A Systematic Study of the Colombian Species of the Genus Calea (Compositae)

John Francis Fruski
Louisiana State University and Agricultural and Mechanical College

Follow this and additional works at: https://repository.lsu.edu/gradschool_disstheses

Recommended Citation
https://repository.lsu.edu/gradschool_disstheses/8371

This Thesis is brought to you for free and open access by the Graduate School at LSU Scholarly Repository. It has been accepted for inclusion in LSU Historical Dissertations and Theses by an authorized administrator of LSU Scholarly Repository. For more information, please contact gradtd@lsu.edu.
A SYSTEMATIC STUDY OF THE COLOMBIAN SPECIES OF THE GENUS CALEA (COMPOSITAE)

A THESIS

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Master of Science in

The Department of Botany

John Francis Pruski
B.S., Louisiana State University, 1978
August, 1982.
MANUSCRIPT THESES

Unpublished theses submitted for the Master's and Doctor's Degrees and deposited in the Louisiana State University Library are available for inspection. Use of any thesis is limited by the rights of the author. Bibliographical references may be noted, but passages may not be copied unless the author has given permission. Credit must be given in subsequent written or published work.

A Library which borrows this thesis for use by its clientele is expected to make sure that the borrower is aware of the above restrictions.

LOUISIANA STATE UNIVERSITY LIBRARY
ACKNOWLEDGMENTS

I would like to thank Dr. Lowell E. Urbatsch for his patience, critical review of the manuscript, and his permission to examine hundreds of specimens on loan to him. Appreciation is extended to Drs. Meredith Blackwell, Russell L. Chapman, Bernard Lowy, and Shirley C. Tucker for their helpful criticism and advice during both research and preparation of the manuscript. The help of Mrs. Carmen Elena Flores de Fernandez, Dr. Walter S. Judd, Dr. Bruce Kirchoff, Mr. Rodney Roberts, and Mr. Jim Wussow, who unselfishly gave their time and advice during preparation of the manuscript, is gratefully acknowledged.

I also wish to express thanks to the Department of Botany at LSU for providing space and facilities, without which completion of the manuscript would have been impossible. Field work was financially supported, in part, by NSF Grant DEB 78-04265. The curators of the following herbaria, from which loans were secured are acknowledged: A, BM, F, GH, K, LL, LIL, MICH, MSC, MO, NY, P, TEX, UC, US, and VEN.

My most sincere thanks is extended to my friend and colleague, Dr. Julian Steyermark for his inspiration and encouragement, and to my wife, Kristin Malin, for typing the manuscript, providing line drawings of all maps and illustrations, and for faith, understanding and fortitude throughout my undergraduate and graduate career.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>ii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>x</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>TAXONOMIC HISTORY</td>
<td>3</td>
</tr>
<tr>
<td>MATERIALS AND METHODS</td>
<td>11</td>
</tr>
<tr>
<td>RESULTS AND DISCUSSION</td>
<td>13</td>
</tr>
<tr>
<td>TAXONOMIC TREATMENT</td>
<td>30</td>
</tr>
<tr>
<td>EXCLUDED TAXA</td>
<td>103</td>
</tr>
<tr>
<td>LITERATURE CITED</td>
<td>106</td>
</tr>
<tr>
<td>FIGURES</td>
<td>115</td>
</tr>
<tr>
<td>TABLE 1</td>
<td>177</td>
</tr>
<tr>
<td>VITA</td>
<td>179</td>
</tr>
</tbody>
</table>
9. *Galea peruviana*. Lower surface of an outer phyllary showing an areole and tomentose pubescence. SEM micrograph. X 68. .......................... 118

10. *Galea prunifolia*. Involucre showing herbaceous outer phyllaries and scarious inner ones.
    SEM micrograph. X 20. ................................. 118

11. *Galea subcordata*. Upper ligule surface showing nearly isodiametric epidermal cells.
    SEM micrograph. X 720. ............................... 118

12. *Galea septuplinervia*. Abaxial anther appendage apices showing glands. SEM micrograph. X 72. ............. 118

13. *Galea solidaginea*. Bifid style and branches showing a pair of stigmatic lines, rounded or acute apices and hispidulous collecting hairs. SEM micrograph. X 63. .......................... 118

    SEM micrograph. X 54. ................................. 118


<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. <strong>Galea barrosoana</strong>. Achene with elliptic pappus squamellae. SEM micrograph. X 23.</td>
<td>120</td>
</tr>
<tr>
<td>18. <strong>Galea septuplinervia</strong>. Pappus of linear-lanceolate scales. SEM micrograph. X 18.5.</td>
<td>120</td>
</tr>
<tr>
<td>19. <strong>Galea subcordata</strong>. Achene showing bifid hairs. SEM micrograph. X 185.</td>
<td>120</td>
</tr>
<tr>
<td>20. <strong>Galea septuplinervia</strong>. Pollen grain. SEM micrograph. X 1850.</td>
<td>120</td>
</tr>
<tr>
<td>21. <strong>Galea subcordata</strong>. Transverse section of leaf through the midrib showing midvein, collenchymatous bundle sheath extensions, homogeneous mesophyll, and bulbous basal subsidiary cells of short hair (•*•). LM photograph. X 250.</td>
<td>122</td>
</tr>
<tr>
<td>22. <strong>Galea prunifolia</strong>. Transverse section of leaf through the midrib showing xylem arc and phloem. LM photograph. X 400.</td>
<td>122</td>
</tr>
<tr>
<td>23. <strong>Galea prunifolia</strong>. Transverse section of leaf mesophyll showing resin duct (➡), palisade mesophyll (P), and spongy mesophyll (S). LM photograph. X 250.</td>
<td>122</td>
</tr>
<tr>
<td>24. <strong>Galea septuplinervia</strong>. Portion of cleared leaf showing a major lateral rib characteristic of campylodromous venation, and veins terminating within areoles. LM photograph. X 25.</td>
<td>122</td>
</tr>
</tbody>
</table>
Figure 25. *Galea prunifolia*. Epidermis of cleared leaf showing the anomocytic stomata configuration. LM photograph. X 400. .......................... 122

26-31. Ray corollas, palaea, and disk corollas of species of *Galea* .......................... 124

32-39. Paleae and disk corollas of species of *Galea* .......... 126


41. Distribution of *Galea abelioides* S. F. Blake, *Galea perijaensis* Cuatr., *Galea tolimana* Hieron. and *Galea yuruparina* Cuatr. ....................... 130

42. Distribution of *Galea berteriana* DC., *Galea solidaginea* H.B.K. var. *solidaginea* and *Galea solidaginea* H.B.K. var. *deltophylla* (Cowan) Pruski and Urbatsch. ......................... 132

43. Distribution of *Galea prunifolia* H.B.K. ......................... 134
<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>44. Distribution of <em>Calea perimbricata</em> Cuatr. and <em>Calea sessiliflora</em> Less.</td>
<td>136</td>
</tr>
<tr>
<td>45. Distribution of <em>Calea angosturana</em> Hieron., <em>Calea colombiana</em> Gand. and <em>Calea septuplinervia</em> Hieron.</td>
<td>138</td>
</tr>
<tr>
<td>46. ISOTYPE of <em>Calea peruviana</em> (H.B.K.) Benth. ex S. F. Blake, Bonpland s. n. (B).</td>
<td>140</td>
</tr>
<tr>
<td>47. ISOLECTOTYPE of <em>Calea peruviana</em> (H.B.K.) Benth. ex S. F. Blake var. <em>tolimensis</em> (Hieron.) Pruski and Urbatsch, <em>Triana</em> 1414 (NY).</td>
<td>142</td>
</tr>
<tr>
<td>48. HOLOTYPE of <em>Calea saxatilis</em> Cuatr., <em>Cuatrecasas</em> 13429 (F).</td>
<td>144</td>
</tr>
<tr>
<td>49. HOLOTYPE of <em>Calea subcordata</em> S. F. Blake, <em>Killip and Smith</em> 19808 (US).</td>
<td>146</td>
</tr>
<tr>
<td>50. HOLOTYPE of <em>Calea perijaensis</em> Cuatr., <em>Haught</em> 4525 (US).</td>
<td>148</td>
</tr>
<tr>
<td>51. ISOTYPE of <em>Calea tolimana</em> Hieron., <em>Lehmann</em> 7497 (K).</td>
<td>150</td>
</tr>
<tr>
<td>52. HOLOTYPE of <em>Calea gargantae</em> Cuatr., <em>Garganta-Fabrega</em> 838 (F).</td>
<td>152</td>
</tr>
<tr>
<td>54. HOLOTYPE of <em>Calea perimbricata</em> Cuatr., <em>Haught</em> 6024 (US)...</td>
<td>156</td>
</tr>
<tr>
<td>Figure</td>
<td>Page</td>
</tr>
<tr>
<td>--------</td>
<td>------</td>
</tr>
</tbody>
</table>
| 55. HOLOTYPE of *Calea berteriana* DC.,  
*Bertero* s. n. (G-DC). | 158 |
| 56. ISOTYPE of *Calea prunifolia* H.B.K.,  
*Bonpland* s. n. (P). | 160 |
| 57. HOLOTYPE of *Calea abelioides* S. F. Blake,  
*Tate* 768 (NY). | 162 |
| 58. ISOTYPE of *Calea solidaginea* H.B.K. var.  
*solidaginea*, *Bonpland* 619 (B). | 164 |
| 59. HOLOTYPE of *Calea solidaginea* H.B.K. var.  
*deltophylla* (Cowan) *Pruski* and *Urbatsch*,  
*Wilson* and *Brown* 82 (NY). | 166 |
| 60. ISOTYPE of *Calea sessiliflora* Less.,  
*Bonpland* 44 (P). | 168 |
| 61. HOLOTYPE of *Calea colombiana* Gand.,  
*Lehmann* 4885 (K). | 170 |
| 62. ISOTYPE of *Calea angosturana* Hieron.,  
*Lehmann* 7479 (K). | 172 |
| 63. ISOTYPE of *Calea septuplinervia* Hieron.,  
*Triana* 1416 (K). | 174 |
| 64. ISOTYPE of *Calea yuruparina* Cuatr.,  
*Cuatrecasas* 7303 (F). | 176 |
ABSTRACT

Calea is a shrubby genus of Compositae (Heliantheae), which contains approximately one hundred species. The genus commonly occurs throughout the Neotropics in open, disturbed montane regions. A treatment has never been provided for the Colombian species of the genus. As a result of this study, seventeen species are recognized from over forty names of Calea attributed to Colombia. In addition, a key to species, descriptions, photographs, geographic distribution maps, and discussion of related species are provided. Also, floral illustrations are given for 13 species. New chromosome counts are given for six taxa of Calea, three of which occur in Colombia. Polyploidy in Calea (sensu stricto) and observations on leaf anatomy in Calea are reported for the first time.
INTRODUCTION

Galea L. is a large polymorphic genus of Compositae (Heliantheae), which contains approximately one hundred species of shrubs and commonly occurs throughout the Neotropics in open, disturbed montane regions. The genus reaches its greatest species diversity in Brazil, the Guayana Highlands, and the Andes. Diagnostic features for the genus Galea include simple, opposite leaves, striate phyllaries, ray and disk pappus of scales, glabrous or glandular and yellow or white corollas, non-striate achenes, and shrubby habit. Treatments of Galea (sensu lato) and its subgenera have been provided by Lessing (1832), de Candolle (1836), Bentham and Hooker (1873), and Hoffmann (1890-1894). More recently, generic concepts of Galea have been modified by Longpre (1970), Fay (1975), Urbatsch and Turner (1975), Robinson (1975, 1978), Turner (1976), Wussow and Urbatsch (1979), and Fernandez and Urbatsch (1982).

Although Galea traditionally (and recently, Stuessy, 1977) has been placed in the subtribe Galinsoginae, it has been suggested by Robinson et al. (1978) that the genus is more closely allied to members of the subtribe Neurolaeninae. In this study it was found that both Galea and Neurolaena contain thymol derivatives, whereas members of the Galinsoginae lack them. On the basis of this evidence, Galea was placed in the Neurolaeninae. Additionally, Bohlmann et al. (1981a) pointed out that species of Galea contain heliangolide types of sesquiterpene lactones and therefore differ
from the genera of the Galinsogineae. Robinson (1981) in his study of the Heliantheae treated *Calea* in the Neurolaeninae and provided a discussion on the limits of this, and other subtribes.

Lessing (1830) and de Candolle (1836) have provided the only inclusive taxonomic treatments for the genus *Calea*. Since then, the major taxonomic publications treating *Calea* have included reports on new species and combinations, and several regional floras. Regional floras of South American species of *Calea* include those by Baker (1882) who recognized forty Brazilian species, by Malme (1933) who treated twelve species of *Calea* in Paran, Brazil, and by Aristeguieta (1964) who treated the twenty-eight Venezuelan species of *Calea*. Studies of the Mexican and Central American species of *Calea* include treatments by Robinson and Greenman (1896), Blake (1926), Stanley (1938), Canne (1975), and Nash (1976). A comprehensive study has never been made of the genus in Colombia, a country rich in numbers of species of *Calea*.

This investigation should contribute substantially to other revisionary studies of *Calea*, particularly because the species are treated throughout their entire ranges (i.e. outside the boundaries of Colombia) making this work more useful than most floristic surveys.
TAXONOMIC HISTORY

Linnaeus (1759) placed several Neotropical species in the genus Santolina L. Later these species, S. jamaicensis L., S. oppositifolia L. and S. amellus L. (the latter two occur, in part, in Colombia) were transferred by Linnaeus to the newly established genus Galea L. The generic limits of Galea, which is typified by C. jamaicensis (L.) L., were expanded by Swartz (1788) who transferred Conyza lobata to Galea (as C. lobata (L.) Sw.), a taxon which occurs, in part, in Colombia. Brown (1817) suggested removing both C. lobata and C. oppositifolia (L.) L. from Galea, however made no nomenclatural changes, and further reduced the generic limits of Galea by placing C. amellus (L.) L. in synonymy with Salmea scandens (L.) DC. The genus was enlarged by Humboldt, Bonpland, and Kunth (1820) who published four new species of Galea, two of which occur in Colombia. Since that time over 200 additional taxa have been attributed to Galea, of which approximately 100 are presently recognized.

The taxonomic history of the genus Galea, with special reference to the species of Galea occurring in Colombia is given in chronological form below.

1763: Linnaeus proposed the genus Galea to accommodate the following three species which he initially included in Santolina (Linnaeus, 1759). These are C. jamaicensis, C.
amellus (= Salmea scandens (L.) DC. var. amellus (L.) O. Kuntze), and C. oppositifolia (= Isocarpha oppositifolia (L.) Cass. var. oppositifolia), the latter two occur, in part, in Colombia.

1788: Swartz made the combination Calea lobata (= Neurolaena lobata (L.) Cass.) based on Conyza lobata L., a common Neotropical species which occurs, in part, in Colombia.

1807: Willdenow published the generic name Leontophthalmum (= Calea) but provided no species description.

1817: Brown redefined the limits of Salmea scandens to include Calea amellus and suggested the removal of C. lobata and C. oppositifolia from Calea.

1820: Kunth, working with Bonpland collections described C. solidaginea H.B.K. from Venezuela, C. prunifolia H.B.K. from Colombia, and C. ternifolia H.B.K., a Mexican species which was incorrectly attributed to Colombia. Kunth also described Leontophthalmum peruvianum H.B.K. (= C. peruviana (H.B.K.) Benth. ex S. F. Blake.) from Peru. However, as a result of the present study this taxon is interpreted as being endemic to Colombia, hence the given epithet is a misnomer.

1822: Cassini published the combination Isocarpha oppositifolia based on C. oppositifolia.

1825: Cassini transferred C. lobata to Neurolaena making the combination N. lobata.
1830: Lessing, in the first monograph of Calea, reduced the genus Caleacte R. Brown to synonymy within Calea. He treated 16 species and described several new ones, including C. sessiliflora, which was published as a Mexican species but determined by Blake (1930) to be Colombian.

1832: Lessing reduced Leontophthalmum to an infrageneric rank in Calea. Although he was the first to treat L. peruvianum as a species of Calea it was not until 1915 that Blake proposed the combination C. peruviana. Lessing also proposed three additional subgeneric names, Caba, Haplocalea, and Monanthocaleza.

1836: De Candolle provided the second and last complete monograph of Calea by treating the 28 species then recognized. He accorded Caleacte and Leontophthalmum sectional rank in Calea, described sections Amphicalea and Discocalea as new, provided the illegitimate name Calea leontophthalmum for Leontophthalmum peruvianum (= C. peruviana var. peruvianum), and described C. berteriana as new based on material from Santa Marta, Colombia.

1873: Bentham and Hooker proposed the subtribe Galionginiae (Heliantheae) and placed Calea in it. They also reduced the genera Allocarpus H.B.K. (= Alloispermum Willd.), Calebrachys Cass., Calydermos Lag., Lemmatium DC., and Meyeria DC. to sectional rank in Calea. They placed the genera Amphicalea (DC.) Gardner, Mocinna Lag., Oteiza
and *Tetrachyron* Schlecht. in synonymy with *Calea*, variously positioning these genera in the sections they recognized.

1880: Gray proposed *Calea* subgenus *Tephrocalea* (= *Tetrachyron*).

1882: Baker, in his work on the Brazilian Compositae, treated *Eucalea*, *Meyeria*, and *Leontophthalmum*, as subgenera in *Calea* occurring in Brazil. He recognized 40 species of *Calea* in Brazil, making that treatment the largest, to date, in number of species ever published for the genus.

1884: Klatt described *C. collina* (= *C. berteriana*) and *C. perforata* (= *C. solidaginea* var. *solidaginea*) from Colombia.

1886: Klatt described as new *C. glomerata* (= *C. sessiliflora*) based on material from Colombia. He incorrectly reported the occurrence of the Colombian *C. leontophthalmum* (= *C. peruviana* var. *peruviana*) in Ecuador.

1890: Hoffmann treated *Calea* as a member of the Heliantheae: *Calisoginae* and recognized the following four sections of *Calea*: *Lemmatium*; *Allocarpus*; *Eucalea*; and *Leontophthalmum*.

1891: Kuntze provided the combination *C. caracasana* (H.B.K.) O. Kuntze (= *Alloispermum caracasanum* H.B.K. var. *caracasanum*) and described *C. caracasana* var. *pilosior* (= *A. caracasanum* var. *caracasanum*) based on material from Colombia.

1894: Hieronymos described *Calea angosturana*, *C. tolimana*, *C. trianae* (= *C. peruviana* (H.B.K.) Benth. ex S. F. Blake var. *tolimensis* (Hieron.) Pruski and Urbatsch), *C. trianae* var.
tolimensis (= C. peruviana var. tolimensis), and C. pachensis (= Alloispermum caracasanum var. caracasanum forma discoideum (Robinson and Greenman) Fernandez and Urbatsch, ined.) from Colombia.

1896: Robinson and Greenman in their work on the Mexican and Central American species of Calea, treated five subgenera and 28 species, of which only seven species are presently recognized (Wussow and Urbatsch pers. comm.). Robinson and Greenman also treated the Colombian C. sessiliflora Less. as a Mexican species.

1899: Robinson and Greenman described C. pittieri (= C. prunifolia) from Costa Rica and placed the Colombian C. perforata in synonymy with C. solidaginea.

1901: Hieronymos described C. septuplinervia and C. pachensis var. trianae (= Alloispermum caracasanum var. caracasanum) from Colombia. He erroneously reported the occurrence of the Central American C. trichomata Don. Smith in Colombia based on Lehmann 5540 (= C. sessiliflora).

1915: Blake provided the combination C. peruviana and also corrected Klatt's erroneous report of the occurrence in Ecuador of this Colombian species.

1918: Gandoger described C. colombiana from Colombia.

1919: Robinson described C. caracasana var. pilosior forma discoidea (= Alloispermum caracasanum var. caracasanum forma discoideum) from Colombia.
1920: Rusby published C. holtoni (= C. berteriana), C. congesta (= C. solidaginea var. solidaginea), and C. herbert-smithii (= C. solidaginea var. solidaginea) from Colombia.

1924: Blake described C. pennellii (= C. peruviana var. peruviana), C. ovalis (= C. tolimana), and C. brevipes (= C. sessiliflora) from Colombia. He also made the new combination C. lindenii (Sch. Bp. ex Wedd.) S. F. Blake (= Alloispermum caracasanum H.B.K. var. lindenii (Sch. Bp. ex Wedd.) Fernandez and Urbatsch, ined.) based on material from Colombia.

1928: Blake described C. longipes (= Sabazia trianae (Hieron.) Longpre) from Colombia.

Knuth used the non-validly published name C. ottonis (= C. berteriana) in reference to material from Colombia and Venezuela.

1930: Blake discovered an error in Bonpland’s collection data and noted that C. sessiliflora Less. is a Colombian, not a Mexican, species and placed the Colombian C. brevipes in synonymy with C. sessiliflora Less. He also placed the genus Aschenbornia Schauer in synonymy with Calea. Furthermore, he noted that specimen #15301 in B-W (interpreted here as an ISOTYPE of C. ternifolia H.B.K.) was the same as C. zacatechichi. Thus, unknowingly Blake placed C. ternifolia H.B.K. 1820 in synonymy with C. zacatechichi Schlect. 1836 and simultaneously excluded C. ternifolia from
the flora of Colombia.

1931: Gleason described the Venezuelan and Colombian C. abelioides based on material from Mount Duida, Venezuela.

1935: Blake described C. subcordata, C. subcordata var. hirtella (= C. subcordata) and C. acoma (= Sabazia acoma (S. F. Blake) Longpre) from Colombia.

1952: Cowan described C. deltophylla (= C. solidaginea H.B.K. var. deltophylla (Cowan) Pruski and Urbatsch) based on material from British Guyana.

1953: Steyermark described C. clematifolia (= C. solidaginea var. deltophylla) based on material from Venezuela.

1954: Cuatrecasas described C. gargantae, C. saxatalis, C. perijensis, C. perimbricata, C. yuruparina, C. chocoensis (= C. prunifolia H.B.K.) and C. ovalis var. sabanensis (= C. tolimana) based on material from Colombia.

1964: Aristeguieta treated 28 Venezuelan species of Calea, many of which occur in Colombia.

1970: Longpre expanded the genus Sabazia to include C. longipes (= S. trianae) and C. acoma (= S. acoma) from Colombia.

1975: Fay resurrected the genus Oteiza from synonymy with Calea. Robinson placed Geissopappus Bentham, which is based on the illegitimate Schomburgkia DC. (not Schomburgkia Lindl.), in synonymy with Calea.

1977: Stuessy et al. reduced the tribe Neurolaeneae Rydb. to subtribe Neurolaeninae (Heliantheae) and they treated Calea
as a member of the Heliantheae: Galinsoginae.

1978: Robinson, Bohlmann, and King transferred *Calea* to the Heliantheae: Neurolaeninae. Robinson resurrected the genus *Alloispermum* from synonymy with *Calea* and provided the new combinations *A. lindenii* (= *A. caracasanum* var. *lindenii*), *A. pachensis* (= *A. caracasanum* var. *caracasanum*), and *A. caracasanum* for two Colombian taxa previously regarded as three distinct species of *Calea*.

