

NEW SPECIES OF *GAMOCHAETA* (ASTERACEAE:
GNAPHALIEAE) FROM THE EASTERN UNITED STATES
AND COMMENTS ON SIMILAR SPECIES

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ABSTRACT

Gamochaeta argyrinea Nesom, sp. nov., is documented from 19 states, primarily in the southeastern U.S.A., and from Puerto Rico. It is a common and abundant species of ruderal habitats and has usually been identified within a broad concept of *Gamochaeta purpurea*, which has a similar but broader geographic range. *Gamochaeta argyrinea* apparently is most closely similar to *G. ustulata*, another species commonly identified as *G. purpurea* but native to the Pacific coast region of the U.S.A. and adjacent Canada. ***Gamochaeta chionesthes*** Nesom, sp. nov., is described from localities in Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, South Carolina, and North Carolina—these plants also have been identified previously primarily as *G. purpurea*. A key and distribution maps are provided for the six species of *Gamochaeta* in the U.S.A. with strongly bicolored leaves: *G. argyrinea*, *G. ustulata*, *G. chionesthes*, *G. purpurea*, *G. simplicicaulis*, and *G. coarctata*. The name *Gamochaeta americana* has been misapplied to *G. coarctata*, but *G. americana* sensu stricto has not been documented for the U.S.A.; it occurs in the Antilles, Central America, Mexico, and South America and is reported to occur elsewhere as an adventive. In order to further clarify its identity, a technical description and commentary are provided for *G. americana*.

RESUMEN

Se documenta ***Gamochaeta argyrinea*** Nesom, sp. nov., de 19 estados, principalmente del Sureste de U.S.A., y de Puerto Rico. Es una especie común y abundante en hábitats ruderales y ha sido identificada usualmente dentro del concepto amplio de *Gamochaeta purpurea*, que tiene un rango geográfico similar pero más amplio. *Gamochaeta argyrinea* es aparentemente más parecida a *G. ustulata*, otra especie identificada comúnmente como *G. purpurea* pero nativa de la región costera del Pacífico de U.S.A. y Canadá adyacente. ***Gamochaeta chionesthes*** Nesom, sp. nov., se describe de localidades de Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, Carolina del Sur, y Carolina del Norte—estas plantas también han sido identificadas previamente como *G. purpurea*. Se ofrece una clave y mapas de distribución de las seis especies de *Gamochaeta* de U.S.A. con hojas bicolores: *G. argyrinea*, *G. ustulata*, *G. chionesthes*, *G. purpurea*, *G. simplicicaulis*, y *G. coarctata*. El nombre *Gamochaeta americana* ha sido mal aplicado a *G. coarctata*, pero *G. americana* sensu stricto no se ha documentado para U.S.A.; está en las Antillas, América Central, México, y América del Sur y se cita de otros lugares como adventicia. Se ofrece una descripción técnica y comentarios sobre *G. americana* para clarificar su identidad.

Studies of North American *Gamochaeta* Wedd. (Godfrey 1958; Nesom 1990) have identified plants with leaves strongly bicolored (persistently white-pannose abaxially with a closely matted vestiture completely obscuring the epidermis, evidently green to grayish green adaxially) mostly as *Gamochaeta purpurea*

(L.) Cabr. Review of North American plants shows that more species are present than recognized in these earlier studies and also that some names have been misapplied. Taxonomic studies of *Gamochaeta* in New Zealand (Drury 1971; Webb 1988), where all the species are non-native and include a number of those found in the U.S.A., have been more discerning, at least in some respects, than previous studies of North American species.

In the present study, two species that have been identified mostly as *Gamochaeta purpurea* are described as new to science. One is distributed over a large part of the eastern U.S.A. and also is known from Puerto Rico; the other is known from Gulf Coast states of the U.S.A. Neither of new species keys unambiguously in a recent overview of *Gamochaeta* (Freire & Iharlegui 1997), and a survey of the genus in South America and Central America indicates that neither of these species now recognized in North America has received a name, although it is possible that one or both is native to South America. It also is possible that both are weeds widely distributed on several continents. Hypotheses regarding the nativity of all species of *Gamochaeta* occurring in the U.S.A. are provided in an accompanying discussion (Nesom 2004). All of the species in North America with strongly bicolored leaves are reviewed here.

The distinctiveness of *Gamochaeta* as a genus was emphasized by Cabrera (1961 and later floristic treatments of South American species, e.g., 1963, 1971, 1974, 1978), Dillon and Sagástegui (1991a, 1991b), Cabrera and Freire (1998), and by other botanists who have treated it (e.g., Nesom 1990; Anderberg 1994; Freire & Iharlegui 1997). *Gamochaeta* is distinguished by its combination of small heads in a spiciform capitulescence, concave post-fruiting receptacles, truncate collecting appendages of the disc floret style branches, small achenes with minute, mucilage-producing papilliform trichomes on the surfaces, and papus bristles basally connate in a smooth ring and released as a single unit.

A widespread new species from eastern U.S.A. related to *Gamochaeta ustulata* Godfrey (1958) noted variation within what he identified as *Gnaphalium purpureum* and I have observed *Gamochaeta* (*Gnaphalium*) *purpurea* sensu stricto growing in close proximity to a “variant” or intermixed with it in many localities in eastern North America. Intergradation apparently occurs rarely if at all and the two entities can be consistently and accurately distinguished, both in the field and herbarium. In fact, the variant is more similar and probably more closely related to *Gamochaeta ustulata* (Nutt.) Holub, a species apparently native to western North America (see comments and description below) than to *G. purpurea*. The plants of eastern North America are recognized here as a previously undescribed species and documented to occur in 19 states.

***Gamochaeta argyrinea* Nesom, sp. nov. (Figs. 1, 2, 3, 4, 6).** TYPE: U.S.A. NORTH CAROLINA. Pender Co.: Hwy 421 at junction with Hwy 210, between towns of Currie and Rocky Point, roadsides and grassy median strip, in sandy soil; in close association with *Gamochaeta purpurea* sensu stricto, *Gamochaeta pensylvanica*, *Gamochaeta antillana*, and *Gamochaeta*



FIG. 1. Habit of *Gamochaeta argyrinea*.



Fig. 2. Habit of *Gamochaeta chionesthes*.

coarctata, all growing along the roadside, 28 Apr 2001, *G. Nesom* WMGT-14 (HOLOTYPE: BRIT; ISOTYPES: AKU, BM, BRIT, CANB, CANU, F, GA, GH, K, LP, MEXU, MO, NCU, NSW, NY, P, RB, S, TEX, UC, US, USF).

Differt a *Gamochaeta purpurea* radicibus plerumque fibrosis, foliis caulinis oblanceolatis vel oblanceolati-spathulatis, trichomatis paginarum foliarium adaxialium filiformibus ad basi a apici, capitulis 3–3.5 mm altis, phyllariis intimis laminis oblongis truncato-rotundatis apiculatis ad apices, et flosculis bisexualibus (3–)4–6.

Plants annual to winter annual, densely fibrous-rooted, rarely slender-taprooted. **Stems** decumbent-ascending from the base, 12–40 cm tall, simple or few-branched, closely white-pannose, the vestiture usually of individually evident trichomes, less commonly nearly cloth-like. **Leaves** basal and cauline, basal persisting and green through flowering, basal and lower cauline oblanceolate to oblanceolate-oblong or oblanceolate-obovate, 1.5–5(–8) cm long, 5–12(–18) mm wide, gradually reduced in size upward, not clasping or decurrent, bicolored, closely white-pannose abaxially, persistently very sparsely arachnoid adaxially (sometimes necessary to examine at 10x). **Capitulescence** cylindrical in early season, 1.5–5 cm long, 10–12 mm wide (pressed), later producing axillary glomerules from lower nodes and elongating, becoming strongly interrupted and up to 18 cm long (but still narrowly cylindrical). **Involucre**s campanulate, 3–3.5 mm, imbedded at base in cottony tomentum; phyllaries in 4–6 series, outermost ovate-acute to ovate-lanceolate, tawny-transparent, 1/3–4/5 as long as the inner, inner elliptic-oblong to oblong, stereome ca. 2/3 the length, lamina apically truncate-rounded and apiculate, flexing slightly outward at maturity, hyaline-translucent and slightly brownish-tinged, often purplish tinged around the stereome/lamina junction; receptacles shallowly concave. **Florets**: bisexual 4–5(–6), all corollas purple- to yellow-brown-tipped; pistillate numerous in a broad zone. **Cypselae** oblong, 0.5–0.6 mm long, tan, papillate.

Flowering Mar–Jun(–Jul, –Oct). Roadsides, fields, lawns, open woods, sand to sandy clay, almost always in open, disturbed areas; ca. 0–250 m. USA: Alabama, Arkansas, Delaware, Florida, Georgia, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia; Puerto Rico; Argentina?, New Zealand?, Australia?, Portugal? In the southeastern U.S.A., *Gamochaeta argyrinea* commonly grows with *G. coarctata* and *G. chionesthes*. The epithet (from Gr. *argyreos*, silvery) alludes to the silvery appearance of the plants, especially when growing in colonies.

