1a. Erect, moderately branched subshrub; leaves with up to 18 leaflets pairs, these about 2 cm long.
4a. var. *flavicom*a
- 1b. Plant up to 0.5 m high richly branched; leaves with 10 leaflet pairs, these about 1 cm long.
4b. var. *andicola*

4a. *Ch. glandulosa* var. *flavicom*a (H.B.K.) Irwin & Barneby, Mem. New York Bot. Gard. 35: 788 (1982). --- Fig. 9.

*Cassia flavicom*a H.B.K., Nov. Gen. Sp. 6: 366 (1824). --- Type: Humboldt & Bonpland, 1837 (P-HBK). For taxonomic synonyms, see Irwin & Barneby, Mem. New York Bot. Gard. 35: 788 (1982).

Up to 1 m tall subshrub. Stem erect, branched, glabrous to vaguely pubescent and pubescent at top. Stipules narrowly triangular, 1.2 cm. Leaves narrowly oblong, up to 12.5 cm long. Glands stalked to very shortly stalked, trumpet-like. 1 or 2 between leaf axils and proximal leaflet pairs, also between middle leaflet pairs. Leaflet pairs up to 18 per leaf, narrowly oblong, with an oblique base and distinct pulvinus, ciliate-margined and pinnate-veined, proximal pair pilose, middle leaflets up to 2.2 cm long. Inflorescences compressed racemes from internodes with 3 flowers, which are flowering solitarily. Pedicel 1.5--2 cm long. Bracts and bracteoles narrowly triangular, parallel-veined. Stamens red, anthers straight to strongly curved. Pistil brownish, ovary pilose, style thin and long, stigma discrete with ciliate margin. Pod 4.5--6 cm long, 0.5 mm wide, with a brownish edge, straight to curved with style and stigma persistent and recurved. Seeds 12--14, up to 3.2 mm wide, brownish with a light and thick edge, and a red emerging root tip.

Chimborazo: Río Chánchan valley, near Huigra, 1200--1500 m alt., 78°58'W, 02°19'S, Camp 3004 (S).

Discussion

Chamaecrista glandulosa var. *flavicom*a resembles *Ch. nictitans* var. *jaliscensis* but differs from that taxon by having leaves with fewer leaflets and larger flowers with longer pedicels.

Ecology and distribution

Var. *flavicom*a is widespread in the Andes being distributed from northern Colombia to Bolivia (Irwin & Barneby 1982) and growing in scrub-chaparral at about 1000 m altitude. However, only a single collection from Ecuador has been seen.

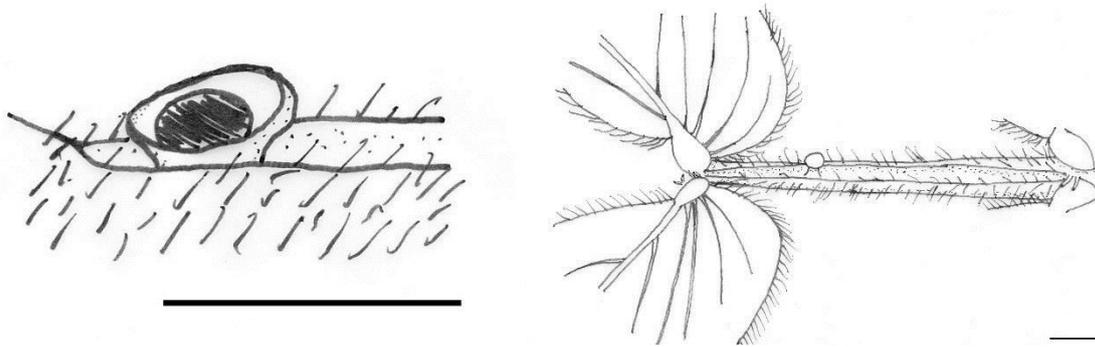


Fig. 9. *Chamaecrista glandulosa* var. *flavicom*a (Camp 3004). Petiolar glands beneath proximal leaflets (left) and between leaflets (right) Scale bars = 1 mm.

4b. *Ch. glandulosa* var. *andicola* Irwin & Barneby, Mem. New York Bot. Gard. 35: 829 (1982). --- Fig. 10.

Type: Peru, Cuzco, 1927, Herrera 1184 (GH, NY). For taxonomic synonyms, see Irwin & Barneby, Mem. New York Bot. Gard. 35: 792 (1982).