1979: Robinson reported the first known occurrence of *C. sodiroi* Hieron. in Colombia and simultaneously transferred this primarily Ecuadorian species to *Alloispermum*. Wussow and Urbatsch removed five anomalous species from *Calea*, placed them in the newly resurrected genus *Tetrachyron*, and enlarged *Tetrachyron* to encompass *Calea* subgenus *Tephrocalena*.

1981: Robinson, in his study of the Heliantheae, treated *Calea* with the subtribe *Neurolaeninae*. Badillo described *C. huberana* (= *C. tolimana*) from Venezuela.

1982: Pruski and Urbatsch described *C. bucaramangensis* based on material from Colombia.
MATERIALS AND METHODS

This study is based largely on herbarium specimens on loan from the following major herbaria: A, BM, F, GH, K, LL, LIL, MICH, MSC, MO, MY, NY, P, TEX, UC, US, and VEN. During the course of this study several field expeditions, supplementing these loans, were made affording the author the opportunity to collect and observe species of *Calea* in their natural habitats in South America, Central America, Mexico, and Jamaica. During these forays, leaf and flower materials were fixed in FAA for anatomic and morphologic observation, buds were fixed in modified Carnoy's solution for cytotoxic taxonomic studies, and bulk leaf samples were collected for chemotaxonomic work. In addition, living materials were brought back for greenhouse observations.

All materials were dehydrated in acidified "DMF" (2,2-dimethoxypropane), following procedures employed by Muller and Jacks (1975), and Postek and Tucker (1976). Some specimens were embedded in "Paraplast Plus" (Sherwood Medical Industries, St. Louis, Missouri), cut with a Spencer 820 rotary microtome to seven \( \mu m \) thick, and stained in either Heidenhain's hematoxylin, toluidine blue or safranin-fast green. Other specimens were embedded in "JB-4" methacrylate resin or in Araldite-Epon epoxy resin. Sections two-four \( \mu m \) thick were cut with a Sorvall JB-4 rotary microtome equipped with a glass knife and stained in toluidine blue (Sakai, 1973). Dried leaves were cleared in 5-10% NaOH and in chloral
hydrate (Shobe and Lersten, 1967). Photomicrographs of sections were taken with a Leitz Orthoplan microscope and Orthomat camera. Scanning electron microscope observations were made on fixed material and from dried or rehydrated herbarium specimens. Achenes were air dried. Pollen was obtained from unopened anthers, acetolysed using the method of Erdtman (1960), and air dried. All other materials were critical point dried with a Denton DCP-1 Critical Point Drier. All materials were mounted on aluminum stubs and sputtercoated with 200 Å of gold-palladium in a Hummer Sputter Coater. The micrographs were taken on a Hitachi S-500 operating at 25 KV.

Chromosome counts were obtained from buds fixed in the field in modified Carney's solution (chloroform-ethanol-acetic acid; 4:3:1). Upon return from these field forays, the buds were transfered to 70% aqueous ethanol and refrigerated until stained by using the procedure outlined by Snow (1963).
RESULTS AND DISCUSSION

As a result of the present study, seventeen species are recognized from the forty or more names of Galea attributed to Colombia. Of these seventeen species, seven are endemic to the Colombian Andes, five are found in the Colombian Andes and adjacent regions of Venezuela, four are plants of the llanos or savanna regions, and one is found in northern South America and Central America. Thus, members of the genus range from the Pacific and Caribbean Coasts to the southern and eastern llanos regions; however, most species occur in the Andes.

Results and discussions on morphology, karyology, distribution and ecology, systematic relationships, and taxonomic criteria are given below.

MORPHOLOGY: The Colombian species of Galea are subshrubs, shrubs, or lianas, commonly with erect stems, although species with decumbent or vining and clambering stems occur within this area. Field and greenhouse studies indicate that the more widely distributed species vary tremendously throughout their entire range. Studies of herbarium specimens confirm this fact and suggest that these traits are influenced by habitat. However, many species have restricted distributions or are known only from the type collection and consequently little is known about their variation in nature.

Species of Galea generally have leaves that are simple and opposite, although several Brazilian species produce whorled leaves.
as do the Colombian *Calea peruviana*, *C. saxatilis* and *C. berteriana*. Leaves range from linear to broadly ovate with most Colombian species producing either ovate or elliptic-lanceolate leaves. Leaf margins are commonly revolute and serrate with entire or lobed margins occurring less frequently. Lower leaf surfaces range from nearly glabrous to puberulent (Fig. 1), and tomentose (Fig. 2). Leaf pubescence includes at least four trichome types: uniseriate, arcuate, six-seven-celled trichomes (long hairs) found more commonly on lower leaf surfaces (Fig. 2); uniseriate, stout, three-four-celled trichomes (short hairs) found most frequently on upper leaf surfaces (Figs. 3, 4); uniseriate, arcuate, constricted, six-seven-celled trichomes (moniliform hairs) (Figs. 5, 6); and biseriate, resinous, glandular, six-tiered trichomes (glands) (Figs. 7, 8). Moniliform hairs and glands commonly occur on both upper and lower leaf surfaces. Short hairs may possess either a ring of bulbous basal subsidiary cells (Fig. 3, 21) or lack such cells (Fig. 4). Carlquist (1976) states that uniseriate, nonglandular and biseriate glandular trichomes are the two basic trichome types in the Compositae. Therefore, long, short and moniliform hairs share a common ancestry whereas glandular hairs are of a basically different nature. Thus, the four different kinds of trichomes observed in *Calea* are derived from only two ancestral types. The leaves of *C. saxatilis* and *C. abeliodes* which possess glands and short hairs, and *C. bucaramangensis* which possesses long and moniliform hairs, are different from all other Colombian species of *Calea*. The 14 other
species possess four types of hairs on their leaves. Leaf texture is either coriaceous or chartaceous. Leaf surfaces range from smooth to rugose and consequently from weakly reticulate to prominently reticulate.

Capitulescences found among the Colombian species of Calea range from possession of solitary, many-flowered heads, a feature listed as primitive by Cronquist (1955), to few-flowered, secondarily clustered heads, an advanced feature according to Cronquist. Calea peruviana, C. saxatilis and C. subcordata possess large solitary heads. Calea perijaensis, C. tolimana, C. gargantae, and C. bucarangensis all possess umbelliform or cymose radiate heads singly on peduncles whereas C. perimbricata, C. berteriana, C. prunifolia, C. abeliodes, and C. solidaginea produce umbelliform or cymose discoid heads singly, less commonly glomerate, on peduncles. Calea sessiliflora, C. colombiana, C. angosturana and C. septuplinervia possess stalked glomerules, of three-nine sessile heads which are paniculately arranged, whereas C. yuruparina has a capitulescence of sessile glomerules each with up to 17 sessile heads.

The involucres range from hemispheric in C. peruviana and C. bucarangensis, to campanulate in C. berteriana, or cylindric in C. yuruparina. Phyllaries of Calea are scarious or grade to inner ones scarious and the outer ones herbaceous. The species of Calea in Colombia all possess outer herbaceous phyllaries. Outer phyllary size and pubescence varies. In C. peruviana the outer phyllaries
are as long or longer than the inner, densely reticulate, and tomentose (Fig. 9), i.e. foliar, a primitive characteristic according to Cronquist (1955). The involucre of G. prunifolia (Fig. 10) and its allies consist of outer phyllaries shorter than the inner ones. Phyllaries are obovate, triangular-ovate to lanceolate and are in two-eight series with most species of Calea in Colombia having three-five-seriate involucres. The most notable exceptions are the four-eight-seriate involucres of G. solidaginea in the Santa Marta region. However, eight-seriate involucres with congested phyllaries can be found on the same plant with three-five-seriate involucres, hence, number of involucre series is not an extremely reliable taxonomic character.

Ray flowers are pistillate and fertile, and the corollas commonly are yellow, although yellow-orange and even white ray corollas are found in Calea. Ray flowers are pappose, a feature which distinguishes Calea from most species of Alloispermum, which has epappose rays. Ligules are about 2-20 mm long, 3-13-nerved, abaxially glandular or glabrous, and apically entire to tetrudenticulate. Rays (when present) in the Colombian species of Calea (Figs. 26-31, 53e) are usually yellow and nearly entire to tetrudenticulate. Ligule length of the Colombian species usually ranges between 7-13 mm; however, G. bucaramangensis, G. gargantae and G. tolimana have ligules about four-seven mm long.

Presence or absence of abaxial ligule pubescence is of critical taxonomic importance, as is ligule vein number. Ligules of G.
bucaramangensis and C. gargantae are five-veined and abaxially glabrous. The other radiate species of Calea in Colombia all have abaxially glandular ligules with C. saxatilis and C. peruviana having more than five veins, and C. subcordata, C. perijaensis and C. tolimana having (three) five-veined ligules. Calea colombiana and C. berteriana, species commonly considered as discoid, do upon occasion produce rays. Those observed in C. colombiana (Fig. 38) are deeply three-lobed, whereas rays of C. berteriana are nearly entire. The adaxial ligule epidermis (Fig. 11) consists of nearly isodiametric, papillose cells and thus, according to Baagoe (1977), is of the basic helianthoid type.

Disk corollas of species of Calea in Colombia exhibit the entire complement of characteristics seen in those of the entire genus. Disks are yellow or white, glabrous or glandular with flaring bases. The shallowly to deeply five-cleft limbs with erect to spreading apically acute lobes found in disk flowers (Figs. 26-39, 53d) are traits seen in various combinations in species of Calea. The glandular disks of C. solidaginea and C. abelioides are the only such ones seen in the Colombian species; all other species have glabrous disks. The resin ducts (veins) of the corollas of members of the Neurolaeninae have reddish resin (Robinson, 1981). Findings in the present study of Calea concur with those of Robinson.

Anthers are exserted and have rounded bases and deltoid apical appendages (Fig. 12). Light and electron microscope studies of ten
Colombian species of *Calea* show that only *C. bucaramangensis* and *C. gargantae* lack abaxial appendage glands, whereas *C. septulinervia* (Fig. 12) and all other species studied have abaxially glandular appendages. In addition, anther thecae are glabrous in all species observed, except in *C. tolimana*, which is unique in having glandular thecae. Styles are usually bifid (Fig. 13). Trifid styles (Fig. 14) are an uncommon trait exhibited by relatively few species of *Calea*. Branches of the styles have paired stigmatic lines (Fig. 13), a trait typical of the Neurolaeninae (Robinson, 1981). The style branch apices (Fig. 13) are either rounded or acute and the abaxial collecting hairs are hispidulous, as are all such structures in the Heliantheae (Cronquist, 1955).

The Colombian species of *Calea* all possess scarious, conduplicate paleae (Figs. 26-39, 53c). These range from being trifid with caudate apices (Figs. 27-29, 53c) to lacerate and truncate or obtuse (Figs. 34-39). Pale yellow paleae occur in all taxa except *C. solidaginea* which possesses white paleae. Receptacle shape ranges from conical or dome-shaped in the larger headed species to cylindric in the smaller headed, fewer-flowered species.

Achenes of ray and disk flowers are similar and are generally prismatic, obconic, black, non-striate and basally asymmetric (Figs. 15, 16, 17). The carpopodia of achenes of species of *Calea* in Colombia are similar to those of *C. jamaicensis*, which were depicted by Robinson (1981). Achenes of a species may have either about 25, ca. 5 mm linear-lanceolate, stramineous scales with attenuate apices
and serrulate margins (Figs. 15, 16, 18) or about 10, ca. 2 mm squamellae which are wider and have rounded apices and serrulate margins (Fig. 17). However, all Calea species in Colombia possess linear-lanceolate scales. Achene pubescence consists of either glandular or bifid trichomes (Fig. 19). Immature achenes are often pubescent and may keep or lose their pubescence during maturation. An example of a species that becomes glabrous with age is C. septuplinervia which has pubescent immature achenes and glabrous mature ones (Fig. 15). When pubescent, most achenes possess bifid trichomes which are either regularly cut (Figs. 16, 19) or irregularly cut (Fig. 17). Pollen of all species is typically helianthous and about 30 µm in diam. with long ectoapertures on rectangular endoapertures (Fig. 20).

LEAF ANATOMY: Two basically different morphologic species groups of Calea exist: radiate and discoid. Leaf anatomy of a species from each group was observed with hopes of more completely documenting the range of anatomic features seen in Calea. Species examined include the radiate C. subcordata and the discoid C. prunifolia. It was found that while these two species share common features, C. subcordata differs from C. prunifolia in several characteristics. The major bundles of both species consist of an arc of xylem and adaxial to it, uniformly thin-walled phloem cells, interspersed with parenchyma. Both species examined have parenchymatous sheaths surrounding the vascular bundles (Fig. 21, 22). Each species has collenchymatous bundle sheath extensions;
however, the size of these sheath extensions varies. Leaves of *C. prunifolia* have 3-4-tiered extensions (Fig. 22) while those of *C. subcordata* have 7-8-tiered extensions (Fig. 21). *Calea prunifolia* occasionally has adaxial resin ducts associated with the vascular bundles (Fig. 23). Resin ducts were not observed in leaves of *C. subcordata*.

The mesophyll of *C. prunifolia* leaves is divided into distinct palisade and spongy parenchyma layers (Fig. 23). The mesophyll of *C. subcordata* consists of isodiametric cells and is dense and homogeneous, not being divided into palisade and spongy parenchymous layers (Figs. 8, 21).

Most of the stomata of species of *Calea* are restricted to the abaxial leaf surface. Leaf venation (Fig. 24) is typically campylodromous with veins terminating within the areoles. The stomata configuration is anomocytic (Fig. 25).

**KARYOLOGY:** There are few chromosome reports for the South American and Caribbean species of *Calea* in the literature. Counts from these species are summarized in Table 1, as are newly reported counts for South American and Caribbean species of *Calea*. The only previous report for the 17 other species of *Calea* in Colombia was that of *C. sessiliflora*. Additionally, reports for the Colombian *C. prunifolia*, *C. septuplinervia*, *C. solidaginea* var. *solidaginea* are given. Polyploidy is reported for the first time in *Calea* (sensu stricto) based on *C. septuplinervia* (*n* = 38), which has stems to 6 m (larger than all other species of *Calea*) and occurs at high
altitudes. Montanoa polyploids (Funk and Raven, 1980) are similar in that they are physically larger than most other species of Montanoa, and they occur at high altitudes.

DISTRIBUTION AND ECOLOGY: The Calea flora in Colombia is composed of both widespread species and ones of restricted geographic distributions (Figs. 40-45). The radiate C. gargantae, which is known only from the type locality, C. bucaramangensis, C. saxatilis, C. perijensis and C. subcordata have restricted ranges and are endemic to the northern Andes in Colombia and Venezuela. The discoid C. perimbricata, C. colombiana and C. angosturana are similar in that these species all have restricted ranges and are endemic to the Colombian Andes. Calea septuplinervia has a slightly greater geographic range, occurring in the Andes of Colombia and Venezuela. Calea peruviana and C. sessiliflora, although restricted to the Colombian Andes are common and are locally abundant throughout parts of this region. Calea berteriana, C. solidaginea and C. prunifolia which occur, in part, in the Andes, have the widest distributions of the Colombian species of Calea. Calea solidaginea occurs from the Colombian Andes into Venezuela, Trinidad, British Guyana and Surinam. Calea berteriana occurs in Colombia and Venezuela, and is largely sympatric with the former species. Calea prunifolia is the only South American Calea known to occur in Central America. This species ranges from Peru north to Colombia, west into Venezuela, and has been found as far north as Nicaragua. Calea yuruparina is a plant known to occur only in a
restricted region of the Colombian llanos whereas *C. tolimana* and *C. abelioides* are much more widely distributed llanos plants. *Calea abelioides* is known from widely separate areas of Colombia and Venezuela, and *C. tolimana* is more widespread, ranging from the eastern foothills of the Andes eastward across the Colombian llanos and into similar regions of Venezuela.

Species of *Calea* are common throughout the Neotropics in open, disturbed montane regions. Colombian species of *Calea* found in such regions include *C. peruviana*, *C. saxatilis*, *C. subcordata*, *C. perijaensis*, *C. gargantae*, *C. bucaramangensis*, *C. perimbircata*, *C. berteriana*, *C. prunifolia*, *C. solidaginea*, *C. sessiliflora*, and *C. colombiana*. These species occur in a variety of xeric habitats in these montane regions including open, rocky, mountain slopes, steep embankments, thickets, overgrown pastures, and washouts. *Calea solidaginea* and *C. prunifolia* occur in such localities and also in mesic coastal areas. *Calea tolimana* and *C. abelioides* occur primarily in the xeric llanos regions. *Calea angosturana* and *C. septuplinervia* occur along stream sides and other mesic areas of the Andes. *Calea yuruparina* also prefers mesic areas and is known only from near various waterways in Vaupes, Colombia.

The species composition of *Calea* in Colombia, taken as a whole, most closely resembles the species composition of *Calea* in Venezuela. Indeed, nine of the seventeen species of Colombian *Calea*
also occur in Venezuela. Of these nine, seven occur in highland regions of northern Venezuela, only two occur in the llanos regions. Only eight species occur in mountains of northern Venezuela, and as such this treatment could essentially serve as a floristic treatment of that region. Of these eight species, only *C. trujilloi* occurs in this region of Venezuela and not in Colombia. This species keys to *C. bucaramangensis* but differs from it in that the former has heads with six or fewer rays and its involucre is four-six-seriate.

The llanas regions of Colombia and Venezuela, with their numerous table-top mountains (tepuis), are known only to share *C. abelioides* and *C. tolimana* as common components of their flora. However, the large numbers of species of *Calea* in the tepuis of southern Venezuela has been documented (Aristeguieta, 1964) and it is possible that extensive collecting on the tepuis of southern Colombia will yield similar species reports for Colombia. Cerro Sipapo, Venezuela, only 100 km east of the Colombian border, has *C. kunhardtii* Maguire, *C. nana* Maguire, *C. politii* Maguire and *C. sipapoana* Maguire included in its known species, and these taxa and possibly undescribed ones, presumably could be the first species reported from the table-top mountains of adjoining parts of Colombia. Conversely, with additional sampling, the Colombian *C. yuruparina* might be found in adjacent regions of both Venezuela and Brazil.

*Calea prunifolia* is the only Colombian species known to occur in Peru, Ecuador, and Panama, three other neighboring countries of
Colombia, and as such, this treatment will not be as useful for botanists treating plants of those countries. It should be noted, however, that while C. kingii H. Robinson occurs in Ecuador, and its close relative C. urticifolia (Mill.) DC. occurs in Panama, no relatives of this species group are known from geographically intermediate Colombia.

SYSTEMATIC RELATIONSHIPS. Although little information has been published concerning species relationships, several species groups were observed during the course of the present study. One such species group includes C. peruviana, C. subcordata, C. gargantae, C. saxatilis, and C. bucaramangensis, all radiate species that resemble each other by possession of large heads and foliar involucres. Radiate Andean species of Calea also have affinities with several large-headed Gran Sabana and tepui species of Calea, a relationship previously noted by Gleason and Killip (1939) and Lasser and Maguire (1950). Another radiate species group includes C. perijaensis, C. tolimana and C. corianeae. The relationship of these three taxa is discussed in the taxonomic treatment after the description of C. tolimana.

Calea berteriana may be conveniently included in a discoid species group with umbelliform species including C. lantanoides Gardn. of Brazil, C. jamaicensis (L.) L. of Jamaica, C. trichomata D. Smith and C. crassifolia Steyermark. The latter two are from Central America. These species, which have similar habit, leaf and floral morphology, can nevertheless be distinguished by technical
features. Although the widespread, umbelliform *C. prunifolia*
resembles members of this group, it is apparently more closely
allied to the obscurely radiate *C. huigreensis* Blake of Ecuador. The
umbelliform *C. solidaginea* also resembles members of the *C.*
berteriana group but can be identified readily by its white florets.
*Galea solidaginea* is most closely allied to *C. perimbricata* of
Colombia and to *C. scandens* Griseb. of Bolivia, which apparently has
a shorter pappus than does *C. solidaginea*. *Galea abelioides* forms a
species group with *C. lucidivenia* Gleason and Blake, *C. cardonae*
Maguire and Wurdack, and *C. oliverii* Robins. and Greenm. from which
it differs by virtue of its densely pubescent achenes. All of these
species groups have predominantly single heads on peduncles and thus
are variously allied.

*Calea sessiliflora* and *C. colombiana* superficially resemble
members of the *C. berteriana* group. However, these two species, by
possession of stalked glomerules of sessile heads, more closely
resemble *C. angosturana* and *C. septuplinervia*, and all are
considered here to belong to the same species group. The
interrelationships of these species are discussed in the taxonomic
treatment of its members. *Calea yuruparina* also has glomerate heads
and somewhat resembles members of this group. However, the
glomerules of this species are sessile, not stalked, and its leaves
are penninerved, not palmately nerved, and thus it stands apart from
members of this group. *Calea yuruparina* appears to have no close
relatives in the genus.
Considering systematics at the generic level, *Galea* is obviously related to the other members of the *Neurolaeninae*, as treated by Robinson (1981). *Galea*, with its opposite leaves and free pappus scales differs from *Brasilia Barrosa*, which has a basally fused pappus, and *Tyleropappus*, which has spiral leaves. These differences were noted by Robinson (1975). *Galea* has about 8-25 pappus scales and differs from *Tetrazyron Schlecht.*, which has four pappus members, and from *Neurolaena R. Br.*, which has a pappus of bristles. Furthermore, Robinson (1981) noted that *Staurochlamys Baker*, which has non-imbricate involucres, and *Unxia*, which has functionally male disk flowers, are unique in the *Neurolaeninae*.

Traditionally, *Galea* has been considered close to *Alloispermum Willd.*, *Sabazia Cass.*, *Galinsoga Ruiz and Pavon*, *Oteiza La Llavae*, and *Tridax L.* However, non-striate achenes (Robinson, 1981) and glabrous or glandular corollas distinguishes *Galea* from these genera, all which possess striate achenes and corollas with uniseriate trichomes. Additionally, habit, nature of the ray flowers, trichome types, chromosome number, and secondary chemical constituents are features which serve to differentiate *Galea* from these and all genera of the *Galinsogineae*.

**TAXONOMIC CRITERIA.** Discussions of the taxonomic value of morphological characteristics used to delineate species of *Galea* in Colombia are included below.

The most obvious single trait used to delineate species groups is presence or absence of rays. Although some *Compositae* species
have both radiate and discoid forms, this trait was found to be relatively constant in Colombian species of *Galea* and is a valuable taxonomic criterion. Additionally, presence or absence of abaxial ligule glands, a characteristic noted by Robinson (1979), and the presence of five or more than five veins are taxonomically important characteristics for species delineation. Flower color in Colombian species of *Galea* is generally yellow. Nevertheless, presence of white flowers, a derived trait (Cronquist, 1955), is found in one species, *G. solidaginea*, and thus is useful in readily identifying this taxon. Presence of absence of abaxial anther appendage glands, as stressed by King and Robinson (1970), is a valuable taxonomic trait, and presence or lack of abaxial glands on anther appendages parallels this trait in the ligules. The nature of the pappus is an easily observed trait used in species delineation in *Galea*. However, this trait is not used here because all Colombian species of *Galea* are similar in that they have uniformly have about 25 linear-lanceolate, stramineous pappus scales.