Representative specimens examined. U.S.A. **ALABAMA**. **Marion Co.**: Hamilton, vacant lot, sandy loam, 22 Apr 1966, *Shinners* 31207 (SMU). **ARKANSAS**. **Cleburne Co.**: Tumbling Shoals, rocky bluffs, 500 ft, 19 May 1951, *Demaree* 39517 (SMU). **DELAWARE**. **Sussex Co.**: 4 mi SE of Laurel, open ground at Moore's (Trussum) Pond, 19 May 1939, *Tatnall* 4163 (DOV). **FLORIDA**. **Leon Co.**: near Tallahassee, fallow field, 31 Mar 1955, *Godfrey* 53123 (SMU). **GEORGIA**. **Clarke Co.**: Athens, along River Road, moist roadside, 700 ft, 2 May 1947, *Cronquist* 4369 (SMU). **KANSAS**. **Cherokee Co.**: tallgrass prairie hay meadow, openings, T34S, R24E, Sec 24, 5 May 1988, *McGregor* 38825 (VDB). **KENTUCKY**. **Whitley Co.**: N of Jellico,

meadow, 11 Jul 1937, *Smith and Hodgdon* 3808 (GH). **LOUISIANA. Lincoln Parish:** Dubach, low ground by hwy, sandy clay, 1 May 1955, *Shinners* 19976 (SMU). **MARYLAND. Calvert Co.:** St. Leonard, District No. 1, 3 Aug 1956, *Seymour* 16837 (MO). **MISSISSIPPI. Rankin Co.:** 1 mi E of Rankin-Madison County line, Hwy 43, sandy weedy field, 2 May 1970, *Jones* 18632 (SMU). **MISSOURI. Howell Co.:** 3.5 mi N of Brandsville, rocky, brushy pastureland, 25 Apr 1992, *Summers* 4827 (MO). **NORTH CAROLINA. Davidson Co.:** ca. 12 mi ESE of Lexington on Hwy 64, 0.7 mi E of jct. Hwy 109, loamy soil of roadbank below steep road cut, area of white oak-hickory woods, 30 May 2001, *Nesom GX1* (BRIT, NCU, MO, US). **Wake Co.:** E. Raleigh, Longview Gardens, fallow field, 20 Apr 1948, *Godfrey* 48072 (SMU). **OKLAHOMA. Delaware Co.:** 8.5 mi SE of Jay, open woods hillside, chert rock soil, 22 Apr 1967, *Stephens* 10543 (SMU). **PENNSYLVANIA. Northumberland Co.:** Herndon, in dry soil along roadside, 30 Sep 1930, *Moldenke* 4186 (NY). **SOUTH CAROLINA. Berkeley Co.:** 0.5 mi N of Honey Hill, sandy soil along route 45, 16 Apr 1971, *Churchill* s.n. (SMU). **TENNESSEE. Knox Co.:** Knoxville, U.T. campus, lawn, 19 Apr 1968, *Morton* 2861 (SMU). **TEXAS. Brazos Co.:** near Peach Creek, open areas in woods, 7 Apr 1974, *Fryxell* 2367 (SMU). **VIRGINIA. Charles City Co.:** 7.5 mi W of Rustic, 30 Apr 1970, *Ware* 2870 (VDB). **WEST VIRGINIA. Cabell Co.:** base of Robert's Hill, Milton, 1 May 1938, *Williams* 699 (MO).

PUERTO RICO. Barranquitas region, wet place, 700 m, 14 Nov 1979, *Liogier* 30027 (NY, UPR); Cuilarte Forest, on slope, 900 m, 16 Jan 1980, *Liogier* 30271 (NY, UPR). **Ciales:** Los Tres Picachos, Rt 149, km 35.5, dirt road through old coffee plantation, disturbed wet mountain forest, ca. 600–750 m, 14 Mar 1992, *Axelrod* 4213 (NY, UPRRP). **Ponce:** Bo. Anón, Toro Negro Forest Reserve, trail along SE side of Monte Jayuya, wet mountain forest, ca. 1200 m, 24 Apr 2003, *Axelrod* 12545 (BRIT); near Cerro de Punta, Jayuya, in thickets, 1200 m, 10 Apr 1982, *Liogier* 33089 (NY, UPR); rte 143 at Cerro de la Punta, roadsides and thickets, 1000 m, 29 May 1988, *Taylor* 8116 (UPRRP). **Salinas:** Barrio Lapa, Las Tetas de Cayey, summit area of E. peak, 820–830 m, low exposed thicket near brink of cliff, 31 Mar 1988, *Proctor* 44634 (SJ).

A population in Davidson Co., N.C. (*Nesom GX1*, as cited above) is a variant—the plants tend to produce small tubers or cormlike swellings. Plants of other populations in the same area often produce offsets that are nearly rhizome-like (e.g., Davie Co., N.C., *Nesom GX2*, BRIT).

Essential differences that distinguish *Gamochaeta argyrynea* from *G. purpurea* are given in the following couplet.

- a. Basal leaves persistent and green at flowering; cauline leaves oblanceolate to oblanceolate-oblong or oblanceolate-obovate, trichomes of adaxial leaf surfaces filiform from base to tip; involucre 3–3.5 mm high; inner phyllaries with lamina oblong, apically truncate-rounded and apiculate; bisexual florets 4–5(–6) per head _____ ***Gamochaeta argyrynea***
- a. Basal leaves usually withered and becoming deciduous at flowering; cauline leaves spatulate, trichomes of adaxial leaf surfaces with basal cells expanded and vitreous; involucre 4–4.5 mm high; inner phyllaries with lamina triangular, apically acute but not apiculate; bisexual florets 3–4 per head _____ ***Gamochaeta purpurea***

Plants common in the Pacific coast region have usually been identified as *Gamochaeta purpurea*, but they are more similar to *G. argyrynea* and are identified here as *G. ustulata*. New Zealand plants identified by Drury (1971) and Webb (1988) as *G. purpurea* var. *ustulata* have measurements characteristic of *G. ustulata*, but plants in Portugal identified as *G. ustulata* by Afonso (1984) are more likely *G. argyrynea*. *Gamochaeta ustulata* (Figs. 3, 4, 7) is recognized by its fibrous rooted habit, large, weakly bicolored leaves persistently arachnoid on



FIG. 3. Involucre of *Gamochaeta* species (left to right). (Top) *G. argyrinea*, *G. ustulata*, *G. coarctata*, *G. americana*, (bottom) *G. purpurea*, *G. chionesthes*, and *G. simplicaulis*.

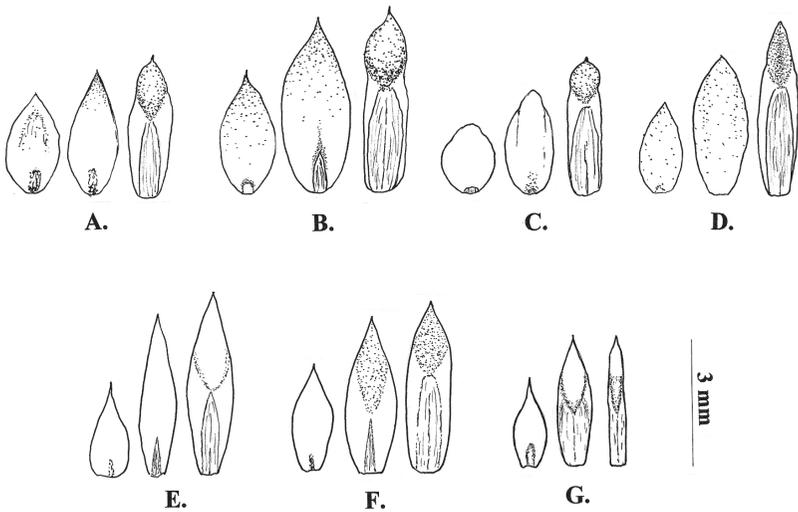


FIG. 4. Phyllary morphology of *Gamochaeta* species: outer, middle, and inner phyllary for each species. (A) *G. argyrinea*, (B) *G. ustulata*, (C) *G. coarctata*, (D) *G. americana*, (E) *G. purpurea*, (F) *G. chionesthes*, and (G) *G. simplicaulis*.

the adaxial surfaces, and large brownish capitula in a thick, usually continuous capitulescence. It differs from *G. purpurea* in its longer duration, thicker and shorter stems, wider and more compact capitulescence, larger capitula, and prominently brown, blunt-apiculate inner phyllaries with a subterminal keel. *Gamochaeta ustulata* and *G. argyrinea* differ primarily by features in the following couplet.

- a. Capitulescence 12–18 mm wide (pressed), uninterrupted or rarely so and only at the base, mostly 1–6(–8) cm long; involucre 4.5–5 mm high; outer phyllaries and often lamina of inner phyllaries dark brown, commonly the whole involucre with a dark brown cast; mid phyllaries with a low, subterminal keel; cypselae 0.7–0.8 mm long _____ **Gamochaeta ustulata**
- a. Capitulescence 10–12 mm wide (pressed), early uninterrupted and 1.5–5 cm long, later producing axillary glomerules from lower nodes and elongating, becoming strongly interrupted and up to 18 cm long; involucre 3–3.5 mm high; phyllaries greenish-silvery to stramineous or golden, sometimes light brown but the whole involucre not with a dark brown cast; phyllaries not keeled; cypselae 0.5–0.6 mm long _____ **Gamochaeta argyrinea**

Gamochaeta ustulata (Nutt.) Holub, *Folia Geobot. Phytotax.* 11:83. 1976 (non Nesom, *Phytologia* 68:196. 1990). *Gnaphalium purpureum* var. *ustulatum* (Nutt.) Boivin, *Naturaliste Canad.* 87:34. 1960. *Gnaphalium ustulatum* Nutt., *Trans. Amer. Philos. Soc. ser. 2*, 7:404. 1841. LECTOTYPE (Nesom 1990): USA. CALIFORNIA: Near St. Barbara in Upper California, [March or April 1836], *T. Nuttall s.n.* (BM, GH-photo!, TEX-photo!).