Richly branched subshrub or erect shrublet up to 0.5 m tall. Stems dark brown to almost black, glabrous to pubescent at base and pubescent to densely pilose at top. Stipules narrowly triangular to deltoid, but most often triangular. Leaves oblong, 3--3.5 cm long. Glands tack-like to reversely cone-like, occurring solitary between leaf base and proximal pair of leaflets, sometimes also present between middle leaflets. Leaflet pairs up to 10 per leaf, green to bluish green, purplish when juvenile, narrowly oblong to oblong, terminal pairs obovate or elliptic, vaguely to densely pilose underneath and glabrous to densely pilose above colaters present at leaflet pairs, middle pairs 0.8--1.2 cm long, aristate at apex, terminal and subterminal leaflets sometimes emarginate. Inflorescences emerging as solitary flowers from the internodes, followed by new flowers from the pedicel axils. Pedicel up to 1.7 cm long. Bracts and bracteoles in pairs, triangular to deltoid. Calyx green with red tips, or dark red, and slightly longer or sometimes shorter than the corolla. Corolla bright yellow to dark golden-yellow, or yellow. Petals pinnate-veined with colaters on inside at base. Stamens creamy yellow to yellow, bottle-shaped and slightly curved. Pistil mostly light green, ovary densely pilose, style thin and slightly curved, stigma without prominent ring and ciliate-margined. Pod 3.5--5 cm long, pale with brownish edge, slightly curved, style and stigma persistent and recurved, with 8--14 seeds. Seeds not seen.

Loja: Loja--Catamayo road, km 7 at Villonaco, 18 km along track to Cera and Chantaco and onwards to La Toma, 2100 m alt., 79°27'W, 03°58'S, G. P. Lewis & B. B. Klitgaard 3075 (AAU, GB). Catamayo--Chinchas road, 13 km W of Catamayo, 1850 m alt., 79°27'W, 03°58'S, G. P. Lewis & B. B. Klitgaard 2989 (AAU, GB); km 45, 2100 m alt., 79°28'W, 03°58'S, B. B. Klitgaard et al. 394 (AAU). Loja--Catacocha road, ca 2 km W of San Pedro de Bendite, 1900 m alt., 79°26'W, 03°57'S, J. E. Madsen 7889 (AAU).

Discussion

This variety is easily recognized because of its combination of light and dark colours. It is not similar to var. *flavicomis* at first glance, because of its low and richly branching habit. However, it has no noticeable difference in flower morphology.

Ecology and distribution

Can be found in the Andean plateau, the inter-Andean valleys Huancavelica; Ayacucho (north side); Apurimac and Cuzco (center), the center Cajamarca and Ecuador highland (south) and the slope of the Andes (northwest) in Bolivia (Irwin & Barneby 1982). The taxon is common to rare. It grows in pastured *Eucalyptus* plantations, secondary scrub, steep slopes and ravines, roadsides, in dry and calcareous soil at an altitude of 1900-2100 m.

