

# Leafcutter and Mason Bees of the Genus *Megachile* Latreille (Hymenoptera: Megachilidae) in Canada and Alaska<sup>1</sup>

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**Abstract.** Leafcutter and mason bees of the genus *Megachile* are common members of the North American bee fauna and many *Megachile* species are important pollinators of summer flowering crops and native plant species. Despite this, no comprehensive account of species in Canada and Alaska has been published. Our objective is to provide an up-to-date revision of the genus *Megachile* of this region, including an interactive key to the species, and summaries of biogeographic distribution and life history. Additionally, divergence in a 658 bp segment of the mitochondrial COI gene (the “DNA barcode” region) was used to clarify the taxonomic status of several *Megachile* species in North America. Based on morphological differences and over 6% sequence divergence in COI, *M. (Litomegachile) onobrychidis* Cockerell, previously considered a subspecies of *M. (Litomegachile) brevis* Say, is recognized here as a valid species. Similarly, *M. (Litomegachile) pseudobrevis* Mitchell, found in the southeastern United States, is also

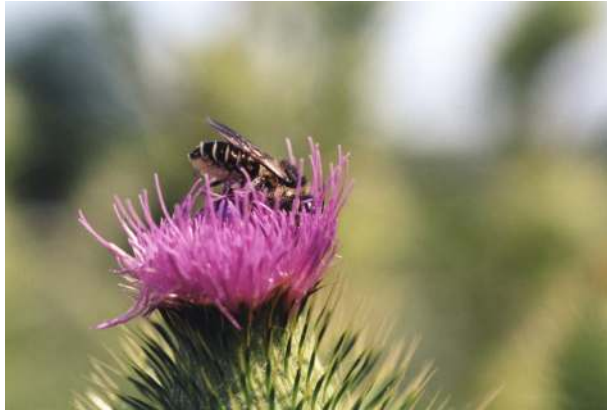
considered a distinct species and removed from synonymy with *M. brevis*. *Megachile (Eutricharaea) apicalis* Spinola, *M. (Megachiloides) casadae* Cockerell and *M. (Megachiloides) umatillensis* (Mitchell) are recorded from Canada for the first time; *M. (Xanthosarus) giliae* Cockerell and *M. (Megachile) nivalis* are placed into synonymy with *M. (Xanthosarus) circumcincta* (Kirby) and *M. (Megachile) lapponica* Thomson, respectively, and are thus considered Holarctic in distribution; *M. subanograe* Mitchell is placed into synonymy with *M. sublaurita* Mitchell (previously only known from its melanistic female form), and the male is described for the first time. *Megachile (Megachiloides) alamosana* Mitchell, known only from the male, *M. (Megachiloides) laurita* Mitchell, and *M. (Megachiloides) laurita semilaurita* Mitchell (both melanistic female forms) are placed into synonymy with *M. (Megachiloides) anograe* Cockerell, the latter three species previously only known only from the females. Full descriptions of all 38 species found in Canada and Alaska are provided.

## Introduction

The Megachilidae is one of two families of long-tongued bees, the other being the Apidae (Michener 2007). In North America, it is the only family in which females of non-cleptoparasitic taxa carry pollen entirely on the underside of the metasoma (Figure A). Most megachilid bees have robust bodies with a head about as wide as the thorax, or wider (Banaszak & Romasenko 1998). Megachilidae is found on every continent except Antarctica, and is one of the largest families in terms of the number of species (4037) and recognized genera (77) (Ascher & Pickering 2011; <http://www.discoverlife.org>; accessed May 16, 2011). Species estimates in Michener (2007) are much lower (3198 in 77 genera).

The tribe Megachilini (Megachilinae) is represented in North America by two of the three genera; *Megachile* Latreille, the leafcutter bees, and their main cleptoparasite, *Coelioxys* Latreille; the third member, *Radoszkowskiana* Popov, is also a cleptoparasite of *Megachile* but is restricted to the Eastern Hemisphere (Rozen & Kamel 2007). *Megachile* is one of the most common and diverse genera of bees (Mitchell 1980; O’Toole & Raw 1991;