Gnaphalium pannosum Gandoger, *Bull. Soc. Bot. France* 65:42. 1918 (non A. Gray 1883; non Schultz-Bip. 1845). SYNTYPES: USA. WASHINGTON. Klickitat Co.: on damp ground, Columbia River, 10 May 1893, W.N. Suksdorf 1580 (NY-2 sheets, US!); WASHINGTON. Chehalis Co.: near Montesano, 200ft, 8 Jun 1898, A.A. Heller 3919 (NY-2 sheets!). Images of both the Suksdorf and Heller collections can be seen on NY and US internet sites.

Plants annual to biennial or short-lived perennial, fibrous-rooted. **Stems** erect to ascending, commonly decumbent-ascending and rhizome-like, 10–40 cm tall, densely white-pannose. **Leaves** basal and cauline, basal persistent but often withering by flowering, spatulate to oblanceolate, 2–5 cm long, 6–12(–35) mm wide, apiculate, not clasping or decurrent, continuing upwards little reduced until into the capitulescence, weakly bicolored, adaxial surfaces sparsely to densely arachnoid with persistent trichomes, closely white-pannose abaxially. **Capitulescence** 1–6(–8 or more) cm long, 12–18 mm wide (pressed), uninterrupted or rarely so and only at the base. **Involucre** campanulate-urceolate, 4.5–5 mm high, base imbedded in cottony tomentum; outer phyllaries broadly triangular-ovate, half as long as the inner, all with a brown or greenish-brown cast, inner with lamina dark brown, apically abruptly obtuse and (on the middle phyllaries) with a low, subterminal keel and apiculum, sometimes purplish at the stereome-lamina junction; receptacles shallowly concave. **Florets**: bisexual (3–)4–6, all corollas yellowish- or sometimes purplish-tipped; pistillate numerous in a broad zone. **Cypselae** oblong, 0.7–0.8 mm long, tan to brownish, papillate.

Flowering Apr–Jul(–Oct). Mostly in coastal and near-coastal localities: dunes and other sandy sites, ocean bluffs, less commonly in clay-loam, fields, roadsides and roadcuts, ditches, cliffs, pine woods, chaparral slopes, tidal marsh edges; 0–650(–1050) m. California, Oregon, and Washington; southwestern British Columbia.

A new species from the Gulf coastal plain

Another species with strongly bicolored leaves, known to me from eight states of the U.S.A. Gulf coastal plain, appears to be undescribed. Among species occurring in North America (including Mexico), it is similar in general aspect to *Gamochaeta argyrinea* because of the basally decumbent-ascending stems, white-pannose vestiture, bicolored leaves (gray-green abaxially), the basal in a persistent rosette, and mostly oblanceolate cauline leaves, but conspicuous details of the vestiture, phyllary morphology, and cypselae are different. It keys to the area of *G. purpurea* and *G. americana* (P. Miller) Wedd. in Freire y Iharlegui (1997), emphasizing the bicolored leaves and acute to acuminate inner phyllaries. Concepts of *G. americana* by Cabrera (1963, 1971, 1974), Cabrera and Freire (1998), and others may represent or include this North American species, judging from illustrations of involucrel and phyllary morphology, but *G. americana* sensu stricto, as interpreted here (see below), does not occur in the U.S.A. It is possible or even likely that the new species is native to South America, as it is known by relatively few and recent collections in the U.S.A.

Gamochaeta chionesthes Nesom, sp. nov. (Figs. 2, 3, 4, 8). TYPE: U.S.A. GEORGIA. Meriwether Co.: town of Gay, mowed lawn of U.S. Post Office on Hwy 74/85, near jct with Hwy 109, loamy soil, *Gamochaeta coarctata*, *G. argyrinea*, and *G. chionesthes* present and abundant at this site, 14 Apr 2004, *G. Nesom GASC04-14* (HOLOTYPE: BRIT; ISOTYPES: CANB, GA, GH, K, LP, LSU, MO, NCU, NY, P, TEX, UNA, US, USF).

Differt a *Gamochaeta purpurea* caulibus ac paginis adaxialibus foliorum with vestimento tenui albido textiloideo, foliis basalibus numerosis persistentibus, foliis caulinis oblanceolatis vel oblanceolatispathulatis, involucri 3–3.5 mm altis, flosculis plerumque luteis (vs. purpureis) ad apices, phyllariis omnibus apicibus aut laminis brunneis, et cypselis pupureis.

Plants annuals to winter annuals, fibrous-rooted. **Stems** erect to decumbent-ascending from the base, 10–45 cm tall, simple or rarely few-branched, closely white-pannose, the vestiture sheath-like, like a continuous covering by a thin, closely appressed, polished cloth formed of filiform trichomes usually not individually evident. **Leaves** basal and cauline, basal persisting and green through flowering, basal and lower cauline oblanceolate to oblanceolate-spatulate, 2–6(–7) cm long, 5–13 mm wide, gradually reduced upward in size to linear bracts into the lower part of the capitulescence, not clasping, strongly bicolored, light green above but persistently lightly arachnoid with extremely closely appressed, nearly microscopic trichomes, closely white-pannose abaxially. **Capitulescence** cylindrical in early season, mostly 3–5(–7) cm long, 10–12 mm wide (pressed),

later producing axillary glomerules from lower nodes and elongating, sometimes strongly interrupted and up to 20 cm long. **Involucre**s campanulate-cylindric, 3.5–4 mm long, base imbedded in cottony tomentum and lightly arachnoid on the lower 1/4–1/2; phyllaries in 4–5 series, all apically acute to acute-acuminate, outermost ovate, 1/3 as long as the inner, inner oblong-lanceolate, with green stereome ca. 3/5 the length of the phyllary, lamina apically acute, not apiculate, lightly striate, slightly flaring outward at maturity, purplish coloration absent or faint and present only at stereome apex and distal margins; receptacles shallowly concave. **Florets**: bisexual 2–4, all corollas brownish-yellow to purple distally, sometimes purple only on adaxial surface of bisexual corolla lobes; pistillate numerous in a broad zone. **Cypselae** oblong, 0.5–0.6 mm long, purple, papillate.

Flowering (Mar–)Apr–May(–Jun). Disturbed, open sites, especially roadsides, clearings, fields, flood plains, low pastures, lawns and almost any other place that has been mowed, sandy, loamy, and clay soil; 0–200 m; Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina. *Gamochaeta chionesthes* is abundant and common at least in Georgia and Alabama, where it often grows with *G. coarctata* and *G. argyrinea*. The epithet (Gr. *chioneos*, snow white, and *esthes*, clothing) alludes to the bright white, cloth-like covering of the stems and abaxial leaf surfaces.

Collections examined. **U.S.A. ALABAMA. Baldwin Co.**: Gulf Shores State Park, arid inland sand hills with *Quercus* spp., *Pinus glauca*, and shrubs, 11 Apr 1966, *Iltis 25208b* (WIS); Spanish Fort, sandy field by Ala. 225, 0.5 mi N of jct US 31, 27 Mar 1971, *Kral 41865* (MO). **Bibb Co.**: Cahaba River at Hwy 24, 2.8 mi SE of Blocton, rocky woods and low, sandy soil of floodplain, 12 May 1977, *Sessler 1329* (VDB). **Chilton Co.**: S of Clanton on Interstate Hwy 65, 4.4 mi S of jct with Hwy 31/22, grassy roadsides, 17 May 2001, *Nesom AL2K1-10* (BRIT). **Choctaw Co.**: low pasture beside Tombigbee River bridge of Ala Hwy 10, 22 Jun 1966 [past mature fruit], *Clark 3084* (NCU); 8.8 mi N of Toxey, longleaf pine hills, 15 Apr 1967, *Kral 28371* (VDB). **Concuh Co.**: Repton, sandy loam of clearing in pine flatwoods by US 84, 5 May 1988, *Kral 74710* (VDB). **Coosa Co.**: roadside on dirt road N of Peckerwood Creek, ca. 1 mi S of Talladega Springs, 29 Apr 1967, *Clark 11391* (NCU); site of Sears Chapel Methodist Church on Hwy 231, 2.3 mi N of jct Hwy 22 in Rockford, open field, cemetery, and roadside, rocky soil, 17 May 2001, *Nesom AL2K1-7* (BRIT, CANB, LSU, MISS, UARK, UNA). **Greene Co.**: by small ditch in Forkland, 6 May 1967, *Naugle G264* (LSUS). **Lee Co.**: 2–3 mi W of junction Ala Hwys 22 and 280, N of Phoenix City, shortleaf pine-oak, sandy soil, 10 May 1969, *Lazor 3161* (NCU). **Pike Co.**: roadside of Banks Hwy, 5 mi N of Troy, 24 Apr 1967, *Shirah 39* (NCU). **Talladega Co.**: ca. 3 mi S of Childersburg (at jct of Hwys 280 and 8) on Ala. Hwy 8, area of cutover woods, pine-mixed hardwood, gravelly clay soil, very common along roadside, 17 May 2001, *Nesom AL2K1-3* (BRIT, MISS, UARK, UNA, US, USF). **Winston Co.**: downtown Haleyville, abandoned homesite near Central Bank, 7 Jun 1975, *Whetstone 4507* (NCU). **ARKANSAS. Hot Springs Co.**: Malvern P.O., Magnet Cove, rocky ridges, 600 ft, 24 Apr 1973, *Demaree 66292* (MO). **FLORIDA. Baker Co.**: 5 mi W of Glen St. Mary, grassy roadside shoulders, 1 May 1959, *Godfrey 58540* (VDB). **Escambia Co.**: N edge of Pensacola, open grassy bank of field, 1 May 1982, *Correll 53821* (NY, USF); just N of Pensacola, E side of US 29 just S of its jct with Burgess Road, 20 May 1981, *Wilhelm and Ladd 8859* (USF). **Leon Co.**: Tallahassee, common in vacant lots, 6 Apr 1958, *Godfrey 56420* (NY-3 sheets). **Washington Co.**: dry roadside, US Hwy 90, 3.2 mi W of Chipley, 12 May 1967, *Ward 6486* (NCU). **GEORGIA. Appling Co.**: along Hwy 121 in town of Surrency, 0.2 mi S of jct Hwy 341/27, front lawn and road border of deserted house, 15 Apr 2004, *Nesom GASC04–38* (BRIT). **Ba-**

