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A Revision of the Bees of the Genus *Melissodes* in North and Central America. Part II (Hymenoptera, Apidae)*

BY

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ABSTRACT: This is the second part of a monographic revision of the bee genus *Melissodes* in North and Central America. Ten species belonging to four subgenera are described. Ten names are relegated to synonymy. One new species, *M. mitchelli*, is described.

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INTRODUCTION

This is the second part of a revision of the bees of the genus *Melissodes* in North and Central America. Ten species belonging to four subgenera are treated. A total of 2,088 specimens representing these ten species have been examined.

Explanations of the methods used in describing the species, the meanings of certain descriptive terminology and methods used in taking certain measurements are described in a section on descriptive methodology in the first part of this revision (LaBerge, 1956). The reader is also referred to the first part of this revision for a complete list of acknowledgments. Certain persons have been of invaluable aid in comparing specimens sent to them with type specimens in their care, in lending types and in generously giving of their time and advice. I am grateful to Dr. I. H. H. Yarrow of

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Subgenus *Tachymelissodes* LaBerge

Tachymelissodes LaBerge, 1956, Univ. Kansas Sci. Bull., vol. 37, p. 1170.

Type species. *Melissodes dagosa* Cockerell, 1909, by original designation.

This subgenus includes three species of *Melissodes* which have the distal pubescent bands of the metasoma narrow, situated on the apices of terga 2 to 4, subequal in width to each other and of about equal width across each tergum in both sexes. In addition, the males have short antennae which barely reach or do not reach the first metasomal tergum in repose and have the minimum length of the first flagellar segment equal to half or more of the maximum length of the second segment.

KEY TO THE SPECIES OF THE SUBGENUS TACHYMELISSODES

Males

1. Apical portion of pygidial plate half or less as broad as basal portion of plate; labrum black; mandible with large basal yellow spot; clypeus all or partly black *sphaeralceae*
- Apical portion of pygidial plate broader than half basal width of plate; labrum often with median yellow spot; mandible usually with basal yellow spot; clypeus usually yellow except dark spots at tentorial pits 2
- 2(3). Basal areas of terga 1 to 3 with ground spaces dulled by dense transverse shagreening; labrum without yellow spot; clypeus with

small regular punctures separated by less than one puncture width *opuntiella*

Basal areas of terga 1 to 3 with ground spaces shiny, with delicate transverse shagreening which scarcely dulls surface, or unshagreened; labrum usually with small median yellow spot; clypeus with coarse punctures which are irregular in size and spacing, *dagosa*

Females

1. Clypeal punctures small, round, evenly spaced, separated by one puncture width or less (mostly by half a puncture width or less); distal pale band of tergum 2 reaches apex of tergum medially, not interrupted medially; hairs of inner surfaces of hind basitarsi yellow or pale red 2

Clypeal punctures coarse, some elongate, some separated by more than one puncture width at least basally; distal pale band of tergum 2 separated from apex of tergum medially, usually narrowly interrupted medially hairs of inner surfaces of hind basitarsi often dark brown or black, occasionally yellowish red, *dagosa*

- 2(1). Terga 2 and 3 with interband zone with small shallow punctures and ground areas dulled by dense transverse shagreening; basal half of tergum 1 with small shallow punctures, ground areas dulled by dense shagreening; mesoscutum with no brown hairs, or brown hair patch extends anteriorly to a transverse line at about middle of tegulae *opuntiella*

Terga 2 and 3 with interband zone coarsely and irregularly punctate, some punctures 2 or 3 times diameter of others, ground areas shagreened but moderately shiny; basal half of tergum 1 with distinct punctures, ground areas shagreened but moderately shiny; mesoscutum with patch of brown hairs usually extending forward to or beyond a transverse line at anterior margins of tegulae *sphaeralceae*

Melissodes (Tachymelissodes) dagosa Cockerell

Melissodes dagosa Cockerell, 1909, Canad. Ent., vol. 41, p. 128; 1928; Univ. Colorado Studies, vol. 16, p. 114; Bohart, Knowlton and Bailey, 1950, Utah State Agric. Coll., mimeo. ser. no. 371, p. 5.

Melissodes calloleuca Cockerell, 1924, Pan-Pacific Ent., vol. 1, p. 55 (new synonymy).

This is the most common and widespread species of this subgenus. The females can be recognized by the coarse clypeal punctation, the usually narrowly interrupted and slightly arched pubescent band of tergum 2 and the hairs of the inner surfaces of the hind basitarsi often being dark brown to black. The males can be recognized by the ground areas of the metasoma and clypeus being shiny, the coarse clypeal punctation and the shape of the pygidial plate as described below.

Female: Measurements and ratios: N, 20; length, 10-12 mm.;

width, 3.5-4.5 mm.; wing length, $M = 3.54 \pm 0.169$ mm.; hooks in hamulus, $M = 12.10 \pm 0.049$; flagellar segment 1/segment 2, $M = 2.41 \pm 0.028$.

Structure and color: Integument black except as follows: apical half of mandible usually red with median golden macula; lower surface of flagellum (except segment 1 and basal half of segment 2) yellow to dark red; eyes blue or greenish blue; tarsi dark reddish brown, claws red basally; tibial spurs pale yellow to pale brown; apices of terga 2-4 (beneath pale pubescent bands) slightly hyaline, brown; apex of tergum 1 usually narrowly hyaline, yellow to brown; sterna often red basally and hyaline apically, except last 2 or 3; wing membranes slightly infumate, veins dark reddish brown to black; tegulae piceous.

Clypeus coarsely and irregularly punctate, punctures, especially basally, often separated by one to two puncture widths, several punctures usually elongate, ground areas shiny, slightly or not at all shagreened; supraclypeal area with deep round punctures widely separated medially, shiny; galeae shiny, unshagreened and sparsely punctate above; maxillary palpal segments in ratio of about 3.0:2.5:2.0:1.5. Mesoscutum with punctures small, round, separated by 2 to 4 puncture widths posteromedially and crowded anteriorly and peripherally, ground shiny; scutellum with punctures similar to those of mesoscutum but separated mostly by about 2 puncture widths, ground shiny; metanotum with small crowded punctures, shiny dorsomedially; lateral surfaces of mesepisterna with deep punctures separated mostly by half of one puncture width or less, ground areas shiny, unshagreened; propodeum with dorsal surface irregularly reticulorugose, dulled by fine tessellation. Metasomal tergum 1 with basal $\frac{3}{4}$ or slightly more with indistinct round punctures separated by one puncture width or less, ground areas dulled by fine transverse shagreening, moderately shiny; tergum 2 with interband zone with small, indistinct punctures separated by 1 to 2 puncture widths medially and by 1 puncture width or less laterally, ground areas dulled by dense, fine shagreening, moderately shiny, especially laterally; interband zones of terga 3 and 4 similar to that of tergum 2 but punctures more crowded.

Hair: On head silvery white except as follows: in darkest specimens hairs of clypeus, labrum, mandibles and vertex between apices of compound eyes dark brown, in palest specimens labral hairs ochraceous and with a few short brown hairs on vertex between apices of compound eyes and lateral ocelli. Mesoscutum often

with posteromedian patch of dark brown hairs extending forwards to a transverse line at middle of tegulae, occasionally dark meso-scutal hairs absent, usually posteromedial area with few or no hairs; scutellum usually with the sparse median hairs brown; mesepisterna often with hairs of anterior, ventral and lower lateral surfaces dark brown, occasionally all pale; pale hairs of dorsum of thorax white to pale yellow, laterally and on propodeum white. Metasomal tergum 1 with long hairs of basal $\frac{3}{4}$ white; tergum 2 with distal and basal pubescent bands silvery white, interband zone with short, brown, subappressed hairs, distal band usually narrowly interrupted medially and separated from apex of tergum in median third or less by narrow zone of short, simple, brown hairs (often rubbed off); tergum 3 and 4 similar to tergum 2 but distal pale bands not interrupted medially nor separated from apices of terga by zones of brown hairs and basal bands consist of dark brown tomentum; terga 5 and 6 with long, appressed, dark brown hairs, white to ochraceous lateral tufts present in pale specimens; sternal hairs dark brown with fringes of long white hairs on apices of all but last two sterna, in darkest specimens apical fringe of hairs pale only laterally. Legs with white hairs except red or yellow on inner surfaces of tarsi and dark brown hairs on basitibial plates in palest specimens; in darkest specimens legs with dark brown hairs except as follows; a few white to ochraceous hairs on outer surfaces of fore and middle tibiae, scopal hairs silvery white except just below basitibial plates and at apices of basitarsi; scopal hairs with relatively few branches (usually 3 to 6 on either side of rachis) and with strong rachises which extend beyond branched portion of hairs by about $\frac{1}{2}$ length of latter.

Male: Measurements and ratios: N, 20; length, 8-11 mm.; width, 2.5-3.5 mm.; wing length, $M = 3.25 \pm 0.258$ mm.; hooks in hamulus, $M = 11.10 \pm 0.280$; flagellar segment 2/segment 1, $M = 1.69 \pm 0.029$.

Structure and color: Color as in female with the following differences: clypeus pale yellow except dark spots at tentorial pits; labrum cream-colored except narrow dark brown apical margin; mandible usually with large triangular basal yellow spot, often reduced but rarely absent; flagellum yellow below, except basal half to two thirds of first segment, dark brown above; eyes green to blue; terga 1-6 with apical margins (beneath pale pubescence) hyaline, usually colorless, occasionally yellowish. First flagellar segment with minimum length equal to half of maximum length of

second segment or more (Fig. 12); penultimate flagellar segment approximately two-thirds as broad as long; antennae reaching base of first metasomal tergum in repose. Integumental sculpturing and structure as in female with the following differences: clypeal punctures usually smaller; mesoscutum with posteromedian area usually with slightly more crowded punctures; metasomal terga with ground areas shiny, with extremely fine and sparse shagreening or none at all. Pygidial plate with apical portion at least as broad as half of base of plate and usually much broader.

Gonostylus capitate and slightly pointed inwards; inner surface of gonocoxite just below gonostylus with abundant short acute hairs and few blunt hairs admixed; penis valve with abundant short hairs on lateral surface below dorsal lamella (see LaBerge, 1956, Figs. 118 to 121). Sternum 7 with median plate with thick short neck, flat apical margin, and blunt apex directed posterolaterally, inner margin straight, slanted inwards towards apex, with abundant short hairs ventrally. Sternum 8 truncate apically with several relatively long hairs at apex, median ventral carina well separated from apex, short, blunt, not bilobed apically.

Hair: Much as in female but generally paler; hairs of head, thorax and legs never dark brown except occasionally with a few brown hairs on vertex of head, in posteromedian area of mesoscutum and medially on scutellum; metasomal hairs as in female but distal band of tergum 2 not interrupted and usually reaching apex medially, tergum 5 with pale distal band as on tergum 4, and terga 6 and 7 with long pale hairs; legs with yellow to red hairs on inner surfaces of tarsi, otherwise white. Often all pale hairs are golden yellow rather than being white; the former bees are considered to be newly emerged, or at least young adults, and the latter are considered to be older faded specimens.

Bionomics: Nothing has been published concerning the nesting habits of this species. Little is known concerning its flower preferences, but from the available records it appears that *M. dagosa* is a polylectic bee and visits a large variety of plants for pollen as well as for nectar. Females have been taken from plants of the families Asclepiadaceae, Leguminosae, Compositae and Cruciferae in that order of abundance. The only records on composites, however, are from thistles, whereas three genera of crucifers have yielded females of this species. *M. dagosa* is probably important in the pollination of alfalfa at least in Utah where this bee seemingly is most abundant.

Type material: Holotype male of *dagosa* from Osborn's Ranch, Grand Coulee, Washington, is the property of the California Academy of Sciences but temporarily deposited in the collection of the Citrus Experiment Station, Riverside, California. The holotype female of *calloleuca* from Saltair, Utah, is in the California Academy of Sciences, San Francisco, California.

Distribution: This species is widespread in the Rocky Mountains from southern Idaho and Washington in the north to middle eastern California in the southwest and the western half of Colorado in the east. It has been collected from May 19 to August 8 but mainly in June and July. In addition to the type material, 133 females and 184 males have been examined from the localities listed below. Localities mentioned in the literature and localities of the type material are included.

CALIFORNIA: Big Pine, Inyo Co.; Bridgeport, Mono Co.; Cedarville, Modoc Co.; Deep Springs, Inyo Co.; Diaz Lake, Inyo Co.; Lone Pine, Inyo Co.; Mammoth Lakes, Mono Co.; Topaz, Mono Co.; Wendel, Lassen Co.; Westgard Pass (7 miles W.), Inyo Co. COLORADO: Alamosa; Boulder; Delta; Eckert; Monte Vista. IDAHO: Aberdeen (5 miles N.); Hot Springs, Owyhee Co. NEVADA: Connor's Pass, White Pine Co.; Dumphy; Fallon; Lovelock; Reno (Sky Ranch). OREGON: Warner Lake, Lake Co.; Harney Co.; Steen Mts., Harney Co.; Umapine; Vale. UTAH: Callao; Cedar Mts. (S.E. end of), Tooele Co.; Delta; Dugway Parade Ground (S. E. of Camel Back Mt.), Tooele Co.; Elberta; Erda; Fillmore; Fish Springs; Fort Duchesne; Gandy; Grantsville; Hinckley; Jensen (10 miles E.); Kelton; Layton; Lehi; Little Salt Lake, Iron Co.; Lynndyl; McCormick; Milford; Nephi; Parowan; Park Valley; Payson; Penrose; Promontory; Saltair; South Fork, Ogden River; West Point. WASHINGTON: Grand Coulee (Osborn's Ranch); Lind; North Yakima; Yakima City. WYOMING: Carbon Co.; Green River; New Castle.

Flower records: *Asclepias* sp., *Cirsium* sp., *Medicago sativa*, *Melilotus* sp., *M. alba*, *Norta altissima*, *Sphaeralcea* sp., *Thelypodium brachycarpa*.