Michener *et al.* 1994; Baker & Engel 2006; Michener 2007). Michener (2007) recognizes 56 extant subgenera; Engel & Baker (2006) describe an additional subgenus from Thailand known only from the male. In the Western Hemisphere, 31 subgenera are known (Raw 2006), though Durante & Abrahamovich (2006) recognize *Chaetochile* Mitchell as a distinct monotypic subgenus and not a synonym of *Dasymegachile* Mitchell. In North America, thirteen subgenera are indigenous, but species belonging to an additional three subgenera have been introduced (Cane 2003; Michener 2007), and also occur in Canada (Richards 1984; Magnum & Sumner 2003; Paiero & Buck 2003; Sheffield *et al.* 2010). Hurd (in Krombein *et al.* 1979) listed 134 species of *Megachile* in America north of Mexico, including the genus *Chalicodoma* Lepelletier (recognized here as the subgenus *Chelostomoides* Robertson); an additional five species were reported by Michener *et al.* (1994). A new North American species was described recently (Gonzalez & Griswold 2007). However, taxonomic knowledge of the genus *Megachile* in North America remains far from complete as almost a third of the species are known from one sex only,



**Figure A.** Female *Megachile inermis* Provancher, showing scopa on the underside of the metasoma. Photo by C.S. Sheffield.

primarily within the subgenus *Megachiloides* Mitchell (Sheffield & Westby 2007). Interestingly, several species of *Megachile* that occur in Canada have been found as gynandromorphs, including *M. angularum* Cockerell, *M. gemula* Cresson, *M. latimanus* Say, *M. onobrychidis* Cockerell, *M. parallela* Smith, *M. perihirta* Cockerell, and *M. rotundata* (Fabricius) (see Wcislo *et al.* 2004).

### Biology of *Megachile*

Much is known about the biology of many leafcutter bees due to their importance in crop pollination (Hobbs & Lilly 1954; Pengelly 1955; Osgood 1974; Peterson *et al.* 1992; Richards 1993; Raw 2002) and the fact that many species accept trap-nests (Medler 1959, 1964; 1965; Fye 1965; Krombein 1967; Frolich & Parker 1983; O'Toole & Raw 1991; Sheffield *et al.* 2008). Most species nest above ground in pre-existing cavities (Figure B) or excavate into pithy stems or decomposing wood (Stephen 1956; Ivanochko 1979). Trap-nesting of bees has allowed detailed study of life-history, nest building, provisioning and egg laying behaviours (Medler 1959, 1964; Klostermeyer & Gerber 1969; Frolich & Parker 1983; Kim 1992), and documentation of incidences of cleptoparasitism (Scott *et al.* 2000; Sheffield *et al.* 2008). Trap-nest surveys also allow association of males and females of the same species (Sheffield & Westby 2007). However, several North American species within the subgenera *Argyropile* Mitchell, *Litomegachile* Mitchell, *Megachiloides*, and *Xanthosarus* Robertson are ground-nesters (Hobbs & Lilly 1954; Eickwort *et al.* 1981; Williams *et al.* 1986; Neff & Simpson 1991; Krombein & Norden 1995; Gordon 2000). Table 1 summarizes nesting site information for species of *Megachile* in Canada and Alaska.

Leafcutter bees require suitable nesting sites (see Table 1), nest building materials, and sufficient/suitable food plants for nectar and pollen. These three factors not only influence the diversity of bees within a given

habitat by meeting their specific needs (i.e., pollen specialists), they also strongly affect the abundance and/or fecundity of certain species through the quantities at which they occur (Müller *et al.* 2006; Williams & Kremen 2007; Sheffield *et al.* 2008). Hobbs & Lilly (1954) noted that nesting site availability dictated which species of *Megachile* were found within specific habitats in southern Alberta; the absence of trees and/or logs (i.e., nesting sites with pre-existing or easily excavated cavities) limited the number of cavity nesting species, whereas ground nesting species were more prevalent. Leafcutters and other cavity nesting bee species can often be encouraged to nest within natural and highly managed systems simply by placing trap-nests within these habitats (Sheffield *et al.* 2008). Using artificial nesting material, *M. rotundata*, which nests gregariously within shelters, was developed as a commercial pollinator of alfalfa in western North America (Free 1993; Richards 1993). Thus, seed production in this important industry owes much of its success to this species.

Cut leaf pieces are the main nesting material used by leafcutter bees for nest cell construction. Hobbs & Lilly (1954) noted that ground-nesting leafcutter bees were common in the prairies within flying distance of leaf sources (e.g., shrubs, etc.), and declined greatly in open prairies without broad leaved plants. However, not all *Megachile* in Canada use leaf pieces as nesting material; members of the subgenera *Callomegachile* (*M. sculpturalis* Smith) and *Chelostomoides* (*M. angularum* and *M. campanulae* (Robertson)) are masons, and collect plant resins, pebbles and mud for cell partitioning and closure (Michener 2007), as does *Megachile* (*Pseudomegachile*) *ericetorum* Lapeletier (Banaszak & Romasenko 1998), a species only recently reported in North America (Sheffield *et al.* 2010). *Megachile* (*Megachile*) *montivaga* Cresson collects flower petals



**Figure B.** Examples of nesting sites of female *Megachile*: a) pre-existing cavity in a brick wall; photo by C.S. Sheffield, b) a space between two pieces of lumber; photo by S. Marshall, c) in a cavity in a metal frame; photo by S. Dumesh.

