

NOTES ON THE LYCHNOPHORINE GENERA *CHRESTA* AND *EREMANTHUS*.

(VERNONIEAE: ASTERACEAE)

Harold Robinson
Department of Botany
Smithsonian Institution, Washington, D.C., 20560.

The Subtribe Lychnophorinae of the Vernonieae has been distinguished by Bentham and Hooker (1873) and Hoffmann (1890-94) by the presence of clustered syncephalous usually few-flowered heads in the inflorescence. The subtribe is partially artificial, but it is notable for containing various elements that are individually very distinct from *Vernonia*. The typical and rather natural element of the subtribe, represented by *Lychnophora*, and *Eremanthus*, and a few other closely related genera, is restricted almost completely to eastern Brasil, and has come under study as a result of efforts to identify various collections from that area. The study has resulted in the discovery of significant characters in the pollen and the nectary, and has shown the need to resurrect the genus *Chresta* from synonymy. One new species of *Eremanthus* and one new species of *Chresta* are described.

The genus *Eremanthus* has been interpreted broadly in most treatments to include those species of the complex in which the inner pappus setae are not contorted and are persistent. The typical element of the genus is distinctly shrubby, but a number of the species are herbaceous and some are scapose from a basal rosette of leaves. A number of generic segregates have been suggested for various of the more herbaceous elements, *Chresta* Vell. ex DC., *Pycnocephalum* (Less.) DC., *Stachyanthus* DC., and most recently *Glaziovianthus* Barroso. It has been necessary to determine the need for segregation of the herbaceous elements of *Eremanthus* and to determine what name or names are applicable.

Typical *Eremanthus*, based on *E. glomerulatus* Less., has short cylindrical basal tubes on the corolla, smooth inner surfaces of the corolla lobes, and *Lychnophora*-Type pollen. The herbaceous species all share some details by which they differ from the shrubby species. Most obviously, the corolla tubes are very elongate and partially funnelform. More detailed examination shows a papillose inner surface at the bases of the corolla lobes, a character that seems unique in the tribe. The papillae differ from those of most other tribes by occurring in a series on each of the elongate cells of the corolla surface, rather than each representing a single cell. One other feature found in most of the herbaceous species is a distinctly lophorate type of pollen grain. These have a pattern with colpar areolae similar to the *Vernonia argyrophylla*-Type, but they have low ridges as in the *Lychnophora*-Type found in typical *Eremanthus*. Only two of

the herbaceous species examined lack the specialized pollen, *E. eriopus* Sch.Bip. ex Baker and *E. curumbensis* (Philips.) H. Robins. On the basis of the combined characters, the more herbaceous series of species is regarded as a separate and natural genus.

Of the four names that have been provided for the various herbaceous species, three have equal priority, dating for purposes of validation from the Prodrumus of de Candolle (1836). One of the names, *Stachyanthus* based on *S. martii* DC., was entirely new at that point. It is also the name most readily dismissed, having been rejected in favor of the later *Stachyanthus* Engler, nom. cons. of the Icacinaceae. The two other names have a history preceding their use by de Candolle. *Pycnocephalum* (Less.) DC., based on *Vernonia plantaginifolius* Less. and *V. scapigera* Less., was originally a section under *Vernonia*. *Chresta* Vell. ex DC., based on *C. cordata* Vell., nom. inval. (= *C. spaerocephala* DC.) and *C. lanceolata* Vell., nom. inval., was initially published without description. Vellozo names are usually considered valid on the basis of the plates with details, but a new genus and its included species cannot be considered validated without a genus description. Given names of equal priority, the choice must be made by a later author. I follow here Gardner (1842) who gave precedence to the name *Chresta*.

The most recent generic name provided in the group, *Glaziovianthus* Barroso (1947), presents special problems. The type was *G. purpureus* Barroso, and reference was made to a previous unvalidated name, *Eremanthus labordei* Glaziou. The most important character of the genus was the deciduous pappus, a feature contrasting with the traditional characters of *Eremanthus*. The species involved closely resembles members of the genus *Chresta*, and might be placed there except for the presence of a *Lychnophora*-Type pollen and the deciduous pappus. Examination shows that the corolla shape and papillosity are as in *Chresta*, and generic distinction is not recommended here. Furthermore, *Eremanthus eriopus* also has *Lychnophora*-Type pollen, but has a persistent pappus, falling between the two groups.