Discoid species of *Galea* sometimes produce single heads on peduncles or sessile heads on stalked glomerules. However, each species has a tendency to produce a large percent of its heads in one of the two manners and thus, as used here, this trait is of critical taxonomic value. The nature of the involucre is used here as an important taxonomic characteristic. The outer phyllaries of the involucres of *Galea* range from scarious to foliar. Although all Colombian species are similar in possessing foliar outer phyllaries,
the length of this structure in proportion to the inner phyllaries varies greatly and is taxonomically significant. However, the trait must be used with caution as greenhouse grown *C. berteriana* and *C. prunifolia* have varied in expression of this trait. The number of involucral series is often useful, although this trait varies greatly within individuals of *C. solidaginea* from the Santa Marta region of Colombia.

Traditional characteristics, which include habit, leaf pubescence, etc. are important criteria and are used throughout the taxonomic treatment to delineate species.

The chromosome number in *Calea* is practically uniform in being $n = 19$. If species of *Calea* were totally uniform in being $n = 19$, then King and Robinson (1970) would be correct in saying that few practical results are obtained in cytotaxonomy. However, the report of polyploidy in *Calea septuplinervia* given here adds support to the conclusions of Grashoff and Turner (1970) who state that cytology "is far from old hat" and is even more intriguing when one considers the implications of polyploidy in *Montanoa* (Funk and Raven, 1980).

Although chemotaxonomic studies have been performed on several South American species of *Calea* (Ferriera et al. 1980; Bolhman et al. 1981a, 1981b, 1981c), the author has performed no such studies involving the Colombian species of *Calea*. Therefore, this potentially valuable taxonomic marker is not used here in species delineation.

Finally, the author's observations in Venezuela, Costa Rica,
Jamaica, and Mexico of natural variation within populations of *Calea* were influential in the taxonomic decisions that follow.
TAXONOMIC TREATMENT

Galea L., Sp. PI. ed. 2, 2: 1179, 1763. Type: Santolina jamalicensis L. = Galea jamalicensis (L.) L.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.

Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.

Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.


Mocinna Lag., Gen. Sp. PI. Nov. 31. 1816. Type: M. serrata Lag. = Calea urticifolia (Miller) DC.
Shrubs, small trees, lianas, or less commonly perennial herbs; stems sparsely to densely trichotomously branched, scandent, erect or climbing, glabrous to tomentose; leaves evergreen, opposite, less commonly whorled with up to 6 leaves per node, simple; petioles wanting to ca. 2 cm long, canaliculate or not so; blades ovate, triangular-ovate, lanceolate, less commonly linear, chartaceous or coriaceous, smooth to rugose, palmately 3-7-nerved or penninerved, apices attenuate to rounded, bases cuneate to cordate, margins serrate, crennate, less commonly lobed or entire, often revolute, nearly glabrous to tomentose, commonly with both biseriate glands and uniseriate trichomes; capitulescences solitary, paniculate, umbelliform, cymose or corymbose; peduncles terminal, often axillary as well, wanting to ca. 20 cm long; involucres hemispherical to cylindrical, 2-8-seriate; phyllaries imbricate, subequal to graduate, obovate, often striate, triangular-ovate to lanceolate, scarious or the outer ones herbaceous or herbaceously tipped; capitula discoid, 3-175-flowered; ray flowers (when present) pistillate, ligules yellow, yellow-orange, rarely white, 3-13-nerved, apically entire to tetradsenticulate, glandular or glabrous abaxially; disk flowers perfect, yellow or white, glabrous or glandular, limb shallowly to deeply 5-cleft with erect or spreading, apically acute lobes, tube flaring basally, anthers exserted, yellow, rarely brown, thecae glabrous, rarely glandular, apical appendages deltoid, glabrous or glandular abaxially, bases
rounded, styles bifid, rarely trifid, branches with paired stigmatic lines and acute to rounded apices; receptacles paleaceous, rarely not so, cylindrical to conical or dome shaped; paleae scarious, flat to conduplicate, ranging from entire to trifid or lacerate, apices obtuse, caudate or truncate, pale yellow, less commonly white; achenes of ray and disk flowers similar, prismatic, usually obconic, bases asymmetric, black, less frequently olivaceous or brown, non-striate, glabrous to densely pubescent with antrorse bifid trichomes and sometimes glands, carpopodia present; pappus bilaterally symetric, stramineous, margins serrulate, usually of ca. 25 long, linear-lanceolate scales but often of ca. 10 minute squamellae; pollen heliantheous, ca. 30 μm in diam., but as large as 65 μm. Chromosome number n = 19, 38.
KEY TO THE COLOMBIAN SPECIES OF CALEA

Heads radiate, rays well developed.

Glistening, globular trichomes abundant on the abaxial surfaces of ligules and anther appendages.

Ligules with 7-13 veins; outer phyllaries foliar and at least as long as the inner.

Leaves greater than 15 mm wide, tomentose with uniseriate hairs and globular trichomes; heads with 20 or more rays...................... 1. C. peruviana

Leaves less than 12 mm wide, pubescence of globular trichomes only; heads with 15 or fewer rays...................... 2. C. saxatilis

Ligules with (3)5 veins; outer phyllaries foliar or with scarious bases, but not as long as the inner phyllaries.

Leaves with 1 or 2 pairs of prominent veins arising from near the base.

Heads solitary with about 18 rays; leaves tomentose, bases cordate............... 3. C. subcordata

Heads variously clustered with about 9 rays; leaves pubescent, bases cuneate to truncate...................... 4. C. perijaensis
Leaves penninerved, most prominent lateral veins usually arising from near the center of the blade................. 5. C. tolimana

Glistening, globular trichomes absent from the abaxial surfaces of ligules and anther appendages.
Achenes pubescent; lower leaf surfaces densely pubescent; stems and leaves with globular trichomes....................... 6. C. gargantae
Achenes glabrous; lower leaf surfaces pubescent; stems and leaves without globular trichomes....................... 7. C. bucaramangensis

Heads discoid, or rarely with a single poorly developed ray.
Heads solitary on peduncles, occasionally in stalked glomerules of 3-5 sessile heads.
Corollas and paleae yellow; capitulescence umbelliform or cymose.
Plants slightly to densely pubescent;
leaf bases various; achenes pubescent.
Achenes essentially glabrous; capitulescence cymose; corolla lobes less than 1.3 mm long....................... 8. C. perimbricata
Achenes puberulent to pubescent; capitulescence umbelliform; corolla lobes generally more than 1.3 mm long.
Leaf bases truncate to cordate;
capitulescence of 3-13 heads; paleae lacerate...................... 9. _C. berteriana_ p. 62

Leaf bases cuneate; capitulescence of 7-45 heads; paleae trifid or nearly so........ 10. _C. prunifolia_ p. 67

Plants essentially glabrous; leaf bases cuneate;
achenes densely pubescent............. 11. _C. abelioides_ 74

Corollas and paleae white; capitulescence umbelliform....................... 12. _C. solidaginea_ p. 76

Heads in stalked glomerules of 3-17 sessile heads, occasionally solitary on peduncles.
Leaves with 1-3 pairs of prominent veins arising from near the base; capitulescence stalked, paniculate; heads with 6 or more flowers; plants of the Andes.
Leaves less than 5 cm long, densely pubescent to tomentose, bases cordate to truncate;
petioles less than 3 mm long....... 13. _C. sessiliflora_ p. 87

Leaves greater than 5 cm long, puberulent to pubescent, bases cuneate; petioles more than 3 mm long.
Outer phyllaries foliar and at least 2/3 as long as the inner; heads usually with 12 or more flowers............ 14. *C. colombiana*

Outer phyllaries foliar with scarious bases but less than 1/2 the length of the inner; heads usually with 12 or fewer flowers.

Corolla lobes less than 1.1 mm long;

leaves puberulent, apices acuminate;

petioles more than 6 mm long.... 15. *C. angosturana*

Corolla lobes usually more than 1.1 mm long;

leaves pubescent, apices acute; petioles less than 8 mm long............ 16. *C. septuplinervia*

Leaves penninerved; capitulescence sessile, glomerate; heads with 3 or 4 flowers;

plants of Vaupes, Colombia............. 17. *C. yuruparina*

Much branched shrubs to 2 m tall; stems ascending—erect, subterete, finely striate, pubescent to tomentose, branching at angles of 15–35°, internodes mostly 1-4 cm long; leaves opposite, rarely whorled; blades ovate-elliptic to elliptic-lanceolate, coriaceous, smooth to subrugose, 3-5-nerved, 2-7.5 cm long, 1.3-4 cm wide, apices acute to rounded, subapiculate, bases cuneate, margins serrate-crenate, revolute, upper surfaces light to dark green, villose to scaberulent, lower surfaces pale green, often prominently reticulate, pubescent to tomentose with resinous, globular trichomes and uniseriate, arcuate, multicellular trichomes; petioles 3-6 mm long, pubescent to tomentose, bases persistent; capitula terminal, solitary, radiate 50-175-flowered; peduncles to 15 cm long, pubescence like that of the stem; involucres hemispherical, 8-20 mm tall, 11-25 mm broad, about 4-seriate; phyllaries imbricate, subequal to graduate, outer four obovate to elliptic, 7-25 mm long, 3.5-11 mm wide, foliar, reticulate, pubescence like that of the leaves, apices acute to rounded, bases cuneate, margins ciliolate, revolute, inner phyllaries elliptic, 8-13 mm long, 3.5-6.5 mm wide, striate, scarious, grading from abaxially puberulent to glabrous, apices membranous, obtuse to broadly acute, margins membranous; ray flowers 15-45, corollas 12-17.8 mm long, tube 2.7-5.3 mm long, glabrous, ligule yellow to yellow-orange, 7-13-nerved, 9.3-12.5 mm long,
3.1-4.7 mm wide, apices 3(4)-lobed, lobes often irregular, shallow to slightly more deeply incised, abaxial surfaces glandular, pappus of 15-23 linear-lanceolate scales, 3.8-5.7 mm long; disk flowers 35-130, corollas yellow to golden, 5-6.5 mm long, glabrous, lobes erect, 0.7-1.4 mm long, pappus of 16-24 linear-lanceolate scales, 3.5-6 mm long, anthers exserted, yellow, 2.1-2.7 mm long, appendages glandular abaxially, styles 6-7 mm long with branches 1-1.5 mm long, receptacles conical, 3-5 mm tall and 3-6.5 mm broad; paleae lanceolate, conduplicate, trifid to pentafid with acuminate to attenuate central lobes, lateral lobes subapical, pale yellow, 3.5-5.5 mm long, 0.7-1.2 mm wide; achenes of ray and disk flowers similar, elongate cylindric to obconic, prismatic, black, 2.1-4 mm long, puberulent apically. Chromosome number unknown.

*Galea peruviana* is apparently endemic to the Andes of Colombia. *Galea peruviana* is expanded here to include *G. pennellii* Blake as examination of types showed them to be conspecific. *Galea trianae* Hieron. and *G. trianae* var. *tolimense* Hieron. are conspecific and are treated here as *G. peruviana* var. *tolimense*. Varietal recognition seems appropriate for these taxa since both exhibit vegetative and morphological patterns and floral traits allying the two but distinguishing them from all species of *Calea*. 
Key to the Varieties of *Galea peruviana*

Plants generally less than 1.5 m tall, leaves commonly tomentose, heads terminal and solitary on stout peduncles 5-15 cm long, heads with 70-175 flowers, rays with 9-13-nerved ligules .........

................................. *G. peruviana* var. *peruviana*

Plants generally 1.5 m or taller, leaves puberulent to densely pubescent, heads axillary on slender peduncles less than 8 cm long, heads with 50-80 flowers, rays with 7-10-nerved ligules .....

................................. *G. peruviana* var. *tolimense*

\[a.\] *Galea peruviana* (H.B.K.) Benth. ex S.F. Blake var. *peruviana*, J. Bot. 53: 155. 1915. *Leontophthalmum peruvianum* H.B.K., Nov. Gen. Sp. 4: 296. tab. 409. 1820. (Clea *leontophthalmum* DC., Prodr. 5: 675. 1836, nom. superfl.). Type: "temeratis Peruvia", no date, M. A. Bonpland s. n. (Holotype: P, IDC microfiche 6209. 113: I.2!, fragments in F!; Isotypes: B, destroyed, Fig. 46, B-W #16401, IDC microfiche 7440. 1183: 2.5!, F!, photograph of B in F!). Bonpland's collection data are presumed to be in error as this species is not known from Peru. Geographic errors in Bonpland's data have been noted by Blake (1935) and Wurdack (1971). The only locality visited by Humboldt
and Bonpland within the range of *C. peruviana* was Bogotá, and their specimens were collected in the mountains east of Bogota between Jul and Sep, 1801.


This variety is common between 2570–3300 m in the Cordillera Oriental of Colombia and is especially abundant in the mountains west of Bogota. It flowers year-round with an apparent peak from May–October. *Calea subcordata*, by virtue of its tomentose, prominently reticulate leaves, shrubby habit, large heads and abaxially glandular ligules, resembles *C. peruviana* var. *peruviana*. However, *C. subcordata*, by its possession of cordate leaf bases, peduncles under five cm, and five-nerved rays, differs from this variety. This species is used medicinally in Colombia and its common name is "cabezona" (Perez-Arbelaez, 1956, 1975).

ADDITIONAL SPECIMENS EXAMINED. COLOMBIA. BOYACA: Quebrada de Becerra al morroeste de Duitama, 2940 m, 4 Aug 1940, Cuatrecasas 10385 (F, US); "El Calvario", en Duitama, 28 Jun 1944, Garganta 728 (F); Monte Carmelo near Hotel Thermales, Paipa, 2570 m, 16 Aug 1953, Langenheim 3456 (MICH, UC, US); CUNDINAMARCA: Usaquen, 23 Mar 1949, Antonio-Camel 12 (F); entre Bogotá y La Calera, 2650–3000 m, 27 Nov
1947, Barkley et al. 176719 (MO, US); Usaquen, near Bogotá, 2800m, Sep 1936, Bequaert 49 (F, GH, US); Quebrada Chico-Bogotá, Dec 1946, Black 46-404 (F); Macizo de Bogotá, Quebrada de Chico, 2640-2670 m, 25 May 1939, Cuatrecasas 5053 (F); N end of Sabana near Suba: Finco San Pedro, 2620-2700 m, 13 Sep 1961, Cuatrecasas and Jaramillo 25939 (US); roadside near Usaquen, Dec 1981-Jan 1982, Douglas 1 (LSU); Cerro de Suba, 2700 m, 6 Mar 1946, Duque-Jaramillo 2821 (LIL); hills 1 km S of Suba, 13 km N of center of Bogotá, 12 Jun 1944, Fasberg 21982 (NY, US); Bogotá, El Chico, 2640 m, 10 Feb 1948, García-Barriga 12658 (US); Usaquen, Jan 1939, Gonzales 1836 (US); Bogotá, 1844, Goudot (F); Usaquen, 2700-2900 m, 18 May 1947, Haught 5738 (US); Bogotá, Subparamo, Vitelma, 2800 m, 4 Jun 1944, Hermann 11365 (GH, MO, US); Bogotá, Paramo de Guascal, 3100-3300 m, 5 Jul 1945, Hodge 6474 (F, GH); E. montibus juxta Bogotam, Oct 1852, Holton 376 (GH, NY); Montserratae in montibus juxta Bogotam, Oct 1852, Holton 377 (K); "Bogua", 2680 m, 29 Jul 1943, Huertas and Camargo 789 (F); Bogotá Chapineo en via al Usaquen, 27 May 1926, Juzepczuk 4692 (US); ca. 14 km NE of Bogotá, 2650 m, 21 Jun 1965, King and Guevara 5686 (F, NY); Usaquen, 2000 m, Nov 1930, Perez-Arbelaez 613 (US); Bogotá, Jul 1931, Perez-Arbelaez 1051 (US); Sabana de Bogotá, May 1923, Pring 162 (MO); Lugar, El Chico, en la serranica Bogotá, 25 Apr 1951, Romero-Castaneda 2476 (F, NY); above Bogotá, 2700-2800 m, 16 Aug 1917, Ruby and Penne21 1291 (NY); Suba Hill, near Bogotá, 4 Feb 1945, Schiefer 411 (GH, MO, UC, US); Cerro El Retiro, Macizo de Bogotá, 2600-2700 m, 1 May 1946, Schultes 7031
lb. **Calea peruviana** (H.B.K.) Benth. ex S. F. Blake var. **tolimensis** (Hieron.) Pruski and Urbatsch comb. nov.

Type: Colombia, Tolima, in silvis prope Dolores, 1400-1800 m, Jan, no year, **F. C. Lehmann** 6357 (Holotype: K!, herb. #1329-129-242; Isotypes: F!, K!, US!, photograph of K Isotype in GH!).


Lectotype (here chosen): Colombia, Sacheta i Gachola, 1750 m, no date, **J. J. Triana** 1414 (BM, fragments and
photograph in US!; Isolectotypes: B, destroyed, NY!  
Fig. 47; photographs of B in F!, GH!, NY!). Syntype:  
Colombia, Cundinamarca, in fruticetis camporum sabinas  
dictorum prope Pacho, 1400-1800 m, Jan, no year, F. C.  
Lehmann 7341 (K?).  

_Calea peruviana_ var. _tolimensis_ is an uncommon variety  
occurring outside of Bogota between 1300-1800 m. It flowers in  
September and January and superficially resembles _C._  
_bucaramangensis_. However, the former possesses glandular leaves,  
peduncles to eight cm and seven-ten-nerved, abaxially glandular  
ligules, whereas the latter has non-glandular leaves, peduncles four  
cm or less in length and non-glandular five-nerved ligules.  

ADDITIONAL SPECIMENS EXAMINED. COLOMBIA: CUNDINAMARCA:  
Guayabetal to Monte Redondo, SE of Quetame, 1300-1500 m, 6 Sep 1917,  
Pennell 1790 (GH, NY).  

9: 236. 1954. Type: Colombia, Norte de Santander region  
del Sarare, estrecho o Callejon del Marqua, Pena de los  
Mincos, 1100 m, 23 Nov. 1941, J. Cuatrecasas 13429  
(Holotype: F!, Fig. 48; Isotype: US!).  

Much branched, low, creeping shrubs; stems weak, decumbent to  
erect, subterete, finely striate, densely pubescent with globular  
and uniseriate trichomes, branching at angles of 25-65°; internodes  
usually 1-3 cm long; leaves opposite or whorled; blades elliptic to
lanceolate, chartaceous-coriaceous, smooth, triplinerved, 1.3-3 cm long, 0.3-1.1 cm wide, apices acute to obtuse, bases narrowly cuneate, margins with 1-2 pairs of supramedial dentations, otherwise entire, upper surfaces lustrous, essentially glabrous, lower surfaces pale green, dotted with resinous globular trichomes, otherwise glabrous; petioles 1-3 mm; capitula terminal, solitary, radiate, ca. 35-flowered; peduncles tortuous, (3-)6-15 cm long, pubescent; involucres hemispherical, 8-10 mm tall, 5-8 mm broad, about 3-seriate; phyllaries imbricate, subequal; outer (4)6 elliptic-lanceolate, 7-12 mm long, 1.5-3 mm wide, herbaceous, pubescence like that of the leaves, apices acute to obtuse, bases cuneate, inner phyllaries ovate to elliptic, 5.5-8 mm long, 2-3 mm wide, obscurely striate, scarious, grading from abaxial puberulent to glabrous, apices acute to acuminate, margins slightly membranous; ray flowers 9-13, corollas 10-14 mm long, tube 2.5-3.1 mm long, glabrous, ligules yellow, 7-10-nerved, 7-11 mm long, 3-4 mm wide, apices with 2-3 shallow lobes, abaxial surfaces glandular, pappus of 19-22 linear-lanceolate scales, 3.5-4.5 mm long; disk flowers ca. 25, corollas yellow, 4.4-5.2 mm long, glabrous, lobes erect, 0.7-1.2 mm long, pappus of 18-22 linear-lanceolate scales; 4-5.6 mm long, anthers slightly exserted, yellow, 1.7-2.2 mm long, appendages glandular abaxially, styles 4.8-5.7 mm long with branches 0.8-1.1 mm long; receptacles conical, 2.5 mm tall and 1.2 mm broad; paleae lanceolate, conduplicate, trifid, apices acute, pale yellow, 4.8-5.2 mm long, 0.7-1 mm wide; achenes of ray and disk flowers similar,
obconic, olivaceous to dark brown, ca. 2.5 mm long, glabrous to puberulent apically. Chromosome number unknown.

*Calea saxatilis*, reported here for the first time as occurring in Venezuela, is a rare species of the Andes of Colombia and Venezuela. It occurs at altitudes between 1200–2100 m and flowers from August–November. It resembles no other Andean species of *Calea* closely, but is related to several Brazilian, Bolivian and Paraguayan savanna species, including *C. rupicola* Chod., *C. uniflora* Less., *C. parviflora* (DC.) Gand. and *C. pilosa* Baker, and to *C. nana* Maguire of Cerro Sipapo, Venezuela. *Calea saxatilis*, which possesses peduncles to 15 cm, abaxially glandular seven–ten–nerved ligules, and occasionally whorled leaves is readily distinguished from its nearest ally, *C. nana*, which has peduncles less than one cm long, glabrous, five–seven–nerved ligules and opposite leaves. *Sabazia trianae* (Hieron.) Longpre superficially resembles *C. saxatilis* and has a similar geographic distribution. However, its disk corollas, pubescent with uniseriate trichomes readily distinguishes it from *C. saxatilis* which has glabrous ones. The foliar traits of *C. saxatilis* most closely resemble *C. abelioides* S. F. Blake, *C. divaricata* Benth. and *C. fluvatilis* S. F. Blake in that the pubescence consists predominantly of globular trichomes.

**ADDITIONAL SPECIMENS EXAMINED.** COLOMBIA. BOYACO: in hill sabana at Bachira, Sierra Nevada del Cocuy, ca. 2100 m, 20 Aug 1957, Grubb et al. 623 (K). VENEZUELA. TACHIRA: open sandstone ridge on summit of Cerro Azul, at Cerro Las Minas, 18 km southeast of Santa
Ana, 1200-1380 m, 11 Nov 1979, Steyermark et al. 120035 (US).

   
   Type: Colombia, Norte de Santander, open hillsides, La Isla, 2000-2500 m, 27 Feb 1927, E. P. Killip and A. C. Smith 19808 (Holotype: US! Fig. 49; Isotypes: A!, GH!, NY!).