con Co.: along Hwy 32, 4 mi W of jct Hwy 23/4-1 in Alma, mowed roadside and lawn-like area between truck stop store and highway, sandy soil, 15 Apr 2004, *Nesom GASC04-34* (BRIT). **Bulloch Co.:** ca. 15 mi SW of Statesboro along Hwy 321, at jct with Hwy I-16, mowed roadside area, gravelly soil, 15 Apr 2004, *Nesom GASC04-45* (BRIT). **Coffee Co.:** E side of city of Douglas on Hwy 32, near jct Hwy 221/135, lawn area of business, 15 Apr 2004, *Nesom GASC04-32* (BRIT). **Cook Co.:** weedy area between highway and a railroad at Cecil, 30 Apr 1970, *Faircloth 6624* (NCU). **Fayette Co.:** N side of Fayetteville, along Hwy 314, ca. 2 mi N of jct with Hwy 85, roadside, mowed, beside strip of pine woods, 14 Apr 2004, *Nesom GASC04-4* (BRIT, GA). **Fulton Co.:** S side of Atlanta area on Hwy 279 (Old National Highway) 2.5 mi S of I-85/285, at jct with Flat Shoals Road, closely mowed lawn area of quick-stop food store, 14 Apr 2004, *Nesom GASC04-2* (BRIT). **Grady Co.:** upland pine woods alongside a logging trail on Balfour's Nickelville forest, 6.3 mi S of Whigham, 11 Apr 1970, *Faircloth 6541* (MO, NCU). **Greene Co.:** 3 mi SW of Greenboro on Hwy 44, at jct with I-20, lawn area of commercial strip bordering highway, 16 Apr 2004, *Nesom GASC04-57* (BRIT, GA). **Lee Co.:** 7 mi E of Leesburg on Hwy 32 at jct with Hwy 91 to Albany, W side of junction, large mowed field on N side of road, drier than roadsides, compacted sand, 15 Apr 2004, *Nesom GASC04-26* (BRIT, GA, LP, MO). **Montgomery Co.:** 2.4 mi E of Ailey on US 80, 18 May 1976, *Solomon 5562* (MO). **Morgan Co.:** S side of Madison, just off Hwy 129/24 at jct with I-20, lawn area of motel, sloping toward southeast, 16 Apr 2004, *Nesom GASC04-58* (BRIT). **Newton Co.:** S side of Covington, at jct of I-20 and Hwy 142, grassy area beside access road from I-20 to Hwy 142, 16 Apr 2004, *Nesom GASC04-59* (BRIT). **Screven Co.:** Georgia welcome station, N side of Hwy 301 ca. 0.2 mi W of South Carolina state line, mowed lawn area, 16 Apr 2004, *Nesom GASC04-48a* (BRIT). **Sumter Co.:** S side of Americus, at jct Hwy 280/49 and Hwy 19, mowed lot beside pecan orchard, sandy loam, 15 Apr 2004, *Nesom GASC04-22* (BRIT, GA). **Tatnall Co.:** ca. 7 mi SW of Mendes on Hwy 169, at jct Hwy 121, mowed area with lawn grass, beside store, 15 Apr 2004, *Nesom GASC04-41* (BRIT). **Turner Co.:** E side of Ashburn on Hwy 107, mowed, lawn-like area between car wash and store, 15 Apr 2004, *Nesom GASC04-29* (BRIT, NCU). **Warren Co.:** ca. 6 mi NW of Norwood on Hwy 278, at jct of I-20, grassy roadside, 16 Apr 2004, *Nesom GASC04-56* (BRIT).

LOUISIANA. Lincoln Par.: [Ruston], Illinois Central Railway right of way, clay soil, 3 May 1984, *Wise 39* (DOV). **Natchitoches Par.:** W of Natchitoches near jct of Interstate Hwy 49 and La Hwy 6, hard-packed sandy soil in front of gas station complex, past flower and fruit, 5 Jul 2004, *Nesom GA04-63* (BRIT). **MISSISSIPPI. Covington Co.:** right-of-way, US Hwy 49, 11.8 mi N of Hattiesburg, 8 May 1966, *Temple 2746* (NCU). **Scott Co.:** Raworth Recreation Area, between Forest and Morton, sticky dark clay soil, open areas in loblolly pine forest, 1 May 1970, *Jones 18493* (VDB). **NORTH CAROLINA. Bladen Co.:** 0.2 mi E of Cape Fear River on NC 41, dry roadside [alongside] flood plain forest, 16 May 1976, *Solomon 1895* (MO). **Duplin Co.:** jct of Hwy 40 and Hwy 117, just N of Magnolia, grassy roadsides, edge of ditch, edge of woods, sandy soil, intermixed with *G. purpurea*, *G. coarctata*, and *G. argyrynea*, 28 Apr 2001, *Nesom WMGT 6* (BRIT, MO, NCU, US). **SOUTH CAROLINA. Aiken Co.:** S side of New Ellenton, at jct of Hwy 278 and Hwy 19, roadside area, sandy soil, 16 Apr 2004, *Nesom GASC04-53* (BRIT, LSU, NCU, USCH). **Aiken Co.:** area of Beech Island (SE of Augusta) near jct of Hwy 278 and Hwy 125, at Beech Island Avenue, ca. 7 mi SE of N. Augusta, roadside and ditch edges, sandy soil, 16 Apr 2004, *Nesom GASC04-54* (BRIT, F, MISS, US, USCH). **Allendale Co.:** along Hwy 301, 5.2 mi WSW of jct Hwy 125/278 in Allendale, 8 mi ENE of Savannah River and state line, grassy roadside median of 4-lane highway, sandy soil, 16 Apr 2004, *Nesom GASC04-50* (BRIT, LP, USCH). **Bamberg Co.:** ca. 2 mi NE of Ulmer, at jct of Hwy 301 and Hwy 321, broad lawn area of Connelly Motel, 16 Apr 2004, *Nesom GASC04-51* (BRIT, K, USCH). **Barnwell Co.:** SE side of Barnwell on Hwy 64, 1.8 mi ESE of jct Hwy 3 in Barnwell, mowed, sandy field beside lookout tower, 16 Apr 2004, *Nesom GASC04-52* (BRIT, USCH).

As noted above, *Gamochaeta chionesthes* is similar to *G. argyrynea*, but the former is distinct in significant features, including habit and phenology, vestiture, capitulescence and involucre morphology, and cypselar color. The

early-season branches of *G. chionesthes* lie nearly flat, with capitulescences on ascending branch tips. The early branches of *G. argyrinea* are basally decumbent-ascending to ascending, but the capitulescences are more quickly borne on stems completely erect or with erect distal portions. The difference in habit is particularly evident in mid-April, because *G. chionesthes* is several weeks later in phenological development and usually lies nearly flat at the same time that *G. argyrinea* is producing abundant, erect flowering branches. Because of this, it is easy to distinguish the two species when they grow intermixed or in close proximity, as is often the case. Additionally, the stems and leaves of *G. chionesthes* are stiff, almost brittle-feeling, compared to the softer ones of *G. argyrinea*.

The cauline vestiture *Gamochaeta chionesthes* is cloth-like, formed of filiform trichomes usually not individually evident but united in a continuous covering like a thin, closely appressed, polished cloth; the abaxial leaf vestiture sometimes is similar. In the closely pannose cauline vestiture of *G. argyrinea* and *G. purpurea*, the trichomes usually are individually evident in their longitudinal orientation; the cauline vestiture of *G. coarctata* also usually is cloth-like, similar to that of *G. chionesthes*. The “tightening” of the individual trichomes apparently is accentuated during drying, because this feature is more easily observed on herbarium specimens.