(Hobbs & Lilly 1954; Ivanochko 1979).

From a standpoint of encouraging leafcutter bees, all three of the requirements mentioned above can be found in most natural habitats. Trap-nests can be provided to accommodate cavity nesting species, supporting increases in species richness and abundance in agricultural systems (Sheffield *et al.* 2008). Although ground nesting *Megachile* species are also important alfalfa pollinators (Hobbs & Lilly 1954; Rank & Goerzen 1981), very few ground nesting bees have been developed for pollination (see Richards 1993).

### Taxonomy

Many of the *Megachile* species in Canada and Alaska are common, though no comprehensive account has been published. Mitchell (1962) published keys to the species found in eastern North America; his descriptions (Mitchell 1927; 1934) and subgeneric revisions (Mitchell 1935a, b, 1936, 1937a-d) cover most of the remaining species found in Canada. Sheffield & Westby (2007) provided a review of the subgenus *Megachile* s. str. in the western Hemisphere, which included the previously undescribed male of *M. nivalis* Friese (considered here as a synonymy of *M. lapponica* Thomson). Ivanochko (1979) provided the first comprehensive account of leafcutter bees in Canada, though he omitted the subgenus *Chelostomoides* (which was later covered by Snelling (1990)), and summarized their biology with respect to alfalfa pollinating potential, but remains unpublished and virtually unknown.

The purpose of this work is to provide a revision of the species of *Megachile* occurring in Canada and Alaska, including an interactive and web-based key. The keys make use of morphological features, but molecular techniques (i.e., divergence levels in a 658 bp segment of the COI mitochondrial gene) have been used to verify male-female associations, and to clarify species designations. A single middle leg was removed from pinned specimens; whenever possible multiple individuals of a species were analyzed to quantify the extent of intra-specific sequence divergence. Specimens were primarily collected in Canada, but material was also obtained from several localities in North America. DNA extracts were prepared following procedures outlined in Hajibabaei *et al.* (2005), and sequences or “DNA barcodes” will be published on BOLD (<http://www.barcodinglife.org>) in the “Bees of Canada” project.

### Notes on using the key, and on identifying leafcutter bees

One of the main difficulties in identifying *Megachile* species, especially females, is that many keys are based on mandibular dentation. In old individuals, mandibles are often so badly worn that the shape of the teeth and even their number are difficult to distinguish (Figure C). A similar problem occurs when identifying dirty specimens or specimens with the mandibles closed. Therefore, we have tried to provide a key in which dentition is not so heavily relied on, but for obvious reasons it remains a useful character for separating some species (and even some subgenera). Colour images of female mandibles (Plate 1), male genitalia (Plate 2), lateral images of females and males (Plate 3) and distribution maps are provided for all species. For difficult specimens (including those females in which mandibles are not visible or useful), users of the key are asked to read through the couplets fully and follow both alternatives within the dichotomy. Full descriptions and diagnoses are also provided to facilitate accurate identification, and these should also be read for additional morphological characters and distribution information. A standard format is used to facilitate quick comparison of specific characters; these are numbered consistently within descriptions of the head, mesosoma and metasoma. The following abbreviations are used in descriptions: F=flagellomere; T=metasomal tergum; S=metasomal sternum.



**Figure C.** Mandibles of females of *Megachile melanophaea* Smith in excellent condition (top), showing all dentation, and worn with the number of teeth not apparent (bottom).



Table 1. Nesting biology summary of the genus *Megachile* in Canada and Alaska.