There are two species names that must be considered in relation to *Glaziovianthus*. *Chresta speciosa* Gardn. was described as having a deciduous pappus, and it is almost certainly a very closely related species, though Gardner's plate (1842) shows much narrower strap-shaped leaves with teeth only near the obtuse tip. *Eremanthus curumbensis* Philipson (1938), according to the description is the same species described by Barroso (1947), and the name should be used in which ever genus the species is placed.

CHRESTA Vell. ex DC., Prodr. 5: 85. 1836. *Chresta* Vell., Fl. Flum. 8: t. 150, 151, nom. inval.

Pycnocephalum (Less.) DC., Prodr. 5: 83. 1836. *Vernonia* sect. *Pycnocephalum* Less., Linnaea 6: 630. 1831.

Stachyanthus DC., 5: 84. 1836, nom. rej. in favor of *Stachyanthus* Engl., nom. cons. (Icacinaceae).

Perennial herbs or subshrubs, with inflorescence terminal or from axils of upper leaves, long-pedunculate, often scapose from a rosette of leaves. Heads clustered in synflorescences, discoid, few-flowered; involucre bracts subimbricate, inner often deciduous. Flowers homogamous, 2-12; corollas reddish to purple; basal tube elongate, very narrowly funnelform; throat very short or lacking; lobes 5, linear, with distinct papillae on lower inside surface; anther appendages with or without glands; nectary elongate; style base without node; style branches filiform, hirtellous abaxially; achenes prismatic, ca. 10-costate; pappus with outer series present, of various lengths, usually not sharply differentiated; inner pappus usually persistent (deciduous in *Glaziovianthus*), tapering to tip. Pollen usually lophorate, with colpar areolae reaching to poles, usually with partial walls above and below pores, usually 2 rows of intercolpar areolae, a few species with *Lychnophora*-Type pollen.

Lectotype species: *Chresta sphaerocephala* DC., present designation.

The following 11 species are recognized.

Chresta angustifolia Gardn., Lond. Jour. Bot. 1: 240, t. 8. 1842.
Eremanthus angustifolius (Gardn.) Baker in Mart., Fl. Bras. 6 (2): 170. 1873.

CHRESTA CURUMBENSIS (Philips.) H. Robins., comb. nov. *Eremanthus curumbensis* Philips., Kew Bull. 7: 298. 1938. *Glaziovianthus purpureus* Barroso, Rev. Brasil. Biol. 7 (1): 115. 1947.

CHRESTA ERIOPUS (Sch. Bip. ex Baker) H. Robins., comb. nov.
Eremanthus eriopus Sch. Bip. ex Baker in Mart., Fl. Bras. 6 (2): 169. 1873.

Chresta exsucca DC., Prodr. 5: 85. 1836. *Eremanthus exsuccus* (DC.) Baker in Mart., Fl. Bras. 6 (2): 166. 1873.

CHRESTA MARTII (DC.) H. Robins., comb. nov. *Stachyanthus martii* DC., Prodr. 5: 84. 1836. *Eremanthus martii* (DC.) Baker in Mart., 6 (2): 167. 1873.

Chresta plantaginifolia (Less.) Gardn., Lond. Jour. Bot. 1: 241. 1842. *Vernonia plantaginifolia* Less., Linnaea 4: 251. 1829. *Pycnocephalum plantaginifolium* (Less.) DC., Prodr. 5: 83. 1836. *Pycnocephalum spathulaefolium* DC., Prodr. 5: 83. 1836. *Chresta spathulaefolia* (DC.) Gardn., Lond. Jour. Bot. 1: 241. 1842. *Eremanthus plantaginifolius* (Less.) Baker in Mart., Fl. Bras. 6 (2): 168. 1873.

Chresta pycnocephala DC., Prodr. 5: 85. 1836. *Eremanthus pycnocephalus* (DC.) Baker in Mart., Fl. Bras. 6 (2): 166. 1873.

Chresta scapigera (DC.) Gardn., Lond. Jour. Bot. 1: 241. 1842. *Pycnocephalum scapigerum* DC., Prodr. 5: 83. 1836. *Eremanthus scapigerus* (DC.) Baker in Mart., Fl. Bras. 6 (2): 168. 1873.