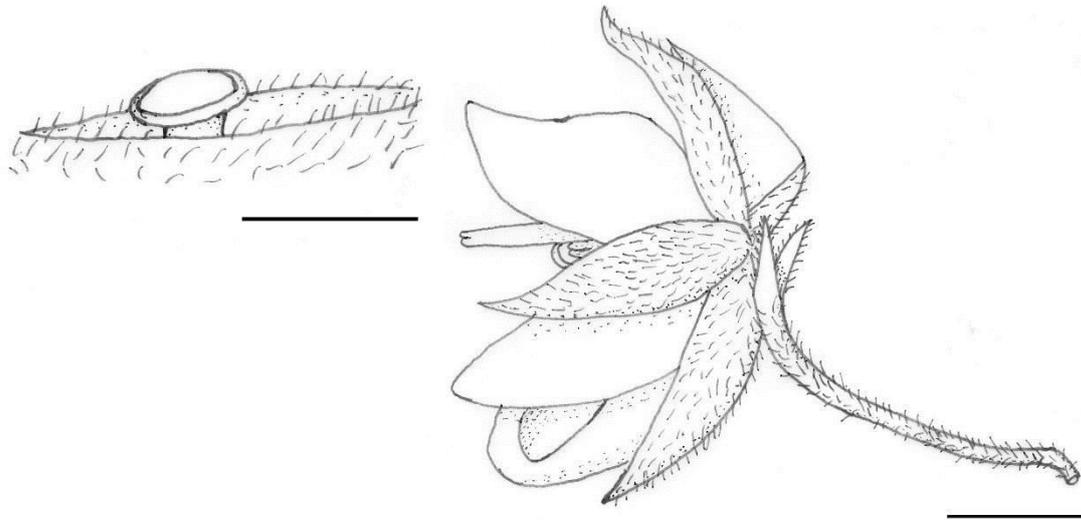


Fig. 10. *Chamaecrista glandulosa* var. *andicola* (Lewis & Klitgaard 3075), showing a tack-like gland near proximal leaflet pairs (left) and flower (right). Scale bars = 1 mm (left) and 5 mm (right).

5. *Ch. absus* (L.) Irwin & Barneby, Mem. New York Bot. Gard. 35: 664 (1982). --- Fig. 11.

Cassia absus L., Sp. Pl. 537 (1753). --- Type: Sri Lanka, Hermann, 1670-1677 (BM). For taxonomic synonyms, see Irwin & Barneby, Mem. New York Bot. Gard. 30: 281 (1978).

Subshrub up to 1 m tall, branched. Stem pale, pilose with simple hairs and setose hairs elevated on large cells. Stipules triangular, ciliate-margined with simple hairs and setose hairs elevated on large cells, pilose on both sides with simple hairs, with colaters at base. Leaves up to 8.5 cm long. Petiole pilose with simple hairs and setose hairs elevated on large cells, canaliculate, without glands. Leaflets obovate, acuminate, pubescent on both sides, pinnately veined, petioluled, without pulvinus, ciliate-margined, with simple hairs and setose hairs, with colaters in leaflet axils. Two leaflet pairs, the proximal pair smaller than ultimate.

Inflorescences as racemes emerging from stem opposite of leaves. Raceme with simple hairs and setose hairs elevated on large cells. Pedicel pilose, 3--4 mm long with simple hairs and setose hairs elevated on large cells. Bracts single, obliquely cordate at base, up to 3 mm long, ciliate-margined with simple hairs and setose hairs elevated on large cells, colaters at base, pubescent on both sides with simple hairs, parallel-veined. Bracteoles triangular, ciliate-margined, pubescent on both sides, less than 1 mm long and alternate, parallel-veined. Calyx pilose with simple hairs and setose hairs elevated on large cells, not ciliate-margined, lobes

lanceolate, mottled, parallel-veined, with bracteoles on inside of base. Corolla yellow to pale yellow-orange. Petals pinnate-veined, lacking colaters. Stamens 5, about the same length, filaments short, anthers linear. Pistil brownish, ovary villous, style curved inward at the top, stigma without prominent ring, ciliate-margined. Pod up to 5.5 cm long, up to 1 mm wide, yellow, pilose with simple hairs and setose hairs elevated on large; brownish cells, apparent edge. Seeds 5--8, up to 5 mm wide, brown or black without emerging root-tip.

Two varieties of *Ch. absus* were recognized by Irwin & Barneby (1982), but only one of these, var. *absus*, occurs in Ecuador.

Guayas: Isla Puná, Puná Nueva to Concordia, 79°55'W, 02°44'S, J. E. Madsen 63579 (AAU); Isla Puná, N. J. Andersson 191 (S). Guayaquil, Cerro Santa Ana, 79°55'W, 02°12'S, E. Asplund 15884 (S).

Discussion

This is the only species of *Chamaecrista* in Ecuador with a true raceme. It is also recognized from the other species in being setose on vegetative and reproductive parts, and by having a single bract per leaf and flower.

Ecology and distribution

Chamaecrista absus is pantropical and probably native to Africa, India or both (Irwin & Barneby 1976). It grows in dense, disturbed vegetation and in semi-deciduous forest.