The phyllaries of *Gamochaeta chionesthes* are evenly graduate in length, all apically acute and usually the whole lamina or at least the apex of each is brown, usually giving the whole involucre a distinctly brown hue; purplish coloration is absent or faint and present only at stereome apex and distal margins. The brown hue of the involucre is a good “field” character even without a lens; with a field lens, the difference in phyllary shape between *G. chionesthes* and *G. argyrinea* is easily evident. And finally, if mature cypselae are present, the purple ones of *G. chionesthes* are distinct from those of similar U.S.A. species, which are tan.

Gamochaeta chionesthes is contrasted individually with both *G. purpurea* and *G. argyrinea* in the following pair of couplets. In the context of all U.S.A. species with strongly bicolored leaves, *G. chionesthes* also is identified in a key further below.

Gamochaeta chionesthes contrasted with *G. purpurea*:

- a. Cauline vestiture a white, closely appressed, cloth-like covering, trichomes usually not individually evident; basal leaves abundant and persistent; cauline leaves oblanceolate to oblanceolate-spatulate; adaxial leaf surfaces appearing not hairy but with a whitish, minutely thin, closely appressed, sheath-like or cloth-like covering (sometimes incomplete) without individually evident trichomes; involucre 3–3.5 mm high; florets mostly yellowish at the apices; inner phyllaries with brown-tinted lamina—purplish coloration, when present on phyllaries, faint and only at the apex and distal margins of the stereome; cypselae purple _____ ***Gamochaeta chionesthes***

- a. Cauline vestiture densely but loosely pannose or pannose-tomentose; basal leaves often few or not persistent; cauline leaves distinctly spatulate; adaxial leaf surfaces loosely arachnoid, trichomes with basal cells expanded and vitreous; involucre 4–4.5 mm high; florets strongly purplish-tipped; inner phyllaries with whitish or slightly silvery lamina at maturity, often purplish when young; cypselae tan _____ **Gamochaeta purpurea**

Gamochaeta chionesthes contrasted with *G. argyria*:

- a. Cauline vestiture a white, closely appressed, cloth-like covering, trichomes usually not individually evident; phyllaries evenly graduate in length, all phyllaries apically erect, acute to acute-acuminate, and with brown apex or lamina; bisexual florets 2–4; cypselae purple _____ **Gamochaeta chionesthes**
- a. Cauline vestiture closely pannose with trichomes individually evident, minutely filiform and longitudinally oriented, the vestiture uncommonly cloth-like; phyllaries unevenly graduate in length, outer and middle phyllaries ovate to ovate-lanceolate, apically obtuse to broadly acute, inner phyllaries with lamina oblong with apex slightly spreading, truncate-rounded and apiculate, hyaline-translucent and slightly brown; bisexual florets 4–5(–6); cypselae tan _____ **Gamochaeta argyria**

Identity of *Gamochaeta purpurea* sensu stricto

Gamochaeta purpurea (Figs. 3, 4, 5) is distributed widely through the world, but the name has been used in various contexts in the U.S.A, often to identify any plant of *Gamochaeta* with bicolored leaves. A narrower, more accurate concept is documented here.

***Gamochaeta purpurea* (L.) Cabr., Bol. Soc. Argentina Bot. 9:377. 1961.** *Gnaphalium purpureum* L., Sp. Pl. 854. 1753. TYPE: Linnaeus noted “Habitat in Carolina, Virginia, Pennsylvania.” A Kalm collection (LINN fiche!) may be part of the type material. Two specimens in the Clayton Herbarium (BM) were annotated by James Reveal in 1990 as syntypes: U.S.A. In Virginia, *J. Clayton* 385 (GH-photo!, internet images! at <<http://internet.nhm.ac.uk/cgi-bin/botany/clayton>>). Accessed March 2004.

Gnaphalium rosaceum I.M. Johnston, Contr. Gray Herb. ser. 2, 68:99. 1923. *Gamochaeta rosacea* (I.M. Johnston) Anderb., Opera Bot. 104:157. 1991. TYPE: MÉXICO. SAN LUIS POTOSÍ: region of San Luis Potosí, 1878, *C.C. Parry and E. Palmer* 426 (HOLOTYPE: GH!).

Gnaphalium heteroides Klatt, Linnaea 42:137. 1878. TYPE: MEXICO: locality unspecified, *Ehrenberg* 972 (GH fragment and drawings!).

Plants winter annual or annual, fibrous-rooted or slender-taprooted. **Stems** erect to basally ascending-decumbent, 10–40(–50) cm, densely but loosely pannose or pannose-tomentose. **Leaves** basal and cauline, oblanceolate-spatulate to spatulate, basal and lower cauline 1–6 cm long, 5–14 mm wide, persisting or withering at flowering, similarly shaped leaves continuing into at least the lower part of the capitulescence, sometimes closely sinuate on the margins, usually strongly bicolored, closely white-pannose abaxially, adaxial surfaces loosely and sparsely arachnoid, the trichomes with basal cells expanded and vitreous, often glabrescent but at least the basal cells of each trichome persisting. **Capitulescence** initially a continuous cylinder 1–4(–5) cm long, (5–)10–15 mm

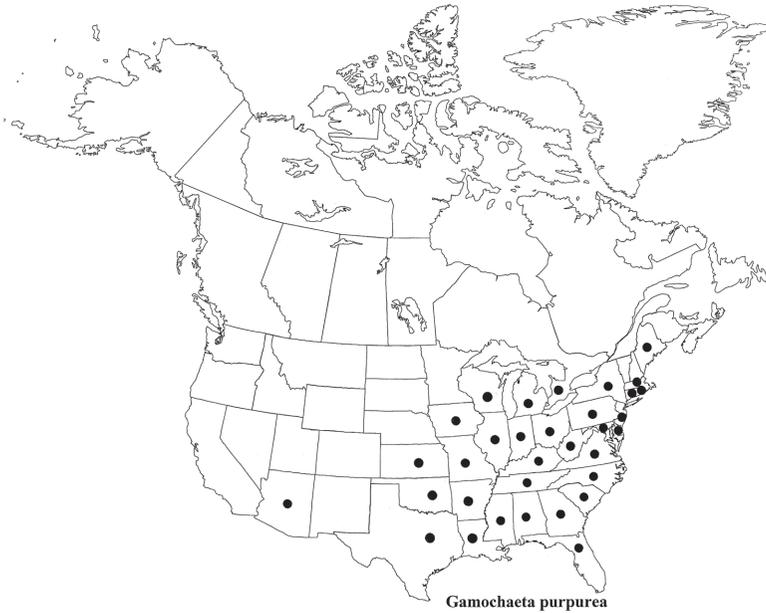


FIG. 5. State-level distribution of *Gamochaeta purpurea*.

wide, the arrangement becoming interrupted and elongate, of widely separated, bracteate glomerules, with lower axillary glomerules of ten on long peduncles. **Involucres** turbinate-cylindric, 4–4.5 mm long, base imbedded in cottony tomentum and lightly arachnoid on the lower 1/3–1/2; outer phyllaries ovate-triangular, inner triangular-lanceolate, apically acute, usually with a prominently striate texture, lamina purplish when young, becoming whitish or slightly silvery at maturity; receptacles shallowly concave. **Florets:** bisexual florets 3–4, all corollas usually purplish-tipped; pistillate numerous in a broad zone. **Cypselae** oblong, 0.6–0.7 mm long, tan, papillate. $2n = 14, 28$, but identities of vouchers for these chromosome reports need to be verified.

Flowering Apr–May(–Jun). Open, usually disturbed habitats, roadsides, fields, woodland clearings and edges, almost always in sand; Canada (Ontario); USA (Arkansas, Arizona, Alabama, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Virginia, West Virginia); Hawaii; Mexico (Nuevo León, San Luis Potosí, Veracruz, Puebla, Michoacán, Chihuahua, Sonora), Central America (Nicaragua), Antilles (Hispaniola); also reported in South America and as adventive in other parts of the world. In the western U.S.A., *G. purpurea* has

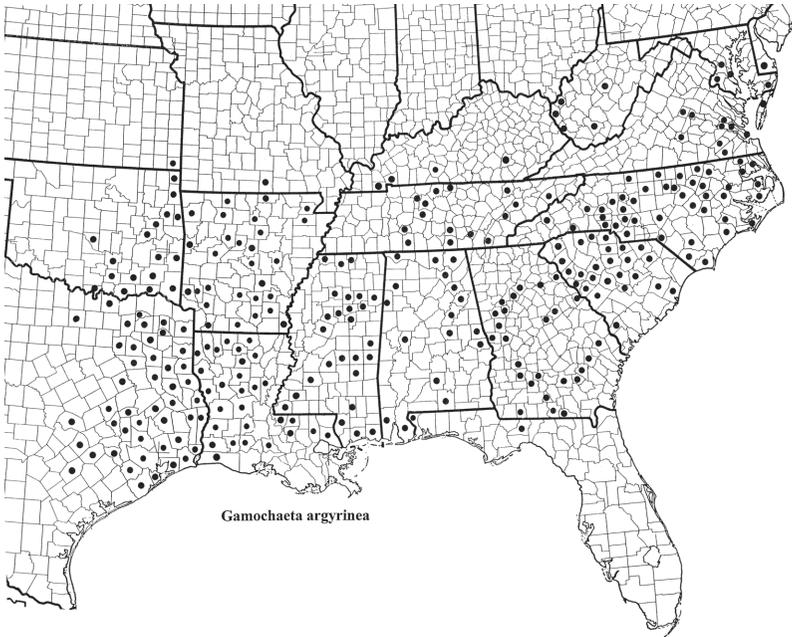


FIG. 6. County-level distribution of *Gamochaeta argyrinea*. With more intensive herbarium surveys and collecting, the distribution probably would be shown as nearly continuous (all counties; personal observation) at least in North Carolina (except perhaps high montane), South Carolina, Georgia, Alabama, Mississippi, and Arkansas. The implied loop in Georgia reflects the route of a collecting trip made in April 2004. The only known record for Pennsylvania (Northumberland Co., as cited in the text) is not shown on the map.