Melissodes (Tachymelissodes) opuntiella Cockerell

Melissodes opuntiella Cockerell, 1911, Canadian Ent., vol. 43, p. 131.

Melissodes albocincta Cockerell, 1919, Ann. Mag. Nat. Hist., ser. 9, vol. 2, p. 119 (new synonymy).

This is the smallest species of this subgenus. It differs from *M. dagosa* in both sexes by the clypeal and pubescence characters described in the diagnosis of the latter. Females of *opuntiella*

can be distinguished from those of *sphaeralceae* by the punctuation of the metasoma and thorax as described below. Males of *opuntiella* differ from those of *sphaeralceae* in having a pygidial plate similar to that of *dagosa* and by usually having an all yellow clypeus (partly black in a few specimens).

Female: Measurements and ratios: N, 20; length, 8-9 mm.; width, 3-4 mm.; wing length, $M = 2.85 \pm 0.016$ mm.; hooks in hamulus, $M = 10.25 \pm 0.138$; flagellar segment 1/segment 2, $M = 2.15 \pm 0.047$.

Structure and color: Integumental color as in *M. dagosa* except as follows: apices of terga 2-4 broadly hyaline, colorless to yellow and apex of tergum 1 narrowly hyaline, colorless, hyaline area of tergum 1 equals about half of hyaline area of tergum 2 medially; wing membranes clear; tegulae piceous to clear yellowish brown.

Integumental sculpturing as in *M. dagosa* except as follows: clypeus with small round regular punctures usually separated by less than one puncture width, without markedly elongated punctures; maxillary palpal segments in ratio of about 3.6:2.25:2.1; mesoscutum with punctures smaller but distributed as in *dagosa*; propodeum dulled dorsally by dense fine irregular rugae and dense fine tessellation; metasomal tergum 1 with basal $\frac{3}{4}$ to $\frac{1}{2}$ with minute, round punctures separated mostly by one puncture width basally to two to four puncture widths apically, ground area dulled by exceedingly minute and dense shagreening; terga 2-4 with small round widely spaced punctures in areas basal to apical pubescent bands, ground areas opaque, dulled by exceedingly fine and dense shagreening.

Hair: Color as in *M. dagosa* with the following differences: Hairs of head and thorax white except occasionally pale brown in posteromedian area of mesoscutum; metasomal tergum 2 with apical pale band not interrupted or separated from apex of tergum medially; hairs of interband zones of terga 2-4 shorter and usually pale brown; basal band of tergum 3 white and of tergum 4 pale brown to white; terga 5 and 6 with lateral tufts of white hairs small or absent; hairs of legs white except as follows: on hind tibiae pale yellow, on inner surfaces of hind basitarsi yellow to red, on inner surfaces of fore and middle tarsi red, on outer surfaces of fore tarsi brown to red.

Male: Measurements and ratios: N, 20; length, 7-9 mm.; width, 2.5-3.0 mm.; wing length, $M = 2.64 \pm 0.167$ mm.; hooks in hamulus, $M = 9.60 \pm 0.197$; flagellar segment 2/segment 1, $M = 1.73 \pm 0.032$.

Structure and color: Integumental color as in *M. dagosa* except as follows: labrum entirely black; basal mandibular yellow spot always large; clypeus occasionally blackened posteriorly. Structure as in *M. dagosa* with the following differences: antennae not surpassing propodeum in repose, penultimate flagellar segment $\frac{3}{4}$ to $\frac{5}{8}$ as broad as long; clypeal punctation and maxillary palpi as in female; sculpturing of terga as in female but punctures slightly larger and more abundant.

Genital capsule as in *M. dagosa* but gonostylus usually less capitate and with fewer hairs on dorsal and outer surfaces, penis valves with fewer hairs laterally and gonocoxite with more abundant blunt hairs on inner surface near apex. Sternum 7 with median plate long-necked, oval in outline and with few minute hairs ventrally; apodeme not capitate at apex (Fig. 1). Sternum 8 emarginate at apex, with a distinct median ventral carina, narrower than in *M. dagosa* and distinctly narrower medially than at level of upper fourth (Fig. 2).

Hair: Much as in *M. dagosa* but paler; never with brown hairs on head or thorax; never with hairs golden yellow, but occasionally pale ochraceous on dorsum of head and thorax.

Bionomics: In keeping with its name this species shows some preference for pollen of cacti of the genus *Opuntia*. However, the few flower records available show that *M. opuntiella* will take pollen from other sources such as the legume *Lindheimera texana*, the mallow *Sphaeralcea pedatifida* and the composites *Cirsium* sp. and *Verbesina encelioides*. This variety of flowers bespeaks a rather polylectic species rather than the oligolecty inferred in its name.

Type material: Holotype male and allotype female of *opuntiella* from Brownsville, Texas, October 23, 1908, Jones and Pratt collectors, on *Opuntia lindheimeri* are in the U. S. National Museum (U. S. N. M. Type No. 14105). Unfortunately, the allotype female is not conspecific with the holotype male but belongs to the following species, *M. sphaeralceae*. The holotype female of *albocincta* from Mexico is in the U. S. National Museum (U. S. N. M. Type No. 23218).

Distribution: This species ranges from southern Utah and southern California in the northwest to eastern Texas and northeastern Mexico in the southeast. It has been collected from March 25 to October 23 but mainly during April and May. In addition to the type material, 49 females and 34 males have been examined from the localities listed below.

ARIZONA: Wickenburg. CALIFORNIA: Hopkins Well (1.8 miles E.), Riverside Co. TEXAS: Brownsville; Corpus Christi; Cotulla; Dilley; Hidalgo; Kerrville; Laredo (2 and 18 miles N.); Pharr (10 miles S. W.); Progreso; Rio Grande (6 miles E. and 20 miles S. E.); San Diego; San Ygnacio; Sonora; Uvalde. UTAH: Heber. COAHUILA: San Pedro de Colonias (3700 feet altitude).

Flower records: *Cercidium texanum*, *Cirsium* sp., *Helenium microcephalum*, *Helianthus annuus*, *Lindheimeri texana*, *Opuntia* sp., *O. lindheimeri*, *Parkinsonia* sp., *Prosopis* sp., *Sphaeralcea* sp., *S. pedatifida*, *Verbesina encelioides*.

Melissodes (Tachymelissodes) sphaeralceae Cockerell

Melissodes sphaeralceae Cockerell, 1896, Entomologist, vol. 29, p. 304; 1897, Bull. New Mexico Coll. Agric. and Mech. Arts, no. 24, p. 20; 1898, Bull. Sci. Lab. Denison Univ., vol. 11, p. 66; 1902, Entomologist, vol. 35, p. 177; 1904, Entomologist, vol. 37, p. 8; 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 75, 86; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 309.

This species is closely related to *M. opuntiella*. The males can readily be distinguished by the form of the pygidial plate as described below. The female can be separated from the female of *dagosa* by the finer punctation of the clypeus and from the female of *opuntiella* by the large patch of brown hairs on the mesonotum and by the more coarsely punctate metasomal terga as described below.

Female: Measurements and ratios: N, 12; length, 9-11 mm.; width, 3-4 mm.; wing length, $M = 3.08 \pm 0.230$ mm.; hooks in hamulus, $M = 11.41 \pm 0.244$; flagellar segment 1/segment 2, $M = 2.44 \pm 0.049$.

Structure and color: Integumental color as in *M. dagosa* with the following differences: eyes gray to grayish blue; tegulae piceous but clear brown posteromedially; tergum 1 with a broad colorless hyaline apical margin; terga 2-4 (beneath apical pubescent bands) hyaline, colorless or yellow; wing membranes clear or somewhat milky apically.

Clypeus finely and regularly punctate, punctures round, separated mostly by half of one puncture width or less, ground areas smooth and shiny; supraclypeal area with round punctures similar to those on adjacent portion of clypeus, ground areas smooth and shiny; galeae as in *M. dagosa*; maxillary palpal segments in ratio of about 2.5:2:2:1. Mesoscutum with large round punctures separated by one to four puncture widths posteromedially and by half of a puncture width or less anteriorly and laterally, ground areas shiny, often with exceedingly fine reticulate shagreening; scutellum similarly

sculptured but punctures distinctly smaller than on mesoscutum; metanotum and mesepisterna sculptured as in *dagosa*; propodeum as in *dagosa* but dorsal surface with large distinct punctures. Metasomal tergum 1 with basal $\frac{3}{4}$ or slightly more with small round punctures, in basal half punctures separated mostly by less than one puncture width, distal to these punctures more widely separated (especially laterally) except for a single row of close-set punctures extending across tergum at about $\frac{3}{4}$ distance from base, ground areas moderately shiny, dulled by exceedingly fine transverse shagreening; interband zones of terga 2 and 3 with round, irregularly spaced punctures of irregular size, separated from nearest neighbors by less than half to four puncture widths (sparser medially than basally or apically), punctures crowded beneath basal pubescent band and beneath basal portion of apical pubescent band, ground areas as in tergum 1; tergum 4 with interband zone more densely punctate than in terga 2 or 3.

Hair: On head and thorax white except long brown hairs on vertex of head between apices of compound eyes, mesoscutal patch of brown hairs which extends forwards well beyond a transverse line at anterior margins of tegulae and scutellum with large median brown hair patch. Metasomal terga with hairs as in *dagosa* with the following differences: hairs of interband zones shorter and more appressed, basal band of tergum 3 pale, distal pale bands of terga 2 and 3 consisting of much shorter, appressed pubescence, that on tergum 2 not interrupted and reaching apex medially. Hairs of legs white except as follows: ochraceous or pale brown distally on middle tibiae and basally on hind tibiae, orange to yellow on inner surfaces of tarsi and tibiae; scopal hairs with 4 to 10 branches on either side of rachis.

Male: Measurements and ratios: N, 19; length, 9-10 mm.; width, 2.0-3.5 mm.; wing length, $M = 3.32 \pm 0.247$ mm.; hooks in hamulus, $M = 10.47 \pm 0.183$; flagellar segment 2/segment 1, $M = 1.79 \pm 0.010$.

Structure and color: Integumental color as in *M. dagosa* with the following differences: clypeus partially or wholly black; mandible with large basal yellow spot never reduced or absent; labrum black; eyes gray or grayish blue.

Minimum length of first flagellar segment equals more than half of maximum length of second segment; penultimate flagellar segment approximately half as broad as long; antennae barely reaching base of first metasomal tergum in repose; galeae and maxillary palpi as in female. Sculpturing as in female with the following

differences: punctation of terga usually somewhat denser, ground areas of interband zones occasionally dulled by dense shagreening. Pygidial plate with apical portion less than half as broad as base of plate and often as narrow as a third basal width.

Gonostylus capitate as in *dagosa*, otherwise capsule as in *opuntiella*. Sternum 8 as in *opuntiella* but median ventral carina sharper and hairs at apex of sternum somewhat more abundant. Sternum 7 as in *opuntiella*.

Hair: On head and thorax as in female but often without brown hairs on vertex and mesoscutal brown patch usually smaller and occasionally absent. Metasomal hairs as in female but tergum 5 with distal pale band as in terga 2-4, tergum 6 usually without lateral tufts of pale hairs and sternal hairs all white. Legs with white hairs except orange to yellow on inner surfaces of tarsi. Body hairs not golden yellow as in *dagosa* on any specimens now before me.

Type material: Lectotype male of *sphaeralceae*, here designated, from Santa Fe, New Mexico, July, is in the collection of the University of Colorado Natural History Museum, Boulder, Colorado.

Distribution: This species ranges from Durango, Mexico, and Brownsville, Texas, north to the Sandia Mountains in New Mexico, and west to Arizona. It has been taken from June 23 to September 4, but mainly in July and August. In addition to the lectotype, 20 males and 12 females have been examined from the localities listed below. This list includes localities reported in the literature.

ARIZONA: Navajo Co. NEW MEXICO: Pecos, San Miguel Co.; Sandia Mountains; Santa Fe. TEXAS: Brownsville. DURANGO: Nombre de Dios; Yerbanis (Cuencame District). HIDALGO: Ixmiquilpan. DISTRITO FEDERAL: Guadalupe; México (city).

Flower records: *Monarda* sp., *Sphaeralcea* sp., *S. angustifolia*, *S. fendleri*.

Subgenus *Apomelissodes* LaBerge

Apomelissodes LaBerge, 1956, Univ. of Kansas Sci. Bull., vol. 37, p. 1175.

Type species: *Melissodes fimbriata* Cresson, 1878, by original designation.

This subgenus, originally intended to include two species (*M. fimbriata* Cresson and *M. apicata* Lovell and Cockerell) which occur in southeastern United States, now includes four species. *Melissodes baileyi* Cockerell is provisionally included at this time and a new species is described below. *M. baileyi* is known from a

single female which does not have a protruding clypeus, long galeae or hooked galeal hairs. The first couplet in the key to the subgenera of *Melissodes* (females) published previously (LaBerge, 1956, p. 922) should accordingly be changed to read as follows:

1. Scopal hairs simple or weakly branched, *if* weakly branched, *then* clypeus in profile protruding beyond eye by $\frac{2}{3}$ width of eye or more *Apomelissodes*
- Scopal hairs branched, usually abundantly so, *if* weakly branched, *then* clypeus in profile not protruding beyond eye by as much as $\frac{2}{3}$ width of eye 2

KEY TO THE SPECIES OF THE SUBGENUS APOMELISSODES

Males

1. Galeae (measured from base of first palpal segment) three times as long as clypeus or longer; pygidial plate notched laterally but not so deeply as to create the impression of two plates; apical pubescent bands of terga 2-5 consist of one to three rows of long silky short-branched hairs arising slightly anterior to one hair length from margins of terga *fimbriata*
- Galeae considerably less than three times as long as clypeus; pygidial plate deeply notched laterally, often appearing like two plates (a large high anterior plate and a small posterior plate on a lower level); apical pubescent bands of terga 2-5 consist of several rows of short, highly plumose hairs arising in a broad zone from bases of bands almost to margins of terga 2
2. Clypeus yellow except black notches posteriorly at tentorial pits, coarsely punctate with median zone impunctate and moderately shiny; galeae with sparse short hairs laterally *mittelli*
- Clypeus all or partly black, densely punctate and dull; galeae with abundant short hairs laterally *apicata*

Females

1. Scopal hairs simple, unbranched 2
- Scopal hairs weakly branched 3
2. Galeae three times as long as clypeus or longer *fimbriata*
- Galeae two times as long as clypeus or less *baileyi*
3. Galeae with sparse short straight hairs laterally; clypeus with posteromedian area slightly depressed or flattened, sparsely and coarsely punctate *mittelli*
- Galeae with abundant long hooked hairs laterally; clypeus with posteromedian area not depressed or flattened, densely and coarsely punctate *apicata*

Melissodes (*Apomelissodes*) *fimbriata* Cresson

Melissodes fimbriata Cresson, 1878, Proc. Acad. Nat. Sci., Philadelphia, vol. 30, p. 203; Fox, 1892, Ent. News, vol. 3, p. 29; Birkman, 1899, Ent. News, vol. 10, p. 245; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 77, 87; Smith, 1910, Ann. Report New Jersey State Museum, 1909, p. 693; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 118; Brimley, 1938, Insects of North Carolina, p. 462.