Chresta speciosa Gardn., Lond. Jour. Bot. 1: 240, t.9. 1842. *Eremanthus speciosus* (Gardn.) Baker in Mart., Fl. Bras. 6 (2): 169. 1873.

Chresta sphaerocephala DC., Prodr. 5: 85. 1836. *Chresta cordata* Vell., Fl. Flum. 8. t. 150, nom. inval. *Chresta intermedia* Gardn., Lond. Jour. Bot. 4: 236. 1845. *Eremanthus sphaerocephalus* (DC.) Baker in Mart., Fl. Bras. 6 (2): 167. 1873.

CHRESTA SOUZAE H. Robins., sp. nov.

Plantae herbaceae perennes rosulatae acaulescentes. Radices subtuberosae. Folia in rosulis spiraliter inserta sessilia; laminae herbaceae obovatae vel oblanceolatae 2-3 cm longae et 0.7-1.0 cm latae base cuneatae margine integrae apice obtusae vel breviter acutae supra glabrae vel glabrescentes glandulo-punctatae subtus plerumque inferne et in nervis villosae vel sublanatae ubique glandulo-punctatae, nervis secundariis paucis utrinque ca. 2 valde ascendentibus. Inflorescentiae scaposae, scapi 4-8 cm longi dense sordide pilosi, pilis appressis vel subappressis T-formibus glomerulis apicalibus solitariis capituliformibus ca. 8-10-capitatis. Capitula sessilia anguste campanulata vel subcylindrica ca. 14 mm alta et 4-5 mm lata; squamae involucri ca. 10 in partibus deciduae breviter oblongae vel anguste ellipticae ca. 5-8 mm longae et 1.8-2.5 mm latae apice breviter acuminatae pungentes margine late scariosae dense minute fimbriatae extus plerumque glabrae superne ad medio fuscescentes ad apicem interdum purpureo-tinctae. Flores ca. 7 in capitulo. Corollae lavandulae 12-13 mm longae, tubis ca. 8 mm longis extus sparse minute glanduliferis, faucibus nullis vel subnullis, lobis anguste oblongis ca. 5 mm longis et 1 mm latis extus superne pauce glandulo-punctatis intus inferne papillois, nervis loborum e marginis remotis; thecae antherarum ca. 2.5 mm longae; appendices antherarum oblongae ca. 0.35 mm longae et 0.25 mm latae margine involutae extus pauce glanduliferae; nectaria elongata ca. 1.5 mm longa glabra; basi stylorum non noduliferi; scapi stylorum in partibus hirtellis superioribus ca. 2.5 mm longi. Achaenia ca. 2 mm longa perdense sericeo-setifera; setae pappi interiores longiores persistentes ca. 15 ad 7.5 mm longae, setae exteriores irregulariter breviores numerosae, setae omnino superne angustiores plerumque ad marginem subbarbellatae. Grana pollinis ca. 60 μ m in diametro distincte lophorata, cristis

humilis minute multo spinuliferis, spinis majoribus nullis (reticulation *Chresta*-Type).

TYPE: BRASIL: Goiás: Chapada dos Veadeiros, 14°S, 47°W, ca. 12 km NW of Veadeiros, wet campo. Elev. 1200 m. Rosette herb from deep root, with fleshy leaves. Heads ca. 10 cm high, magenta. Locally common. *H.S. Irwin, R. Souza, R. Reis dos Santos 9286* (Holotype UB, isotype US).

The new species seems closest to *Chresta plantaginifolia*, but the plants are much smaller with shorter, less lepidote, more prominently glandular-punctate leaves, and the involucre bracts are distinctly sharply acuminate. On the basis of field notes the leaves are also more fleshy, and the venation is not prominent in the dried plants.

The revised concept of *Eremanthus* is as follows:

EREMANTHUS Less., *Linnaea* 4: 317. 1829.