   Much branched subshrubs to shrubs to 2.5 m tall; stems semiprostrate to erect, subterete, finely striate, densely pubescent to tomentose, branches at angles of 15-40°, leaves opposite; blades ovate to cordiform, coriaceous, smooth to subrugose, 5-7-nerved, 1.5-7.5 cm long, 1-6.5 cm wide, apices acute to rounded, bases cordate to truncate, margins remotely serrate, revolute, upper surfaces light to dark green, scaberulent, lower surfaces pale green, prominently reticulate, pubescent to tomentose with resinous, globular trichomes and uniseriate, arcuate, multicellular trichomes; petioles 3-8 mm long, densely pubescent to tomentose, bases persistent giving nodes swollen appearance; capitula terminal, solitary, radiate, 75-120-flowered; peduncles to 5 cm long, pubescence like that of the stems; involucres hemispherical, 9-11 mm
tall, 11-14 mm broad, 3-4-seriate; phyllaries imbricate, subequal-graduate, outer 4 obovate to elliptic, 8-13 mm long, 5-10 mm wide, herbaceous, reticulate, pubescence like that of the leaves, apices acute to rounded, bases cuneate, margins ciliate, subrevolute, inner phyllaries elliptic, 7-10 mm long, 3-4.2 mm wide, striate, scarious, grading from abaxially puberulent to glabrous, apices membranous, obtuse to acute, margins membranous; ray flowers 15-18, corollas 11.5-15.5 mm long, tube 4-4.5 mm long, glabrous, ligules deep yellow, 5-nerved, 7.5-11 mm long, 3-4.5 mm wide, apices with 3-4 shallow lobes, abaxial surfaces with resinous globular trichomes, pappus of 21-26 linear-lanceolate scales, 4.2-5.7 mm long; disk flowers 60-100, corollas yellow, 5.3-7.2 mm long, glabrous, lobes erect, 0.9-1.6 mm long, pappus of 21-28 linear-lanceolate scales, 5-6.5 mm long, anthers exserted, yellow, 2-2.5 mm long, appendages glandular abaxially, styles 6-7.5 mm long with branches 1-1.5 mm long; receptacles conical, 3-4 mm tall and broad; paleae lanceolate, conduplicate, mostly trifid with acuminate central lobes, lateral lobes subapical, pale yellow, (3.8)4.5-6.5(7.5) mm long, 0.8-1.2 mm wide; achenes of ray and disk flowers similar, cylindric to obconic, prismatic, black, 2.2-3.5 mm long, glabrous or slightly pubescent apically. Chromosome number unknown.

*Calea subcordata* is locally abundant in remote regions of the Cordillera Oriental in Norte de Santander and Santander, Colombia, and Tachira, Venezuela, where it occurs in open grassy hillsides,
thickets, and roadside embankments between 1500-2600 m. This species flowers sporadically throughout the year. It is most closely related to *C. peruviana* and *C. gargantae* by virtue of its shrubby habit, large heads, and densely pubescent leaves. However, *C. peruviana* has a more southern distribution, cuneate leaf bases and abaxially glandular 7-13-nerved ligules and thus differs from *C. subcordata* which has subcordate leaf bases and abaxially glandular five-nerved ligules. *Calea gargantae* has pubescent achenes and abaxially glabrous five-nerved ligules and can be differentiated from both *C. peruviana* and *C. subcordata*.

ADDITIONAL SPECIMENS EXAMINED. COLOMBIA. NORTE DE SANTANDER: region de Ocana, Ceranias de La Maria, cerros aridos, 1950 m, 25 Sep 1969, Cuatrecasas and Rodriguez 27947 (US); Santa Margarita, near Ocana, 1500 m, Cure 1606 (F); alrededores de Pamplona, 25 Sep 1943, Garganta-Fabrega 663 (F); de La Hacienda del Talco a Terebinto, camino de Bachalema a Durania, 2 Jun 1944, Garganta-Fabrega 824 (F); Pamplona, sudoeste de la ciudad, por el Rosal, 30 Jun 1945, Garganta-Fabrega 1060 (F, US); camino Pamplona a Pamplonita, 3 May 1946, Garganta-Fabrega 1185 (F); mountain slopes around Ocana, 5000-7000 ft, 11 Oct 1877, Mathews 240 (K); SANTANDER: vicinity of Charta, 2000 m, 1-11 Feb 1927, Killip and Smith 18866 (GH, NY); hillside, vicinity of Charta, 2000-26000 m, 1-11 Feb 1927, Killip and Smith (A, GH, NY, US). VENEZUELA. TACHIRA: between Las Delicias and Paraguita, bordering Rio Tachira, along Colombian-Venezuelan boundary, 1675-1890 m, 12 Jul 1944, Steyermark
57135 (F, NY, US); entre Las Delicias y Villa Paez, arriba del Río Tachira, a lo largo de la frontera Colombo-Venezolana, 1500-1920 m, 16-26 May 1967, Steyermark and Dunsterville 98887 (F, US); 3.7 km north of Villa Paez along road to Las Delicias, near the Río Tachira, along the Venezuelan-Colombian border, 1750 m, 9 Dec 1979, *Urbatsch and Pruski 3427 (LSU).

   9: 234. 1954. Type: Colombia, Magdalena, Sierra de Perija, open fields above "Africa" on trail to Villanueva, 1700 m, 17 Dec 1944, O. Haught 4525 (Holotype: US!, Fig. 50; Isotypes: COL, NY!, UC!).

Subshrubs, usually 0.8-1.5 m high; stems erect, subterete, striate, pubescent, resinous globular trichomes dotted, internodes 4.5-7 cm long, sparsely branched, branching at angles of 20-30°; leaves opposite; blades ovate to ovate-elliptic, chartaceous-coriaceous, smooth, triplinerved, (4)5.5-9 cm long, (2.5)3.5-6 cm wide, apices obtuse, bases broadly cuneate to subtruncate, margins serrate with 8-9 pairs of teeth, upper surfaces dark green, slightly scabrous, resinous globular trichomes present, lower surfaces paler green, prominently reticulate, densely pubescent with resinous, globular trichomes and uniseriate, arcuate, multicellular trichomes; petioles (4.5)6-10 mm long, pubescent; capitulescences of terminal or axillary umbelliform or cymose
clusters of 7-18 heads; peduncles 0.7-1.9 cm long, pubescence like that of the stem; involucres campanulate, 8-11.5 mm tall, 5.5-6.5 mm broad, 4-5-seriate; phyllaries imbricate, graduate, outer ones ovate-elliptic, 3-4.4 mm long, 1.2-1.8 mm wide, herbaceous, pubescence like that of the leaves, apices acute, bases cuneate, margins ciliate, inner phyllaries elliptic, 8-10 mm long, 1.3-2.7 mm wide, striate, scarious, grading from abaxially pubescent to glabrous, apices membranous, acute to obtuse, margins membranous; capitula radiate, 32-46-flowered; ray flowers 7-10, corollas 8.6-10.2 mm long, tube 1.4-2 mm long, glabrous, ligules pale yellow, 5-nerved, 7.2-8.2 mm long, ca 2 mm wide, apices entire or with 2-3 shallow lobes, abaxial surfaces lightly glandular, pappus of 18-23 linear-lanceolate scales, 3.9-4.8 mm long; disk flowers 25-36, corollas yellow, 6.4-7.5 mm long, glabrous, lobes erect, 1.4-1.9 mm long, pappus of 18-23 linear-lanceolate scales, 5-6 mm long, anthers exserted, yellow, 2.5-3 mm long, appendages glandular abaxially, styles 7.5-8 mm long with branches 1-1.5 mm long; receptacles conical, 1-2 mm tall and broad; paleae lanceolate, conduplicate, generally trifid with acuminate central lobes and subapical lateral lobes, but ranging from entire to pentafid, pale yellow, 5.5-7 mm long, 0.6-0.9 mm wide; achenes of ray and disk flowers similar, obconic, prismatic, brown, (2.5)2.7-3 mm long, pubescent.

Chromosome number unknown.

*Calea perijaensis* is a rare shrub occurring from Mt. Perija of the Colombian-Venezuelan border eastward toward Maracaibo,
Venezuela. This taxon has been collected at 1700 m and is known to flower in December and March. The combination of heads with about nine rays, each with (three)five-nerved, abaxially glandular ligules, ray tubes about two mm, and palmately veined leaves makes this taxon unique among species of *Calea* from Colombia and adjacent mountainous regions of the Venezuelan Andes. Its closest ally is *C. tolimana* of the savannas of parts of Colombia and Venezuela. *Calea tolimana* has eight or fewer rays, thus resembling *C. perijaensis*. However, the possession of penninerved leaves in *C. tolimana* clearly separates it from *C. perijaensis*.

**ADDITIONAL SPECIMEN EXAMINED.** VENEZUELA: ZULIA: mountains of Maracaibo, Sep 1822, Perea s. n. (K!, herb. #1329-129-231).

Aristeguieta (1964) cited the following collection: ZULIA: Perija, Gines 2014.

5. *Calea tolimana* Hieron., Bot. Jahrb. Syst. 19: 57. 1894. Type: Colombia, Tolima, crescit in fruticetis apertis prope Dolores, 1000-1600 m, Mar 1892, F. C. Lehmann 7497 (Holotype: B, destroyed, fragments in US!, photographs of B in F!, GH!, NY!; Isotype: K!, Fig. 51.).

*Calea ovalis* S. F. Blake, Contr. U.S. Natl. Herb. 22: 645. pl. 61. 1924. Type: Colombia, Cundinamarca, open slope, "Monte Redondo", south of Quetane, 1600-2000 m, 6 Sep 1917, F. M. Pennell 1821 (Holotype: US!;
Isotypes: GH!, NY!).


Subshrubs to shrubs, 0.5–2 m high; stems erect, subterete, striate, puberulent to pubescent, internode length of main stems highly variable, as short as 1.5 cm but generally 4–6 cm long, branches ascending at angles of 15–40°; leaves opposite; blades ovate-elliptic to elliptic-lanceolate, coriaceous, smooth, pinnately nerved, 4–11.5 cm long, 1–7 cm wide, apices acute to obtuse, bases rounded to cordate, margins serrate to crennate, occasionally revolute, upper surfaces dark green, slightly scabrous, lower surfaces paler green, reticulate, glandular to pubescent, pubescence of resinous globular trichomes and often of long uniseriate
multicellular trichomes; petioles 2-7 mm long, sometimes
canalicate, lightly pubescent; capitulescences of terminal or
axillary, cymose to umbelliform clusters of 5-15 heads; peduncles
4-15.5 cm long, pubescence like that of the stems; involucres
hemispherical, 8-10 mm tall, 6-9 mm broad, 3-4(5)-seriate;
phyllaries imbricate, graduate to subequal, outer ones elliptic to
lanceolate, often with a slight medial constriction, 4-5 mm long,
1.5-2.2 mm wide, herbaceous throughout, or with scarious bases,
puberulent, apices acute to rounded, inner ones grading from
elliptic to lanceolate, 3.5-9.5 mm long, 2.5-3.4 mm wide, striate,
scarious, often with herbaceous tips, golden, glabrous or nearly so,
apices acute to rounded, membranous; capitula radiate,
(12)25-50-flowered; ray flowers (2)3-8, corollas 7.5-10.5(11.5) mm
long, tubes 3.2-4.5 mm long, glabrous, ligules yellow, 5(3)-nerved,
4.3-6(7) mm long, 1.2-1.7 mm wide, apices with 3(2) shallow lobes,
abaxial surfaces glandular, pappus of 17-22 linear-lanceolate 4-5.5
mm long; disk flowers (10)21-42, corollas yellow, 4.5-6 mm long,
glabrous, lobes ascending, 1-1.8 mm long, pappus of 18-24
linear-lanceolate scales, 4.2-5.7 mm long, anthers exerted, yellow,
often glandular abaxially from appendages to bases, 2.3-3 mm long,
appendages glandular, styles 6.3-7.1 mm long with branches ca. 1.1
mm long; receptacles conical, ca. 1.5 mm tall and broad; paleae
elliptic-lanceolate, conduplicate, mostly trifid, scarious,
(3.2)4-5.7 mm long, 1-1.4 mm wide; achenes of ray and disk flowers
similar, obconic, prismatic, black 1.5-2.8 mm long, grading from
puberulent to pubescent, and glandular. Chromosome number unknown.

*Calea tolimana* is widely distributed and occurs from Cordillera Oriental of Colombia eastward into the white sand savannas of Amazonas, Venezuela. Its penninerved leaves, anthers that are often glandular along the entire length, and heads with only one-seven rays make this *Calea* unique among species of the region. A cline with respect to leaf width and pubescence exists between the high and low altitude forms. The high altitude plants have oval, more pubescent leaves, while the low altitude plants have narrowly elliptic puberulent leaves. *Calea ovalis* is placed in synonymy under *C. tolimana* as examination of their respective types show them to be conspecific. Similarly, after reviewing the description of *C. huberana* and examining Huber 1019, a paratype, no significant difference was observed between this taxon and *C. tolimana*. Badillo (1981) suggested that *C. huberana* has cuneate to rounded leaf bases and, therefore differs from *C. ovalis* (ie. *C. tolimana*), which has cordate leaf bases. However, this trait was found to be too variable to be a good taxonomic marker. The closest relatives of *C. tolimana* are *C. coriacea* DC. of Peru and Bolivia, a shrub with penninerved leaves and *C. perijaensis* of Mt. Perija of the northern reaches of the Colombian-Venezuelan border. *Calea coriaceae* differs from *C. tolimana* by possession of ligules with more than seven nerves, disks with lobes less than one mm long, achenes up to 3.5 mm long, and generally larger heads, while *C. perijaensis* is clearly distinguished by its palmately veined leaves.
ADDITIONAL SPECIMENS EXAMINED. COLOMBIA. META: 60 km E of Villavicencio, 400 m, 22 Dec 1938, Haught 2479 (US); Ranch Menegua, ca. 100 km SE of Villavicencio, 15 Jul 1945, Schiefer 810 (GH); TOLIMA: Dolores, 1400-1800 m, Jan, Lehmann 6385 (GH; photo of K); VAUPES: Rio Kuduyari, Yapoboda, 4-6 Oct 1951, Schultes and Cabrera 14341 (GH, US); Rio Parana Pichuna (trib. of Rio Vaupes), 700 ft, 1°10' N, 70°30' W, Jun 1953, Schultes and Cabrera 19914 (NY, UC, US); Rio Kuduyare (trib. of Rio Vaupea), Yapoboda, 900-1000 ft, 1°20' N, 70°30' W, Apr 1953, Schultes and Cabrera 19993 (US); Mitu' and vicinity; lower Rio Kubiyu, 30 Jan 1976, Zarucchi and Bolick 1781 (GH, US); VICHADA: 70 km S 65°E of Drocue, 150 m, 25 Apr 1939, Haught 2790 (K, NY, UC, US); Rio Vachada at Bopimi, ca. 14 km NW of San Jose De Ocune, 100 m, 25 Jan 1944, Hermann 11109 (NY, US); DEPTO. UNKNOWN: Casanaie, Tauramena, sabonoso do Aguablano, 550 m, 30 Jan 1961, Uribe Uribe 3761 (US); VENEZUELA. AMAZONAS: Cerro Valipano a Orillas del Rio Parucito, 6°N, 65°43'W, Aug 1962, Brewer 24 (VEN); Rio Paru, cano Asisa, Rio Venturari, west base of Cerro Paru, 200m, 15 Feb 1951, Cowan and Wurdack 31477 (NY); Santa Barbara, 3°57'N, 67°6'W, 1968, Eden 218/1 (K, VEN); entre la Estacion de Pisci, entre la carretera Lacia, Samariapo y la pista se atezzizaje de Aeropuerto de Puerto Ayacucho, 5°37'N, 67°36'W, ca. 75m, 24 Aug 1977, Huber 1019 (VEN); Cerro Yapaca da Rio Orinoco, 125m, 1 Jan 1951, Maguire et al. 30581 (F, NY); Cerro Moriche Rio Ventuari, 800 m, 14 Jan 1951, Maguire et al. 30904 (NY, VEN); Cerro Moriche Rio Ventuari, 1100 m, 15 Jan 1951, Maguire et al. 30957 (NY,
US); Cano Guavianto Rio Manapiaie, Rio Ventuari between Camp Verada and Camp M. Perez, Cano Verada, 900-1100 m, 30 Jan 1951, *Maguire et al. 31656* (NY, VEN); Santa Barbara, jct of Rios Orinoco and Ventuari, 22 Feb 1951, *Maguire et al. 32031* (NY); AMAZONAS-BOLIVAR BOUNDARY: Pica Carcara del Orinoco-San Juan de Manapiare, Rio Suapure at sur de Caicara, 100-200 m, 5°45'N, 60°10'W, Mar 1975, Delascio and Lopez 2815 (VEN); BOLIVAR: Sabana Cardona, Rio alto Suapure (afluente Orinoco), 380 m, 6°02'N, 66°14'W, 9 Oct 1970, Cardona-Puig 3042 (NY, US).

6. *Calea gargantae* Cuatr., Revista Acad. Colomb. Ci. Exact. 9: 236. 1954. Type: Colombia, Norte de Santander, de la hacienda del Talco a Terehinto, camino de Bochalema a Durania, 2 Jan 1944, M. de Garganta-Fabrega 838 (Holotype: F!, Fig. 52).

Shrubby; stems ascending, tortous, subterete, striate, puberulent branching at angles of 35-40°; leaves opposite; blades cordiform, coriaceous, smooth to subrugose, generally 5-nerved, 2.5-5 cm long, 1.3-3 cm wide, apices acute, bases cordate to truncate, margins serrate-crenate with about 8 pairs of teeth, subrevolute, upper surfaces dark green, slightly scabrous, lower surfaces pale green, tomentose, pubescence of resinous, globular trichomes and of uniseriate, arcuate, multicellular trichomes; petioles 2.5-5 mm long, often canaliculate, densely pubescent;
capitulescences umbelliform (cymose); peduncles 1.5-2 cm long, densely pubescent; involucres hemispherical, ca. 8 mm tall, 7-10 mm broad, 3-4-seriate; phyllaries imbricate, subequal-graduate, outer 4 ovate to ovate-elliptic 5-7 mm long, 3-4 mm wide, herbaceous, densely pubescent, apices acute to obtuse, bases cuneate, margins ciliate, inner phyllaries ovate-elliptic, 7-8 mm long, 3-3.5 mm wide, substriate, scarious, grading from abaxially puberulent to glabrous, apices membranous, obtuse, margins slightly membranous; capitula radiate, 35-45-flowered; ray flowers ca. 10, corollas 7-8 mm long, tube 3.3-3.8 mm long, glabrous, ligules deep yellow, 5-nerved, 3.7-4.2 mm long, 1.5-2 mm wide, apices with 3-4 shallow lobes, abaxial surfaces lacking glands, pappus of 18-23 linear-lanceolate 4-5 mm long; disk flowers ca. 30, corollas yellow, 5-5.9 mm long, glabrous, lobes erect, 1.2-1.7 mm long, pappus of 18-23 linear-lanceolate 5-5.8 mm long, anthers slightly exserted, yellow, ca. 2 mm long, appendages deltoid, glabrous, styles 5.5-6.2 mm long with branches ca. 7 mm long; receptacles conical, ca. 2.2 mm tall and broad; paleae lanceolate, conduplicate, mostly trifid with acuminate central lobes, lateral lobes subapical to supramedial, 5-6 mm long, 1.3-1.9 mm wide; achenes of ray and disk flowers similar, obconic, prismatic, dark brown, 1.7-2.2 mm long, pubescent.

Chromosome number unknown.

_Calea gargantae_ is known only from the type locality, occurs approximately at 1500 m, and has been collected in flower during June. It has tomentose leaves, densely pubescent achenes and
non-glandular, five-nerved ligules, and thus differs from all species of Calea in its range. Its closest ally is C. bucaramangensis which has non-glandular, pubescent leaves and glabrous achenes. Calea subcordata is also related to C. gargantae but differs in its possession of abaxially glandular ligules with seven-ten nerves and glabrous achenes.

7. Calea bucaramangensis Pruski & Urbatsch, ined. Type:
Colombia, Santander, 61 km SE of Bucaramanga on the road to Malaga, 1650 m, 18 Jun 1977, J. Olsen and L. Escobar 567
(Holotype: LSU!, Fig. 53; Isotype: LL!).

Shrubs to 3 m; stems erect, becoming vine-like, subterete, finely striate, densely pubescent, becoming glabrous with age, branching at angles of 60-85°, internodes mostly 2.5-5 cm long; leaves opposite; blades cordiform, chartaceous to coriaceous, smooth to rugose, palmately 3-5-nerved, 2.5-7 cm long, 1.3-4.2 cm wide, apices acute to acuminate, bases cordate, margins remotely serrate, often revolute, upper surfaces dark green, scabrous with uniseriate, arcuate, multicellular trichomes ca. 1 mm long, lower surfaces paler green, hirsute, trichomes as on upper leaf surfaces, resinous globular tichomes absent; petioles 2.5-4 mm long, often canaliculate, densely pubescent, base persistent; terminal capitulescences umbelliform, lower axils with solitary heads; peduncles 1.5-4 cm long, pubescence like that of the stems; involucres hemispherical, 7-11 mm tall and broad, 3-4-seriate;
phyllaries imbricate, subequal to graduate, outer four ovate-obovate, 5.5-7.5 mm long, 2.5-3 mm wide, herbaceous, pubescence like that of the leaves, apices acute, margins ciliate, inner phyllaries deltoid to elliptic, 4-5.6 mm long, 2-3 mm wide, striate, scarious, grading from abaxially puberulent to glabrous, apices membranous, acute, margins membranous; capitula radiate, 50-65-flowered; ray flowers 10-15, corollas 7.5-11 mm long, tubes 2.5-4 mm long, glabrous, ligules yellow-orange, 5-nerved, 4.5-7 mm long, 2.4-3 mm wide, apices with 4(3) shallow lobes, abaxial surfaces lacking glands, pappus of 23-30 linear-lanceolate 3.7-4.8 mm long; disk flowers 40-50, corollas yellow, 5-5.6 mm long, glabrous, lobes erect, 0.8-1.4 mm long, pappus of 25-30 linear-lanceolate scales, 4.5-5.8 mm long, anthers exserted, yellow, 2.1-2.5 mm long, appendages glabrous, styles 5.5-6.5 mm long with branches 0.7-1.1 mm long; receptacles conical, 2.4-2.7 mm tall and broad; paleae lanceolate, conduplicate, mostly trifid with prominent acuminate central lobes and subapical lateral lobes, but ranging from entire to lacerate, 4-5.5 mm long, 0.8-1.3 mm wide; achenes of rays and disks similar, obconic, prismatic, black, 1.8-2.4 mm long, glabrous; pollen heliantheous, ca. 25 μm in diam., ectoapertures long, endoapertures rectangular. Chromosome number unknown.

_Calea bucaramangensis_ is a shrub or a shrubby vine flowering in May and June. It ranges from open hillsides to canyon walls between 1230-1675 m.

_Calea bucaramangensis_ can easily be distinguished from all
other species of *Calea* on the basis of floral, vegetative, and habit characteristics. In particular, the total lack of resinous globular trichomes in *C. bucaramangensis* makes this taxon unique among species of *Calea* from this region.

*Calea bucaramangensis* is most closely allied to the shrubby *C. gargantae* Cuatr. in having umbelliform capitulescences and non-glandular, five-nerved ligules. However, the former possesses moderately pubescent leaves, glabrous achenes, and lacks globular trichomes, whereas the latter has densely pubescent glandular leaves and pubescent achenes.

**ADDITIONAL SPECIMENS EXAMINED:** COLOMBIA. SANTANDER: high on the SE facing walls of Cañón de Chicamocha, near Hacienda de Los Cacaos, Mesa de Los Santos, 1600-1675 m, 17 Jun 1953, J. H. Langenheim 3027 (GH, UC); full exposure, Bucaramanga, 4000 ft, May 1948, C. Sandeman 6006 (K).


Exact. 9: 235. 1954. Type: Colombia, Cundinamarca, Pacho, San Cayetano Highway, 2300m, 1 Aug 1947, O. Haught 6024 (Holotype: US!, Fig. 54; Isotype: COL). A specimen in F was cited by Cuatrecasas as being the holotype. However, the US sheet was annotated by Cuatrecasas as being the holotype and therefore is considered here to be the holotype.