Melissodes perplexa, Cresson, 1878, Proc. Acad. Nat. Sci., Philadelphia, vol. 30, p. 206 (misidentification of male).

Melissodes fimbriata is easily separated in both sexes from the other members of this subgenus by use of the characters listed in the key given above. Several other striking distinctions exist and are described below.

Female: Measurements and ratios: N, 18; length, 11.0-13.0 mm.; width, 4.0-5.0 mm.; wing length, $M = 21.38 \pm 0.381$ mm.; hooks in hamulus, $M = 15.56 \pm 0.271$; flagellar segment 1/segment 2 (N, 16), $M = 1.95 \pm 0.002$.

Structure and color: Integument black except as follows: lower surfaces of flagellar segments 2-10, apical half of mandible, legs (or at least distitarsi) and sterna (at least apically) dark reddish brown; apical half of mandible usually with median golden macula; eyes bluish gray to green; tegulae piceous; wing membranes somewhat infumate, yellow or yellowish brown, veins dark brown to black.

Clypeus with small deep round dense regular-sized punctures separated by half a puncture width or less, ground areas shiny, unshagreened except sparsely so laterally and posteriorly; supra-clypeal area densely punctate laterally, sparsely punctate medially, ground areas medially dulled by fine tessellation; flattened area of vertex between compound eye and lateral ocellus densely punctate, punctures deep, round, separated by one puncture width or less; galeae from base of first palpal segment to tips equal 3.5 to 4.0 times median length of clypeus, with exceedingly sparse short straight hairs scattered over surface, ground moderately shiny above, dulled laterally and below by reticular shagreening; maxillary palpal segment in ratio of about 2.75:3.5:3:1. Mesoscutum with small round punctures separated mostly by one puncture width or less posteromedially and less than half a puncture width anteriorly and peripherally, ground areas shiny, unshagreened; scutellum as densely punctate as posterior declivous portion of mesoscutum; mesepisterna with punctures slightly larger than on anterior half of mesoscutum, separated mostly by half a puncture width or less, ground areas shiny, unshagreened; metanotum densely punctate medially, less so laterally, shiny, slightly shagreened laterally; propodeum with dorsal surface with large coarse punctures except medially, moderately shiny, surface dulled by irregular tessellation, with posterior surface densely and coarsely punctate except medially, dulled by irregular tessellation except dorsomedial area, with

lateral surface densely and coarsely punctate, ground areas moderately shiny to shiny. Metasomal tergum 1 sparsely punctate in basal $\frac{1}{2}$ of dorsal surface, punctures shallow, becoming denser anteriorly and laterally, ground dulled by coarse reticulotransverse shagreening; tergum 2 with interband zone sparsely punctate, punctures shallow and separated mostly by 2 puncture widths or more, with apical area impunctate except for row of dense punctures near anterior margin of apical pale band, with basal area densely punctate, ground areas dulled as in tergum 1; terga 3 and 4 as in tergum 2, but interband zones progressively more densely punctate.

Hair: On head white, occasionally a few long dark brown hairs on vertex behind median ocellus. Thorax with white hairs except large mesoscutellar patch of dark brown to black hairs which extends forward beyond a transverse line at anterior margins of tegulae and scutellar hairs dark brown to black except posterior and lateral fringes of white hairs; tegulae and humeral angles of wings with abundant dark brown hairs. White hairs in basal $\frac{1}{2}$ of dorsal surface of metasomal tergum 1 extend to apex laterally, bare apicomedia; tergum 2 with basal band of white highly plumose pubescence, with apical band of white pubescence composed of long, silky hairs with short branches, with interband zone with abundant erect or suberect bristlelike white short hairs which are longer at extreme sides; terga 3 and 4 similar to tergum 2 but basal pubescent bands dark brown, apical bands denser and bristlelike hairs all or mostly dark brown and longer; terga 5 and 6 with long appressed dark-brown hairs, usually with small tufts of white hairs at extreme sides of tergum 5; sternal hairs reddish brown basally and medially, white apicolaterally. Legs with hairs white except as follows: outer surfaces of fore tarsi, outer surfaces of middle and hind distitarsi, basally on hind tibiae and apically on fore and middle tibiae brown; inner surfaces of tarsi and hind tibiae yellow to orange-red; scopal hairs simple, white to ochraceous.

Male: Measurements and ratios: N, 20; length, 9.0 to 13.0 mm.; width, 3.0-4.5 mm.; wing length, $M = 21.34 \pm 0.369$ mm.; hooks in hamulus, $M = 13.55 \pm 0.271$; flagellar segment 1/segment 2, $M = 4.20 \pm 0.256$.

Structure and color: Integument black except as follows: clypeus yellow except black notches posteriorly at tentorial pits, occasionally posterolateral angles (mesad to tentorial pits) darkened and apical margin dark reddish brown; labrum usually black, rarely with small posteromedial yellow spot; mandible as in female; lower sur-

faces of flagellar segments 2 to 11, distitarsi and apical margins of sterna dark reddish brown; eyes gray to bluish gray; wing membranes somewhat infumate yellowish brown, veins dark brown to black.

Galeae long as in female; maxillary palpi as in female; minimum length of first flagellar segment equals $\frac{1}{4}$ to $\frac{1}{5}$ of maximum length of second segment. Sculpturing of head and mesosoma as in female. Sculpturing of metasoma as in female except as follows: tergum 1 with basal $\frac{1}{2}$ to $\frac{5}{8}$ densely punctate; terga 2-5 with interband zones somewhat more densely punctate, medially on tergum 2 punctures separated mostly by one to two puncture widths; pygidial plate flat, notched laterally at about a third of length from apex, apical portion about $\frac{2}{3}$ width of basal portion or more; sternum 6 shiny, shallowly grooved medially, slightly emarginate apically, with coarse, round punctures separated by one puncture width or less on each side of median groove.

Terminalia described and figured by LaBerge (1956, Figs. 111-113). Sternum 7 with median plate long-necked. Sternum 8 pointed medioapically.

Hair: Color as in female with the following differences: vertex of head without dark hairs; long white hairs of metasomal tergum 1 reach apex; terga 2-5 with apical fringes of long white silky short-branched pubescence arising in one to three rows at about the length of one hair from apices of terga; terga 3-5 with abundant erect bristlelike hairs in interband zones, those of tergum 2 white; terga 6 and 7 with long dark-brown appressed hairs; sternal hairs white to ochraceous except reddish brown posteromedially on sterna 2-5 and dark brown on sternum 6. Legs with white hairs except yellow to orange on inner surfaces of tarsi and hind tibiae.

Bionomics: The evidence available from labels on the specimens indicates that *M. fimbriata* is an oligolectic bee dependent upon plants of the genus *Oenothera* (Onagraceae) for pollen as well as nectar. Out of 15 collections with flower data, 13 are from *Oenothera*, whereas the other two consist each of one male, the first from *Kneiffia* sp. (Onagraceae) and the second from *Helianthus petiolaris* (Compositae).

Type material: Female lectotype and male lectoallotype of *fimbriata* from Texas are in the Academy of Natural Sciences of Philadelphia, Pennsylvania. The lectoallotype male of *perplexa* from Georgia is, unfortunately, not conspecific with the lectotype female, but is the same as the male lectoallotype of *fimbriata*.

Distribution: This species ranges from Virginia in the northeast

to Georgia in the southeast, west to Texas and northwest to southwestern Kansas. It has been collected from April 25 to July 27. In addition to the type material, 18 females and 27 males have been examined. These records are so widely and sporadically distributed that it is deemed best to list here the collection data in full.

GEORGIA: 1 ♂, lectoallotype of *M. perplexa* Cresson. KANSAS: Garden City, 1 ♂, June 3, 1952, Cheng Liang; Tribune, 1 ♂, June 16, 1949, C. D. Michener and R. H. Beamer, on *Helianthus petiolaris*. MISSISSIPPI: Hattiesburg, 1 ♂, July 22, 1944, C. D. Michener; Mississippi State College, 1 ♂, April 26, 1949, 1 ♀, June 5, 1947, student collectors. NORTH CAROLINA: Burgaw, 2 ♀ ♀, May 18, 1950, T. B. Mitchell, on *Oenothera* sp.; Garford, 1 ♀, June 7, 1927, C. S. Brimley; Lexington (12 miles E.), 1 ♀, June 13, 1950, T. B. Mitchell, on *Oenothera* sp.; Merry Oaks, 1 ♂, July 27, 1926, T. B. Mitchell, on *Oenothera* sp.; Raleigh, 1 ♀, May 25, 1922, on *Oenothera* sp.; 2 ♂ ♂, July 18, 1922, on *Oenothera* sp., 1 ♂, July 20, 1927, on *Oenothera* sp., 1 ♀ and 1 ♂, May 23, 1929, on *Oenothera* sp., 2 ♀ ♀, May 25, 1929, on *Oenothera* sp., 2 ♀ ♀, May 25, 1933, on *Oenothera* sp., 1 ♂, July 7, 1933, on *Oenothera* sp., 1 ♂, May 26, 1935, 1 ♀, May 15, 1938, on *Oenothera laciniata*, 1 ♀, May 29, 1938, 1 ♂, May 15, 1939, 1 ♀, April 25, 1942, 1 ♂ and 2 ♀ ♀, May 29, 1950, on *Oenothera* sp., 4 ♂ ♂, May 17, 1951, on *Oenothera* sp., T. B. Mitchell; Willard, 2 ♂ ♂ and 1 ♀, May 11, 1951, T. B. Mitchell. TEXAS: Kerrville, 1 ♂, May 22, 1908, F. C. Pratt; 1 ♂, "Collection T. Pergande"; 3 ♂ ♂, "Collection Belfrage". VIRGINIA: Dawson's Beach, 1 ♂, June 6, 1931, on *Kneiffia* sp., J. C. Brimwell. A single male in the collection of the Illinois Natural History Survey is labeled "Tamarack Bog" with the numeral 4 above.

Melissodes (Apomelissodes) baileyi Cockerell

Melissodes baileyi Cockerell, 1906, Ann. Mag. Nat. Hist., ser. 7, vol. 17, p. 361.

This species, known only from the female holotype, seemingly is closely related to *M. fimbriata*. It is similar to the latter in having simple scopal hairs, but differs in having a relatively flat clypeus and short galeae. It can be separated from the female of *M. apicata* by the lack of abundant hooked galeal hairs. If it were not for the simple scopal hairs, *M. baileyi* would probably be placed in the subgenus *Tachymelissodes*. However, the simple scopal hairs, together with the form of the metasomal pubescence, seems to relate this species to *M. fimbriata* and it is, accordingly, placed in the subgenus *Apomelissodes*. Study of the male terminalia will undoubtedly solve this problem.

Female: Measurements and ratios: N, 1; length, 11.0 mm.; width, 4.0 mm.; wing length, 3.33 mm.; hooks in hamulus, 13; flagellar segment 1/segment 2, 1.97.

Structure and color: Integument black except as follows: Mandible dark reddish brown in apical $\frac{3}{4}$, apical half with large median golden macula; flagellar segments 3 to 10 red beneath; eyes gray; legs and sterna dark reddish brown; metasomal tergum 1 with apical margin hyaline, colorless; tegulae piceous; wing membranes hyaline, colorless, veins dark brown.

Clypeus with dense round punctures of regular size separated mostly by half of one puncture width or less, ground areas moderately shiny; supraclypeal area impunctate medially, shiny, coarsely punctate laterally; flattened area of vertex posteromesad of apex of compound eye with abundant round punctures of irregular size separated mostly by one puncture width or less, ground shiny; galeae about twice as long as median length of clypeus, shiny, unshagreened above or only delicately so, with sparse, short, straight hairs and sparse punctures; maxillary palpi 4-segmented, segments in ratio of about 2.5:2:2:1. Mesoscutum with small round punctures separated by one or slightly more puncture widths postero-medially and by half a puncture width in anterior half and peripherally; scutellum with small punctures of about same size as on adjacent part of mesoscutum, separated by one to half of one puncture width medially and less peripherally; ground areas of mesoscutum, scutellum and mesepisternum shiny, unshagreened; mesepisternum with large shallow punctures separated by half of one puncture width or less, many punctures not well defined posteroventrally; metanotum with abundant small punctures half size of punctures on posterior part of scutellum or a little larger, dense medially, sparse laterally, ground shiny medially and dull laterally; propodeum with dorsal surface reticulorugose except medially, with a few large punctures posteriorly, surface dulled by dense fine tessellation, with posterior surface densely punctate except upper median impunctate triangle, ground areas dulled by dense tessellation. Metasomal tergum 1 with dorsal surface punctate in basal half, punctures separated by one to two puncture widths apically in median half and by half a puncture width or less basally and laterally to apex, ground areas moderately shiny, with dense coarse transverse shagreening; tergum 2 with interband zone with exceedingly small punctures, almost impunctate medially but separated by one puncture width or less laterally, apical area impunctate, basal area densely punctate, ground areas

opaque, dulled by dense fine transverse shagreening; terga 3 and 4 similar to tergum 2 but more densely punctate in interband zones.