Shrubs or subshrubs, with inflorescences terminal on branches, leaves not in rosettes. Inflorescences corymbose-paniculate. Heads densely corymbose or clustered in synflorescences, discoid, few-flowered; involucre bracts subimbricate, inner often deciduous. Flowers homogamous, 1-11 (typical element 1-flowered); corollas reddish to purple; basal tube usually short-cylindrical, rarely slightly funnelform; throat short or lacking; lobes 5, linear, smooth on inner surface; anther appendages glabrous, with tips flat and somewhat indurated; nectary shorter than wide, usually glabrous (hirsute in 1 species); style without basal node; style branches filiform, hirtellous abaxially; achenes prismatic or slightly obcompressed, ca. 10-costate; pappus with outer series of various lengths, sometimes not sharply differentiated; inner pappus persistent, setae tapering to tip. Pollen of *Lychnophora*-Type.

Type species: *Eremanthus glomerulatus* Less.

As presently recognized the genus excludes all strictly herbaceous and rosette-forming species. The present concept does include all the species approaching *Vernonia* in the presence of looser inflorescences, such as *E. crotonoides* Sch.Bip., *E. elaeagnus* (Mart.) Sch.Bip., *E. leucodendron* Mattf., and *E. veadeiroensis* described below. The generic placement of the last of these is discussed briefly below.

Three collections matching the description of *Eremanthus mattogrossensis* O.Kuntze have been seen, and in all three the nectary is densely hirsute. The character is readily observable since the nectary remains with the achene after the corolla falls. The genus was not completely surveyed, but no other species has been seen with the character. Only one other example of a pubescent nectary is presently reported in the Asteraceae, *Sciadocephala amazonica* K. & R., in the Eupatorieae (King & Robinson, 1974).

The following species is described as new.

EREMANTHUS VEADEIROENSIS H. Robins., sp. nov.

Plantae fruticosae vel contorte arborescentes 1.5-3.0 m altae multo ramosae. Caules teretes dense brunnescentiter velutini, internodis brevibus plerumque 3-8 mm longis. Folia spiraliter inserta, petiolis indistinctis; laminae oblanceolatae plerumque 3-6 cm longae et 0.8-1.1 cm latae base subpulviniformes fere ad basem constrictae superiores sensim latioribus margine integrae apice anguste rotundatae vel breviter obtusae supra et subtus dense breviter griseo-tomentosae, nervis pinnatis, nervis secundariis subobscuris utrinque ca. 6 ascendentibus. Inflorescentiae in ramis terminales dense corymbosae vel subcymosae pauci-capitatae, ramis dense velutinis vel tomentosis, bracteis foliiformibus plerumque 0.9-2.5 cm longis et 3-8 mm latis. Capitula in greggis parvis sessilia vel breviter pedunculata ca. 11-14 mm alta et 6-7 mm lata; squamae involucris ca. 45 subimbricatae 4-5-seriatae appressae ovatae vel elliptico-lanceolatae 2-7 mm longae et ca. 1.5 mm latae apice acutae purpurascens margine inferne anguste scariosae extus griseo-tomentosae; receptacula cristifera minute denticulata. Flores 8-11 in capitulo. Corollae lavandulae in textura subfirmae 7.0-7.5 mm longae, tubis cylindricis ca. 3.5 mm longis ca. 1 mm latis extus plerumque glabris base et apice in seriebus solitariis glanduliferis, faucibus nullis vel subnullis, lobis anguste lanceolatis ca. 4 mm longis et 0.8 mm latis extus dense glandulo-punctatis subapice uni- vel pauci-setiferis, setis valde contortis interdum parum T-formibus; thecae antherarum ca. 3 mm longae; appendices antherarum oblongo-ovatae ca. 0.8 mm longae et 0.3 mm latae apice anguste rotundatae glabrae; scapi stylorum in partibus hispidulis superioribus ca. 0.5 mm longi. Achaenia ca. 3.5 mm longa leniter asymmetrica costata sparse antrorse setifera; setae pappi albae vel rubrescentes persistentes interiores 40-45 ca. 7 mm longae subcomplanatae apice vix angustiores margine et extus scabridulae, setae exteriores filiformes vel subsquamaeformes apice attenuatae extus sparse scabridulae. Grana pollinis ca. 50 μ m in diametro inter spinulam irregulariter areolata (*Lychnophora*-Type).