Shrubs, ca. 1 m tall; stems scandent, flexuous, subterete,
striate, lightly pubescent, branching at angles of 45-75°, internodes mostly 2-5 cm long; leaves opposite; blades elliptic, chartaceous, smooth, triplinerved, 4-8 cm long, 1.5-3.7 cm wide, apices acute, bases broadly cuneate, margins often revolute, remotely serrate with 4-5 pairs of teeth, upper surfaces dark green, scabrous, pubescence of short, uniseriate, multicellular trichomes, lower surfaces paler green, puberulent, pubescence of long, uniseriate, multicellular trichomes, and resinous globular trichomes; petioles 4.5-8 mm long, puberulent; capitulescences cymose, simple or branched, terminal and axillary cymes each with about 5 heads; peduncles pubescent, 2-10 mm long; involucres cylindrical, 7.5-9 mm tall, 4-5 mm broad, 4-6-seriate; phyllaries imbricate, graduate, outer ones deltoid, ca. 2 mm long, 1 mm wide, striate, herbaceous, pubescent, apices acute to acuminate, margins ciliate, inner ones grading from elliptic to lanceolate, 5-6.5 mm long, 1.5-2.2 mm wide, striate, scarios, tips membranous, glabrous or nearly so, apices rounded, margins often ciliate; capitula discoid, 16-19-flowered, corollas yellow, ca. 5.2 mm long, glabrous, lobes spreading, 1.1-1.3 mm long, pappus of ca. 22 linear-lanceolate scales, 4.7-6 mm long; anthers exserted, yellow, 2-2.3 mm long, appendages glabrous, rarely glandular abaxially, styles 6-6.5 mm long with branches 0.7-1.1 mm long; receptacles conical, 3.5-4 mm tall, ca. 1.2 mm broad; paleae lanceolate, conduplicate, entire to lacerate, 4.6-5.2 mm long, 1.3 mm wide; achenes obconic, prismatic, black, 2-2.5 mm long, essentially glabrous. Chromosome number

that ca 1 mm
tube ca 2.6
Galea perlmbricata is known from only two collections, and these show that it occurs approximately between 1900-2300 m, and flowers in May and August. While its habit and structure of heads ally it to C. solidaginea it differs in having more coriaceous leaves and cymose (not umbelliform) capitulescences. In foliar traits C. perlmbricata most closely resembles C. septulinervia, but the glomerate heads of the latter versus heads singly on peduncles of the former differentiate these taxa.

ADDITIONAL SPECIMEN EXAMINED. COLOMBIA. CUNDINAMARCA: Pacho, haciendo de Patasia, 1900 m, May 1949, Uribe-Uribe 1963 (F).

9. Calea berteriana DC., Prodr. 5: 672. 1836. Type: Colombia, Sanctam-Martham (Santa Marta), 1822, C. G. L. Bertero s.n. (Holotype: G-DC, Fig. 55, IDC microfiche 800. 975: III. 7.!, photographs in F!, GH(2)!, NY!, TEX!).

Calea holtoni Rusby, Desc. So. Am. Pl. 156. 1920. Type:
Colombia, on Campo 5 miles east of Bonda, below 3000 ft, Sep-Oct 1898-1899, H. H. Smith 524 (Holotype: NY; Isotypes: F!, GH!, LL!, MICH!, MO!, UC!, US!).


Sparingly to much branched shrubs to 2 m tall; stems erect, striate, lightly pubescent, branching at angles of 30-70°, internodes mostly 1.5-4.5 cm long; leaves opposite, rarely whorled; blades ovate to elliptic, chartaceous-coriaceous, smooth to rugose, triplinerved, 1.5-7 cm long, 1-5.5 cm wide, apices acute, occasion ally rounded, bases broadly cuneate to cordate, margins commonly revolute, serrate-crenate, with 5-12 pairs of teeth, upper surfaces dark green, scabrous, with long multicellular arcuate trichomes, lower surfaces paler green, reticulate, densely pubescent with of long, uniseriate, multicellular trichomes and resinous globular trichomes; petioles 3-10 mm, pubescent; capitulescences of axillary and terminal cymose or umbelliform clusters of 3-13 heads (which occur singly on peduncles); peduncles 5-15(25) mm long, lightly pubescent; involucre campanulate, 5-6.5 mm tall, 3-5(6) mm broad, about 3-seriate; phyllaries imbricate, graduate, outer ones elliptic to lanceolate, (1.5)3-6(11) mm long, 0.8-2(4.5) mm wide, herbaceous, pubescence like that of the leaves, apices acute to rounded, inner ones grading from ovate, to elliptic, 3-6.5 mm long,
1.2-2.5 mm wide, finely striate, scarious, yellow, glabrous or nearly so, apices acute to obtuse, membranous; capitula discoid (rarely with a single, non-lobed, pistillate ray), 10-22-flowered, corollas yellow, 4.2-5.5 mm long, glabrous, lobes ascending to spreading, 1.4-2.6 mm long, pappus of 17-23 linear-lanceolate scales, 3.6-4.7 mm long, anthers exserted, yellow, 1.8-2.3 mm long, appendages glandular abaxially, styles 4.8-6.1 mm long with branches mm long; receptacles conical, 1.2-1.8 mm tall, 0.8-1.1 broad, paleae lanceolate, conduplicate, lacerate, occasionally trifid, striate, pale yellow, 4-6 mm long, ca. 1.3 mm wide; achenes obconic, prismatic, black, 1.8-2.5(3) mm long, pubescent, rarely glandular. Chromosome number unknown.

_Calea berteriana_ is common, widespread, and morphologically variable. It occurs in an arc from the Cordillera Central of Colombia north and eastward into Venezuela and southward across Rio Orinoco into the llanos on the northern edge of the Gran Sabana between 150-2750 m and flowers year-round with peaks in July and December. Although collections from the Andes superficially differ in leaf traits from collections made south of Rio Orinoco, when grown under identical greenhouse conditions, plants of these widely separate geographic areas are quite similar. The differences observed in greenhouse-grown plants of both areas, while nearly identical to field collections, do consistently differ in three traits which are production of outer, foliar phyllaries longer than the inner phyllaries, occasional rays, and flowers only from
December-February. Therefore, plants of this taxon are of a variable genetic stock, and adaptable, thus, the morphologic variabilities in the field may be better understood. The lacerate paleae of *C. berteriana* differentiate it from its nearest allies, *C. crassifolia*, *C. jamaicensis*, *C. lantanoides* and *C. trichomata*. 

*Calea berteriana* is used medicinally, and its common name is "carroposa" (Perez-Arbelaez 1956, 1975.).

**ADDITIONAL SPECIMENS EXAMINED. COLOMBIA. CUNDINAMARCA:**

Tocaima, Dec 1932, Perez-Arbelaez 2113 (US); Girardot, 350-400 m, 19 Jul 1917, Rusby and Pennell 131 (GH, MO, NY, US); Jerusalem, Jul 1930, Perez 573 (US); MAGDALENA: Poponte, Magdalena valley, 19 Oct 1924, Allen 780 (MO); near Codazzi, 150 m, 3 Nov 1943, Haught 3803 (F, GH, NY, US); META: alrededores de Villavicencio cerca del cano Quename, 450 m, 24-28 Jul 1946, Jaramillo et al. 313 (US); El Mico airstrip (camp #1), last savanna before Rio Guejar, 450 m, 6 Nov 1949, Philipson et al. 1321 (NY); NORTE DE SANTANDER: entre Gramalote y rio Seralons, 700-1000 m, 24 Jul 1940, Cuatrecasas and Barriga 10114 (F); region de Ocana, Cerconias de Apacico, hacia La Playa, 7700 ft, 26 Sep 1969, Cuatrecasas and Rodriguez 27964 (US); de la Hacenda del Talco a Terebindo, camino de Bochalema a Durania, 2 Jun 1944, Garganta-Fabrega 837 (F); SANTANDER: envalle hondo, 40 km al sur de Bucaramanga, 600 m, 16 Dec 1948, Molina and Barkley 185323 (US); TOLIMA: Piedras, 400 m, 29 Oct 1938, Haught 2400 (F, US); Supra Honda, Rio Magdalena, Dec 1952, Holton 353 (K, NY); Ibague, 700-800 m, 2 Aug 1952, Koie 5117 (US); DEPTO. UNKNOWN:
1760–1808, Mutis 3812 (US); Triana 1411 (US). VENEZUELA: ARAGUA: Regio Tagua-Tagua, Anzoategui, Oct 1942, Garroni 77 (UC, VEN); BOLIVAR: Laderas del Cerro Bolivar, Cuidad Piar, 450 m, Apr 1954, Aristeguita 2202 (NY, VEN); Cerro Altamira, 10 km E of Cuidad Piar, 425–650 m, 19 Oct 1953, Maguire et al. 35867 (K, NY); upper slopes of Cerro Toribio, 450–500 m, 22 Oct 1953, Maguire et al. 35939 (F, NY, US, VEN); 16.8 km ESE of Upata along Hwy 10, 500 m, 21 Dec 1979, Pruski and Steyermark 1470 (LSU); dry, upland, rocky savanna, 15 km W of Upata, 500 m, 21 Dec 1979, Pruski and Steyermark 1474 (LSU); 5 km W of Upata, 500 m, 31 Jul 1944, Steyermark 57525 (F, NY, VEN); just S of Rio Chiguirete, 6°45’N, 63°30’W, 420 m, 11 Oct 1954, Wurdack & Guppy 24 (NY, VEN); 3 km E of Cano Azul, 6°45’N, 63°30’W, 470 m, 23 Oct 1954, Wurdack and Guppy 185 (NY, VEN); FALCON: entre La Peno y San Luis, 13 Aug 1952, Lasser and Foldats 2975 (VEN); La Pena, Aug 1952, Lasser and Foldats 3203 (VEN, 2 sheets); LARA: Las Cojobas, 300–450 m, 3 Aug 1930, Saer 526 (F, VEN); Distrito Palavecino, entre Terepaima y Cabudare, mirando al noroeste, 500–900m, 5–10 Aug 1970, Steyermark et al. 103439 (K, NY, US, VEN); MERIDA: la mesa de los Indios, 1800m, 27 Oct 1943, Badillo 503 (VEN, 3 sheets); Alrededores de Chiguara, Dto Sucre, 700 m, 17 Oct 1972, Badillo 5180 (F); environs de Merido, 1600–2200 m, 14 Sep 1952, Humbert 26196 (US); arriba de afluente de Rio Chang, en la carretera a Chiguara, 600–700 m, 31 Aug 1966, Steyermark and Rabe 97007 (NY, US, VEN); 3.0 km N of Estangues, 1.6 km N of the Rio Chama bridge along road to Chiguara, 750 m, 10 Dec 1979, Urbatsch
and Pruski 3455 (LSU); TRUJILLO: arid slopes, vicinity of Valena, 17 Nov 1922, Pittier 10709 (GH, NY, US, VEN); on road to Valera, near Escuque, 10 Jan 1929, Pittier 13137 (F, MO, NY, US, VEN); ZULIA: sabanas de Madugues, Perija, Jan 1948, Lasser 2541 (VEN); vicinity of Mene Grande, 2 Nov 1922, Pittier 10650 (GH, NY, VEN); EDO. UNKNOWN: Carretera Coro-Curimoqua, cerca Jane de Reboo, 1200m, 27 Aug 1962, Lasser 4406 (VEN).


Type: Colombia, banks of Rio Magdalena, near Honda, elev. 140 hex., no date, M. A. Bonpland s. n. (Holotype: P, IDC microfiche 6209. 112.: III. 5!; Isotypes: B, destroyed, B-W herb. #15387, IDC microfiche 7440. 1091:2. 5!, F!, P!, Fig. 56; photographs of B in F!, GH!, NY!, US!). Humboldt and Bonpland were in the vicinity of Honda from 13 Jun-5 Jul 1801 (Sprague, 1926) and the type is assumed to have been collected there at that time.


Costa Rica, Chemin de la Caldera between San Mateo and San Roman, 25 Jan 1892, P. Bioley 7015 (GH!; Isolectotype: US!). Syntypes: Costa Rica, banks of Rio Ceibo near Buenes Ayres, 200 m, Jan 1892, H. Pittier 4913 (GH!); in woods at Baruca, 450 m, Feb
1891, H. Pittier 3729 (GH!). The Bioley collection is the collection that most closely matches Robinson and Greenman's original description with respect to leaf length and other features and hence is designated here as the Lectotype.


Much branched shrubs, 1-6 m tall; stems spreading to ascending or climbing, striate, pubescent, branching at angles of 50-80°, internodes mostly 1.5-5 cm long; leaves opposite; blades elliptic to ovate, chartaceous-coriaceous, smooth to rugose, triplinerved, 1.5-12.5 cm long, 1-6.5 cm wide, apices acute to obtuse, bases rarely subcordate, broadly cuneate to obtuse, margins often revolute, serrate with 3-8 pairs of teeth, upper surfaces dark green, scabrous, lower surfaces paler green, smooth to prominently reticulate, nearly glabrous to densely pubescent, pubescence of long uniseriate, multicellular trichomes and resinous globular trichomes; petioles 2-16 mm long, nearly glabrous to pubescent; capitulescences of axillary or terminal umbellate clusters of 7-45 heads; peduncles 0.2-4 cm long, lightly to densely pubescent; involucres cylindrical, 5.2-8.3 mm tall, 2.5-4.5 mm broad, 3-5-seriate; phyllaries imbricate, graduate, outer ones oblanceolate to ovate, 1.5-6 mm
long, 1-4 mm wide, herbaceous, lightly to densely pubescent, pubescence like that of the leaves, apices acute to rounded, inner ones grading from ovate-elliptic to lanceolate, 3-6.8 mm long, 1.5-2.5(3) mm wide, striate, scarious, yellow, glabrous or nearly so, apices obtuse to acuminate, membranous; capitula discoid, 5-26-flowered, corollas yellow, 4.4-5.8 mm long, glabrous, lobes erect to spreading, 1-1.7(2) mm long, pappus of 18-25 linear-lanceolate scales, 3.5-5(5.7) mm long, anthers exserted, yellow, 1.6-2.2 mm long, appendages glandular abaxially, styles 4.8-6.4 mm long with branches 0.8-1.5 mm long; receptacles conical, 0.7-2 mm tall, 0.5-0.9 mm broad; paleae lanceolate, conduplicate, slightly trifid, pale yellow, 4.5-6(7) mm long, ca. 1.5 mm wide; achenes obconic, prismatic, black 1.6-2.7 mm long, puberulent.

_Calea prunifolia_ is common and ranges from Peru northward into Colombia, eastward into Venezuela and as far north as Nicaragua. This species occurs in such diverse areas as near sea shores of the Pacific coast of South America and the Caribbean coast of Central America as well as on rocky hillsides of 1600 m in the Andes. It flowers year-round with apparent peaks in July and December.

The concept of _C. prunifolia_, as treated here, encompasses _C. pittieri_ and _C. chocoensis_, as examination of their respective types show them to be conspecific. Sea level populations of _C. prunifolia_ have puberulent leaves up to 12.5 cm and outer phyllaries four-six mm long, and populations of this taxon at 1600 m in the Andes have pubescent leaves less than eight cm long and outer phyllaries less
than two mm long and 1.5 mm wide, hence upon cursory examination appear to be distinct. However, upon examination of this taxon throughout its range, it is clear that leaf and phyllary traits vary greatly and in different ways. In particular, extremely variable populations are found in the Río Magdalena Valley and in the Canal Zone of Panama. These characteristics are assumed here to be environmentally influenced. Support for this conclusion is derived from study of upland plants collected near Guanare, Venezuela which were consistently induced, presumably by ample watering under greenhouse conditions, to produce puberulent leaves and abnormally long and wide outer phyllaries, resembling costal populations. Thus the upland and lowland forms are not distinct as species, nor do they deserve varietal recognition. Individual plants have the capacity to vary greatly and the variability of the species as a whole is therefore more clearly comprehensible. The common name of this species is "escobilla" (Croat, 1978). The chromosome number for this taxon is \( n = 19 \) (Table 1).

ADDITIONAL SPECIMENS EXAMINED. COLOMBIA. ANTIOQUIA: Belen, 24 Dec 1930, Archer 1037 (TEX, US); vicinity of Medellin-Santiago, \( q \) \( q \), 12 Nov 1927, Toro 738 (NY); CALDAS: near La Dorado, 250 m, 18 Dec 1936, Haught 2105 (F,GH,NY,US); CAUCA: between Santander de Quilichao and Río Orejas, 1500 m, 3 Feb 1965, Cuatrecasas et al. 26859 (US, 2 sheets); La Paila, 4 Jul 1853, Holton 348 (NY); along Río Cauca, S of Agunche, 150-1200 m, 3 Jun 1922, Pennell and Killip 6281 (GH, NY, US); CHOCO: Costa del Pacifico, camino entre Nuquí y
Pangui, 3 Jun 1950, Fernandez 240 (NY); hills behind Bahia Solano (Puerto Mutis), 0-250 m, 5 Jan 1973, Gentry and Forero (LL, MO);

CUNDINAMARCA: Sasaima, 10 Dec 1948, Antonio-Camilo 2 (F); Sasaima, 9 Jul 1942, Antonio-Camilo 140 (F); Sasaima, 7 Jul 1941, Antonio-Camilo 142 (F); La Palma, carretera a Pacho, Rio Murca, 1150-1400 m, 29 Jul 1947, Garcia-Barriga 12419 (LIL, US); ca. 5 km SW of La Mesa, 6 Jul 1965, King and Guevara 5885 (F, NY, US);

Popayan, Lehmann 7981 (US); HUILA: 1 km SW of San Antonio Fort alecillas, 20 km E of Neiva 2 57'N, 75 6'W, 1000 m, 16 Jan 1943, Fosberg 19717 (F, US); entre Hobo y Gigante, 675-860 m, 19 Mar 1940, Perez-Arbelaez and Cuatrecasas 8327 (F); foot of Cordillera Oriental near Neivo, 31 Jul 1917, Rusby and Pennell 497 (GH); E of Neiva, 700-1500 m, 31 Jul 1917, Rusby and Pennell 498 (NY); E of Neiva, 700-1500 m, 31 Jul 1917, Rusby and Pennell 499 (NY);

MAGDALENA: Poponte, Magdalena Valley, 150 ft, 22 or 16 Dec 1924, Allen 874 (K, MO); NARINO: Is Gogona, sea level, 6 Feb 1924, Choesman 513 (K); south end of Gorgona Is, sea level, 9 Feb 1939, Killip and Garcia 33129 (US); NORTE DE SANTANDER: Ocana, 1500 m, Jan 1928, Cure 1604 (F); Ocana, 6000 ft, 1851, Schlim 335 (K); SANTANDER: northern slope of Mesa de los Santos, 1000-1500 m, 11-15 Dec 1926, Killip and Smith 15416 (A, GH, NY, US); Bucaramanga and vicinity, 1000 m, 28 Dec 1926, Killip and Smith 16189 (F, GH, NY, US); TOLIMA: Ibague, 1-9 Mar 1876, Andre K1257 (K, NY); Mariguila, environs de Ibague, Jan 1843, Linden 885 (F, GH); Honda, 250-300 m, 3-4 Jan 1918, Pennell 3613 (MO, NY); La Plata, 800-1500 m, Tomas 385 (F, GH, K,
NY); VALLE: Cali, Loma Los Cristales, 1300-1400 m, 25 Dec 1959, Cuatrecasas et al. 25668 (US, 2 sheets); west of Cali, 8 Jan 1963, Cunningham 24 (US); El Negro, 1400 m, Mar 1939, Dryander 2340 (US); Rio Daguar, 300-800 m, Lehmann 7980 (F, K); In Tocola–above Rio Daguar, 600-900 m, Lehmann 9054 (F, GH, K, NY, 2 sheets); Pavas, 1500-1600 m, 22 May 1922, Pennell 5940 (US); La Esmeralda near Jamundi, Cauca Valley, 1200 m, Jan 1906, Pittier 939 (F, US); Jardin Botanico "Juan Maria Cespedes", Municipio de Tulua, 1210 m, 24 Jan 1976, Plowman and Vaughan 5257 (GH); DEPTO. UNKNOWN: Tneremal, Jaigna, 23 Jan 1935, Perez-Arbelaez 3001 (US); Tomas 486 (K); Tomas 491 (NY); Tomas 942 (GH, K, NY); Triana 1412 (K); VENEZUELA: BARINAS: cerca de Cuidad Boliva, Feb 1953, Aristeguieta 1609 (VEN); Reserva Forestal de Ticopora, Feb 1969, Aristeguieta and Zabala 6939 (VEN); COJEDES: cerca de Tinaquillo, 30 Dec 1947, Gawayo 3387 (VEN); PORTUGESA: between Portuguesa and Guanare, 25 DEC 1925, Pittier 12041 (NY); ca. 1.5 km NNE of Unnellez, alta Mesa Cavoca, Parroquin; Guarroguanore, elev 750 m, 8 Dec 1979, Urbatsch and Pruski 3407 (LSU); ca. 1.5 km NNE of Unnellez, Alta Mesa Cavoca, Parroquin; Guarroguanore, 725 m, 8 Dec 1979, Urbatsch and Pruski 3408 (LSU); ca. 1.5 km NNE of Unnellez, Alta Mesa Cavoca, Parroquin; Guarroguanore, 700 m, 8 Dec 1979, Urbatsch and Pruski 3409 (LSU).

REPRESENTATIVE SPECIMENS EXAMINED FROM CENTRAL AMERICA. COSTA RICA. ALAJUELA: 9.7 km SW of San Ramon on Pan American Hwy, 2 Jan 1979, Wussow and Pruski 143 (LSU, TEX); GUANACASTO: Collines aux environs de Nicoya, Jan 1900, Tonduz 13592 (GH, K, NY, US); LIMON:
roadside near beach, just north of town, Puerto Limon, 12 Sep 1963, Porter 1127 (GH); playas del Parismiva, 9 Oct 1951, Shank and Molina 4345 (F, GH, US); PUNTARENAS: ca. 17 km N of Pan American Hwy along unpaved road to Monte Verde and Santa Elena, 800-1100 m, 31 Dec 1938, Wussow and Pruski 133 (LSU, TEX); SAN JOSE: along Pan American Hwy, ca. 7.6 km S of Cartago, 1450 m, 3 Jan 1979, Pruski 442 (CR, LSU, VEN); NICARAGUA. CHONTALES: bosques pantanosos de San Miguelito, drenaje del Lago Granada, 30 m, 13 Nov 1951, Shanbk and Molina 4570 (F, GH, US); ZELEYA: vicinity of Bluefields, sea level, 21 Apr–23 May 1949, Standley 19987 (F); PANAMA. BOCAS DEL TORO: Isla Colon, 7 Jan 1941, Wedel 2477 (GH, MO, US); Shepherd Island, 22 Sep 1941, Wedel 2731 (GH, MO, US); CANAL ZONE: shoreline of Miller Peninsula parallel to Bohio Reach, 5 Oct 1968, Croat 6729 (F, MO, NY); Ancon Hill, 26 Nov 9 Dec 1923 Standley 25195 (GH, MO, US); CAMARCO DE SAN BLAS: Soskatupo, 0-150 ft, 15 Aug 1967, Elias 1665 (GH, MO, US); Chiriqui, in savannas, Cerro Vaca, 900-1136 m, 25–28 Dec 1911, Pittier 5299 (GH, US); COLCE: dry hills S of El Valle de Anton, 600-800 m, 13 Nov 1941, Allen 2813 (GH, MO, US); COLON: lumber road about 8 km NE of Santa Rita along ridge, ca. 650 ft, 12 Jan 1970, Wilbur and Weaver 10834 (F, GH, LL, MICH, MO, NY); DARIEN: Chepigana, Duke and Bristan 273 (MO, US); Herrera, 2 miles NW of Oue, 16 Feb 1963, Stern et al. 1967 (MICH, MO, US); PANAMA: near beach at Nueva Gorgona, 8 Oct 1961, Duke 4992 (GH, MO, US); open thicket, costal bluffs, Punta del Cabo, San Jose Island, 29 Jun 1945, Erlanson 394 (GH, NY, US); VERAGUAS: beach, cliffs and
adjacent swamp, mouth of Rio Concepcion, 4 Dec 1967, Lewis et al. 2842 (MO, UC); dry savanna about 5 miles NW of Santiago, 17 Jan 1971, Wilbur and Teeri 13341 (F, GH, LL, MICH, MO, NY).