Hair: On head white; mesosomal hairs white except as follows: mesoscutellar patch of dark brown hairs extending forward to a transverse line at anterior margins of tegulae, scutellar hairs dark brown except peripherally. Metasomal tergum 1 with long white hairs in basal half medially and to apex laterally; tergum 2 with basal band of white pubescence, apical band of long white silky short-branched pubescence, interband zone of short simple bristle-like dark-brown hairs about equal in width to apical pale band, apical and basal pale bands connected laterally by white erect hairs; terga 3 and 4 similar to tergum 2 but basal bands dark brown; terga 5 and 6 with long dark-brown hairs, with long white tufts laterally on tergum 5; sternal hairs reddish brown except white apicolateral hairs on each sternum but the first and last. Legs with white hairs except as follows: brown on outer surfaces of fore tarsi, distally on fore and middle tibiae and basally on hind tibiae, yellow to orange on middle and hind basitarsi and hind tibiae; scopal hairs simple, unbranched, white to pale yellow.

Type material: Holotype female of *baileyi* from Fedor, Lee County, Texas, April 5, 1904, Rev. G. Birkman coll., is the property of the California Academy of Sciences, San Francisco, California, but is temporarily deposited in the collection of the Citrus Experiment Station, Riverside, California.

Melissodes (Apomelissodes) apicata Lovell and Cockerell

Melissodes apicata Lovell and Cockerell, 1906, *Psyche*, vol. 13, p. 111.

This species is very distinct from the other species in this subgenus. The female of *apicata* can be recognized by the protruding clypeus, the weakly branched scopal hairs, the short galeae and the abundant long hooked galeal hairs. The males can be distinguished by the short galeae which bear abundant short straight hairs laterally, the peculiar pygidial plate described below and the all or partially black clypeus. In addition, both sexes often have three-segmented maxillary palpi, a feature unique in the genus *Melissodes*.

Female: Measurements and ratios: N, 20; length, 11.0-14.0 mm.; width, 4.0-5.5 mm.; wing length, $M = 21.56 \pm 0.252$ mm.; hooks in hamulus, $M = 13.85 \pm 0.379$; flagellar segment 1/segment 2, $M = 1.98 \pm 0.075$.

Structure and color: Integument black except as follows: mandible with apical half red with median golden macula; eyes gray to

bluish gray; flagellar segments 2 to 10 beneath slightly reddish; distitarsi and often basitarsi, tibiae and femora and occasionally sterna reddish brown; wing membranes somewhat infumate to deeply so, brown, veins black; tegulae piceous; metasomal tergum 1 often narrowly hyaline apically.

Clypeus strongly protuberant, with coarse, irregular-sized punctures separated mostly by half a puncture width or less, with irregular, longitudinal, median carina in apical half or less, ground areas shiny, unshagreened; supraclypeal area coarsely punctate, ground area shiny; vertex with flattened areas mesad of apices of compound eyes coarsely punctate, punctures large, separated mostly by less than half a puncture width, ground areas shiny, unshagreened; galeae shiny, unshagreened, with abundant small punctures especially laterally, length less than three and more than two times median clypeal length; maxillary palpal segments usually three in ratio of about 4.0:4.0:2.5, occasionally a minute fourth segment present. Mesoscutum with abundant round punctures separated by half to one and a half puncture widths posteromedially and by half a puncture width or less anteriorly and peripherally, ground areas shiny, unshagreened; scutellum with punctures about same size as on adjacent part of mesoscutum, separated by half a puncture width or less, ground areas shiny, unshagreened; mesepisternum with large shallow punctures mostly larger than those of posteromedial area of mesoscutum and separated mostly by less than a third of one puncture width, ground areas shiny to moderately so, bottoms of punctures etched by reticulate shagreening; metanotum with abundant crowded punctures medially, sparser laterally, punctures separated by half a puncture width or less, smaller than those in middle of scutellum, ground areas shiny medially, shagreened laterally; propodeum with dorsal surface weakly reticulorugose except in median sixth, ground areas opaque, tessellate, with posterior surface sparsely punctate except broad, upper, impunctate triangle, ground dulled by tessellation but impunctate triangle usually moderately shiny. Metasomal tergum 1 with basal $\frac{3}{4}$ weakly punctate, punctures small, round, shallow, separated by one to two puncture widths apically and by less than one width basally and laterally, ground areas moderately shiny, with fine transverse shagreening; tergum 2 with minute punctures in interband and basal zones, punctures separated mostly by two puncture widths but somewhat more crowded laterally, with apical area impunctate, ground areas moderately shiny to dull, transversely

and densely shagreened; terga 3 and 4 similar to tergum 2 but punctures more abundant especially in basal areas.

Hair: On head white except abundant long black or dark brown hairs on vertex between apices of compound eyes and on face almost to antennae; galeae with abundant long hooked hairs, especially laterally. Mesosoma with white hairs except large mesoscutellar patch of dark brown to black hairs which extends forward beyond a transverse line at anterior margins of tegulae and often almost reaches pronotum, posterior lobes of pronotum with abundant long black hairs mixed with the pale, tegulae and humeral angles of wings with dark brown hairs, scutellum with hairs dark brown to black except long white hairs peripherally. Metasomal tergum 1 with long white hairs in basal half to three fifths and to apex at extreme sides; tergum 2 with basal and apical bands of white pubescence connected at extreme sides, apical band with sinuate anterior margin and almost interrupted medially, interband zone with abundant black or dark brown, erect or suberect, bristle-like hairs, apical band consists of several rows of short highly plumose hairs; terga 3 and 4 with basal bands of dark brown to black tomentum, with apical bands of white pubescence similar to that of tergum 2 but not sinuate anteriorly and with abundant dark brown bristlelike hairs in interband zones; terga 5 and 6 with long dark brown to black appressed hairs and with lateral tufts of long white hairs on tergum 5; sternal hairs brown except white at extreme sides near apices of all but first and last sterna. Legs with white hairs except as follows: outer surfaces of fore tarsi, apices of fore and middle tibiae, bases of hind tibiae and basitibial plates brown; inner surfaces of tarsi yellow (especially distitarsi) to dark brown, inner surfaces of hind basitarsi usually reddish brown; scopal hairs weakly plumose, each with one to five branches on each side of rachis and usually three or four, more highly plumose on basitarsi than on tibiae, pale ochraceous to white, occasionally pale brown on tibiae.

Male: Measurements and ratios: N, 20; 10.0-13.0 mm.; width, 4.0-5.0 mm.; wing length, $M = 21.35 \pm 0.293$ mm.; hooks in hamulus, $M = 12.65 \pm 0.215$; flagellar segment 2/segment 1, $M = 6.11 \pm 0.118$.

Structure and color: Integument black except as follows: clypeus yellow or yellowish orange, with black apical margin and black posterior margin, posterior infuscation often extends forward to cover half or more of clypeus (one specimen entirely black); mandible with apical half red with median golden macula; flagellar

segments 2-11 yellow to red beneath, dark brown above; eyes dark violet gray, gray, yellowish green, or bluish gray; distitarsi, often basitarsi and tibiae, occasionally femora and coxae dark reddish brown; wing membranes infumate, yellowish brown, veins dark brown to black, tegulae piceous.

Structural characters as in female with the following differences and addition: minimum length of first flagellar segment equals approximately $\frac{1}{6}$ of maximum length of second segment, often less; metasomal tergum 1 punctate almost to apex medially; terga 2-5 with ground areas shiny to moderately so, weakly shagreened; pygidial plate deeply notched at about a third distance from apex to base, apical margin of apical portion and apicolateral margins of basal portion upturned, basal portion usually on a slightly higher level than apical portion so as to give the impression of two pygidial plates.

Genital capsule essentially as in *M. fimbriata* but penis valve with lateral process somewhat more acute (Figs. 3 and 4). Sternum 7 as in *fimbriata* but median plate larger, with more hairs ventrally and without a distinct neck but joined to sternum by almost its entire width, with lateral plates more rounded than in *fimbriata* (Fig. 5). Sternum 8 similar to that of *fimbriata* but with fewer, shorter hairs apicomediaally and with numerous short hairs scattered over ventral surface in apical half (Fig. 6).

Hair: As in female with the following differences: with few or no brown hairs on vertex of head; galeal hairs abundant, especially laterally, but straight, not hooked; mesoscutal and scutellar patches of dark hairs usually somewhat smaller; metasomal tergum 1 with pale hairs extending to, or almost to, the apex; tergum 2 with apical white pubescent band not nearly interrupted medially, not sinuate anteriorly; terga 2-5 with narrow apical white bands subequal to each other in width and subequal in width across each tergum, with dark brown bristlelike hairs more abundant and longer; terga 6 and 7 with long brown hairs; sternal hairs largely white to ochraceous, darker basally on each sternum except the first and last, apices of sterna with fringes of long hairs white and highly plumose laterally and ochraceous to reddish brown medially; legs with white hairs except yellow to brown on inner surfaces of tarsi, occasionally brown on outer surfaces of hind basitarsi below basitibial plates and occasionally ochraceous on outer surfaces of tarsi and tibiae (especially hind tibiae).

Bionomics: This species is apparently oligolectic and restricted to plants of the genus *Pontederia* (family Pontederiaceae) for both

pollen and nectar. The hooked galeal hairs of the female are probably an adaptation for removing pollen from the narrow tubular flowers of this plant. The longer galeae and protruding clypei to house them are probably adaptations for retrieving nectar from the deep nectaries of *Pontederia*.

Type material: Holotype female from Waldoboro, Maine, July 21, 1904, on *Pontederia cordata*, J. H. Lovell collector, is in the collection of the North Carolina State College, Raleigh, North Carolina.

Distribution: *M. apicata* occurs along the Atlantic coast from Maine to Florida. It has been collected from March 21 to July 21, but mainly in April and May. In addition to the holotype, 23 females and 45 males have been examined. The collection data for these are listed below in full, since this is a rare and poorly known species.

DISTRICT OF COLUMBIA: Washington, 2 ♂♂, July, 1901, J. C. Bridwell. FLORIDA: Alachua Co., 1 ♀ and 5 ♂♂, April 12, 1955, on *Pontederia* sp., 5 ♂♂, April 12, 1955, with no floral data, T. B. Mitchell, April 13, 1955, 2 ♂♂ on *Melilotus alba* and 2 ♂♂ on *Stachys floridana*, H. V. Weems Jr., April 12-13, 1955, 7 ♂♂ on *Melilotus alba*, R. A. Morse, April 15, 1955, 2 ♂♂, with no floral data, R. A. Morse, April 12, 1955, 1 ♂, on *Hydrocotyle umbellata*, R. A. Morse; Englewood, 1 ♀, April 8, 1944, J. G. Needham; Fort Ogden, 1 ♀, April 9, 1952, G. S. Walley; Gainesville, Alachua Co., 2 ♂♂, May 4, 1923, Alexander and Walker; Highlands Hammock State Park, 5 ♂♂, April 7, 1955, on *Pontederia* sp., T. B. Mitchell; Island Grove, 1 ♂, 1890; Jacksonville, 1 ♂, W. H. Ashmead collection; Lake Iamonia, 1 ♂, May 12, 1916, on *Pontederia cordata*, W. D. Pierce; Moon Lake, Pasco Co., 1 ♀, April 16, 1952, J. R. Vockeroth; Orlando, 1 ♀, April 4, 1955, taken on sand, K. V. Krombein; Osceola Co., 2 ♂♂, March 27, 1952, F. E. Lutz; Sarasota, 1 ♂, April 2, 1938, F. E. Lutz; Sebring, 1 ♂, March 25, 1938, F. E. Lutz. GEORGIA: Chauncey, 3 ♀♀ and 1 ♂, April 28, 1949, P. W. Fattig. MAINE: Waldoboro. MARYLAND: Mason Spring, 1 ♂, July 12, 1931, on *Pontederia cordata*, P. H. Timberlake. MASSACHUSETTS: Concord, J. Bequaert. NEW JERSEY: Atsion, 1 ♂, 4 ♀♀, July 9, 1955, on *Pontederia* sp., A. F. Shinn; Vineland, 1 ♂, Mourice River. NORTH CAROLINA: Wilmington, 8 ♀♀ and 1 ♂, May 20, 1934, on *Pontederia* sp., T. B. Mitchell. An additional female labeled "7-14-92" and "Ag. Coll. Mich." has been identified as of this species.

Melissodes (Apomelissodes) mitchelli, sp. nov.

This species is named in honor of T. B. Mitchell who collected five of the ten known specimens and who has contributed a great deal to the knowledge of the species of *Melissodes* by means of the specimens collected by him in the eastern states. *M. mitchelli* is closely related to *M. apicata* from which it can be distinguished by the characters appearing above in the keys. It is so much like *apicata* in appearance that a detailed description would largely be a repetition of the description of that species. The description which follows, therefore, is largely an innumeration of the characters in which *mitchelli* and *apicata* differ.

Female: Measurements and ratios: N, 6; length, 11.0-12.0 mm.; width, 4.0-4.5 mm.; wing length, $M = 21.15 \pm 0.161$ mm.; hooks in hamulus, $M = 13.83 \pm 0.374$; flagellar segment 1/segment 2, (N, 5) $M = 1.78 \pm 0.048$.

Structure and color: Integumental color as in *apicata*. Structure as in *apicata* with the following differences: clypeus with postero-median area flattened or slightly depressed, with punctures small, round, and sparse medially almost to apical margin, ground shiny, unshagreened, punctures round, regular in size and shape laterally; galeae shiny, with sparse punctures bearing short straight hairs laterally; maxillary palpal segments four, in ratio of about 2.5:4:3:1; propodeum with dorsal face with broader impunctate zone medially; metasomal tergum 1 with basal $\frac{2}{3}$ or less of dorsal surface punctate; terga 1-3 with ground areas dulled by fine, dense, transverse shagreening, duller than in *apicata*; pygidial plate $\frac{3}{4}$ as broad at extreme base than median length, distinctly broader than in *apicata*.