been recorded only from Arizona (see comments and documentation in Nesom 2004). *Gamochaeta purpurea* commonly occurs in disturbed sites, but at least in the eastern and southeastern USA, it seems more of ten to occur in more nearly natural sites, such as woodland edges and clearings, it is true to sandy soil, and it is my impression that in the last 50 years, *G. purpurea* probably has become much less common. *Gamochaeta purpurea* is uncommon compared to *G. argyrinea*, *G. chionesthes*, and *G. coarctata* (personal observation), in the range of the latter three. The species is rare or extirpated in the northeastern U.S.A. (summary in Kartesz 1999), where the latter three do not occur. *Gamochaeta purpurea* was excluded from Wisconsin's flora by Wetter et al. (2001), but Cochrane (pers. comm. 2004) notes that an undated collection from Sheboygan by Charles Goessl (WIS, photocopy-BRIT!) probably should be accepted as a valid record, although it probably was a garden weed or waif; it remains the only collection for the state. The species is described by Voss (1996) as "doubtless adventive" in the few southern counties of Michigan from which it is known.

Gamochaeta purpurea is recognized by its mostly spatulate cauline leaves,

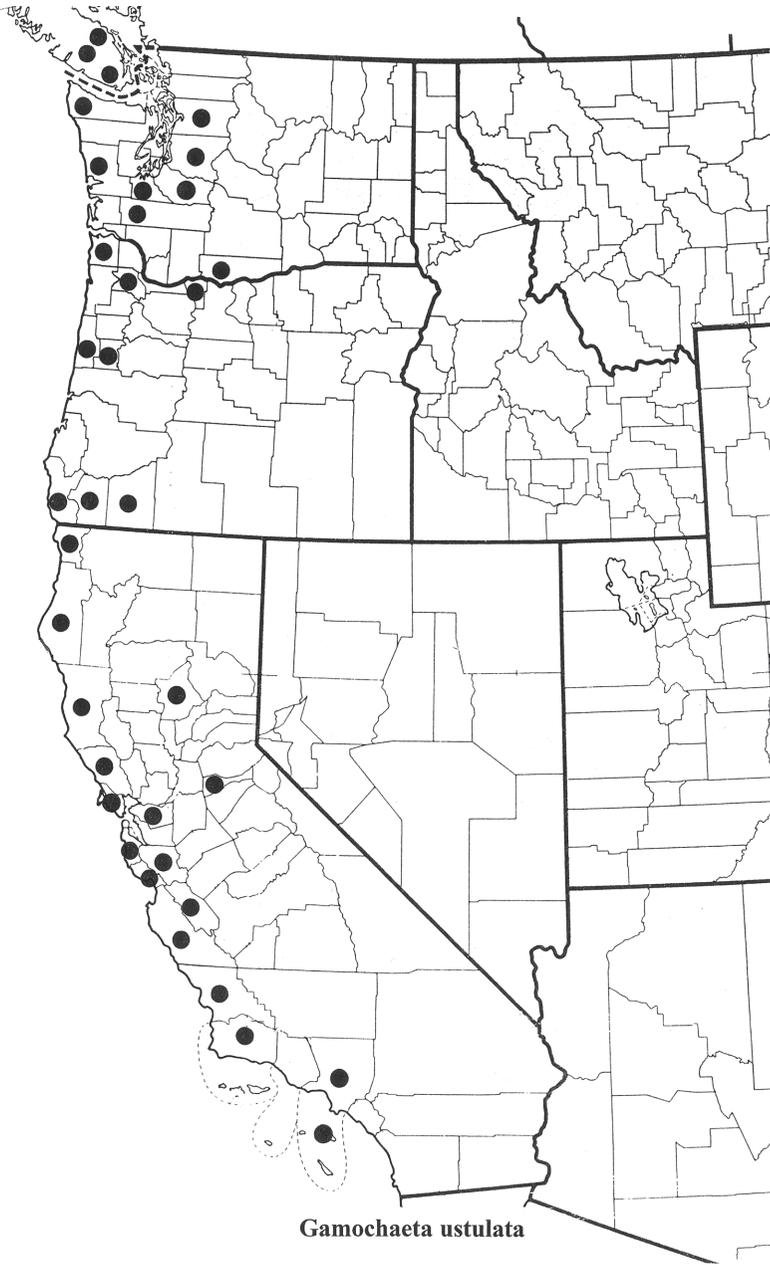


Fig. 7. County-level distribution of *Gamochaeta ustulata*.

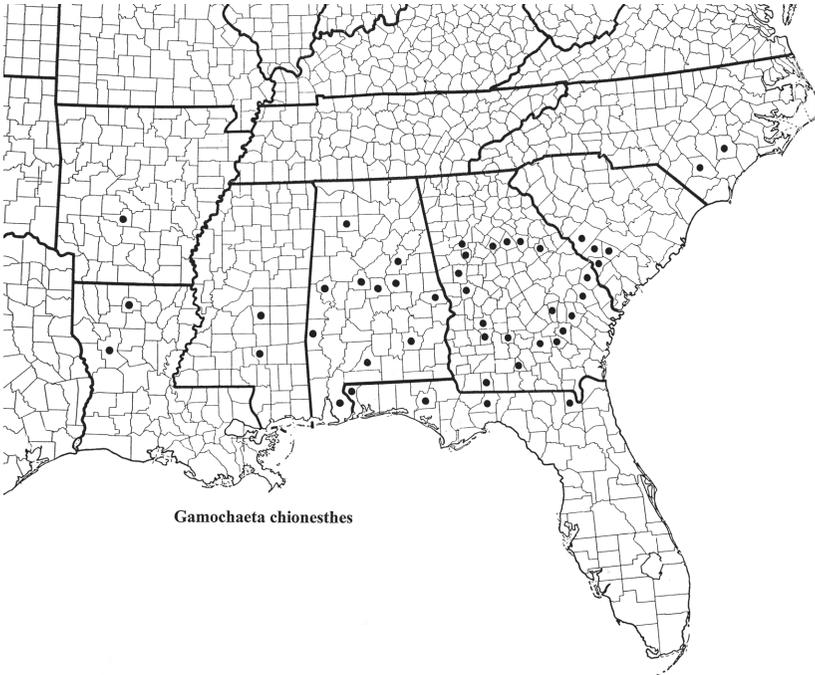


FIG. 8. County-level distribution of *Gamochaeta chionesthes*. At least in Georgia and Alabama, this species is much more common than indicated by the map, and it probably extends across South Carolina. The loop shown in Georgia and South Carolina reflects an April 2004 collecting trip, where the author found it remarkably simple to collect the species in every county sampled.

involucres 4–4.5 mm high, and inner phyllaries with whitish-hyaline, erect, apically acute lamina. The purple-tipped corollas are visible through the translucent lamina. The base of the trichomes on the adaxial leaf surfaces also is a diagnostic character—the basal cells of each trichome are expanded and glassy (use a lens), compared to comparable trichomes of most other species, which are evenly filiform to the very base. The pronouncedly spatulate leaves are distinctive and with experience, one can usually distinguish this species from others by leaf shape, but it is admittedly a subtle difference and the leaf dimensions of *G. purpurea* are similar to those in other species. In localities from Maryland northward, plants of *G. purpurea* are clearly annual, usually producing a small basal rosette and very shallow fibrous roots or a filiform taproot; southward and southwestward from Maryland, the basal rosette tends to be larger and the fibrous roots denser, and plants may be winter annual in this region, or at least the longer growing season is reflected in the plant habit.