11. Galea abelioides S. F. Blake, Bull. Torrey Bot. Club 58: 488. 1931. Type: Venezuela, Amazonas, ridge crest, savanna hills, summit of Mount Duida, 4400 ft, Aug 1928–Apr 1929, G. H. H. Tate 768 (Holotype: NY!, Fig. 57, photographs in F!, NY!; Isotype: US!).

Shrubs 0.5–2.5 m tall; stems erect, subterete, striate, lightly pubescent becoming glabrous with age, branching at angles of 55–70°, internodes mostly 1.5–3 cm long; leaves opposite; blades elliptic, chartaceous, smooth, triplinerved, 2–6.5 cm long, 1.1–2.8 cm wide, apices acuminate, bases cuneate, margins subrevolute, remotely serrate with 4–5 pairs of teeth, upper surfaces dark green, glabrous, lower surfaces paler green, puberulent, pubescence of resinous globular trichomes, and a few uniseriate multicellular trichomes primarily along the veins; petioles 2–8 mm long, lightly pubescent; capitulescences umbelliform, less commonly glomerate; peduncles, 1.5–12 mm long; involucres cylindrical, 5–6 mm tall, 3–3.5 mm broad, 3–4-seriate; phyllaries, imbricate, subequal to graduate, outer ones lanceolate, 3.5–5 mm long, ca. 1 mm wide, herbaceous, lightly pubescent, apices acute, margins ciliolate, inner ones ovate to elliptic, 3.5–5.8 mm long, 2–2.5 mm wide,
striate, scarious, glabrous, apices acute, membranous; capitula discoid, 5-10-flowered, corollas yellow, 4-5 mm long, slightly glandular, lobes ascending to spreading, 1.3-2 mm long, pappus of 21-24 linear-lanceolate scales, 3.3-4.6 mm long, anthers exserted, tan, 1.8-2.2 mm long, appendages glandular abaxially, styles 5.3-5.7 mm long with branches ca. 1 mm long; receptacles conical, ca. 0.7 mm tall and broad; paleae lanceolate, conduplicate, trifid to lacerate, 4.7-5.7 mm long, ca. 1 mm wide; achenes obconic, prismatic, black, 2-2.7 mm long, densely pubescent. Chromosome number unknown.

Calea abelioides was previously known from only the white sand savanna regions of southern Venezuela, and its occurrence in southeastern Colombia is documented here for the first time. It occurs between 560-1900 m and flowers from April-May and September-January. Its closest allies occur in the Gran Sabana and include C. oliverii Robins. and Greenm., C. cardonae Maguire and Wurdack, and C. lucidivenia Gleason and Blake. Calea abelioides differs from these taxa in its possession of densely pubescent achenes and heads with less than ten flowers. The aforementioned three taxa have puberulent to pubescent achenes and 15 or more flowers per head.

ADDITIONAL SPECIMENS EXAMINED. COLOMBIA. VAUPES: Macaya-Ajaju River confluence, Mount Chiribiguste, 1700-2100 ft, 15-16 May 1943, Schultes 5483 (GH, US); VENEZUELA. AMAZONAS: Alto Orinoco, Isla del Esfuerzo, 13 Sep 1951, Croizat 555 (US); Cerro
Huachanacari, Rio Cunucunuma, 1900 m, 11 Dec 1950, Maguire et al. 30162 (NY, US); Cerro Yapacana, Rio Orinoco, 800–1000 m, 1 Jan 1951, Maguire et al. 30524 (NY); Cerro Yapacana, Rio Orinoco, 800 m, 1 Jan 1951, Maguire et al. 30584 (NY); Cerro Yapacana, Rio Orinoco, 1200 m, 3 Jan 1951, Maguire et al. 30660 (K, NY); Cerro Guanay, Cano Guaviarito, Rio Manapiare, Rio Vertuari between Camp Verader and Camp M. Perez, 900–1100 m, 30 Jan 1951, Maguire et al. 31672 (NY); Cerro Duidu, Savanna Hills, 1025–1200 m, 2 Sep 1944, Steyermark 58260 (F, NY); Sierra Parima, Rio Matacumi, frontero Venezulan–Brasilera, frontero #7, 4°5’N, 64°40’24"W, 1500 m, 19 May 1973, Steyermark 107518 (MO).


Much branched vine-like shrubs to 2.5 m tall; stems prostrate to climbing, striate, puberulent, branching at angles of 60–90°, internodes mostly 4–7 cm long; leaves opposite; blades deltoid to narrowly elliptic, chartaceous, smooth to slightly rugose, triplinerved, 3–11 cm long, 1–4.5 cm wide, apices acute to acuminate, bases cuneate to rounded, margins nearly entire to serrate with 5–8 pairs of prominent teeth, upper surfaces dark green, mildly scabrous with long multicellular arcuate trichomes, lower surfaces paler green, lightly to densely pubescent with long, uniseriate, multicellular trichomes and resinous globular trichomes; petioles 5–17 mm long, canaliculate, pubescent; capitulescences of axillary or terminal umbelliform clusters of (3)5–13 heads;
peduncles 4—13 mm long, lightly pubescent; involucres cylindrical, 5—7.5 mm tall, 2.5—4 mm broad, 3–5(8)—seriate; phyllaries imbricate, graduate, outer ones elliptic, (0.8)1.5—2.7 mm long, 0.4—0.8 mm wide, herbaceous or at least apically so, pubescence of herbaceous portions like that of the leaves, apices acute to rounded, inner ones grading from ovate-elliptic to lanceolate, 2.5—6.5 mm long, 0.9—1.7 mm wide, striate, scarious, yellow, glabrous or nearly so, apices acute, membranous; capitula discoid, 6—11-flowered, corollas white to pale yellow, 3.7—5.2 mm long, glabrous or sparsely glandular, lobes spreading or ascending, 0.9—1.7 mm long, pappus of 19—25 linear—lanceolate scales, 3—4(4.6) mm long, anthers exserted, yellow 1.6—2.2 mm long, appendages glandular abaxially, styles 4.3—5.7 mm long with branches 0.8—1.3 mm long; receptacles conical, 1—1.5 mm tall, 0.5—0.8 mm broad; paleae lanceolate, conduplicate, lacerate, white, (3)3.5—4.5(5.2) mm long, ca. 1.2 mm wide; achenes obconic, prismatic, black, 1.9—2.7 mm long, puberulent, often glandular.

*Calea solidaginea* is widespread and occurs throughout much of the mountainous and savanna regions of Colombia, Venezuela, Trinidad, Guyana and Surinam. It most frequently is encountered on exposed bluffs and in thickets, although it is found in open areas as well from near sea level to 1900 m and commonly flowers from September—March with apparent peaks in December and January.

*Calea solidaginea* is expanded here to include *C. congesta*, which has about seven-seriate involucres, and *C. herbert-smithii*,
which has rounded leaf bases, both of which were described based on material from Ocaña, Colombia. *Calea perforata* was placed in synonymy with *C. solidaginea* by Robinson and Greenman (1899). *Calea solidaginea* is readily identified by its white florets and distribution, and it appears to resemble *C. scandens* Griseb. of Bolivia. However, judgement is reserved on the treatment of *C. scandens* because only photographs of the type have been seen by the author, and Griseback's description does not mention flower color, an obviously important trait, as *C. solidaginea* is partially characterized by its essential white-or-cream-colored flowers.

In addition, field, lab, and greenhouse observations show that the vining *C. deltophylla* of the Guyana Highlands closely resembles *C. solidaginea* and is treated here as a variety. Plants of both taxa, collected in Venezuela and grown in greenhouses under identical conditions, only partially retained their identity. *Calea deltophylla* usually produces ovate leaves with serrate margins and cordate or truncate bases on the main stems with elliptic or lanceolate leaves produced only at the young growing apices. *Calea solidaginea* rarely produces oval leaves with serrate margins and thus can generally be distinguished from *C. deltophylla*. However, these traits are not extremely reliable at the specific level, hence the treatment of *C. deltophylla* as a variety of *C. solidaginea* is justified.

These varieties have different distributions and habit preferences. *Calea solidaginea* var. *solidaginea* is found from sea
level to 1900 m and occurs only north and west of Rio Orinoco, whereas *C. deltophylla* is known from intermediate altitudes south and east of Rio Orinoco.

Key to The Varieties of *C. solidaginea*

Achenes pubescent to densely pubescent with bifid trichomes and sometimes resinous glands, leaves commonly lanceolate with revolute margins, occurs north and west of Rio Orinoco in Colombia, Venezuela, and Trinidad. **Calea solidaginea** var. **solidaginea**

Achenes sparsely pubescent, not glandular, leaves of main stems ovate, bases cordate, margins serrate, occurs south and east of Rio Orinoco in Venezuela, Guyana and Surinam. **Calea solidaginea** var. **deltophylla**

12a. **Calea solidaginea** H.B.K., var. **solidaginea**, Nov. Gen. Sp. 4: 295, tab. 407. 1820. Type: Venezuela, montis Silla de Caracas, elev. 800 hex., Jan, no year, M. A. Bonpland 619 (Holotype: P?; Isotype: B, destroyed, Fig. 58, photographs in Fl, GH!, NY!). Sandwith (1925) noted that Bonpland was in the vicinity of Caracas in Jan 1800 and it is presumed here that this collection was made during this time.

**Calea perforata** Klatt, Leopoldina 20: 95. 1884. Type:
Colombia, in ripa fluminis Mayquetaeae, E. Otto 459
(Holotype: GH!, ex. herb. Klatt; Isotypes: B, destroyed, K!, SCH-BIP, fragments of SCH-BIP in US!, photographs of B in Fl!, GH!, NY!). The type material apparently is from La Guagna, Venezuela and was collected 28 Dec 1839.

Type: Colombia, Ocaña, Dec 1898-1899, H. H. Smith 648
_in part_ (Holotype: NY!; Isotype: US!).

Type: Colombia, Ocana, Dec 1898-1899, H. H. Smith 648
_in part_ (Holotype: NY!, photograph and fragments in US!; Isotypes: Fl!, GH!, K!, LL!, MO!, TEX!, UC!, US!).

_Calea solidaginea var. solidaginea_ occurs in thickets, clambering over the vegetation on exposed bluffs, embankments, and roadisdes in Colombia, Venezuela and Trinidad. The taxon can be recognized by its pubescent achenes, generally elliptic to lanceolate leaves with revolute margins and distinctive geographic distribution. This taxon flowers from October-March from near sea level to 1900 m, with the lower altitudinal forms showing a teleology for flowering from December-March, and the higher elevational forms showing a slight preference for flowering between October and January. The chromosome number for this taxon is _n_ = 19
(Table 1).

ADDITIONAL SPECIMENS EXAMINED. COLOMBIA. BOYACA: San Mateo, 28 Dec 1941, Villarreal 146 (F); MAGDALENA: Minca, Jan 1942, Apolinar-Angel 549 (UC); Pueblo Bello, Munic. Valle Dupar, 1200 m, Dec 1944, Apolinar-Angel 745 (US); Sierra Nevada de Santa Maria, southeastern slopes, Hoya del Rio Donachui, Lomas de Donachui, upward to Portachuelo de la Nariz, 1700-1900 m, 14 Oct 1959, Cuatrecasas 24851 (US); Sierra de Perija, east of Manaure Haciendo Nuevo Horizonte, El Podrido, 1500-1600 m, 15 Nov 1959, Cuatrecasas and Romero-Castanedo 25362 (US); Sierra Nevada de Santa Marta, Valley del Rio Ponachury, camino Donachyy-Sogrome-Sacaracunque, 1385 m, 13 Oct 1958, Hammer 1054 (US); near "Africa" (Sierra Perija) on trail to Villanueva, 1600 m, 17 Dec 1944, Haught 4524 (NY, UC);
META: Uribe, Rio Duda, 21 Dec 1942, Fosberg 19480 (F, US); SANTANDER: carretera al norte de Bucaramanga 10 km, 1500 m, 15 Dec 1948, Araque-Molina and Barkley 185.214 (US); northern slope of Mesa de los Santos, 1000-1500 m, 11-15 Dec 1926, Killip and Smith 14987 (F, GH, NY); Rio Surata valley near Bucaramanga, 400-600 m, 28 Dec 1926, Killip and Smith 16233 (GH, US); VALLE: Cali, Sierra de La Crus, 1000 m, May 1892, Kunze (NY); DEPTO. UNKNOWN: Masinga Vieja, 1000 ft, 30 Dec 1898-1899, Smith 2617 (F, MICH, MO, NY(2), US).
TRINIDAD: Monos Island, 14 Mar 1920, Britton and Mendelson 583 (NY, US); heights of St. Ann, 17 Mar 1920, Britton et al. 670 (NY, US); road ascending to Blue Basin, Diego Martin, 1 Jan 1926, Broadway 5872 (K, MO, UC); St. Ann, 10 Jan 1933, Broadway 9144 (A, MO); near
the sea, Icacos, St. Quin, 4 Dec 1933, Broadway 9322 (LL); Santa
Cruz, old road, San Juan, 9 Jan 1938, Cheesman 79 (K); Gallow Point,
south coast, 100 m, 26 Mar 1959, Cowan and Forster 1279 (US);
1877-80, Fender 472 (K, NY); Lockhart s. n. (K); 4 Apr 1874, Kuntze
644 (NY); 13 Apr 1874, Kuntze 926 (NY); Hori-Trin look out, 12 Jan
1889, no collector given, 3415 (US); VENEZUELA. ARAGUA: Alto de
Choroni, Carretera Maracay-Choroni, 1400 m, 26 Dec 1965, Badillo
4314 (NY); Carretera Cata-Cuyagua, Dto. Girardot, 300-400 m, 15 Jan
1972, Badillo 4792 (F, MY); Carretera Cata-Cuyagua, Dto. Girardot,
300-400 m, 15 Jan 1972, Badillo 4800 (MY); mas abajo de la Cumbre de
Choroni, Dto. Girardot, 1200-1300 m, 16 Jan 1975, Badillo 6637 (MY);
mas abajo de la Cumbre de Charoni, Dto. Girardot, 1200-1300 m, 16
Jan 1975, Badillo 6648 (MY); alrededores de Cayagua, Dpt. Girardot,
400 m, 20 Jan 1977, Badillo 7273 (MY); Rancho Grande, 600 m, 13 Nov
1963, Montaldo 3950 (MY); Parque Nacional, between Rancho Grande
and Maracay, 240-455 m, 9 Dec 1943, Steyermark 54952 (F, NY);
alrededores La Victoria, 650-700 m, 13 Nov 1949, Trujillo and
Fernandez (MY); Guamitas P.N., 780 m, 1939-1940, Williams 10447
(F); CARABOBO: Rio Bardurata, 2.5-6 km al sur de Borburata, 150-200
m, 3 Jan 1969, Steyermark et al. 102420 (F, US, VEN); DISTRITO
FEDERAL: Caracas and vicinity, 300-3500 ft, Dec 1920-Jan 1921,
Bailey 162 (GH, NY, US); reforested hills of the Caracas Botanical
Gardens, 870-980 m, Berry 551 (MO, VEN); near Caracas, Dec 1854,
Berschel s. n. (K); Silla de Caracas, Geb 1940, Elias 157(151?) (F);
old road from Caracas to La Guairci, 700 m, 2 Feb 1969, Oberwinkler
cerros del Avila, 1600 m, 7 Oct 1921, Pittier 42 (GH, NY, US, VEN);
heights of Galipann, near Caracas, 19 Dec 1921, Pittier 214 (GH);
sabanas de Agua Negra, 18 Dec 1936, Pittier 13797 (LL, US); Cerros
adjacentes Hda Sosa, El Valle, Dec 1949, Trujillo and Fernandez 756
(MY); cerro Arriba de Punta de Mulat, 7 Jun 1950, Trujillo 1226
(MY); alrededores de San Jose, Caracas, 4 Jan 1949, Vogl 465 (VEN);
Umgebung von Maracay und Caracas, 1930-1934, Vogl 677 (GH, US); en
las foldas a lo largo de la carretera de Caracas a la Guaira, 700 m,
3 Jan 1940, Williams 12266a (F); la sabaneta de Agua Negra, 900-1000
m, 4 Jan 1940, Williams 12271 (F, GH, MICH, US); MERIDA: la cortada
del Guayabo, 1300 m, Oct 1943, Badillo 677 (VEN); Parque National
Guatopo, near park headquarters at south entrance, 13 Feb 1973,
Croat 21792 (MO, US); los Teques, in German plantations, Parque de
los Barbaros, 1400-1500 m, 21 Dec 1917, Pittier 7609 (GH, US, VEN);
la Cortado neaar Petare, road to Guatire, 11 Nov 1923, Pittier 11223
(GH, NY(2), P, US, VEN); hills above las Teques, 18 Nov 1923,
Pittier 11253 (GH, US, VEN); in valley, road El Valle-Cua, 13 Dec
1925, Pittier 11969 (NY, US); ridge top of Morro de Aguaramal,
passing Rio Taquasita and Rio San Lorenzo, Parque Nacional de
Guatopo, 800 m, 25 Nov 1961, Steyermark 90024 (NY, US); NUEVA
ESPARTA: Copey, Dec 1951, Gines 3005 (US); SUCRE: 7 km E of the
Mochima Hwy intersection along Hwy 9 between Cumana and Puerto La
Cruz, 250 m, 16 Dec 1973, Davidse 5041 (MO, US, VEN); TACHIRA: La
Grita, 1500 m, 15 Nov 1976, Charpin and Jacquemoud 13433 (US); 1 km
S of Las Delicias on road to Villa Paez, near Rio Tachira, along the Venezuelan-Colombian border, 1750 m, 9 Dec 1979, Urbatsch and Pruski 3420 (LSU); YARACUY: Rancho Grande, Parque Nacional Henry Pittier, Maracay, 1000-1100 m, 28 Dec 1956, Badillo 4364 (MY); 2 km subiendo desde la alcabala de El Limon Nacia Guamita, 16 Jan 1969, Car 817 (MY); Albarico, 11 Dec 1951, Carrou 75 (MY); el Amparo hacia candalaria, 7-10 km al Norte de Salom, 1100-1300 m, 27-30 Dec 1972, Steyermark and Carreno-Espinoza 100802 (US, VEN); 5.9 km N of Salom plazo along road to Candelaria, 1380 m, 12 Dec 1979, Urbatsch and Pruski 3466 (LSU); ZULIA: Perija, 2000 m, 29 Dec 1950, Gines 2028 (US); EDO. UNKNOWN: Aricana, 5 Jan-22 Feb 1923, Broadway 725 (GH, NY, US); Tovar, 1856-1857, Fender 637 (GH, MO); between El Castano and summit, 1100 m, 18 Feb 1937, Pittier 13897 (F);

12b. Calea solidaginea H.B.K. var. deltophylla (Cowan) Pruski and Urbatsch, comb. and stat. nov.

Calea deltophylla Cowan, Brittonia 7: 413. 1952. Type:
British Guiana, Sand Creek, Rupununi River, foothills Mt. Bulakuk-taba-ial, Sep 1948, Wilson and Browne 82 (Holotype: NY!, Fig. 59, photographs in MO!, NY(2)!
Isotypes: K!, NY!).

Calea clematidifolia Steyermark, Fieldiana 28: 627.
1953. Type: Venezuela, Bolivar, along stream in Gran
Sabana, between Kun and Uaduara-paru, in valley of Rio Kukenan, south of Mount Roraima, 1065-1220 m, 1 Oct 1944, J. Steyermark 59072 (Holotype: F!; Isotypes: NY!, VEN!).

*Calea solidaginea* var. *deltophylla* has the same habit as *C. solidaginea* var. *solidaginea*, however these taxa have allopatric distributions. This taxon differs from the typical variety in possession of puberulent achenes, and generally wider, deeper serrate leaves.

Lowland forms of *Calea solidaginea* var. *solidaginea* have ovate, serrate leaves and thus somewhat resemble *C. solidaginea* var. *deltophylla*, a relationship noted by Cowan (1952). However, the former has pubescent achenes and therefore can be distinguished from the latter which has puberulent to glabrous achenes. *Calea solidaginea* var. *deltophylla* flowers from July-January between 35-1160 m. The chromosome number for this taxon is \( n = 19 \) (Table 1).

ADDITIONAL SPECIMENS EXAMINED. GUYANA. RUPUNUNI: Kanuku Mountains, Iraimakipang Summit, 3500 ft, 18 Aug 1963, Goodland and Maycock 447 (NY); Iraimakipang Summit, 3500 ft, 13 Sep 1963, Goodland and Persaud 706 (NY); on top of mountain, 23 Jul 1958, Harrison 1353 (K); Orinduik Falls, Tung River, 9 Aug 1958, Harrison 1414 (K); SURINAM. SARAMACCA: Voltzberg, 19 Sep 1933, Lanjouw 898 (LIL, MO); VENEZUELA. BOLIVAR: alrededore km 109, carretera El
Dorado, Nov 1958, Aristeguieta 3729 (NY, US, VEN); km 105 de El Dorado hacia Sta Elena, 1 Jan 1957, Foldats 2781 (F, MY, NY, VEN); Ciudad Bolivar, 35 m, 4-25 Nov 1929, Holt and Gehriger 194 (GH, NY, US, VEN); 11.4 km ESE of Upata on road to El Callao, 500 m, 17 Dec 1979, Pruski and Steyermark 1359 (LSU); km 98 S of El Dorado, 330 m, 18 Dec 1979, Pruski and Steyermark 1364 (LSU); rocky roadside, km 105 S of El Dorado, 500 m, 20 Dec 1979, Pruski and Steyermark 1455 (LSU); rocky roadside, km 97 S of El Dorado, 330 m, 20 Dec 1979, Pruski and Steyermark 1456 (LSU); rocky cascades of Rio Upata, west of Upata, 500 m, 31 Jul 1944, Steyermark 57559 (F); outcrops along hills bordering Rio Toro (Rio Grande), between Rio La Reforma and Puerto Rico, north of El Palmar, 200-250 m, 12 Dec 1960, Steyermark 87963 (NY); woods bordering savana NW of dwarf forest between camp and Agua Linda, 7 km E of Hato de Nuria, E of Miamo Altiplanicie de Nuria, 400 m, 14 Jan 1961, Steyermark 88484 (NY, US).
13. *Galea sessiliflora* Less., *Linnaea* 5: 158. 1830. Type: Colombia (not Mexico), interpreted here as being collected between Jul and Dec 1801, M. A. Bonpland 44 (Holotype: B-W #15241, IDC microfiche 7440. 1095: II. 4!, fragments in P!, photograph of B-W in MSC!; Isotypes: B-W #15241, IDC microfiche 7440. 695: II. 5!, P!). The sheet seen on microfiche 7440. 1095:II. 4 is the only sheet of the two sheets in B-W bearing Lessing’s handwriting and therefore is considered the holotype.