Hair: Color of hairs as in *apicata* with the following differences: vertex with black hairs less abundant; lobes of pronotum without dark hairs; dark mesoscutellar patch not almost reaching pronotum but extending forward to a transverse line at or beyond anterior margins of tegulae; tegulae and humeral angles of wings with pale hairs; metasomal tergum 2 with apical band separated from apex of tergum in median third or less and often narrowly interrupted medially; scopal hairs with one to three branches on either side of each rachis, never brown on tibiae except immediately below basitibial plates.

Male: Measurements and ratios: N, 4; length, 10.0-12.0 mm.; width, 3.5-4.0 mm.; wing length, $M = 20.90 \pm 0.643$ mm.; hooks in

hamulus, $M = 12.25 \pm 0.479$; flagellar segment 2/segment 1, $M = 5.30 \pm 0.174$.

Structure and color: Integumental color as in *apicata* with the following differences: clypeus entirely yellow except black notches posteriorly at tentorial pits; labrum with small median yellow spot (holotype) or entirely black; mandible with (holotype) or without small basal pale spot. Structure as in *apicata* except as follows: clypeus with coarse round punctures separated from each other by half to one puncture width laterally and with a narrow longitudinal impunctate median area, ground areas shiny, unshagreened; minimum length of first flagellar segment equals $\frac{1}{2}$ to $\frac{1}{3}$ of maximum length of second segment; maxillary palpi as in female; galeae as in female; metasomal terga with ground areas dulled by fine dense transverse shagreening; pygidial plate broader than in *apicata* and less deeply notched laterally.

Genital capsule essentially as in *M. fimbriata* and *M. apicata*; penis valve with lateral process short and blunt as in *fimbriata*. Sternum 7 as in *apicata* but with median plates more distinctly necked, with more abundant hairs ventrally on median plates, with membranous area between plates much smaller and with apodemes longer and narrower (Fig. 7). Sternum 8 as in *apicata* but with apical margin truncate or slightly concave.

Hair: As in *apicata* except as follows: tegulae and humeral angles of wings with pale hairs; posterior lobes of pronotum without dark hairs; metasomal tergum 2 with apical white band narrowly interrupted medially; terga 2 and 3 with apical bands not reaching apical margins of terga in median thirds or less; inner surfaces of basitarsi and tibiae with yellow hairs.

Type material: Holotype male and allotype female from Levy County, Florida, April 13, 1955, on *Opuntia* sp., T. B. Mitchell, is in the collection of the North Carolina State College, Raleigh, North Carolina. Four female and three male paratypes are as follows: FLORIDA: Alachua Co., 1 ♀, April 27, 1955, on *Opuntia* sp., R. A. Morse; Lake Co., 1 ♂, April 20, 1922, T. P. Winter; Gainesville, 1 ♀, May 1, 1955, on *Opuntia* sp., R. A. Morse; Orange City, 1 ♀, April 22, 1928, C. O. Bare. GEORGIA: Wadley, 1 ♂, April 23, 1938, C. H. Curran. NORTH CAROLINA: Southern Pines, 2 ♀ ♀, May 20, 1953, on *Opuntia* sp., T. B. Mitchell; Wayne Co., 1 ♂, April 7, 1954, T. B. Mitchell. The paratypes will be deposited in the collections of the North Carolina State College, Raleigh, the Snow Entomological Museum, Lawrence, Kansas, the American Museum of Natural His-

tory, New York City, the University of Michigan, Ann Arbor, the State Plant Board of Florida, Gainesville, and in the author's collection.

Subgenus *Psilomelissodes* LaBerge

Psilomelissodes LaBerge, 1956, Univ. Kansas Sci. Bull., vol. 37, p. 1173.

Type species. *Melissodes intorta* Cresson, 1872, monotypical and by original designation.

This subgenus was erected to include a single species which is distinctive because of its sparse pubescence, the weak scopal hairs in the female, the short male antennae and the black male clypeus. A complete subgeneric description is given by LaBerge (1956).

Melissodes (Psilomelissodes) intorta Cresson

Melissodes intorta Cresson, 1872, Trans. Amer. Ent. Soc., vol. 4, p. 278; Birkmann, 1899, Ent. News, vol. 10, p. 245; Cockerell, 1902, Entomologist, vol. 35, p. 177; 1906, Trans. Amer. Ent. Soc., vol. 32, p. 75; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 121.

Melissodes wickhami Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, p. 112 (new synonymy).

Female: Measurements and ratios: N, 7; length, 11.0-12.0 mm.; width, 4.0-4.5 mm.; wing length, $M = 24.10 \pm 0.389$; hooks in hamulus, $M = 13.43 \pm 0.298$; flagellar segment 1/segment 2, $M = 2.14 \pm 0.082$.

Structure and color: Integument black except as follows: mandible with apical half red or covered by a large median golden-yellow macula (in unworn condition); flagellar segments 2-10 dark reddish brown to brown below; eyes gray; tarsi and often remainder of legs brown; tegulae piceous, but often clear posteromedially; wing membranes infumate, brownish, veins brown to black; terga 1-4 with narrow colorless apical margins.

Clypeus with round, regular, small punctures separated mostly by less than one puncture width, with a short median carina near apex, ground areas shiny, unshagreened; supraclypeal area with deep round punctures, ground shiny; galeae sparsely punctate above, ground shiny, unshagreened; maxillary palpi 4-segmented, in ratio of about 6:5:3:1; flattened areas of vertex extending mesad from apices of compound eyes with small round punctures separated by one puncture width or less, ground shiny, unshagreened. Mesoscutum with deep round punctures relatively evenly spaced but slightly sparser posteromedially than anteriorly and laterally and becoming distinctly larger and more crowded in posterior declivity, ground areas somewhat dulled by exceedingly fine tessellation posteromedially, shiny elsewhere; scutellum with abundant

crowded punctures similar to posterior declivity of mesoscutum, ground shiny; mesepisterna with large, round, deep punctures separated by half a puncture width or less, many confluent with neighbors, ground shiny; metanotum somewhat elevated medially, punctate in median third, impunctate or indistinctly punctate in lateral thirds, lateral areas dulled by fine tessellation; propodeum with dorsal surface irregularly rugose laterally, surface dulled by tessellation, with posterior surface sparsely punctate laterally, punctures becoming more abundant at extreme lateral margins, ground areas dulled by coarse tessellation, with lateral surfaces coarsely and densely punctate and tessellate. Metasomal tergum 1 with sparse, shallow, indistinct punctures scattered over basal $\frac{3}{4}$ of dorsal surface, punctures separated by one puncture width at extreme base and extreme sides and by two puncture widths or more elsewhere, ground areas opaque, dulled by dense, coarse, reticulate shagreening; tergum 2 with interband zone irregularly and sparsely punctate, punctures of irregular size and separated by one to several puncture widths from nearest neighbors in any direction, with dense coarse punctures beneath distal pubescent band, apical area impunctate, ground areas opaque, dulled as in tergum 1; terga 3 and 4 similar to tergum 2 but interband zones with more abundant punctures; sterna coarsely punctate, ground areas dulled by fine tessellation.

Hair: On head white except abundant brown hairs on vertex between apices of compound eyes and ochraceous hairs on labrum and mandibles. Thorax with white hairs except large brown posteromedian mesoscutellar patch which extends forwards beyond a transverse line at anterior margins of tegulae and scutellar hairs brown except marginal white hairs. Metasomal tergum 1 with sparse white hairs basally and laterally on dorsal surface; tergum 2 with sparse basal band of white pubescence, narrow distal band of white pubescence which becomes thinner and is interrupted medially, basal and distal bands connected at extreme sides by white pubescence, apical and interband areas with sparse, white, short pubescence; tergum 3 similar to tergum 2 but with apical and interband areas with more abundant pale pubescence and with short, erect or suberect, spinelike, pale brown hairs present in interband zone; tergum 4 similar to tergum 3 but pale pubescence and spinelike hairs of interband zone more abundant and the latter longer and with distal pale band reaching apex of tergum although often with a bare median patch at apex; terga 5 and 6 with long, dark brown, appressed hairs. Sternal hairs dark brown.

Legs with hairs as follows: coxae, trochanters and femora white except brown at tips of femora; fore and middle tibiae with outer surfaces white basally and pale brown apically; outer surfaces of middle basitarsi pale brown; inner surfaces of fore tibiae and middle basitarsi, fore tarsi, middle and hind distitarsi brown; inner surfaces of hind basitarsi and tibiae reddish yellow to brownish red; scopal hairs ochraceous medially, brown surrounding and below basitibial plates and pale brown on apical halves of basitarsi. Scopal hairs weak, sparse, mostly with two or three long weak usually curved branches on either side of rachises and often with fewer branches, surface of tibiae is clearly visible through the weak hairs.

Male: Measurements and ratios: N, 20; length, 11.0-13.0 mm.; width, 3.0-4.0 mm.; wing length, $M = 24.18 \pm 0.339$ mm.; hooks in hamulus, $M = 12.65 \pm 0.335$; flagellar segment 2/segment 1, $M = 1.12 \pm 0.001$.

Structure and color: Color as in female except as follows: flagellar segments 2-11 yellow to red below; tergum 1 more broadly hyaline apically; tergum 5 hyaline apically; hyaline marginal zones of terga 1-5 usually yellow or translucent brown rather than colorless. Structure and sculpturing as in female with the following additions: minimum length of first flagellar segment equals maximum length of second segment or slightly less, usually about $\frac{1}{2}$ of second segment (Fig. 13); tergum 1 with basal $\frac{3}{4}$ or more punctate, punctures somewhat more abundant than in female, especially laterally and basally; interband zones of terga 2 and 3 more densely punctate; terga 4 and 5 similar to tergum 3; sternum 6 with prominent short oblique carinae near apex, broadly convex medially, truncate, with sparse punctures posterior to apical carinae, ground shiny, with sparse transverse shagreening.

Terminalia described and figured by LaBerge (1956, Figs. 122-125).

Hair: As in female with the following differences: vertex of head often without brown hairs; tergum 1 with long white hairs more abundant; tergum 2 with distal pale band often complete; interband zones of terga 2-4 with more abundant pale pubescence and more abundant spinelike hairs; terga 4 and 5 with distal pale bands as in tergum 3 but with sparse brown tomentum at extreme bases; terga 6 and 7 with dark brown hairs; sternal hairs pale at least lateroapically; legs with white hairs except red to yellow on inner surfaces of tarsi.

Bionomics: It is probable that this is an oligolectic bee dependent upon malvaceous plants of the genus *Callirhoe* for its pollen. However, only eight females are known and among these only two bear flower labels. These two specimens were collected by R. H. Beamer visiting flowers of *Gaillardia*. One of these has *Callirhoe* pollen in its scopae, whereas the other bears pollen from some other plant (it is not certain whether this is *Gaillardia* pollen or not). The males have been collected visiting *Callirhoe* flowers in several localities in Texas and Kansas.

Type material: The lectotype male of *intorta* is in the Academy of Natural Sciences, Philadelphia, Pennsylvania. The holotype female of *wickhami* is in the University of Colorado Natural History Museum, Boulder, Colorado.

Distribution: This species ranges from eastern Texas north to eastern Kansas. It has been collected from April 14 to June 27. In addition to the type material, 22 males and 7 females have been examined from the localities listed below.

KANSAS: Baxter Springs (5 miles E. and 5 miles S.); Brookville; Gove Co.; Manhattan; Riley Co.; Scott City (12 miles N.). TEXAS: Childress; Fedor, Lee Co.; Gillespie Co.; Giddings; Goliad (16 miles E.); Lee Co.; Stonewall; Sweet Home; Weser, Goliad Co.

Remarks: A single specimen labeled "Camd. Co., N. J., Collection W. J. Fox" is evidently mislabeled. I have found several specimens of other species of *Melissodes* of the W. J. Fox collection, ostensibly from Camden Co., New Jersey, which belong to western species and are obviously mislabeled.

Flower records: *Asclepias latifolia*, *Callirhoe* sp., *C. digitata*, *C. leiocarpa*, *Gaillardia* sp., *Rorippa sinuata*.

Subgenus *Heliomelissodes* LaBerge

Heliomelissodes LaBerge, 1956, Univ. Kansas Sci. Bull., vol. 37, p. 1172.

Type species. *Melissodes desponsa* Smith, 1854, by original designation.

This subgenus consists of two species widely distributed in North America. The subgenus can be distinguished by the protruding clypei and long galeae in both sexes and by the male antennae being of moderate length. A detailed description is given by LaBerge (1956). The subgenus is restricted to plants of the genus *Cirsium* (Compositae) or related genera for pollen sources.