TYPE: BRASIL: Goiás: Chapada dos Veadeiros, ca. 20 km N. of Alto do Paraíso, elev. ca. 1250 m, Outcrops, Cerrado on sandstone outcrops with adjacent wet campo (brejo). Shrub ca. 1.5 m tall. Heads pinkish lilac. *H.S. Irwin, R.M. Harley, G.L. Smith 32752* (Holotype UB, isotype US). PARATYPE: BRASIL: Goiás: Chapada dos Veadeiros, 14°S, 47°W, ca. 20 km W. of Veadeiros. Elev. 1000 m. Rocky slopes and wet campo. Gnarled tree ca. 3 m X 6 cm. Heads dull rose-violet. *H.S. Irwin, J.W. Grear, Jr., R. Souza, R. Reis dos Santos 12561* (US).

The new species was originally put aside as an undescribed *Vernonia* because of the non-syncephalous inflorescence and the general resemblance to *V. eremophila* Mart. Detailed analysis has indicated relationship to the *Lychnophorinae*, however. The gnarled stems with velutinous pubescence are reminiscent of *Lychnophora*, while the pollen is of the *Eremanthus-Lychnophora*-

Type which is comparatively rare in *Vernonia*. The number of flowers in the head is much less than $\frac{1}{2}$ the number of involucre bracts, a feature found in *Vernonia* only in the section *Critoniopsis* which the new species does not resemble. Nevertheless, the heads of the new species do contain more flowers than most other members of the *Lychnophorinae*. The receptacle bears low denticulate crests of a type unknown in *Vernonia*. Detailed examination of the flowers shows a pappus, an achene shape, rather evenly tapering corolla lobes, and a short-cylindrical corolla tube matching those found in *Eremanthus*. In aspect, the new species most strongly resembles two other species with non-syncephalous inflorescences, *E. elaeagnus* of Minas Gerais which has only 3 flowers per head, and *E. leucodendron* of Bahia which has 5 flowers per head. According to the description, the latter species also differs by having a more funnelform tube on the corolla.

The study has also resulted in the recognition of the following new species which falls within the presently accepted technical limits of the genus *Lychnophora*.

LYCHNOPHORA SANTOSII H. Robins. sp. nov.

Plantae fruticulosae ad 1.5 m altae dense ramosae. Caules teretes superne canescentiter dense lepidoti, lepidis stellatis peltatis breviter stipitatis breviter ramosis. Folia spiraliter inserta vel raro subopposita subsessilia, petiolis 1-2 mm longis; laminae ellipticae vel leniter obovatae plerumque 1.2-1.5 cm longae et 0.5-0.7 cm latae base acutae margine integrae apice rotundatae vel breviter obtusae supra glauco-virides non pilosae dense appresse glandulo-punctatae subtus perdense compactae albotomentosae, pilis individuis stellatis. Inflorescentiae in ramis terminales syncephalae, bracteis foliiformibus ad 1.2 cm longae in petiolis ad 4 mm longis. Capitula unusquisque in axillis bracteorum disposita subcylindrica ca. 9 mm alta et ca. 2 mm lata; squamae involucri sordido-virides ca. 20 subimbricatae erectae subappressae ovatae vel anguste oblongae 1.5-4.5 mm longae et 0.8-1.0 mm latae apice acutae margine superne anguste scariosae minute fimbriatae in partibus purpureo-tinctae extus dense pallide glandulo-punctatae. Flores 3 in capitulo. Corollae lavandulae? 5.5-6.5 mm longae extus etiam ad basem dense glandulo-punctatae, tubis 2-3 mm longis, faucibus subnullis, lobis oblongo-lanceolatis ca. 3 mm longis et 0.5-0.7 mm latis; thecae antherarum ca. 2.3 mm longae; appendices antherarum anguste ovatae ca. 0.7 mm longae et 2.7 mm latae margine involutae extus glabrae; basi stylorum non noduliferi; scapi stylorum in partibus hispidulis superioribus ca. 0.5 mm longi. Achaenia ca. 2.8 mm longa inter costas dense breviter setifera, carpopodiis minutis; setae pappi purpurascens interiores ca. 25 aliquantum deciduae plerumque 5.0-5.5 mm longae anguste taeniiformes leniter tortuae, squamae exteriores numerosae lanceolatae ca. 1 mm longae. Grana pollinis ca. 45 μ m in diametro

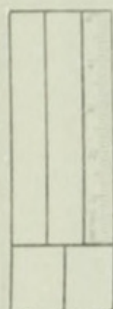
(*Lychnophora*-Type).