Type: Colombia, Cauca, in campis prope Anserma nuova, 1000 m, 11 Jan 1883, F. C. Lehmann 3336 (Holotype: GH! ex. herb. Klatt; Isotypes: B, destroyed, K!, US!, photographs of B in F!, GH!, NY!).


Moderate to densely branched shrubs to 2.5 m tall, rarely clambering to 5 m tall; stems ascending, subterete, striate,
pubescent, branching at angles of 30-80°, internodes mostly 1-4 cm long; leaves opposite; blades cordiform to elliptic, chartaceous-coriaceous, smooth to rugose, triplinerved, less commonly pentanerved, 2-5 cm long, 1-3.3 cm wide, apices acute, bases cordate to truncate, margins slightly revolute, remotely serrate with 3-5 pairs of teeth to entire, upper surfaces dark green, scabrous, densely pubescent with long, uniseriate, multicellular trichomes, lower surfaces paler green, prominently reticulate, pubescent to tomentose with long, uniseriate, multicellular trichomes and resinous globular trichomes; petioles 1-3 mm long, densely pubescent; capitulescences of terminal and axillary stalked glomerules of generally 3 essentially sessile heads; peduncles wanting to 1 mm long, densely pubescent; involucre cylindrical, 4.5-6.5 mm tall, 3-4 mm broad, 2-3-seriate; phyllaries, imbricate, graduate, outer ones ovate to obovate, 4-5.5 mm long, 1.5-2.3 mm wide, basally striate, herbaceous or scarious and herbaceously tipped, herbaceous portions pubescent, pubescence of uniseriate, multicellular trichomes and resinous globular trichomes, glabrous otherwise, apices rounded to acute, inner ones grading from elliptic to lanceolate, 3.5-6.5 mm long, 1.8-2.3 mm wide, striate, scarious, yellow, glabrous or nearly so, apices acute to acuminate, membranous; capitula discoid, 10-14-flowered, corollas yellow, 4-5 mm long, glabrous, lobes ascending to spreading, 1.5-2 mm long, pappus of 20-28 linear-lanceolate scales, 3.5-4.8 mm long, anthers exerted, yellow, 1.5-1.9 mm long, appendages glandular abaxially,
styles 4.3-5.2 mm long with branches 0.8-1.1 mm long; receptacles conical, 1.6-2.1 mm tall, 0.5-1 mm broad; paleae lanceolate, conduplicate, 1-nerved, lacerate, apices obtuse or acute, pale yellow, 3.8-5.2 mm long, 0.9-1.3 mm wide, achenes obconic, prismatic, black, 2-2.8 mm long, apically pubescent. Chromosome number: \( n = 19 \).

**Calea sessiliflora** is common and widely distributed in all three Cordilleras of Colombia. This species occurs in thickets, weedy pastures, and open, exposed rocky areas of hillsides between 900-2500 m and flowers year-round with apparent peaks in December and May-July. The clustering of heads into glomerules allies this species with the more geographically restricted **C. angosturana**, **C. colombiana**, and **C. septuplinervéa**. *Calea sessiliflora* differs from these three species in possession of generally cordiform, densely pubescent leaves with petioles less than three mm long. The aforementioned three species all possess elliptic-lanceolate, puberulent leaves with petioles longer than three mm. *Calea sessiliflora* somewhat resembles **C. berteriana** and **C. trichomata** vegetatively, however, the latter two species possess heads which occur singly on peduncles. This species is used medicinally in Colombia and its common name is "chicharron" (Perez-Arbelaez 1956, 1975).

**ADDITIONAL SPECIMENS EXAMINED. COLOMBIA. ANTIQUOIA:** Bello, 1500-1800m, 17 Jun 1930, *Archer 139* (US); Bello, 1500-1800 m, 17 Jun 1930, *Archer 159* (US); Medellin, 1500 m, 5 Dec 1930, *Archer 750*
(US); 4 km de Palmitas, 1700 m, 5 Jan 1949, Barkley et al. 546 (US); alrededores de Antioquia, 1000m, Barkley 18C653 (US); San Pedro, Jul 1938, Daniel 351 (F); Boqueron, 28 Mar 1935, Daniel 444 (F, US); Copacabana alrededores de Medellin, 1560 m, Oct 1945, Henriquez and Hodge a. n. (US); cerro de "El Volador" al oeste de Medellin, 1600 m, 8 Dec 1948, Molina and Barkley 18AN373 (LIL, UC, US); en las alrededores de Bocana cerca al camino vieja a Rionegra, a 7 km al este de Medellin, 2100 m, 13 Feb 1949, Molina and Barkley 19AN098 (F, 2 sheets, US); Bello, alrededores de Medellin, 1,560 m, Oct 1945, Noquera 35 (GH); Sanson, vicinity of Medellin, 20 Jul 1928, Toro 1240 (NY); Medellin, 6000 ft, Dec 1947, Sandeman 5524 (K); Medellin, 1700 m, 17 Jan 1952, Uribe 2279 (NY); CAUCA: along road between Popayan and Tambo, 7 May 1935, Archer 3376 (LL, US); camino near Ortega, 1800 m, 24 Aug 1944, Core 1080 (F, NY, UC); Hoya del rio Palo, margenes del rio entre Tacueyo y La Tolda, 1780-1900 m, 19 Dec 1944, Cuatrecasas 19513 (A(2), F); entre Popayan y Rio blanco, 1850-1780 m, 6 Jan 1947, Cuatrecasas 23412 (F); entre Popayan y Rio blanco, 1850-1780 m, 6 Jan 1947, Cuatrecasas 23413 (F); cerca a Mondomo, 1500 m, 11 Sep 1968, Espinal and Ramos 2676 (US); westside of valley of Rio Guachicono 8 km NE of El Bordo, 47 km SW of Popayon, 2°13'N, 76°59'W, 26 Sep 1943, Fosberg 21038 (F, NY, US); Carretera al Purace, La Hermita, Popayon, 1820-1760 m, 17 Jul 1948, Garcia-Barriga and Hawks 12696A (LIL, US); Mercaderes, 1100 m, 31 Oct 1946, Haught 5161 (F, US); ad pou El Tambo, 1930, Hulten 49 (GH); near Cajibio, 23 km north of Popayon, 1740 m, 24 May 1944,
Killip and Lehmann 38488 (US); Quilichao and Popayan, 1000-1800 m, Jan-Jun, Lehmann 5540 (F); 17 km NW of El Tambo, near Los Cruces, 2100 m, 3 Jun 1977, Olsen and Escobar 513 (LL, LSU); Cercado Popayan, Malorralis en Rioblanco, 1800 m, 9 Jul 1939, Perez-Arbelaez and Cuatrecasas 5777 (F, US); San Antonio above Cali, road to Buena Ventura, 1800 m, 21 Dec 1905, Pittier 747 (US(2), ad pag. El Tambo, 1700 m, 31 Jul 1934, Sneidern 344 (A, US); ad pag. El Tambo, 1700 m, 5-6 Jun 1938, Sneidern 1533 (A, US); Popayan, 1700 m, 20 Jul 1946, Sneidern 5637 (US); Popayan, Triana 1410 (NY); CUNDINAMARCA: Fusagasuga, 1800 m, 5 Feb 1876, Andre 1427 (K); Fusagasuga, 1500 m, 16 Feb 1876, Andre 1611 (K); S of Silvania on toll road to Fusagasuga near km marker 37, 1450 m, 5 Jun 1972, Barclay et al. 3478 (US); Puente de Serviez Centre Chipoguex Caquezo, 1940 m, 31 Dec 1939, Cuatrecasas 7927 (F, US); entre Cachipay y Petaluma, 1700 m, 10-15 May 1946, Duque-Jaramillo s. n. (LIL); camino de herrachura de La Mesa a San Javier, 950-1320 m, 2-20 Jan 1947, Garcia-Barriga s. n. (US); 16 km NE of Fusagasuga, 2500-2700 m, 26 Jun 1965, King and Guevara 5765 (F, NY, US); ca. 4 km NE of Fusagasuga, 29 Jun 1965, King and Guevara 5792 (F, NY, US); ca. 2 km ENE of La Mesa, 3 Jul 1965, King and Guevara 5832 (NY, US); Fusagasuga, 1700 m, 18 Jun 1952, Koie 5239 (US); HUILA: La Plata, Tomas 699 (F(2), GH, K, NY, US); Narino: El Pedregal y Pilcuan Mpio de Funes, 2000 m, 1 Dec 1962, Mora 2490 (US); TOLIMA: Canon del Rio Guali, camino de Fresno a Galon, 1120-1700 m, 5 Dec 1939, Garcia-Barriga 8319 (US); Icononzo a "Boca de Monte", camino a Melgar, 1340-1400 m, 18 Apr 1946,
Garcia-Barriga 12020 (US); Ibague, Jul 1844, Goudot s. n. (P);

VALLE: Cerro de Tres Cumbres, en los alrededores de Cali, 1100 m, 1 Dec 1947, Bermudez and Barkley 17C833 (US); Cerro de Tres Cumbres, en los alrededores de Cali en piedras y suelos arenosos, 1100 m, 1 Dec 1947, Bermudez and Barkley 17C856 (US); Hoya del rio Sanquinini, loma con matorrales en Naranjal, 1200 m, 8 Dec 1943, Cuatrecasas 15362 (F); Hoya del rio colí, Pichindo: Morro Pilado, 2270-2320 m, 17 Oct 1944, Cuatrecasas 18134 (F); Hoya del rio Cali, vertiente derecha: La Tulia, 1950 m, 3 Nov 1944, Cuatrecasas 18531 (F); Hoya del Rio Cali, Pichindo: El Abismo, 1700-1790 m, 5 Nov 1944, Cuatrecasas 18664 (F, US); Hoya del rio Bugalagrande, lado derecho: Las Alegrias, 2300 m, 27 Mar 1946, Cuatrecasas 20453 (F); Hoya del rio Bugalagrande: Quebrada de los Osos, 2170 m, 20 Apr 1946, Cuatrecasas 20948 (F); Quebrada de La Elvira, 1730 m, 13 Mar 1947, Cuatrecasas 23784 (F); SE of Palmira, along the road to La Buitrera padway to Quebrada de Aguacalara, 1200 m, 15 Oct 1962, Cuatrecasas and Willard 26581 (UC, US); Cali, Loma Los Cristales, 1300-1400 m, 25 Dec 1959, Cuatrecasas et al. 25680 (US); Peliquia, 1500 m, Nov 1937, Dryander 2021 (US); Cerro de Las Cruces, near Cali, 1100 m, 1936, Dryander 2195 (US, 2 sheets); Ciebito, 1500 m, May 1939, Dryander 2389 (US); Maleza, 1900 m, May 1946, Dryander 2897 (F, 2 sheets); Hoya del rio Cali-Pichinde, 1500 m, Duque 1697 (US);

Quebrada Rio Yumbo, above Yumbo, 1200 m, 1 Jul 1944, Ewan 15840 (F, US); Cuenca del rio Cali, cercancas de Penas Blancas, 10-11 Jan 1963, Figueiras 8182 (US); Quebrada "Bermijal", Funes "La
Primavera", Bosque "El Guayabo", Municipio Tunia, 1650 m, 13 May 1964, Figuelras 8526 (US); forest of Finca Kyburz, eastern slope above the Bitaco River, Bitaco Valley 1 km above and E of Bitaco, 4500 ft, 28 Nov 1963, Hutchinson and Wright 3294 (F, UC); Cerro de las Cruces near Cali, 1060–1200 m, 21 May 1944, Killip and Cuatrecasas 38395 (F, GH); de Saladito a 15 km al accidente de Cali, 1400 m, 5 Nov 1948, Moldenke et al. 18UC003 (LIL(2), NY); La Cumbre, 1500–1750 m, 8 May 1922, Penne1 5202 (GH, NY, US); "Potredillo" to "Mirafloros" Palmira, 1200–1800 m, 27 May 1922, Penne1 and Killip 6093 (GH, US); Zarzal Cuaca Valley, 970–1050 m, 21 Jul 1922, Penne1 et al. 8442 (GH, NY, US); DEPTO. UNKNOWN: 18 Sep 1919, Enplehardt s. n. 2942123 (US); Aguadita: 20 Nov 1942, Ricardo 143 (F); Tomas 484 (K, NY); Tomas 486 (K); Tomas 492 (K, NY); Tomas 986 (F, GH, K, NY); Salamina, Jun 1943, Tomas-Alberto 1857 (F).


1918. Type: Colombia, Cauca, Aganche, north slopes of plateau of Popayan, 1000–1500 m, Sep–Oct 1887, Lehmann 4885 (Holotype: K! herb.#1329/79/14, Fig. 61, fragments and photograph in US!; Isotypes: Fl, GH!, K! herb.#1329/79/260, US!).

Moderately branched shrubs to 2 m tall; stems ascending, subterete, striate, densely pubescent, branching at angles of 50–80°, internodes mostly 3–7 cm long; leaves opposite; blades narrowly elliptic, chartaceous, smooth, tripli to pentanerved,
4.5-14 cm long, 1.5-3.7 cm wide, apices acute to acuminate, bases cuneate, margins often slightly revolute, remotely serrate with 4-6 pairs of teeth, upper surfaces dark green, scabrous, pubescent with long, uniseriate, multicellular trichomes, lower surfaces paler green, reticulate, lightly pubescent, pubescence of long uniseriate, multicellular trichomes and resinous globular trichomes; petioles (3)5-9(11) mm long, densely pubescent; capitulescences paniculate, of terminal and axillary stalked glomerules of 3-5, generally sessile heads; peduncles, densely pubescent, wanting to 7 mm long; involucres cylindrical, 7-10 mm tall, 4-5 mm broad, 3-4-seriate; phyllaries, imbricate, subequal, outer ones oblanceolate to elliptic, 6-9 mm long, ca. 2 mm wide, basally striate, herbaceous or at least apically so, pubescent, apices rounded, inner ones grading from ovate to lanceolate, 4-8.5 mm long, 1.5-2.5 mm wide, striate, scarious, yellow, abaxially pubescent to glabrous, apices acute or rounded, membranous; capitula discoid (rarely with a single deeply 3-lobed, pistillate ray), 11-22-flowered, corollas yellow, (4.5)5.5-7 mm long, glabrous, lobes ascending to spreading, 1.6-2.3 mm long, pappus of 20-27 linear-lanceolate scales, 5-6.5 mm long, anthers exserted, yellow, 2-2.8 mm long, appendages glandular abaxially, styles (5.5)6.5-8 mm long branches 1-1.5 mm long; receptacles conical, 1.5-2 mm tall, 0.8-1.2 mm broad; paleae elliptic-lanceolate to lanceolate, conduplicate, mostly lacerate, (4.5)5-7 mm long, ca. 1.5 mm wide; achenes obconic prismatic, black, 2.2-3.1 mm long, glabrous or nearly so. Chromosome number unknown.
Calea colombiana grows in the Cordillera Central of Colombia and apparently is most abundant in the vicinity of Popayan. This species grows between 1400-2200 m, flowers from May-November, and is readily distinguished from all species of Calea in this region. The clustering of heads into glomerules resembles C. sessiliflora, C. angosturana and C. septuplinervia. However, the foliar nature of the outer phyllaries, which are at least half the length of the involucre, and the petioles, which are longer than six mm long, clearly differentiate C. colombiana from the three afforementioned species.

ADDITIONAL SPECIMENS EXAMINED. COLOMBIA. CAUCA: roadside thicket near Cajibio, ca. 23 km N of Popayan, 1740 m, 24 May 1944, Killip and Lehmann 38487 (F, US); low thicket, Cauca Valley, Cautro Esquinas, 1700-1800 m, 5 Jun 1922, Pennell and Killip 6316 (GH, NY, US); clearing, San Antonio-Rio Ortega, 2000-2200 m, Pennell and Killip 8040 (GH, NY, US); woodland, Cauca Valley, El Ramal to Rio Sucio, W of Popayan, 2000-2200 m, Pennel and Killip 8093 (US); highlands of Popayan, 1400-1800 m, Tomas 1154 (K, NY); DEPTO. UNKNOWN: Tomas 1294 (F, GH, NY).


Type: Colombia, Antioquia, Angostura, 1500-1700 m, Dec 1891, F. C. Lehmann 7479 (Holotype: B, destroyed; fragments in US!, photographs of B specimen in F!, GH!, NY!; Isotype:
Kl, Fig. 62, photograph in GH!).

Much branched shrubs becoming lianas to 5 m; stems ascending to clambering, subterete, generally striate, puberulent, branching at angles of 60-80°, internodes mostly 2-6 cm long; leaves opposite; blades elliptic-lanceolate to lanceolate, chartaceous, smooth to subrugose, palmately 5-7-nerved, 6-13 cm long, 1.5-4.5 cm wide, apices acuminate, bases cuneate, margins sometimes revolute, remotely serrate with up to 5 pairs of widely spaced teeth, upper surfaces dark green often lustrous, glabrous to scaberulent, pubescence of scattered globular trichomes and short uniseriate multicellular hairs, lower surfaces paler green, puberulent with resinous, globular trichomes and long, uniseriate, multicellular hairs; petioles 6-11 mm long, canaliculate, puberulent; capitulescences paniculate, glomerulate with generally 3-7(9) essentially sessile heads per glomerule; peduncles pubescent, 0.5-2.5 mm long, lower most branches of panicles 2-4 cm long; involucres cylindrical, 5.5-7 mm tall, 2.5-4 mm broad; phyllaries imbricate, graduate, 3-4-seriate, outermost phyllaries lanceolate, 2-3 mm long, 1 mm wide, herbaceous, slightly pubescent, apices acute to acuminate, inner phyllaries grading from 2-7 mm long, 1-2.5 mm wide, scarious with membranous acute apices, markedly 3-5 deeply brown striate, glabrous or nearly so, margins ciliate; capitula discoid, (7)9-12-flowered, corollas yellow, 4.5-6 mm long, glabrous, lobes erect, 0.7-1.1 mm long, pappus of 17-28 linear-lanceolate scales, 4-5.5 mm long, anthers exserted, yellow, 2-2.3 mm long,
appendages glandular abaxially, styles 5-7 mm long with branches 1-1.5 mm long; receptacles conical, 1-1.5 mm long, ca. 1 mm broad; paleae lanceolate, entire, becoming trifid with acuminate, elongate medial lobes, conduplicate, pale yellow, 5-6.5 mm long, 1-2 mm wide; achenes obconic, prismatic, black, 1.3-2 mm long, glabrous to puberulent apically. Chromosome number unknown.

_Calea angosturana_ occurs in the Cordillera Central of Colombia between 1500-2450 m and flowers in December-January and May-August. The clustering of heads into glomerules in _C. colombiana_, _C. septulinervia_, and _C. sessiliflora_ ally these three taxa to _C. angosturana_ with _C. septulinervia_ being most similar to _C. angosturana_. The acuminate leaf apices, nearly glabrous lanceolate leaves, petioles that are longer than six mm, phyllaries with deep red striations, and corolla lobes less than 1.1 mm of _C. angosturana_ differentiate it from _C. septulinervia_. _Calea solidaginea_ superficially resembles _C. angosturana_ in foliar traits. However, the former has corolla lobes up to 1.7 mm and heads singly on peduncles and thus is differentiated from _C. angosturana_.

**ADDITIONAL SPECIMENS EXAMINED. COLOMBIA. ANTIOQUIA:** in camino 1-2 km west of Argelia, 1580 m, 20 May 1944, Core 802 (US); La Tablaza, Dec 1939, Daniel 2134 (US); Los Alpes, between Retiro and Rionegro, Jan 1940, Daniel 2277 (US); Salto del Buez (La Ceja), Jan 1949, Daniel 4197 (US); partially cultivated moist ground along stream 36 km NE of Medellin, 2450 m, 12 Jun 1977, Olsen and Escobar 539 (LL, LSU); Bello, Aug 1938, Tomas 385 (US); Medellin, al borde
del camino viejo a Santa Elena, 1900–2300 m, Jan 1950, Uribe–Uribe 2085 (F); entre El Retiro y La Ceja, bosquecellas al lado de la carretera de Medellín, 2300 m, 27 Jun 1963, Uribe–Uribe 4339 (US); CALDAS: wet cliffs in forest, Río Santa Rita, Salento, 1600–1800 m, 29 Jul 1922, Killip and Hazen 12082 (GH, NY, US); Tolima: Ibague, May 1844, Goudot s. n. (P); DEPTO. UNKNOWN: San Pedro, Dec 1937, Daniel 2091 (F).


1901. Type: Colombia, Arracachal, 1600 m, no date, J. J. Triana 1416 (Holotype: B, destroyed, fragments in US!, photographs of B in F!, GH!, NY!; Isotypes: K!, Fig. 63, NY!).

Much branched shrubs becoming lianas to 6 m; stems ascending to clambering, subterete, generally striate, pubescent, branching at angles of 60–80°, internodes mostly 2–5 cm long; leaves opposite; blades elliptic to elliptic-lanceolate, chartaceous, smooth to subrugose, palmately 5–7-nerved, 4–10 cm long, 1.5–5 cm wide, apices acute, bases cuneate, margins sometimes revolute, remotely serrate with up to 5 pairs of widely spaced teeth, upper surfaces dark green, often lustrous, scaberulent, pubescence of scattered globular trichomes and short uniseriate multicellular hairs, lower surfaces paler green, puberulent with pubescence of resinous globular trichomes and long, uniseriate, multicellular hairs; petioles 3–8 mm long, canaliculate, pubescent; capitulescences paniculate,
glomerulate with generally 3-9 essentially sessile heads per glomerule; peduncles pubescent, 0.5-3 mm, lower most branches of panicles 1.5-3.5 cm long; involucres cylindrical, 5.5-7.5 mm tall, 2.5-4 mm broad, 3-4-seriate; phyllaries imbricate, graduate, outermost phyllaries lanceolate, 2.5-3.5 mm long, 1 mm wide, herbaceous, puberulent, apices acute to acuminate, inner phyllaries 2-6 mm long, 1-2.5 mm wide, scarious, slightly membranous tipped, glabrous or nearly so, apices acute, margins ciliate; capitula discoid, 6-8(11)-flowered, corollas yellow, 4-6 mm long, glabrous, lobes erect, (1)1.5-2 mm long, pappus of 20-27 linear-lanceolate scales, (4)4.5-6 mm long, anthers exserted, yellow, 1.9-2.2 mm long, appendages glandular abaxially, styles 5-7 mm long with branches 1-1.5 mm long; receptacles conical, 1-1.5 mm long, ca. 1 mm broad; paleae lanceolate, conduplicate, entire to trifid with acuminate, elongate medial lobes, chartaceous, pale yellow, 5-6.5 mm long, 1-2 mm wide; achenes obconic, prismatic, black, 1.7-3 mm long, glabrous to puberulent apically. Chromosome number: \( n = 38 \) (Table 1).