KEY TO THE SPECIES OF THE SUBGENUS HELIOMELISSODES

Males

1. Metasoma with black pubescence and hairs on terga 2 to 7; mesoscutum with few or no black hairs posteromedially; legs with black hairs on outer surfaces of tibiae and tarsi *desponsa*
 Metasoma usually with some pale ochraceous to white pubescent bands or fasciae medially at least on tergum 2, often on terga 3 and 4 and occasionally on tergum 5 as well; legs usually with pale hairs on outer surfaces of tibia and often pale on tarsi as well *rivalis*

Females

1. Metasoma without pale pubescent bands or fasciae on terga 2 to 4; mesoscutum without posteromedian patch of dark hairs or this patch smaller than dark scutellar patch; mesoscutum with punctures posteromedially mostly separated by one puncture width or less *desponsa*
 Metasoma usually with pale pubescent bands or fasciae at least on tergum 2 and often on terga 3 and 4 as well, if without pale pubescence, then mesoscutum with posteromedian patch of dark hairs larger than dark scutellar patch; mesoscutum usually with a posteromedian area of sparse punctures separated mostly by two puncture widths or more *rivalis*

Melissodes (Heliomelissodes) desponsa Smith

Melissodes desponsa Smith, 1854, Cat. Hymen. British Museum, Part II. Apidae, p. 310; Cresson, 1879, Trans. Amer. Ent. Soc., vol. 7, p. 225; Provancher, 1882, Le Naturaliste Canadien, vol. 13, p. 174; Robertson, 1894, Trans. Acad. Sci. St. Louis, vol. 6, pp. 455, 459, 470, 473, 475; 1897, Trans. Acad. Sci. St. Louis, vol. 7, p. 354; 1901, Canad. Ent., vol. 33, p. 230; Viereck, et al., 1905, Canad. Ent., vol. 37, p. 320; Lovell and Cockerell, 1906, Psyche, vol. 13, p. 109; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 76, 83; Smith, 1910, Ann. Rept. New Jersey State Museum, 1909, p. 693; Viereck, 1916, Bull. Connecticut State Geol. and N. H. Surv., vol. 22, p. 732; Criddle, Curran, Viereck and Buckell, 1924, Rept. Ent. Soc. Ontario, vol. 33, p. 99; Leonard, 1926, Cornell Univ. Agric. Exp. Sta. Mem., No. 101, p. 1028; Graenicher, 1935, Ann. Ent. Soc. Amer., vol. 28, p. 304.

Melissodes daponsa (sic) Bridwell, 1899, Trans. Kansas Acad. Sci., vol. 16, p. 211.

Melissodes nigripes Smith, 1854, Cat. Hymen. British Museum, Part II. Apidae, p. 311 (♂, nec ♀); Cresson, 1879, Trans. Amer. Ent. Soc., vol. 7, p. 225; Provancher, 1888, Addit. Faun. Can., Hymen., vol. 2, p. 300; Smith, 1896, Rept. Ent. Dept. New Jersey Agric. Coll. Exp. Stat., fig. 21; Robertson, 1900, Trans. Acad. Sci. St. Louis, vol. 10, p. 53; 1901, Canad. Ent., vol. 33, p. 230; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, p. 102; Smith, 1910, Ann. Rept. New Jersey State Museum, 1909, p. 693.

Melissodes cnici Robertson, 1901, Canad. Ent., vol. 33, p. 230; Cresson, 1879, Trans. Amer. Ent. Soc., vol. 7, p. 225; Robertson, 1905, Trans. Amer. Ent. Soc., vol. 31, p. 369; Cockerell, 1905, Canad. Ent., vol. 37, p. 312; 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 77, 83, 89; Graenicher, 1911, Bull. Publ. Mus. Milwaukee, vol. 1, p. 247; Gileson, 1914, Forty-fourth Ann. Rept. Ent. Soc. Ontario, 1913, p. 125; Robertson, 1914, Ent. News, vol. 25, p. 69; 1926, Ecology, vol. 7, p. 379; 1928, Flowers and Insects, p. 8; Pearson, 1933, Ecol. Monogr., vol. 3, p. 381.

The status of the various names which have been applied to this bee has been confusing. Cresson in 1879 first synonymized *M.*

nigripes Smith with *M. desponsa* Smith. He was followed in this by Dalla Torre (1895). Robertson in 1901 named this species *M. cnici*. Lutz and Cockerell (1920) recognized that *M. cnici* Robertson was a new name for the male (but not the female) of *M. nigripes* Smith and stated that *M. cnici* might include the female of *desponsa*.

Dr. I. H. H. Yarrow of the British Museum (Natural History) has kindly examined specimens of *M. cnici* sent to him and assures me in a letter dated August 4, 1954, that the female type of *M. desponsa* Smith and the male cotype of *M. nigripes* Smith are both conspecific with the specimens of *M. cnici*. I, therefore, concur with the opinion expressed by Lutz and Cockerell (1920) that the names *nigripes* and *cnici* should be regarded as synonyms of *desponsa*. The female cotype of *M. nigripes* Smith is, unfortunately, a *Tetralonia*, according to Dr. Yarrow. In addition to this male and female of *nigripes* in the British Museum, Dr. Yarrow has brought to light two males labeled *nigripes* Sm. by Smith himself. One of these is from Mt. Pleasant (R. Forster) and is undoubtedly *cnici* Robertson, but the second which is from the United States has a very swollen clypeus and is probably an *Emphor*. Dr. Yarrow (in a letter dated November 23, 1955) agrees that the male of *nigripes* which was in the British Museum before Dr. Yarrow found the additional two males should be designated as the lectotype. This, in effect, retains the name *nigripes* Smith in the genus *Melissodes* as a synonym of *M. desponsa* Smith.

This species is distinctive because of the black metasoma and the pale upper surface of the mesosoma. It converges in this coloration with a race of the closely related *M. rivalis* Cresson occurring in the Pacific Northwest. However, it can be distinguished from these darker specimens of *rivalis* by the lack of a patch of dark hairs posteromedially on the mesoscutum, or this patch is small and no larger than that on the scutellum. Minor differences in punctuation and structure also separate the two species and these are described below.

Female: Measurements and ratios: N, 20; length, 11.5-16.0 mm.; width, 4.0-5.5 mm.; wing length, $M = 25.21 \pm 0.157$ mm.; hooks in hamulus, $M = 14.00 \pm 0.229$; flagellar segment 1/segment 2, $M = 2.03 \pm 0.020$.

Structure and color: Integument black except as follows: flagellar segments 2-10 dark reddish brown below; apical half of mandible red with broad golden macula apically; apical margin of clypeus often reddish; eyes grayish blue to green; distitarsi dark

red; wing membranes infumate, brownish; tegulae piceous; tibial spurs piceous.

Clypeus with small crowded punctures separated by less than one puncture width, without a distinct median carina, ground areas dulled by coarse transverse shagreening, moderately shiny; supraclypeal area with coarse round punctures, ground areas dulled by coarse, reticular shagreening; vertex with flattened area extending posteromesad of apex of compound eye with small, deep, round punctures separated by less than half to two puncture widths, ground areas shiny to moderately so, with fine shagreening; maxillary palpal segments in ratio of about 3.5:2.5:2.5:1, the last segment often much shorter; galea shiny above with small sparse scattered punctures bearing short straight hairs, shagreened near tip and laterally. Mesonotum coarsely punctate, punctures separated by less than half a puncture width anteriorly and peripherally, by slightly more posteromedially just before posterior declivity, slightly larger posteromedially than anteriorly, ground areas slightly dulled by fine reticular shagreening; scutellum coarsely punctate, similar to mesoscutal sculpturing but shagreening finer or absent; metanotum with scattered punctures, ground dulled by tessellation; propodeum with dorsal surface reticulorugose basally, coarsely punctate apically, with posterior surface coarsely punctate except on upper impunctate median triangle, with lateral surfaces coarsely punctate, with ground areas opaque, dulled by coarse, dense tessellation; mesepisterna with lateral surface with large shallow punctures separated by less than half a puncture width, some confluent medially, becoming smaller and more distinct dorsally and posteriorly, ground areas somewhat dulled by irregular shagreening. Metasomal tergum 1 with a line of close-set punctures just beyond middle, these separated by a slight gap in median $\frac{1}{2}$ of tergum from basal area with abundant small round shallow punctures, ground areas dulled; tergum 2 with minute, round deep punctures at extreme base, with interband zone relatively impunctate medially and with small crowded punctures laterally, apical zone with minute, sparse punctures laterobasally, ground areas dulled; terga 3 and 4 similar to tergum 2 but with punctures smaller and more abundant in interband and apical zones.

Hair: Generally shorter and more abundant on mesosoma, shorter on prosoma and less abundant on metasoma than in *M. mysops*. Head with black to dark brown hairs on clypeus, genal areas, mandibles and often an occiput behind vertex, with hairs

of face and vertex all pale ochraceous or ochraceous and brown mixed. Metasoma with pale ochraceous hairs except as follows: mesoscutum with posteromedian patch of dark brown to black hairs often present but never extending forward to a transverse line at middle of tegulae and scarcely, if at all, any larger than that on scutellum; scutellum with dark brown to black hairs medially; lateral surfaces of mesepisterna with dark hairs on lower half or more; metepisterna and lateral surfaces of propodeum with dark brown to black hairs. Mesosoma with dark brown to black hairs except as follows: white to pale ochraceous on basal $\frac{3}{4}$ of dorsal surface of tergum 1 (often mixed with dark hairs), tergum 2 with basal band often consisting of at least partially pale pubescence. Legs with dark brown to black hairs except scopal hairs which are yellow to ochraceous and hairs of inner surfaces of hind tibiae which are red to yellow.

Male. Measurements and ratios: N, 20; length, 9.0-14.0 mm.; width, 2.5-4.5 mm.; wing length, $M = 23.79 \pm 0.280$ mm.; hooks in hamulus, $M = 13.00 \pm 0.218$; flagellar segment 2/segment 1, $M = 2.93 \pm 0.059$.

Structure and color: Integument black except as follows: clypeus pale yellow except reddish brown apical margin and black notches marking tentorial pits, in specimens from eastern parts of the range often infuscated in posterior angles from tentorial pits to posterior margin in middle of clypeus; flagellar segments 2-11 yellow to red below; eyes green to gray; distitarsi, sterna and often apices of terga dark reddish brown; wing membranes somewhat infumate, brownish; tegulae and tibial spurs piceous.

Minimum length of first flagellar segment at least as long as one third of maximum length of second segment and usually longer. Maxillary galeae, palpa and sculpturing of head and body as in female with the following differences: clypeal punctures smaller and denser; lateral areas of vertex often with ground dulled by shagreening; first metasomal tergum punctate in basal $\frac{3}{4}$ of dorsal surface medially and to the apex in lateral thirds, punctures small and shallow; tergum 2 with interband zone with punctures small, indistinct but scarcely any sparser than interband zone of terga 3 and 4; last exposed sternum with truncate apical margin, with strong lateral oblique carinae near apex, with short median depression in apical half between and posterior to apices of oblique carinae, shiny and unshagreened but with small deep punctures basally.

Terminalia as described and figured by LaBerge (1956, Figs. 114-117). Spatha of genital capsule feebly emarginate medially on apical margin. Sternum 7 with few short hairs apically, narrower in middle than at anterior third. Sternum 8 with apodemes truncate and slightly capitate.

Hair: Color generally as in the female but usually with more abundant pale hairs on head and sides of thorax and hairs of hind legs all dark brown to black except on inner surfaces of hind tarsi.

Bionomics: Nothing has been reported concerning the nesting sites or nest architecture of *M. desponsa*. This bee is oligolectic and prefers flowers of the genus *Cirsium* as pollen sources, although it has been collected occasionally on other genera of Composites and also on flowers of other families. A total of 263 of the specimens studied by the author bear flower labels. The data from these specimens are summarized in Table 1. Additional flower records available in the literature are not included in this table, since no quantitative data were available. The table clearly demonstrates the preference of *desponsa* for flowers of the genus *Cirsium*.

TABLE 1

Family	Plant data		<i>M. desponsa</i> data			
	Number of genera	Number of spp.	Number of colls.	Number of ♀ ♀	Number of ♂ ♂	Total number of bees
Compositae, other than <i>Cirsium</i>	7	9	11	6	8	14
Compositae, <i>Cirsium</i> spp.....	1	8	64	126	118	244
Labiatae.....	1	1	1	1	0	1
Leguminosae.....	1	1	1	0	1	1
Verbenaceae.....	1	2	2	0	3	3
Totals.....	11	21	79	133	130	263

Type material: Female holotype of *desponsa* from Ohio is in the British Museum (Natural History) (17B855). Male lectotype of *nigripes*, here designated, from the United States is in the British Museum (Natural History) (17B836). Lectotype male and lectoallotype female of *cnici*, here designated, from Carlinville, Illinois,

August 18, 1897, on *Cnicus lanceolatus*, Charles Robertson collector, are in the collection of the Illinois Natural History Survey, Urbana, Illinois.

Distribution: This species ranges from Nova Scotia in the northeast, to North Carolina in the southeast, to Alabama in the south and to Oklahoma and eastern North Dakota in the west. One specimen labeled Laramie, Wyoming, was seen by the author. This label is of doubtful validity. It has been collected from June 26 to October 16, but mainly in August. In addition to the type material, 474 females and 344 males have been examined from the localities listed below. This list includes localities reported in the literature.