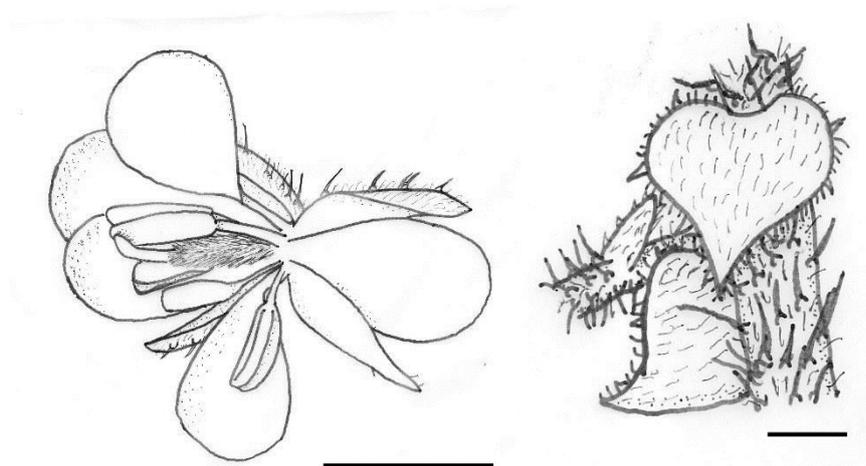


Fig. 11 *Chamaecrista absus* (Asplund 15884), showing flower (left) and part of young raceme with the single bracts (right). Scale bar = 5 mm (left) and 1 mm (right).

6. *Ch. rotundifolia* (Pers.) Greene Pittona 4:31 (1899). --- Fig. 12.

Cassia rotundifolia var. *grandiflora* Benth. in Martius, Fl. 15(2): 162 (1870). --- Type: Bahia, Amanduá, Blanchet 3844 (BM). For taxonomic synonyms, see Irwin & Barneby, Mem. New York Bot. Gard. 35: 733 (1982).

Tall, erect, branched subshrub with a pale and villous stem. Stipules triangular with cordate leaf base and sometimes also oblique, ciliate-margined with longer and shorter hairs, parallel-veined. Leaves up to 6 cm long. Petiole pilose canaliculate, eglandular. Leaves with a single pair of leaflets. These are pinnate-veined, ciliate-margined, obovate, apex aristate, oblique with a distinct pulvinus. Colaters present in leaflet axils, colaters long and hair-like. Leaflets up to 5.5 cm long. Inflorescences axillary from leaf base as solitary flowers with new flowers emerging from pedicel axils. Pedicel up to 5.5 cm long, villous, receptacle with a whorl of long hairs. Bracts and bracteoles in pairs, narrowly triangular and ciliate-margined. Bracts without colaters at base. Bracteoles alternate, with colaters clustered at one side of leaf base

and flocks of long hairs under the leaf base. Calyx villous, not ciliate-margined or longer than corolla. Lobes lanceolate with parallel venation and no colaters at base. Corolla yellow, petal without colaters at base. Stamens 7 or 8, filaments short, anthers linear, two shorter and the rest about twice as long and bottle-shaped. Pistil brownish to yellow, ovary pilose, style thin and long, stigma without prominent ring, ciliate-margined. Pod 3.8--4.5 cm long, 0.5 cm wide, pilose and slightly curved, style and stigma persistent, very short, pointing downward. Seeds 12--15, yellowish, up to 4 mm wide and with a transparent root-tip.

Two varieties have been recognized (Irwin & Barneby 1982), but only var. *grandiflora* can be recognized in Ecuador.

Guayas: Noból, 80°02'W, 01°55'S, E. Asplund 16677 (S). Isla Puná, 79°55'W, 02°44'S, N. J Andersson 190 (S, many sheets).

Discussion

Chamaecrista rotundifolia is readily recognized in being villous and by having eglandular, long-petioled leaves with only two leaflets. In addition, the pedicel is very long, much longer than the flower it supports.

Ecology and distribution

Var. *grandiflora* is distributed from Honduras to Argentina (Irwin & Barneby 1982). Growing in places like savanna.

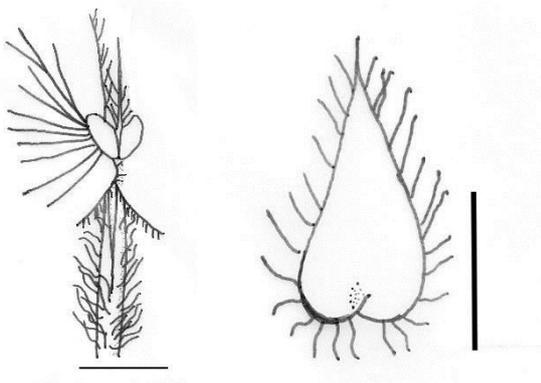


Fig. 12 *Chamaecrista rotundifolia* (Andersson 190), showing canaliculate petiole (left) and stipule with a cordate leaf base (right). Scale bars = 5 mm (left) and 1 mm (right).