I have identified *Gamochaeta purpurea* in various localities in Mexico (state

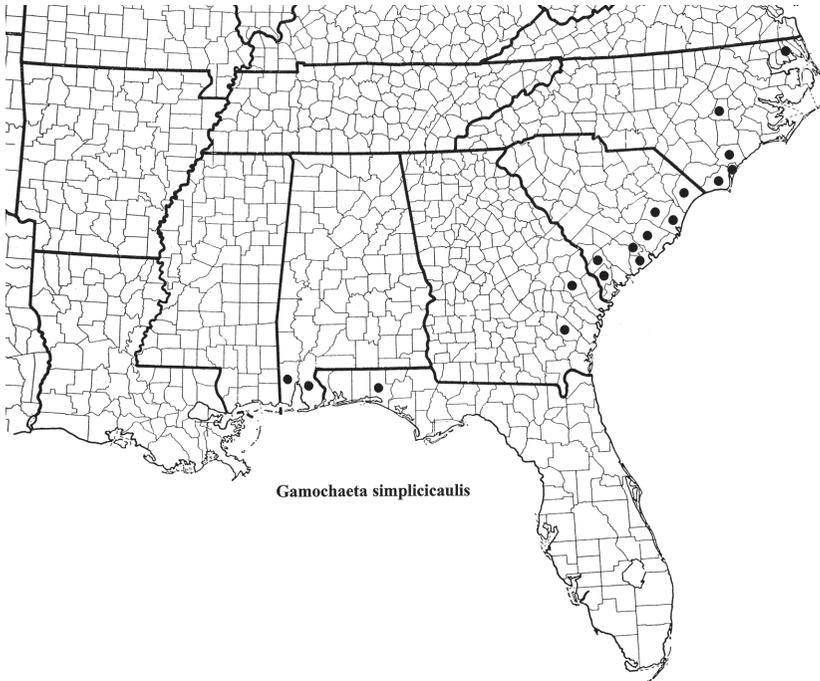


Fig. 9. County-level distribution of *Gamochaeta simplicicaulis*.

citations above) at elevations of 1300–2800 meters. Phyllaries of these plants characteristically are distinctly brownish on the lamina and apices, but the plants otherwise are similar to those of the U.S.A.

***Gamochaeta coarctata* vs. *Gamochaeta americana* in the USA.**

Plants of the U.S.A. previously identified as *Gamochaeta americana* (e.g., Nesom 1990, 1999) are here identified as *Gamochaeta coarctata* (Willd.) Kerg. (Figs. 3, 4, 10). Godfrey (1958) correctly identified these plants as *Gnaphalium spicatum*, although the latter name is now treated as a synonym. *Gamochaeta coarctata* occurs mostly in the southeastern states and also apparently is naturalized in California (see Nesom 2004).

***Gamochaeta coarctata* (Willd.) Kerg.**, *Lejeunia* 120:104. 1987. *Gnaphalium spicatum* Lam., *Encycl. Méth. Bot.* 2:757. 1788, hom. illegit. (non P. Miller 1768). *Gnaphalium coarctatum* Willd., nom. nov., *Sp. Pl.* 3(3):1886. 1803. *Gnaphalium radians* Benth. var. *spicatum* (Lam.) Klatt, nom. illeg., *Linnaea* 42:140. 1878. *Gnaphalium purpureum* L. var. *spicatum* (Lam.) Baker in Mart., nom. illeg., *Fl. Bras.* 6(3):125. 1882. *Gamochaeta spicata* Cabr., nom. nov. illeg., *Bol. Soc. Argent.* 9:380. 1961. HOLOTYPE: [URUGUAY]. “In Monte-video,” *Commerson s.n.* (P-LAM, IDC microfiche 6207.325.I11). Cabrera (1961, p. 380–381) cited as “lectotype” of *Gnaphalium spicatum* Lam. “Des environs de Buenos Ayres,” without date, *Commerson s.n.* Lamarck’s protologue,

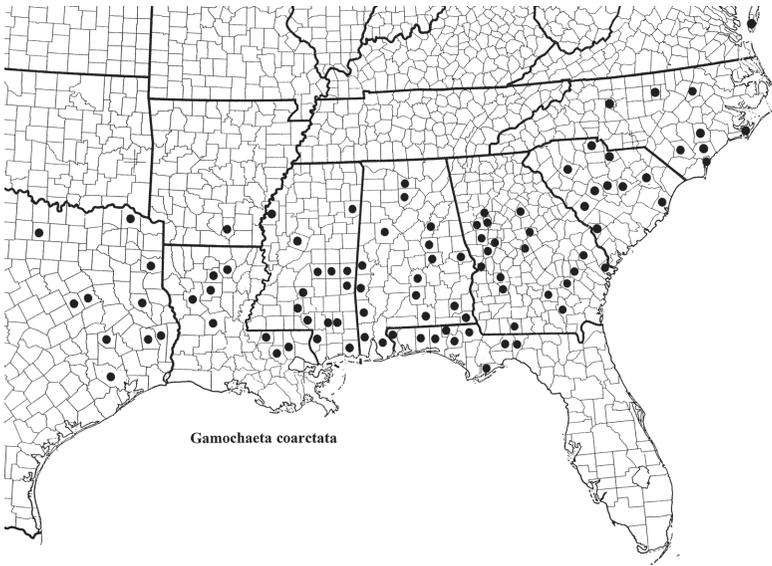


FIG. 10. County-level distribution of *Gamochaeta coarctata*. At least within the outline implied by the records mapped here, the distribution is essentially continuous (all counties; personal observation), probably reflecting a rapid, recent spread. Counties of occurrence in California are cited in Nesom (2004).

however, specified the locality as "Monte-video," as does the P-LAM sheet cited above as holotype. See Pruski and Nesom (2004) for discussion of the typification of this species.

Plants winter annual or biennial(?) herbs, fibrous-rooted. **Stems** basally decumbent-ascending, 15–35(–50) cm tall, usually several from the base, white-pannose, the tomentum usually sheath-like. **Leaves** basal and cauline, basal in a persistent rosette, spatulate to oblanceolate-obovate, (1.5–)3–8(–12) cm long, 6–15(–22) mm wide, cauline gradually or little reduced in size above the basal, not clasping or decurrent, slightly succulent and often becoming crenulate-margined upon drying, strongly bicolored, the adaxial surfaces green and glabrate to completely glabrous, closely white-pannose abaxially. **Capitulescence** usually a dense and continuous cylinder 2–20 cm, becoming branched and highly interrupted in older plants with elongation of branches at lower nodes. **Involucres** cylindric-campanulate, 2.5–3 mm high, shiny and completely glabrous from base to apex; phyllaries: outermost elliptic-obovate to broadly elliptic ovate with rounded to obtuse apices, often slightly but distinctly purplish or rosy, 1/3–1/4 as long as the inner, inner with a distinctly brown-hyaline, apically rounded to blunt, apiculate lamina; receptacles shallowly concave. **Florets**: bisexual 2–3, all corollas usually purplish-tipped; pistillate numerous in a broad zone. **Cypselae** oblong, 0.5–0.6 mm long, tan, papillate. $2n = 28$.

Flowering Apr–Jun. Ditch banks, roadsides, lawns, fields, gardens, sidewalk cracks, shaded spots around buildings; 0–150 m; U.S.A. (Alabama, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Texas, Virginia); Mexico, Antilles (Jamaica, Puerto Rico), South America, Europe, Japan, Taiwan, Australia, New Zealand. In the southeastern USA, *Gamochaeta coarctata* commonly grows with *G. argyrinea* and *G. chionesthes*. Collections documenting the occurrence of this species in Arkansas, California, and Virginia are cited in Nesom (2004).

Plants of *Gamochaeta coarctata* are recognized by their persistent, slightly succulent, strongly bicolored leaves (green and glabrate or usually completely glabrous on the adaxial surfaces), involucre 2.5–3 mm high, completely glabrous and evidently purplish-tinted, outer phyllaries elliptic-obovate to broadly elliptic ovate with rounded to obtuse apices, and 2–3 bisexual florets per head. It usually can be distinguished at a glance from *G. argyrinea* and *G. chionesthes* because of the distinctive vestiture and involucre.

The status of *Gamochaeta americana*

Gamochaeta americana (Figs. 3, 4) is another species with strongly bicolored leaves. Its occurrence in the U.S.A. has not been documented, which is remarkable in view of its widespread distribution in the Antilles and Mexico. The name has been incorrectly used to identify species of the U.S.A. (Nesom 1990).

The type collection of *Gamochaeta americana* was made from Jamaica (below), and I have studied collections from Jamaica, Puerto Rico, Hispaniola, and Cuba (all at NY) and from South America, Central America, and Mexico (various herbaria). It is reported from New Zealand (Drury 1971; Webb 1988) and Australia (Everett 1990). *Gamochaeta americana* was designated lectotype of the genus by Cabrera (1961, p. 362).

Gamochaeta americana (P. Mill.) Wedd., Chlor. Andina 1:151. 1856. *Gnaphalium americanum* P. Mill., Gard. Dict. ed. 8, no. 17. 1768. *Gnaphalium purpureum* L. var. *americanum* (P. Mill.) Klatt, Linnaea 42:140. 1878. LECTOTYPE (Fawcett & Rendle 1936, p. 206): JAMAICA. 1731, *Houstoun s.n.* (BM, NY-photo).

Gnaphalium guatemalense Gandoger, Bull. Soc. Bot. France 65:42. 1918. *Gamochaeta guatemalensis* (Gandoger) Cabr., Bol. Soc. Argent. Bot. 9:371. 1961. TYPE: GUATEMALA. Alta Verapaz, *Tuerckheim* (not seen).

Gamochaeta irazuensis Nesom, Phytologia 68:199. 1990. TYPE: COSTA RICA. Volcan Irazú, 10,000–11,330 ft, 1 Dec 1937–1 Jan 1938, *P.H. Allen 702* (HOLOTYPE: FI).