*Calea septuplinervia* ranges from the Cordillera Central of Colombia eastward into Barinas and Merida, Venezuela. This species flowers from November-January between 1600-2300 m. *Calea angosturana* and *C. septuplinervia* are similar and thus pose potential difficulties in accurate identification. A discussion of their relationship is given in the taxonomic treatment of *C. angosturana*.

ADDITIONAL SPECIMENS EXAMINED. COLOMBIA. ANTIOQUIA: selva
abierta y humeda en los alrededores de Angelopolis, ca. 1950 m, 22 Nov 1947, Barkley and Gutierrez /1963/ (LIL, MICH, NY, US); SANTANDER: Rio Surata valley, above Surata, 2000-2300 m, 5-6 Jan 1927, Killip and Smith /16626/ (F, GH, NY, US); wooded banks of Rio de la Baja, below La Baja, 2200-2300 m, 26 Jan 1927, Killip and Smith /18304/ (A, GH, NY); VENEZUELA. BARINAS: Selva cercana al pueblo de Sto. Domingo. Carretera Mucubaji-Barinas, 10-11 Nov 1952, Aristeguieta /1054/ (NY, US, VEN); Merida: secondary forest-edge, La Mucuy, 15 km ENE of Merida, 2240 m, 19 Dec 1963, Breteler /3462/ (NY, US, VEN); moist ground along stream, 4.6 km from the Tobay Plaza, just SE of La Mucuy, 0.2 km from the entrance to Sierra Nevada National Park, 2200 m, 11 Dec 1979, Urbatsch and Pruski /3457/ (LSU).


9: 236. 1954. Type: Colombia, Vaupes, Yurupari, 350 kmts. arriba de Mitu; margenes del Rio Vaupes, 200 m, 25 Oct 1939, J. Cuatrecasas /7303/ (Holotype: COL; Isotypes: F!, Fig. 64, US!).

Shrubs, 2-4 m tall; stems erect, subterete, striate, pubescent; dichotomously branching at angles of 40-65°, internodes mostly 1-2 cm long; leaves opposite; blades elliptic-lanceolate, chartaceous, smooth or nearly so, pinninerved, 2-6.5 cm long, 1-2.5 cm wide, apices acute, bases cuneate, margins with about 5 pairs of teeth, upper surfaces red-tinged, puberulent with uniseriate, multicellular trichomes, lower surfaces of a paler red cast, pubescence of
resinous glands and uniseriate multicellular trichomes; petioles
2-3.5 mm long, canaliculate, pubescent; capitulescences of terminal,
especially sessile, dense rounded glomerules, each with up to 17
heads and immediately subtended by mature leaves; peduncles wanting
to 7 mm long, pubescent; involucre cylindrical, 8-9 mm tall, 2-3
broad, about 4-seriate; phyllaries imbricate, graduate, outer 2-3
phyllaries 3-4.5 mm long, ca. 1 mm wide, finely striate, herbaceous
or at least apically so, pubescence like that of the leaves, apices
acute, inner ones grading from elliptic to lanceolate, 1.5-8 mm
long, 1-1.5 mm wide, striate, scarious, membranous tips grading from
abaxially puberulent to glabrous, apices acute, margins ciliate;
capitula discoid, 3-4-flowered, corollas yellow, 4.8-5.4 mm long,
 glabrous, lobes erect, 1.2-1.8 mm long, pappus of 20-26
linear-lanceolate scales, 5-6 mm long, anthers exerted, yellow,
2.5-3.5 mm long, appendages glandular abaxially, styles 6-7.5 mm
long with branches 0.9-1.4 mm long; receptacles conical, ca. 0.5 mm
long and broad; paleae lanceolate, conduplicate, entire to lacerate,
pale yellow, 6.5-8 mm long, ca. 1 mm wide; achenes obconic,
prismatic, dark brown, 2-3 mm long, sometimes lightly glandular,
glabrous otherwise. Chromosome number unknown.

Calea yuruparina is known to occur only in Vaupes, Colombia.
This taxon occurs at ca. 250 m near waterways and flowers from
September-November. If one agrees with the conclusions of Cronquist
(1955), the characteristics of this species (i.e. few flowered,
secondarily clustered heads), must be considered derived. This
taxon is the only _Calea_ from Vaupes that possesses such traits and thus is readily differentiated from all species of _Calea_ from this region.

EXCLUDED TAXA


Calea longipes S.F. Blake, J. Wash. Acad. Sci. 18: 34. 1928.
Calea oppositifolia (L.) L., Sp. Pl., 2,2: 1179. 1763. = Isocarpha oppositifolia (L.) Cass. var. oppositifolia, Dict. Sci. Nat. 24: 19. 1822. This taxon does not occur in Colombia (Keil and Stuessy, 1981). However, Adams (1972) lists this taxon as occurring in Colombia, and it is excluded here to avoid further confusion.


Calea ternifolia H.B.K. Although reported to be a Colombian species, C. ternifolia is not known to occur in Colombia. Blake (1930) noted that B-W specimen number 15301, reported to be from Colombia, actually was synonymous with the Mexican and Central American C. zacatechichi Schlecht. However, B-W specimen
number 15301 is interpreted here as being an isotype of *C. ternifolia* H.B.K. 1820 and thus Blake unknowingly excluded this taxon from the flora of Colombia and simultaneously placed it in synonymy with *C. zacatechichi* Schlecht. 1836! Pruski and Urbatsch (1980) treated *C. albida* Gray, *C. hypoleuca* Robins. & Greenm., and *C. pringlei* Robinson as components of the *C. zacatechichi* group and conclude that these species may be conspecific. However, it should be noted that *Calea ternifolia* has priority over all of the above-mentioned taxa. Wussow & Urbatsch (in prep.) are treating this group in their study of *Calea* in Central America.
LITERATURE CITED


227-263.


Coleman, J.R. 1968. Chromosome numbers in some Brazilian...
Compositae. Rhodora 70: 228-240.


France 65: 24-69.


----------. and ----------. 1899. Supplementary notes upon


Sandwith, N.Y. 1925. Humboldt and Bonpland's itinerary in


Fig. 1. *Calea septuplinervia*. Lower leaf surface showing glands, moniliform hairs and long hairs. Scanning electron microscope (SEM) micrograph. X 90.

Fig. 2. *Calea subcordata*. Lower leaf surface showing glands and long hairs. SEM micrograph. X 45.

Fig. 3. *Calea subcordata*. Upper leaf surface showing glands, moniliform hairs and short hairs with bulbous basal subsidiary cells. SEM micrograph. X 180.

Fig. 4. *Calea prunifolia*. Upper leaf surface showing glands, moniliform hairs, long hairs and short hairs. SEM micrograph. X 90.

Fig. 5. *Calea subcordata*. Moniliform hair on lower leaf surface. SEM micrograph. X 900.

Fig. 6. *Calea subcordata*. Transverse section of leaf showing moniliform hair. Light microscope (LM) photograph. X 530.
Fig. 7. **Calea subcordata.** Lower leaf surface showing glands.
SEM micrograph. X 460.

Fig. 8. **Calea subcordata.** Transverse section of leaf showing the biseriate nature of a gland (►). LM photograph. X 600.

Fig. 9. **Calea peruviana.** Lower surface of an outer phyllary showing an areole and tomentose pubescence. SEM micrograph. X 68.

Fig. 10. **Calea prunifolia.** Involucre showing herbaceous outer phyllaries and scarious inner ones.
SEM micrograph. X 20.

Fig. 11. **Calea subcordata.** Upper ligule surface showing nearly isodiametric epidermal cells.
SEM micrograph. X 720.

Fig. 12. **Calea septuplinervia.** Abaxial anther appendage apices showing glands. SEM micrograph. X 72.

Fig. 13. **Calea solidaginea.** Bifid style and branches showing a pair of stigmatic lines, rounded or acute apices and hispidulous collecting hairs. SEM micrograph. X 63.

Fig. 14. **Calea oliverii.** Trifid style and branches.
SEM micrograph. X 54.
Fig. 15. **Calea septuplinervia.** Achene with linear-lanceolate pappus scales. SEM micrograph. X 28.

Fig. 16. **Calea abelioides.** Achene with linear-lanceolate pappus scales and a dense pubescence of bifid hairs. SEM micrograph. X 26.

Fig. 17. **Calea barrosoana.** Achene with elliptic pappus squamellae. SEM micrograph. X 23.

Fig. 18. **Calea septuplinervia.** Pappus of linear-lanceolate scales. SEM micrograph. X 18.5.

Fig. 19. **Calea subcordata.** Achene showing bifid hairs. SEM micrograph. X 185.

Fig. 20. **Calea septuplinervia.** Pollen grain. SEM micrograph. X 1850.
Fig. 21. *Galea subcordata*. Transverse section of leaf through the midrib showing midvein, collenchymatous bundle sheath extensions, homogeneous mesophyll, and bulbous basal subsidiary cells of short hair (>). LM photograph. X 250.

Fig. 22. *Galea prunifolia*. Transverse section of leaf through the midrib showing xylem arc and phloem. LM photograph. X 400.

Fig. 23. *Galea prunifolia*. Transverse section of leaf mesophyll showing resin duct (>), palisade mesophyll (P) and spongy mesophyll (S). LM photograph. X 250.

Fig. 24. *Galea septuplinervia*. Portion of cleared leaf showing major lateral rib characteristic of campylodromous venation, and veins terminating within areoles. LM photograph. X 25.

Fig. 25. *Galea prunifolia*. Epidermis of cleared leaf showing the anomocytic stomata configuration. LM photograph. X 400.
Figs. 26-31. Ray corollas, palaea, and disk corollas of species of *Calea*.

Fig. 26. *C. perijensis*, Pierl. s. n. (K).

Fig. 27. *C. tolimana*, Lehmann 7447 (K).

Fig. 28. *C. gargantae*, Garganta-Fabrega 838 (F).

Fig. 29. *C. subcordata*, Urbatsch and Pruski 3427 (LSU).

Fig. 30. *C. peruviana* var. *peruviana*, Goudot s. n. (P).

Fig. 31. *C. saxatilis*, Steyermark et al. (US).
Figs. 32-39. Paleae and disk corollas of species of Calea

(plus an obscure ray on Fig. 38).

Fig. 32. C. prunifolia, Pruski 442 (LSU).

Fig. 33. C. prunifolia, Haught 5455 (US).

Fig. 34. C. berteriana, Pruski and Steyermark 1474 (LSU).

Fig. 35. C. solidaginea var. solidaginea, Killip and Smith 14987 (NY).

Fig. 36. C. angosturana, Goudot s. n. (P).

Fig. 37. C. sessiliflora, Bonpland 44 (P).

Fig. 38. C. colombiana, Pennell and Killip 8093 (US).

Fig. 39. C. septuplinervia, Urbatsch and Pruski 3457 (LSU).
32 C. prunifolia

33 C. prunifolia

34 C. berteriana

35 C. solidaginea var. solidaginea

36 C. angosturana

37 C. sessiliflora

38 C. colombiana

39 C. septuplinervia
Fig. 41. Distribution of *Calea abelioides* S. F. Blake,

*Calea perijaensis* Cuatr., *Calea tolimana* Hieron., and

*Calea yuruparina* Cuatr.
Fig. 42. Distribution of *Calea berteriana* DC., *Calea solidaginea* H.B.K. var. *solidaginea*, and *Calea solidaginea* H.B.K. var. *deltophylla* (Cowan) Pruski and Urbatsch.
Fig. 43. Distribution of Calea prunifolia H.B.K.
Galea prunifolia
Fig. 44. Distribution of *Calea perimbricata* Cuatr. and *Calea sessiliflora* Less.
• Galea perlmbricata
# Galea sessiliflora

* Calea perimbricata
* Calea sessiliflora
Fig. 45. Distribution of *Calea angosturana* Hieron.,

*Calea colombiana* Gand., and *Calea septuplinervia* Hieron.
- Galea angosturana
- Galea septulinervia
- Galea colombiana
Fig. 46. ISOTYPE of *Calea peruviana* (H.B.K.) Benth.

ex S. F. Blake var. *peruviana*, Bonpland s. n. (B).
By Herb. Kunth.

Leontopodium alpinum
persicum
Kunth
in Herb. Berol. p. 296. t. 489.

Verweb.

E. Herb. Kunth. N.
Fig. 47. ISOLECTOTYPE of *Calea trianae* Hieron., *Triana*

1414 (NY) = (*Calea peruviana* (H.B.K.) Benth. ex S. F. Blake var. *tolimensis* (Hieron.) Pruski and Urbatsch.
**TYPE SPECIMEN**

Category of type: ISOLECTOTYPE

Basionym: *Calea trianae* Hieron.


Current name: *Calea peruviana* (H.B.K.) Benth. ex Blake var. *triana* (Hieron.)

Locality: Louisiana State University, Baton Rouge, LA

John Pruski 1982

Ex Herbario Musei Britannici

*Galea trianae* Hieron.

LOCALITY

*Subota 1 Gebude* 17:00

J. J. Triana No. M14
Fig. 48. HOLOTYPE of Calea saxatilis Cuatr.,

Cuatrecasas 13429 (F).
Calea saxatilis Cuatr.


Current name: Calea saxatilis Cuatr.

John Pruski 1982

HERBARIO NACIONAL COLOMBIANO

Calea saxatilis Cuatr.

Holotype

Frutex rastrero. Corola amarilla.

Cordillera Oriental, Departamento Norte de Santander; región del Sur: Estrecho o Callejón del Maguá, Peta de los Micos, 1,100 m. alt.

No. 13429 { J. CUATRECASAS} collect. 22. Noviembre 1981

TYPE SPECIMEN

Category of type: HOLOTYPE

Bequest: Calea saxatilis Cuatr.


Current name: Calea saxatilis Cuatr.

John Pruski 1982

1304908

CHICAGO

NAT.HIST. MUSEUM
Fig. 49. HOLOTYPE of *Calea subcordata* S. F. Blake, Killip and Smith 19808 (US).
Calea subcordata

HOLOTYPE

Calea subcordata Blake

J. Wash. Acad. Sci.

Type Specimen

Category of type: Holoype

Basionym:

Calea subcordata Blake

Literature reference:

J. Wash. Acad. Sci.

Current name:

Calea subcordata Blake

Louisiana State University, Baton Rouge, LA

John Pruski 1982

UNITED STATES NATIONAL MUSEUM

EXPLORATION IN COLOMBIA

Calea subcordata Blake

Shrub 1-3 ft; rays & styles yellow; corollae greenish yellow. Open hillside.

Dept. Norte de Santander: Between Pampina and La Isla; alt. 1,000-2,100 meters.

No. 19958

E. P. Krogh

Albert C. Smith

Collectors, Feb 17, 1937

Collected under the auspices of the New York Botanical Garden,
Gray Herbarium of Harvard University, United States
Fig. 50. HOLOTYPE of *Calea perijaensis* Cuatr.,

Haught 4525 (US).
TYPE SPECIMEN

Category of type: HOLOTYPE

Basionym: Calea perijaensis Cuatr.


Current name: Calea perijaensis Cuatr.

Locality: Louisiana State University, Baton Rouge, LA

John Pruski 1982

Calea perijaensis Cuatr.

Holotype

UNITED STATES NATIONAL MUSEUM
PLANTS OF COLOMBIA

OSCAR MAUGHER, CURATOR

148
Fig. 51. ISOTYPE of Calea tolimana Hieron., Lehmann 7497 (K).
Fig. 52. HOLOTYPE of Calea gargantae Cuatr.,
Garganta-Fabrega 838 (F).
PLANTS OF COLOMBIA

Calca garganta Cúatr.  
Holotype

Collector:  
John Pruski 1982

Location:  
Departamento Norte de Santander  
No. 838  
MUSEUM OF NATURAL HISTORY
Fig. 53. Drawing of HOLOTYPE of *Calea bucaramangensis* Pruski and Urbatsch, Olsen and Escobar 567 (LSU).
Fig. 54. HOLOTYPE of Calea perimbricata Cuatr., Haught 6024 (US).
Calea perimbricata Linst.  
Holotype

PLANTS OF COLOMBIA
DEPARTMENT OF COLOMBIA

UNITED STATES NATIONAL MUSEUM
Fig. 55. HOLOTYPE of *Calea berteriana* DC.,
Bertero s. n. (G-DC).
Fig. 56. ISOTYPE of *Calea prunifolia* H.B.K.,

Bonpland s. n. (P).
TYPE SPECIMEN

Category of type: ISOTYPE

Basionym: Calea promifolia H.B.K.


Current name: Calea promifolia H.B.K. var. promifolia

Louisiana State University, Baton Rouge, LA
John Prunkl 1982

ISOTYPE

Herb. MUS. PARIS.


Cam. Math. 25, 299. 1820.

(25. feller)

Histoire de l'Amérique équatoriale,

connue par M. A. Rostlund.

Bibliothèque nationale de France.

160
Fig. 57. HOLOTYPE of *Calea abelioides* S. F. Blake, Tate 768 (NY).
**Galea abelioides Blake**


**John Freas** 1982

**AMERICAN MUSEUM OF NATURAL HISTORY**

**PLANTS OF THE TYLER-DUIDA EXPEDITION**

**August 1922 to April 1923**

**Ridge crests, Savannah Hills. Herb 1.5 ft. high.**

**SUMMIT OF MOUNT DUIDA, VENEZUELA. ALT. 4400 ft.**

**NO. 768**

G. H. M. Tate, Collector
Fig. 58. ISOTYPE of *Calea solidaginea* H.B.K. var. *solidaginea*, Bonpland 619 (B).
Fig. 59. HOLOTYPE of *Calea solidaginea* H.B.K. var. *deltophylla* (Cowan) Pruski and Urbatsch, Wilson and Browne 82 (NY).
Galea deltophylla Cowan


Galea solidaginacea H.B.K. var. deltophylla (Cowan) Fruški and Lomn. St. University. Request LA University John Fruški 1982

**TYPE OF: Galea deltophylla Cowan**

**FORREST DEPARTMENT OF BRITISH COLUMBIA**

Date: Sept/66  
Field No.: W1662  
Record No.:  
Loc.: Sand ck, Rappahannock.

**Desc.** Prostrate woody shrub - flowers green - florula tubular - pappus of linear aseae - achenes notiled.

**Vern. Name**  
**Bot. Name**  
**Family** COMPOSITAE  
**N.C.O.: 080**  
**New York Botanical Garden 3462**
Fig. 60. ISOTYPE of Calea sessiliflora Less.,
Bonpland 44 (P).
LECTOTYPE
Galea sessiliflora Less.
Linnaea 5: 158, 1830.

Current name:
Galea sessiliflora Less.

Louisiana State University, Baton Rouge, La.

John Pruski 1982
Fig. 61. HOLOTYPE of *Calea colombiana* Gand.,

Lehmann 4885 (K).
TYPE SPECIMEN

Category of type: BOLTYPE

Basionym: Calca colombiana Gand.


Current name: Calca colombiana Gand.

Type specimen: Louisiana State University, Baton Rouge, LA

John Pruski 1982

HERRIARUM KEWENSE

Herbarium Lemmariarum Coloniae, 1906.
Fig. 62. ISOTYPE of Calea angosturana Hieron.,

Lehmann 7479 (K).
**LECTOTYPE**

*Calce angusturana* Hieron.

**Category of type:** Lectotype


**Current name:** *Calce angusturana* Hieron.

**Locality:** Louisiana State University, Baton Rouge, LA

**Collected by:** John Pruski 1982

**Type Specimen:**
Fig. 63. ISOTYPE of *Calea septuplinervia* Hieron.,

*Triana 1416* (K).
TYPE SPECIMEN

LECTOTYPE

Basionym:
Calea septuplinervia Hieron.

Literature reference:

Current name:
Calea septuplinervia Hieron.

Louisiana State University, Baton Rouge, LA
John Pruski 1982
Fig. 64. ISOTYPE of Calea yuruparina Cuatr.,
Cuatrecasas 7303 (F).
Table 1. Chromosome Reports for Caribbean and South American Species of Calea

<table>
<thead>
<tr>
<th>TAXON</th>
<th>GAMETIC NUMBER</th>
<th>REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>* C. cardonae Maguire and Wurdack</td>
<td>19</td>
<td>VENEZUELA: Bolivar. Pruski &amp; Steyermark 1433</td>
</tr>
<tr>
<td>C. huigreensis S. F. Blake</td>
<td>19</td>
<td>VENEZUELA: Bolivar. Pruski &amp; Steyermark 1453</td>
</tr>
<tr>
<td>* C. jamaicensis (L.)L.</td>
<td>19</td>
<td>JAMAICA: St. Thomas. Urbatsch &amp; Pruski 3401</td>
</tr>
<tr>
<td>C. jelskii Hieron.</td>
<td></td>
<td>Turner et al. 1967</td>
</tr>
<tr>
<td>C. multijuga Krasch</td>
<td>16</td>
<td>Coleman 1968</td>
</tr>
<tr>
<td>(reported as C. multipega)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. pinnatifida Banks</td>
<td>19</td>
<td>Coleman 1968</td>
</tr>
<tr>
<td>++ C. prunifolia H.B.K.</td>
<td>19</td>
<td>COSTA RICA: San Jose. Pruski 442</td>
</tr>
<tr>
<td>C. reticulata Gardn.</td>
<td>18</td>
<td>VENEZUELA: Portuguesa. Urbatsch &amp; Pruski 3407</td>
</tr>
</tbody>
</table>

177
Table 1. Chromosome Reports for *Calea* continued.

<table>
<thead>
<tr>
<th>TAXON</th>
<th>GAMETIC NUMBER</th>
<th>REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>+# <em>C. septuplinervia</em> Hieron.</td>
<td>38</td>
<td>VENEZUELA: Merida.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Urbatsch &amp; Pruski 3457</td>
</tr>
<tr>
<td>+ <em>C. sessiliflora</em> Less.</td>
<td>19</td>
<td>Powell &amp; King 1969</td>
</tr>
<tr>
<td>(reported as <em>C. glomerata</em>)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. serrata</em> Less.</td>
<td>19</td>
<td>Coleman 1970</td>
</tr>
<tr>
<td>* <em>C. solidaginea</em> H.B.K. var. deltophylla* (Cowan) Pruski &amp; Urbatsch</td>
<td>19</td>
<td>VENEZUELA: Bolivar.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pruski &amp; Steyermark 1359</td>
</tr>
<tr>
<td>+* <em>C. solidaginea</em> H.B.K. var. solidaginea</td>
<td>19</td>
<td>VENEZUELA: Tachira.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Urbatsch &amp; Pruski 3420</td>
</tr>
</tbody>
</table>

+ Taxon known from Colombia

# First report for genus

* First report for species

Vouchers for new reports are deposited in LSU
VITA

John Francis Pruski was born in Oakland, California on October 3, 1955, the son of Leonard Pruski and Olive Wright Pruski. After graduating from O. Perry Walker High School in New Orleans, Louisiana in 1973, he attended Tulane University for two years before enrolling at Louisiana State University in Baton Rouge, Louisiana in the Fall of 1976. He received the degree of Bachelor of Science from Louisiana State University in May, 1978. In August 1978, he entered the graduate school of Louisiana State University. On March 20, 1982, he married Kristin Malin. He is currently a candidate for the Master of Science degree in Botany.

Permanent address: 5800 MacArthur Blvd.

New Orleans, LA. 70114
EXAMINATION AND THESIS REPORT

Candidate: John Francis Pruski

Major Field: Botany

Title of Thesis: A Systematic Study of the Colombian Species of the Genus Calea (Compositae)

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination: July 6, 1982