TYPE: BRASIL: Bahia: Municipio de Rio de Contas. Pico das Almas, a 18 kms ao NW de Rio de Contas. Elev. 1600-1850 m. Shrub 1½ m tall, flowers all past anthesis. *R.M.King, S.Mori, T.S.Santos & J.Hage 8114* (Holotype RB, isotype US).

The species has a pappus most like that of *Lychnophora blanchetii* Sch.Bip., also from Bahia, but there is no evidence of complete reduction of the outer pappus series as sometimes occurs in the latter species. The new species is unusual in *Lychnophora* by the broad elliptical to obovate leaves lacking recurved margins. The equally broad bracts of the inflorescence are also prominent with their whitish undersurfaces among the reddish heads.

Literature Cited

- Baker, J. B. 1873. Compositae. 1. Vernoniaceae. In Martius, *Flora Brasiliensis* 6 (2): 1-179, pl. 1-50.
- Barroso, G. M. 1947. Um gênero novo da familia "Compositae." *Rev. Brasil. Biol.* 7 (1): 113-115.
- Bentham, G. & J. D. Hooker 1873. Ordo CXXXVIII. Compositae. *Genera Plantarum* 2 (1): 163-533, 536-537.
- Candolle, A. P. de 1836. Ordo CII. Compositae. *Prodromus Systematis Naturalis Regni Vegetabilis* 5: 4-706.
- Gardner, G. 1842. Characters of three new species of *Chresta*, with remarks on the identity of *Pycnocephalum* and *Chresta*. *Lond. Jour. Bot.* 1: 238-241, pl. 8-9.
- Hoffmann, O. 1890-1894. Compositae. In Engler, H. G. A. and K. A. E. Prantl, *Die natürlichen Pflanzenfamilien* 4 (5): 87-391.
- King, R. M. and H. Robinson 1974. Studies in the Eupatorieae (Asteraceae). CXXVII. Additions to the American and Pacific Adenostemmatinae. *Adenostemma*, *Gymnocoronis* and *Sciadocephala*. *Phytologia* 29 (1): 1-20.
- Philipson, W. R. 1938. Four new species of Vernoniaceae collected by Glaziou in Brasil. *Kew Bulletin* 1938 (7): 298-300.



Chresta souzae H. Robinson Holotype

THE NEW YORK BOTANICAL GARDEN
Plants of the Pico do Brasil
Chapada dos Veadeiros, Estado de Goiás, 14°S, 47°W
No. 9286

(Comp.)

Rosette herb from deep root, with fleshy leaves. Heads ca. 10 cm. high, magenta. Locally common. Wet campo, recently burned-over, Chapada dos Veadeiros, ca. 12 km. N.W. of Veadeiros, Goiás. Elevation 1200 m.

H. S. Irwin, R. Souza,
R. Reis dos Santos

19 October 1965

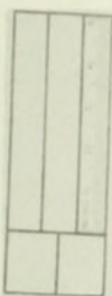
Field work conducted with the collaboration of the Universidade de Brasília, Instituto Agrário de Brasília, and the Ministério da Agricultura. Supported in part by funds from the National Science Foundation.



Chresta souzae H. Robinson, Holotype, Herbário Universidade de Brasília. Photos by Victor E. Krantz, Staff Photographer, National Museum of Natural History.



Eremanthus veadeiroensis H. Robinson, Holotype, Herbário
Universidade de Brasília.



ASTERACEAE of BAHIA, BRAZIL

Cytological and/or Biochemical Vouchers

No. 8114

Lychnophora santosii H. Robins.

Holotype

Município de Rio Contas, Pico das Almas - 18 km as NW de Rio de Contas.
Elevation 1600-1850 meters.