ALABAMA: Kushla. CONNECTICUT: Canaan City; Chappinville; Colebrook; Greenwich. ILLINOIS: Attwood; Bath; Beverly Hills; Bluffs; Carlinville; Champagne; Charleston; Chicago; Downers Grove; Kankakee; Matteson; McHenry; Olive Branch; Pittsfield; Urbana; Willow Springs. INDIANA: Allen Co.; Lafayette; Warren Co.; White Co. IOWA: Ames; Dickinson Co.; Iowa City; Lake Okoboji; Ledges State Park; Mt. Pleasant; Nevada; Sioux City. KANSAS: Baldwin; Delavan, Morris Co.; De Soto, Johnson Co.; Douglas Co.; Iola; Kansas City; Lawrence; Manhattan; McPherson Co.; Norton, Riley Co.; Olathe; Riley Co.; St. George; Sunflower; Topeka; Wildcat. MAINE: Waldoboro; Winthrop. MARYLAND: Bethesda; Cabin John; Glen Echo; Millington. MASSACHUSETTS: Holden; Lexington; Lowell, Montossy; Needham; Wollaston; Woods Hole. MICHIGAN: Alger Co.; Ann Arbor; Cheboygan; East Lansing; Grand Rapids; Ingham Co.; Midland; Millington; Otsego Co.; Pontiac; Tuscola Co. MINNESOTA: Alex; Dakota Co.; Eitzen; Erskine; Excelsior; Faribault Co.; Frazer; Freeborn Co.; Grand Meadow; Hastings; Hayward; Hennepin Co.; Jordan; Lake Park; Olmsted Co.; Ramsay Co.; Rochester; Rock Co.; Spring Valley; Stanton; St. Anthony Park; St. Cloud; St. Paul; Warren; Washington Co.; Zumbra Heights, Carver Co. MISSOURI: Columbia; Hannibal; Sedalia; Smithton; St. Louis. NEBRASKA: Fullerton; Gordon, Sheridan Co.; Lincoln; Long Pine; Malcolm; Nebraska City; Neligh; Omaha; Roca; West Point. NEW HAMPSHIRE: Alstead; Durham; Pelham. NEW JERSEY: Arlington; Englewood; Kearny; New Brunswick; Princeton. NEW YORK: Brooklyn; Calicoon; Fishers Island; Flatbush; Fort Wadsworth; Huguenot; Ithaca; Long Island; New Baltimore; Staten Island; Stockport; Van Cortland Park, New York City; Westville. NORTH CAROLINA: Black Mts. (valley of); Bryson

City; Doughton Park. NORTH DAKOTA: Fargo; Henkinson; Oakes. OHIO: Columbia; Ironton; Logan Co. OKLAHOMA: Umatilla. PENNSYLVANIA: Carlisle; Philadelphia; Pike Co. RHODE ISLAND: Scituate. SOUTH DAKOTA: Brookings; Vermillion; Yankton. VERMONT: Chittenden (Rutland); Hartland; Woodstock. VIRGINIA: Alexander Island; Falls Church; Vienna (2 and 3 miles W.). WEST VIRGINIA: Canaan Valley. WISCONSIN: Farmington; Hudson; Madison; Maiden Rock, Pierce Co.; Milwaukee; Nevers Dam, Polk Co.; Prescott; Randall, Burnett Co.; Shullsburg, Lafayette Co.; Washington Co.; Worden Township, Clark Co. WYOMING: Laramie (questionable). NEW BRUNSWICK: Grand Manan Island. NOVA SCOTIA: Weymouth. ONTARIO: Carp (5 miles W.); Marmora; Ottawa; Toronto; West Hill. QUEBEC: Cap Rouge; Fort Coulogne; Lowe; Montreal; Quebec City; Ste. Annes; St. Fargeau.

Flower records: *Aster novaeangliae*, *Brauneria purpurea*, *Carduus crispus*, *Cassia* sp., *Centaurea* sp., *C. jacea*, *Cirsium* sp., *C. altissimum*, *C. arvense*, *C. discolor*, *C. hillei*, *C. odoratus*, *C. pumilum*, *C. undulatum*, *C. vulgare*, *Coreopsis aristosa*, *Helianthus annuus*, *H. grosseserratus*, *Inula helenium*, *Monarda fistulosa*, *Pontederia cordata*, *Pycnanthemum* sp., *Rudbeckia laciniata*, *Silphium perfoliatum*, *Solidago* sp., *S. canadensis*, *S. puberula*, *Verbena* sp., *V. stricta*.

Melissodes (Heliomelissodes) rivalis Cresson

- Melissodes rivalis* Cresson, 1872, Trans. Amer. Ent. Soc., vol. 4, p. 277; Cockerell, 1906, Trans. Amer. Ent. Soc., vol. 32, p. 76; Cresson, 1916, Mem. Amer. Ent. Soc., vol. 1, p. 129.
- Melissodes desponsiformis* Cockerell, 1905, in Viereck *et al.*, Canadian Ent., vol. 37, p. 320 (new synonymy); 1906, Trans. Amer. Ent. Soc., vol. 32, p. 89.
- Melissodes mysops* Cockerell, 1905, Entomologist, vol. 38, p. 146 (new synonymy); 1905, Canadian Ent., vol. 37, p. 321; 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 88, 89, 113; 1907, Entomologist, vol. 40, p. 269; 1910, Ann. Mag. Nat. Hist., ser. 8, vol. 6, p. 128; 1910, Univ. Colorado Studies, vol. 7, p. 128; Criddle, Curran, Viereck and Buckell, 1924, Fifty-fourth Ann. Rept. Ent. Soc. Ontario, p. 99; Scullen, 1928, Pan-Pac. Ent., vol. 4, p. 176; Bohart, Knowlton and Bailey, 1950, Utah State Agric. Coll., mimeo. series no. 371, p. 5.
- Melissodes hexacantha* Cockerell, 1905, Psyche, vol. 12, p. 100 (new synonymy); 1906, Trans. Amer. Ent. Soc., vol. 32, p. 75; Snow, 1906, Kansas Acad. Sci., vol. 20, p. 137; Bohart, Knowlton and Bailey, 1950, Utah State Agric. Coll., mimeo. series no. 371, p. 5.
- Melissodes nigrosignata* Cockerell, 1905, Psyche, vol. 12, p. 101 (new synonymy); 1906, Trans. Amer. Ent. Soc., vol. 32, pp. 88, 109, 309; Snow, 1906, Trans. Kansas Acad. Sci., vol. 20, p. 137.
- Melissodes habilis* Cockerell, 1925, Ann. Mag. Nat. Hist., series 9, vol. 16, p. 229 (new synonymy); 1928, Univ. Colorado Studies, vol. 16, p. 114; 1937, Amer. Mus. Nov., no. 899, p. 5.

This is a highly variable species. No subspecies will be recognized

in this paper for reasons expounded below. The males of *rivalis* are distinguished by the pale pubescent bands on terga 2 and 3 and often on 4 and 5 as well, and by the posterior edge of the clypeus usually being darkened. The females of *rivalis* can usually be recognized by having pale pubescent bands on terga 3, 2 or 4, in that order, or at least having lateral fasciae of white pubescence on one of these terga, or, if without pale pubescence on any metasomal tergum, by having a large patch of black hairs on the mesoscutum which exceeds the size of the dark scutellar patch.

Female: Measurements and ratios: N, 20; length, 12.0-17.0 mm.; width, 4.5-6.0 mm.; wing length, $M = 25.14 \pm 0.339$ mm.; hooks in hamulus, $M = 15.25 \pm 0.376$; flagellar segment 1/segment 2, $M = 2.03 \pm 0.036$.

Structure and color: As in *M. desponsa* with the following differences: eyes usually grayish blue; wings infumate brown; apical margin of clypeus black; clypeus with irregular crowded punctures, with a distinct median longitudinal carina in apical half or less; mesoscutum usually with posteromedian area with sparse punctures separated mostly by two puncture widths or more.

Hair: Darkest specimens as in dark specimens of *M. desponsa* with the following differences: mesonotum with large patch of dark brown to black hairs which extends forward to or beyond a transverse line at anterior margins of tegulae; mesepisterna with dark brown hairs at least on lower two thirds; posterior pronotal lobes and tegulae with dark hairs; metasomal tergum 1 with long dark brown hairs basally; inner surfaces of hind basitarsi and tibiae with dark red to black hairs. Palest specimens with head hairs white or grayish white except some brown hairs on vertex, with mesepisternal and pronotal hairs white or pale ochraceous, with dark mesonotal patch extending forward to a transverse line at least at middle of tegulae; metasomal tergum 1 with long pale hairs basally, tergum 2 with basal band of white pubescence and distal band of pale ochraceous pubescence (the latter narrowed and often interrupted medially, separated from apical margin of tergum), tergum 3 with distal pale pubescent band, tergum 4 with apical pale pubescent band, tergum 5 with small lateral tufts of white hairs; sterna 2 to 4 with pale hairs apicolaterally, red to brown hairs medially; inner surfaces of hind basitarsi and tibiae and fore and middle basitarsi with hairs red to reddish brown. All intergrades occur between these two extremes of vestiture coloration. The tergal pale hairs appear in the following order: (1) base of tergum 1 and basally on

tergum 2, (2) lateral fasciae on tergum 2, (3) lateral fasciae on tergum 3, (4) lateral fasciae on tergum 4, (5) lateral tufts on tergum 5. The lateral fasciae become progressively wider in paler specimens forming complete pubescent bands in the same order of appearance.

Male: Measurements and ratios: N, 20; length, 11.0-16.5 mm.; width, 4.0-5.0 mm.; wing length, $M = 23.94 \pm 0.088$ mm.; hooks in hamulus, $M = 13.85 \pm 0.318$; flagellar segment 2/segment 1, $M = 2.88 \pm 0.062$.

Structure and color: As in *M. desponsa* with the following differences: rarely with basal mandibular yellow spot and with small median labial pale spot (in less than 2 per cent of specimens); clypeus with posterior margin darkened at least in lateral angles mesad of tentorial pits, often with posterior third to half black and rarely more, never entirely black, usually posterior margin of yellow clypeal area produced posteriorly in median third; sculpturing as in female.

Terminalia essentially as in *M. desponsa* but with fewer hairs on gonostyli and sternum 7 with slightly smaller membranous areas between median and lateral plates and with broader, less capitate apodemes (Figs. 8-11).

Hair: Darkest specimens as follows: head hairs white to pale ochraceous except brown on vertex; scutellum with abundant dark brown hairs medially, mesoscutum with posteromedian patch of dark brown hairs extending forward to or beyond a transverse line at middle of tegulae, other mesosomal hairs white to ochraceous; metasomal tergum 1 with long pale hairs basally, short dark hairs apically, tergum 2 with complete distal pale pubescent band separated from apical margin of tergum and narrowed medially and with basal pale pubescent band, tergum 3 with distal pale pubescent band interrupted medially by brown hairs, terga 4-7 without pale hairs, legs with pale hairs at least on outer surfaces of middle and hind tibiae, inner surfaces of hind tibiae and fore, middle and hind basitarsi with hairs red to reddish brown. Palest specimens similar but with the following differences: without dark hairs on head, mesoscutum or scutellum, with complete pale pubescent bands on terga 2, 3, 4 and 5 and lateral tufts of long pale hairs on tergum 6, with sternal hairs red medially and pale ochraceous laterally on sterna 2 to 5, brown on sternum 6, legs with white to ochraceous hairs except pale brown on outer surfaces of fore tarsi and tibiae, red on inner surfaces of fore middle and hind basitarsi and hind tibiae. As in the females, all intergrades occur between these two

extremes in vestiture coloration. Progressively, from darkest to palest, pale hairs appear in the following order: (1) lateral fasciae of pale pubescence on tergum 4 and then on tergum 5 as the interrupted band of tergum 3 closes medially, (2) lateral fasciae of pale pubescence on tergum 4 closes in medially to form a complete band and those on tergum 5 close in as the head and thoracic hairs become pale, (3) scutellum is the last area to retain brown hairs.

Bionomics: The nesting of *M. rivalis* has been described by Scullen (1928) (*M. mysops*). Scullen discovered a group of about sixty individual nests scattered for a distance of about twenty feet in a sand bank along the summit of a sea cliff in the Coos Bay region on the Oregon coast. Both males and females were collected on nearby thistles (*Cirsium* sp.). Two nests were opened on July 2, 1926, and were found to contain pollen but no eggs. On July 13 nests were again opened and half-grown larvae and eggs were found. On July 21 seemingly full-grown larvae were present.

Scullen did not describe the nest architecture in his brief note and has kindly forwarded his field notes so that the nests can be more thoroughly described at this time. The following quotation is taken from a copy of field notes made by H. A. Scullen on July 13, 1926.

"Nests opened up show two to four branches leading off from each main gallery. Branches leading in various directions. Leave main gallery every one to two inches. Branches one to two inches long, crooked. A mass of pollen apparently moistened with honey at the bottom with one long egg on top. Pollen looked like thistle pollen. No cover over pollen. Side gallery not apparently closed unless by loose soil. Wall of gallery smooth and shiny as though coated with a secretion but no noticeable layer of special deposit.

"Egg in one cell apparently suspended by a series of web like threads attached to roof of cell. The egg was in contact with the honey-pollen mass but was readily lifted by grasping the mass of webbing. The webbing may have been for preventing the egg sinking in the semiliquid mass of food material. The web might have been threads of mould as three other masses of pollen were found badly moulded."

This account is interesting for at least two reasons. First, this is the third species which has definitely been reported in the literature as having been found nesting in a large group (see *M. obliqua* and *M. tepida* in LaBerge, 1956). However, one of the latter (*M. obliqua*) is also known to nest singly. Perhaps species of

Melissodes nest in groups only where certain areas with a favorable substrate are found to coincide with a large population of bees, concentrated, perhaps, by the nearby occurrence of favorable or preferred host plants.

Secondly, the webbing by which the egg in one cell was suspended from the roof of the cell is of interest. The present writer is inclined to the second opinion expressed by Scullen, that is, that the webbing was probably threads of mould.

The bees of this species are oligolectic. They, just as *M. desponsa*, seemingly are dependent upon composites of the tribe Cynareae and, particularly, upon plants of the genus *Cirsium*. Table 2 summarizes the plant-host data taken from labels of 201 specimens representing at least 74 collections.

TABLE 2

Family	Plant data		<i>M. rivalis</i> data			
	Number of genera	Number of species	Number of colls.	Number of ♀ ♀	Number of ♂ ♂	Total number of bees
Compositae, other than <i>Cirsium</i>	6	6	6	8	3	11
Compositae, <i>Cirsium</i> sp.	1	5	58	71	100	171
Labiatae.....	2	3	5	4	4	8
Other (4).....	4	4	5	1	10	11
Totals.....	13	18	74	84	117	201

Geographical variation: As has been stated above, and as can be deduced from the description given above, *M. rivalis* is highly variable. A number of characters (4 male and 3 female) have been examined with the viewpoint of describing significant geographical variation. However, a statistical method for handling these data has not yet been settled upon. The variation will, therefore, be described below omitting such variation which is not obviously significant.

The vestiture of both females and males varies greatly in color. The darkest specimens occur in the humid coastal area of California and Oregon. The females from this area can be readily recognized

and have been described as a species (*M. desponsiformis* Cockerell). The males, however, are not much darker than specimens from inland California, Oregon, Washington and British Columbia and a majority of the males from the coastal area cannot be distinguished from most of the males from the inland areas. A cline apparently exists from the darkest specimens of the coastal areas to the paler specimens of the more inland areas and no apparent step occurs in this cline. Perhaps with many more specimens taken in series from a number of localities in the critical areas of Oregon and Washington, a stepped cline might be shown to exist.