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SAMMANFATTNING

En taxonomisk revision av släktet *Chamaecrista* (Fabaceae) i Ecuador

Denna studie är utförd för att få kännedom om artavgränsning och utbredning av släktet *Chamaecrista* i Ecuador. Släktet är dåligt känt i detta område och rapporten ska ge oss en bättre förståelse för vilka arter som finns där och hur väl deras taxonomiska status motsvarar äldre klassifikationer med hjälp av analyser av tillgängliga samlingar i nordiska herbarier.

Studien är baserad på herbariematerial från Naturhistoriska riksmuseet, Stockholm, Herbarium GB, Göteborgs universitet och Herbarium Jutlandicum, Århus universitet. Kompletterande uppgifter hämtades från Internet och litteraturen.

Herbarieexemplaren sorterades först i vad som förmodades vara avgränsbara taxa, och studerades sedan närmare med hjälp av ett stereomikroskop. Efter att ha studerats under förstoring och morfometriska data insamlats, sorterades materialet till sina nya tillhörigheter. Insamlade data, främst mätdata, låg sedan som underlag för de formella beskrivningarna samt bestämningsnycklar.

Information om typmaterial hämtades från Internet och originalpublikationer.

Chamaecrista är ett släkte med huvudsakligen halvbuskar, d.v.s. de har en vedartad, flerårig bas och örtartade nyare delar som kan torka tillbaka från ett år till ett annat. Bladen är sammansatta och parbladiga. Alla arter har en fåra på bladskaftets ovensida och många arter har skaftade eller sessila glandler på bladskaftet och på bladrachis. Blommorna är svagt zygomorfa och kronan är färgad i olika nyanser av gul. Ståndarknapparna är liniära och fruktämnet hårigt.

Chamaecrista nictitans är en mycket variabel art med ett stort antal av varieteter. Variationen är speciellt påtaglig i bladkaraktärer, t.ex. när det gäller glandel-struktur och antal småblad. Arten växer torrt och soligt, och är ofta ogräsartad.

Var. *jaliscensis*, som dominerar i låglandet väster om Anderna, känns igen på sina långskaftade glandler. Den urskiljer sig även genom sitt foder, som sträcker sig något över kronan, och genom längre småblad än hos de andra varieteterna.

Var. *disadena* är den mest svårbestämda av de observerade varieteterna då den inte har några tydliga, specifika karaktärer. De skaftade glandlerna är dock ungefär lika långa som breda och oftast är blomskaftet lite längre än hos de andra varieteterna.

Var. *pilosa* är ett litet ris som växer på hög höjd i Anderna. Den känns igen på att den är rikligt grenad och har mycket mindre blad än de andra varieteterna.

Var. *paraguariensis* är lätt igenkännlig på sina oskaftade, ofta urgröpta, glandler. Den har även mycket långa blad med många, korta småblad.

Var. *glabrata* är lätt att avgränsa tack vare flera säregna morfologiska karaktärer, som hårranden på stjälken, den hårlösa stipelkanten, hårranden på blomskaftet med den ojämt håriga blomaxeln och den platta, veckade och hårkantade pistillen. Eftersom var. *jaliscensis* är lika kortvuxen som var. *glabrata*, i ett av herbariearken där båda varieteterna var närvarande, är det möjligt att var. *glabrata* kan växa sig lika stor som *jaliscensis* i gynnsam miljö.

Chamaecrista glandulosa särskiljs främst på sina dubbla glandler mellan bladbasen och de första småbladsparen och på det långa blomskaftet. De två varieteterna som finns i Ecuador är lätta att skilja åt och skulle lätt kunna ges artrang. Detta eftersom var. *flavicomma* är en upprätt växt med långsträckta grenar medan var. *andicola* är ett kort och mycket grenat ris.

En storväxt *Ch. nictitans* var. *jalescensis* och *Ch. glandulosa* var. *flavicomma* kan vara svåra att skilja åt då båda är höga halvbuskar med många, ovala och ca. två cm långa småblad. Var. *flavicomma* har färre bladpar på längre blad och mycket längre blomskaft än var. *jalescensis*.

Chamaecrista absus är den enda arten i Ecuador av släktet med blommor i en äkta klase. Växten är borsthårig, har endast en brakté per blomskaft och har blad med fyra, skaftade småblad.

Chamaecrista rotundifolia är en långhårig växt med blad med två stora småblad och blommor med ett mycket långt blomskaft.