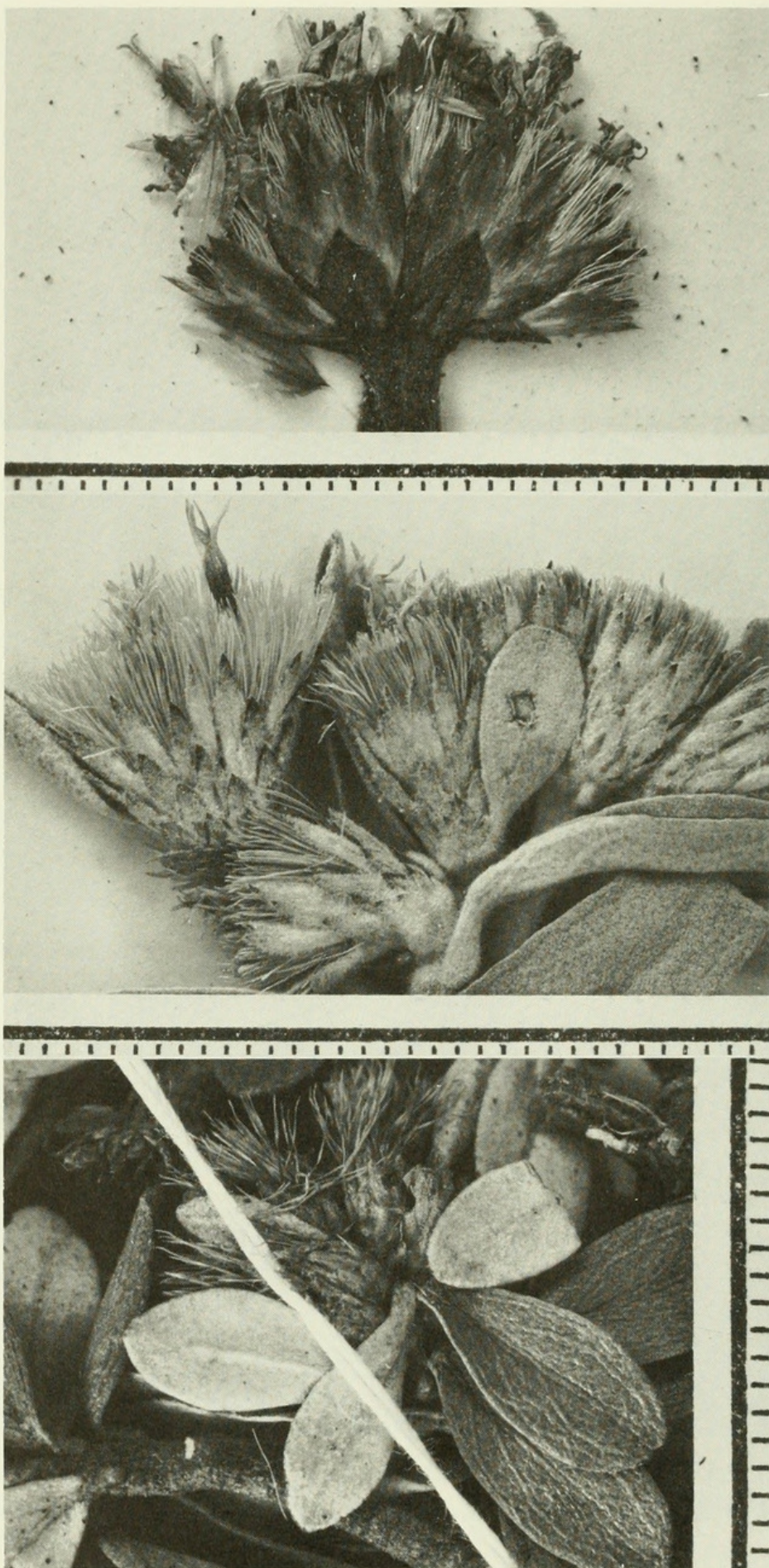
Shrub 1 1/2 meters tall, flowers all past anthesis.

Robert M. King, Scott A. Mori, T. S. dos Santos
& J. L. Hoge

July 22, 1979

Specimens collected for the United States National Herbarium and the Herbario
Centro de Pesquisas do Cacau at Itabuna.

Lychnophora santosii H. Robinson, Holotype, Jardim Botânico,
Rio de Janeiro.



Enlargements of heads. Top. *Chresta souzae*. Middle. *Eremanthus veadeiroensis*. Bottom. *Lychnophora santosii*.



Robinson, Harold Ernest. 1980. "Notes on the Lychnophorine genera Chresta and Eremanthus." *Phytologia* 45, 89–100.

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