The palest specimens occur in Kansas, Texas and New Mexico. These specimens seem to be quite distinct from the specimens from the Rocky Mountain regions. However, so few specimens are known from this large prairie area, that definite conclusions are unwarranted. Specimens from northern Arizona show an unusual condition in that the females are as pale as the eastern prairie specimens, whereas the males are as dark as, and undistinguishable from, the northern Rocky Mountain specimens. A large gap exists between the specimens collected in New Mexico, Texas and Kansas and those collected in Arizona, Utah or Colorado. It is impossible to see whether smooth or stepped clines occur between the pale and the darker populations. Specimens from the northern prairie region of North Dakota, Minnesota, Saskatchewan and Manitoba are indistinguishable from the Rocky Mountain specimens. Very few specimens are known from South Dakota and Nebraska and nothing can be determined about the cline in color that probably exists between the southern and the northern prairie populations.

In general, specimens from the region from the middle of Oregon east to Minnesota, north to southern British Columbia and south to Colorado and Utah are intermediate in color between the California and Oregon coastal populations and the populations from the southern prairies. However, each population examined exhibits differences in the average darkness of the vestiture from adjacent populations. The bees from this large region have been called *M. mysops* Cockerell in the past.

The coloration of the male clypeus also varies greatly. To study this character, the median length of the posterior dark area was measured. It was found that specimens with the greatest amount of posterior infuscation of the clypeus occur in northern Arizona and southeastern Utah. The populations with the palest clypei, on the other hand, were collected in New Mexico, Texas, Kansas

and eastern North Dakota. Specimens from western North Dakota and southern Manitoba, eastern Wyoming and northeastern Colorado, central and southern Colorado and northern Utah had the next palest clypei. Other than the Arizona populations, those with the darkest clypei were from Oregon and northern California. Two marked exceptions occurred from this general distribution of the clypeal coloration of males. First, the northern coastal Californian specimens and, second, the southern Idaho specimens exhibited very pale clypei. In general, there appears to be a cline in the amount of infuscation of the posterior part of the clypei of males from the darkest in the northwestern to palest in the southeastern and northeastern parts of the range of *M. rivalis*. Three exceptional areas occurred: an area with dark clypei in Arizona and Utah and the two above mentioned areas with pale clypei in California and Idaho. No steps, other than the above mentioned irregularities were observed in this cline.

The specimens also varied greatly in size. Two measurements were made on both males and females to represent size. The median length of the clypeus and the wing length were measured (see section on Descriptive Methodology in LaBerge, 1956, for method of measuring). These two measurements were highly correlated in each of the two sexes and, therefore, only one, that of wing length, is discussed below.

The distribution of wing length means for the two sexes was not highly correlated so they will be discussed separately. In the males, specimens with the shortest wings occurred in the coastal areas of Oregon and northern California. There seems to be an even cline in increasing male wing length toward the northeast—specimens with longest wings occurring in north central Washington (state). The male wings decrease again in length towards the north (British Columbia), the east (North Dakota and Manitoba) and the southwest (Utah, Colorado and Arizona), but nowhere average as short as in the coastal areas of northern California and southern Oregon. The wings increase in length in New Mexico and Kansas and again decrease in Texas, although the last decrease is, perhaps, not significant. The clines described in this paragraph do not correlate well with the clines described for color of vestiture or color of male clypeus.

The female wing length follows the same clines as the male with the following differences. In the females there appears to be a sharp step in the cline of increasing wing length from the coastal

areas of northern California and southern Oregon towards the northeast. The shortest winged specimens occur in northwestern Oregon and southwestern Washington, whereas populations from southern British Columbia, central Washington, eastern Oregon, eastern Washington, Idaho and western Montana have mean wing lengths considerably longer. The long-winged specimens from New Mexico and Kansas contrast more strongly in the females than in the males with populations in Texas, Colorado, Arizona and New Mexico.

From the above discussion it can be seen that clines of at least three characters are not highly concordant. On the other hand, clines of any two characters examined can be seen to be concordant in at least some parts of the range of the species. No subspecies are recognized here and it seems unlikely that any should be recognized in the future due to the discordant nature of the clines and the inherent difficulties in recognizing the limits of any of the races. Perhaps when longer series of specimens from critical areas become available for a more thorough statistical analysis, subspecies (for which names already exist) will be recognized.

Type material: Lectotype male of *rivalis* from Texas is in the Academy of Sciences of Philadelphia. The female type of *desponsiformis* from Corvallis, Oregon, has not been located by the author. It is presumably lost or destroyed. The lectoallotype male, here designated, of *mysops* from Maybell, Colorado, August 1, 1904, is in the University of Colorado Museum, Boulder, Colorado, and the lectoallotype female, here designated, with the same data, is the property of the California Academy of Science, but is on temporary deposit in the collection of the Citrus Experiment Station, Riverside, California. The holotype male of *hexacantha* from Arizona, August, 1902, F. H. Snow, and the holotype female of *nigrosignata* from Oak Creek Canyon, Arizona, 6000 feet, August, F. H. Snow, are in the Snow Entomological Museum at the University of Kansas, Lawrence. The holotype male of *habilis* from Colorado Springs, Colorado, 6000-7000 feet, July 20-26, 1896, H. F. Wickham is in the American Museum of Natural History, New York City.

Distribution: *M. rivalis* ranges from northern California north to southern British Columbia, east to southern Manitoba and northwestern Minnesota, south to south central Texas, central New Mexico and central Arizona. It has been collected from May 14 to the beginning of October but most abundantly in July and August. In addition to the type material, 291 females and 375 males have been

examined from the localities listed below. This list includes localities reported in the literature.

ARIZONA: Flagstaff; Grand Canyon; Houserock Canyon; Kaibab Forest; Oak Creek Canyon; Phoenix. CALIFORNIA: Camass Swamp, Glen Blair Road, Mendocino Co.; Carrville; Callahan; Crescent City; Dyerville; Fairfax; Fort Ross; Guerneville; Kneeland Prairie, Humboldt Co.; Lagunitas; Myers; Point Pinos, Monterey Co.; Salinero; Shasta Springs; Van Duzen River, Humboldt Co. IDAHO: Burley; Deary; Gifford; Hazelton (4 mi. N.); Idaho Falls; Lewiston; Moscow; Paris; Shoshone; Twin Falls. KANSAS: Dickinson Co.; Ellis Co.; Meade Co.; Ness Co.; Pratt Co.; Rice Co.; Russell Co. MINNESOTA: Marshall Co. MONTANA: Como Lake; Flathead Lake; Hot Springs, Sanders Co.; Missoula; Monterey; Whitehall. NEVADA: White Pass, White Pine Co. NEW MEXICO: Alto; Nogal; Roswell; Vaughn. NORTH DAKOTA: Beach; Bismarck; Dickinson; Fargo; Kenmare; Minot; New Rockford; Oakes; Sentinel Butte, Golden Valley Co.; Slope Co. (Logging Camp Ranch); Stanley; Williston. OREGON: Amity; Albany; Baker; Bellfountain; Bend; Canyon City; Cove; Grand Ronde; Grand Ronde River (N. of Imbler); Gold Beach; Griffin Creek, Jackson Co.; Heppner Junction, Gilliam Co.; Hood River, Hood River Co.; Hurricane Creek (Wallowa Canyon), Wallowa Co.; La Grande, Lake Appelgate, Jackson Co.; Lostine; Medford; Murphy; Oakridge; Oregon City; Prineville; Redmund; Richland; Roseburg; Siskiyou Summit, Jackson Co.; Summit Prairie; The Dalles; Thomas; Three-sisters (Lake Creek Lodge), Deschute Co.; Umatilla; Union; Wallowa Canyon, Wallowa Co.; Wilderville. SOUTH DAKOTA: Faulkton; Whitewood. TEXAS: Austin; Dallas; Eastland Co.; Hillsboro; Weser. UTAH: Big Cottonwood Canyon (near Salt Lake City); Brigham; Cache Valley (Beven Dam), Cache Co.; Clear Creek Canyon, Sevier Co.; Cottonwood Canyon; Echo; Fillmore; Fort Douglas; Helper; Huntsville; Hyde Park; Laketown; Logan; Logan Canyon; Manilla; Monticello; Parly's Canyon (E. of Salt Lake City); Salt Lake City; South Cove Fort, Millard Co.; South Willow Canyon, Stansbury Mts., Tooele Co.; Thistle; Tintic; Uintah Mts., Duchesne Co.; Vivian Park; Wasatch Mts., Tooele Co.; Wellesville; White Sands. WASHINGTON: Asotin (on Snake River); Blue Mts.; Govan; Liberty; Lind; Packwood; Pullman; Ritzville; Tucannon Canyon, Garfield Co.; Yakima. WYOMING: Bridger Basin, Teton Co.; Carbon Co.; Cheyenne; Grand Teton National Park; Jackson; Laramie; Laramie Co.; Lusk; Rock River, Albany Co.; Shell Canyon Falls, Bighorn Mts.; Uinta Co.;

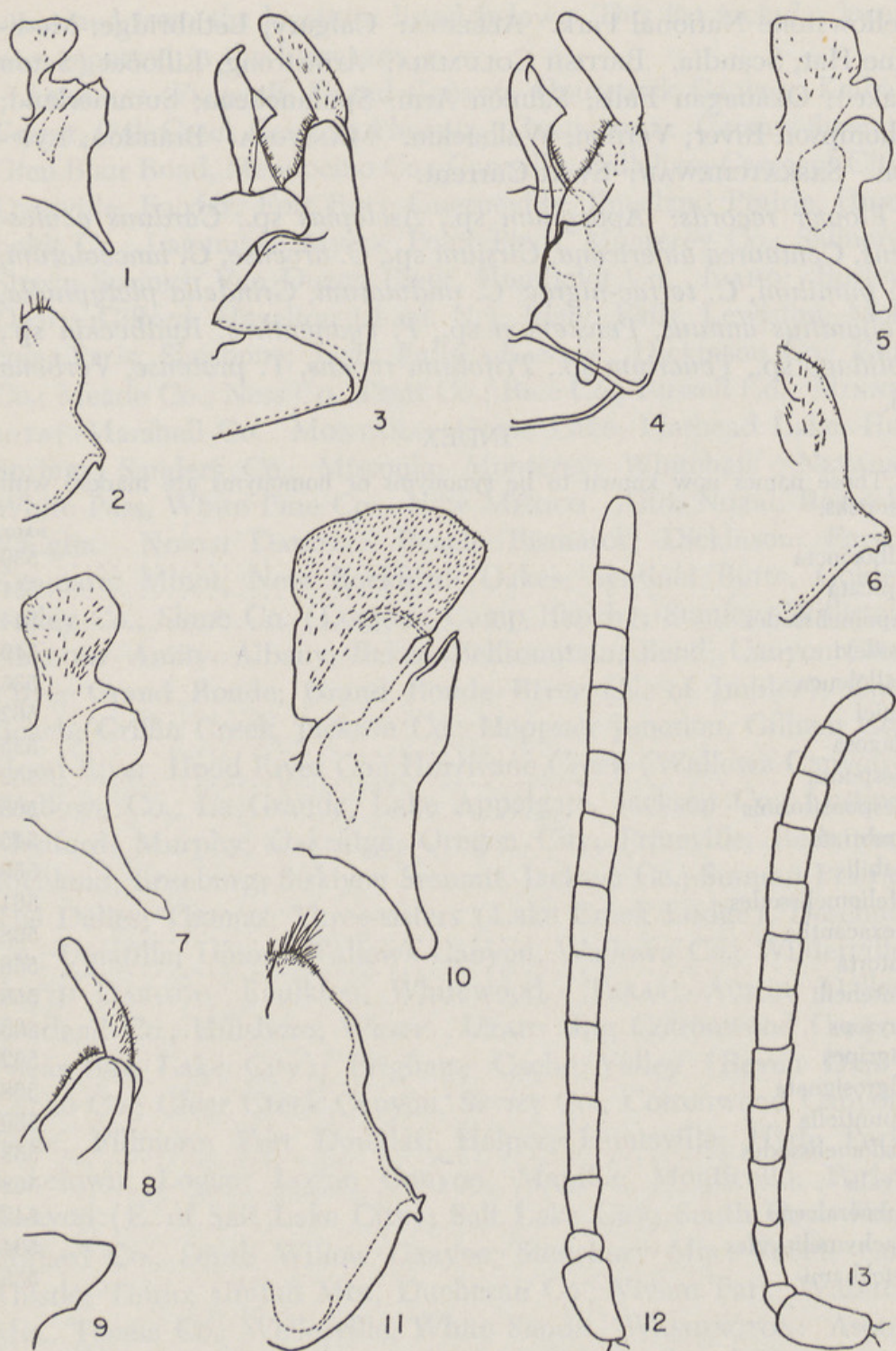
Yellowstone National Park. ALBERTA: Calgary; Lethbridge; Medicine Hat; Scandia. BRITISH COLUMBIA: Armstrong; Lillooet (Seton Lake); Okanagan Falls; Salmon Arm; Spulanchcan; Summerland; Thompson River; Vernon; Wallhackin. MANITOBA: Brandon; Lyleton. SASKATCHEWAN: Swift Current.

Flower records: *Apocynum* sp., *Asclepias* sp., *Carduus aculeatus*, *Centaurea americana*, *Cirsium* sp., *C. arvense*, *C. lanceolatum*, *C. pumilum*, *C. terrae-nigrae*, *C. undulatum*, *Grindelia platyphylla*, *Helianthus annuus*, *Penstemon* sp., *P. cyananthus*, *Rudbeckia* sp., *Solidago* sp., *Teucrium* sp., *Trifolium repens*, *T. pratense*, *Verbena* sp.

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Those names now known to be synonyms or homonyms are marked with asterisks.

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LaBerge, Wallace E. 1956. "A Revision of the Bees of the Genus *Melissodes* in North and Central America. Part II (Hymenoptera, Apidae)." *The University of Kansas science bulletin* 38(6), 533–578. <https://doi.org/10.5962/p.376392>.

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