Plants annual to short-lived perennial herbs from a slender, short but lignescent taproot, shallow fibrous roots, or a short, fibrous-rooted rhizome or caudex region. **Stems** usually erect from the base, less commonly decumbent-ascending, 10–40(–65) cm tall, arising singly or less commonly with 2–3 shoots, decumbent stems often developing adventitious roots, loosely lanate-tomentose (not sheath-like). **Leaves** basal and cauline, basal obovate-oblongate, 3–7(–10) cm long, 4–12(–16) mm wide, usually withering or withered by flowering and not

persisting in a rosette, lower and midcauline often distinctly subclasping (but not auriculate), often slightly decurrent, cauline oblong to oblong-ob lanceolate, sometimes narrowly revolute, adaxial surfaces glabrous to glabrate, sometimes more densely and persistently hairy, abaxial surfaces densely white to gray-white pannose. **Capitulescence** a continuous spiciform cluster 1–6 cm long, 8–12(–15) mm wide (pressed), usually becoming much longer and strongly interrupted by development of axillary clusters from lower nodes. **Involucre**s campanulate-cylindric, 4–4.5 mm high, shiny and completely glabrous from base to apex; phyllaries in 4–5 series, outermost ovate to lanceolate-ovate with broadly acute to nearly obtuse apices, 1/4–1/2 as long as the inner, inner oblong-lanceolate, with light green stereome 2/3 the length of the phyllary, lamina dark brown-hyaline, apically broadly acute, sometimes nearly rounded, to (less commonly) obtuse apiculate, erect, without purplish coloration or slightly purplish only around the stereome-lamina junction; receptacles shallowly concave. **Florets**: bisexual ca. 3–6, all corollas yellowish distally; pistillate numerous in a broad zone. **Cypselae** oblong, 0.5–0.6(–0.7) mm long, tan, papillate.

Flowering all year, perhaps most abundantly Jun–Sep. Llanos, openings in pine, pine-oak, and deciduous woods, fallow fields, pastures, roadsides and other disturbed sites, commonly in wet or moist soil; 1250–3200 m. Mexico (Chiapas, Chihuahua, Colima, Dist. Federal, Durango, Guerrero, Hidalgo, Jalisco, México (Edo.), Michoacan, Morelos, Nuevo León, Oaxaca, Puebla, San Luis Potosí, Sinaloa, Sonora, Veracruz); Central America (Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama); Antilles (Cuba, Hispaniola, Jamaica, Puerto Rico); South America; Galapagos Islands.

Gamochoeta americana is generally recognized by erect stems, strongly bicolorled leaves with glabrate to glabrous adaxial surfaces, the cauline oblong to oblong-ob lanceolate and relatively narrow, commonly subclasping and slightly decurrent, heads clustered in an interrupted spike, involucre shiny and completely glabrous, usually with a distinctly brownish cast. The lamina of the inner phyllaries characteristically are dark brown and sharply delimited in color from the proximal portion of the phyllaries; often the whole involucre is infused with brown color.

Considerably more variation is expressed within *Gamochoeta americana*, at least as it is understood here, than in similar species in the U.S.A. In Central America and Mexico, plants of *G. americana* commonly appear to be short-lived perennial, or at least biennial, because of the development of fibrous roots from a short caudex or rhizome or adventitious roots from the lower portion of decumbent stems. In the Antilles (including the type locality, Jamaica), South America, and scattered through the Mexican and Central American range are plants with shallow fibrous roots or a thin taproot—these plants apparently distinctly annual.

Leaves of *Gamochoeta americana* are characteristically strongly bicolorled,

with adaxial surfaces glabrous to glabrate, but in western Mexico (mostly Durango, Chihuahua, and Sonora), there is a tendency for the adaxial surfaces to be persistently hairy, sometimes resulting in a weakly bicolored appearance. Similar plants also appear sporadically in other parts of Mexico, and Dillon and Sagástegui (1991) noted that similar variation also occurs in South America. In Cordillera de Talamanca region of Costa Rica, a distinctive race with dense, silvery-white vestiture on abaxial leaf surfaces and with sheath-like cauline vestiture is being described as a new species (Nesom & Pruski in prep.).

Identification of *Gamochaeta* species in the U.S.A. with strongly bicolored leaves

The following key distinguishes the six species of *Gamochaeta* with strongly bicolored leaves currently known to occur in the U.S.A. *Gamochaeta americana* is included so that the key might be used in regions outside of the U.S.A., but its position in the first couplet directs the key toward contrasts of species known within the U.S.A. The abaxial leaf surfaces of all of these are white-pannose with a closely matted vestiture completely obscuring the epidermis, while the adaxial surfaces are evidently green to grayish green, glabrous to sparsely arachnoid. Five of these species occur primarily in the eastern and southeastern U.S.A. *Gamochaeta ustulata* occurs mostly in coastal and near-coastal Pacific localities in the western U.S.A. and British Columbia.

From observations in herbarium and field, *Gamochaeta* species in the U.S.A. appear to be remarkably constant in diagnostic morphological features, particularly in the vestiture of stems, leaves, and phyllaries and in the shape, size, and coloration of the phyllaries. The species common grow closely intermixed, but intermediates that might indicate hybridity are not common, or at least they are not often observed. In contrast, the capitulescence may vary in degree of compactness or openness to a greater degree than has been generally recognized. In *G. purpurea*, *G. argyrinea*, and *G. coarctata*, for example, the capitulescence begins as an essentially uninterrupted cylinder but may elongate greatly and become highly interrupted and branched. Keys that utilize a difference of this sort in capitulescence morphology (e.g., Freire & Iharlegui 1997) probably are recognizing artificially separated taxa.

1. Basal leaves usually withering or withered by flowering and not persisting in a rosette, cauline oblong to oblong-oblancoelate, lower and midcauline often distinctly subclasping (but not auriculate), often slightly decurrent _____ ***Gamochaeta americana***
1. Basal leaves usually persisting in a rosette at flowering (except in *G. simplicicaulis*), cauline spatulate to oblancoelate, oblancoelate-oblong, or oblancoelate-obovate, none clasping or decurrent.
 2. Basal and lower cauline leaves on elongate internodes, usually withered or absent at flowering, clusters of small leaves usually produced in cauline axils; stems strictly erect, (30–)50–85 cm tall; inner phyllaries apically acute; flowering mostly July–August _____ ***Gamochaeta simplicicaulis***
 2. Basal and lower cauline leaves on relatively congested nodes, usually green and persistent at flowering, clusters of small leaves absent in cauline axils; stems erect

- to decumbent-ascending, mostly less than 50 cm tall; inner phyllaries apically acute to obtuse or rounded; flowering mostly April–June.
3. Adaxial leaf surfaces usually completely glabrous; involucre 2.5–3 mm high, completely glabrous, with evident purplish coloration; outer phyllaries elliptic-obovate to broadly elliptic-ovate, apically rounded to obtuse; bisexual florets 2–3 per head _____ **Gamochaeta coarctata**
 3. Adaxial leaf surfaces with persistent vestiture (sometimes necessary to view at 10x); involucre 3–4.5 mm high, base imbedded in cottony tomentum and often lightly arachnoid on the lower 1/5–1/2, with or without purplish coloration; outer phyllaries ovate, apically acute to acute-acuminate; bisexual florets 2–6 per head.
 4. Stems usually appearing not hairy but with a white, closely appressed, cloth-like covering, trichomes usually not individually evident; involucre 3–3.5 mm high; all phyllaries apically acute to acute-acuminate and brownish; bisexual florets 2–4 per head; cypselae purple _____ **Gamochaeta chionesthes**
 4. Stems usually closely white-pannose with trichomes individually evident, minutely filiform and longitudinally oriented; involucre 3–4.5 mm high; inner phyllaries apically acute or oblong and blunt-apiculate, at least outer and mid phyllaries not apically brownish; bisexual florets 3–6 per head; cypselae tan.
 5. Cauline leaves mostly spatulate, trichomes of adaxial surfaces with basal cells expanded and vitreous; involucre 4–4.5 mm high; inner phyllaries with lamina triangular, apically acute but not apiculate; bisexual florets 3–4 per head; fibrous-rooted or slender-taprooted _____ **Gamochaeta purpurea**
 5. Cauline leaves oblanceolate to oblanceolate-oblong or oblanceolate-obovate, trichomes of adaxial surfaces filiform from base to tip; involucre 4.5–5 or 3–3.5 mm high; inner phyllaries with lamina oblong, apically truncate-rounded and apiculate; bisexual florets (3–)4–6 per head; fibrous-rooted, rarely slender-taprooted.
 6. Capitulescence 12–18 mm wide (pressed), uninterrupted or rarely so and only at the base, mostly 1–6(–8) cm long; involucre 4.5–5 mm high; outer phyllaries and often lamina of inner phyllaries dark brown, the whole head commonly with a dark brown or greenish brown cast; mid phyllaries with a low subterminal keel; cypselae 0.7–0.8 mm long _____ **Gamochaeta ustulata**
 6. Capitulescence 10–12 mm wide (pressed), early uninterrupted and 1.5–5 cm long, later producing axillary glomerules from lower nodes and elongating, becoming strongly interrupted and up to 18 cm long; involucre 3–3.5 mm high; phyllaries greenish-silvery to stramineous or golden, sometimes light brown but never dark brown, the whole head not with a dark brown cast; phyllaries not keeled; cypselae 0.5–0.6 mm long _____ **Gamochaeta argyrirea**

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