Species	Nesting substrate	Reference
<i>M. addenda</i>	Sandy soil	Medler & Lussenhop 1968; Ivanochko 1979; Cane <i>et al.</i> 1996
<i>M. angularum</i>	Cavities, trap-nests	Barthell <i>et al.</i> 1998; Frankie <i>et al.</i> 1998
<i>M. anograe</i>	Soil	Hobbs & Lilly 1954; Bohart & Youssef 1972; Mitchell 1973
<i>M. apicalis</i>	Cavities, trap-nests	Barthell <i>et al.</i> 1998
<i>M. brevis</i>	Cavities, hollow plant stems, soil, rolled leaves	Hicks 1926; Michener 1953; Hobbs & Lilly 1954; Pengelly 1955; Ivanochko 1979; Baker <i>et al.</i> 1985; Packer 1987; Reed 1871
<i>M. campanulae</i>	Cavities, trap-nests	Medler 1966; Krombein 1967; Baker <i>et al.</i> 1985
<i>M. casadae</i>	Unknown (probably soil)	
<i>M. centuncularis</i>	Cavities, trap-nests	Krombein 1967; Sheffield <i>et al.</i> 2008
<i>M. circumcineta</i>	Soil	Latter 1906
<i>M. coquilletti</i>	Cavities, trap-nests, probably soil?	Bohart 1957; Barthell <i>et al.</i> 1998
<i>M. dentitarsis</i>	Soil	Hobbs & Lilly 1954; Bohart 1957
<i>M. ericetorum</i>	Cavities, plant stems	Banaszak & Romasenko 1998
<i>M. fidelis</i>	Cavities, trap-nests	Barthell <i>et al.</i> 1998; Frankie <i>et al.</i> 1998
<i>M. fortis</i>	Soil	Ivanochko 1979; Neff & Simpson 1991
<i>M. frigida</i>	Rotting logs, trap-nests	Hobbs & Lilly 1954; Pengelly 1955; Stephen 1956; Jenkins & Matthews 2004
<i>M. gemula</i>	Poplar logs, hollow twigs	Peck & Bolton 1946; Fye 1965; Medler & Lussenhop 1968
<i>M. gentilis</i>	Cavities, trap-nests	Snelling 2003; Kim 1992
<i>M. inermis</i>	Cavities, trap-nests, rotting logs	Stephen 1956; Medler 1958; Sheffield <i>et al.</i> 2008
<i>M. lapponica</i>	Cavities, trap-nests	Sheffield & Westby 2007
<i>M. latimanus</i>	Soil	Mitchell 1936; Bohart 1957; Ivanochko 1979
<i>M. lippiae</i>	Probably soil	Hicks 1926; Hobbs & Lilly 1954 (as <i>M. cleomis</i> )
<i>M. manifesta</i>	Unknown (probably soil)	
<i>M. melanophaea</i>	Soil	Hobbs & Lilly 1954; Pengelly 1955
<i>M. mellitarsis</i>	Unknown	
<i>M. mendica</i>	Trap-nests; soil	Medler 1965; Krombein 1967; Baker <i>et al.</i> 1985; Williams <i>et al.</i> 1986
<i>M. montivaga</i>	Soil; old stems	Ivanochko 1979; Hicks 1926; Hobbs & Lilly 1954; Baker <i>et al.</i> 1985
<i>M. onobrychidis</i>	Probably soil and/or cavities?	Bohart 1957
<i>M. parallela</i>	Soil	Fischer 1951; Hobbs & Lilly 1954
<i>M. perihirta</i>	Soil	Sladen 1918; Hicks 1926; Hobbs & Lilly 1954; Bohart 1957; Ivanochko 1979
<i>M. pugnata</i>	Cavities, trap-nests, rotting logs	Medler 1964; Hobbs & Lilly 1954; Sheffield <i>et al.</i> 2008
<i>M. relativa</i>	Cavities, trap-nests	Medler & Koerber 1958; Sheffield <i>et al.</i> 2008
<i>M. rotundata</i>	Cavities, trap-nests, soil in vertical banks	Krombein 1967; Sheffield <i>et al.</i> 2008
<i>M. sculpturalis</i>	Cavities, trap nests, <i>Xylocopa</i> nests	Mangum & Sumner 2003
<i>M. sublaurita</i>	Soil	Bohart & Youssef 1972
<i>M. subnigra</i>	Unknown (probably soil)	
<i>M. texana</i>	Soil	Krombein 1953; Hobbs & Lilly 1954; Eickwort <i>et al.</i> 1981
<i>M. umatillensis</i>	Sandy soil	Bohart & Youssef 1972
<i>M. wheeleri</i>	Sandy soil, trap-nests at ground level	Hobbs & Lilly 1954; Gordon 2000

**Key to bees of the genus *Megachile* in Canada and Alaska**

- 1 Metasoma with six exposed sterna bearing a dense brush of scopal hairs (Figure 1a); antenna 12-segmented (Figure 2a) (**females**) ..... 2
- Metasoma with up to four exposed sterna, bearing moderately short, slender hairs (Figure 1b); antenna 13-segmented (Figure 2b)(**males**)..... 39
- 2 (1) Mandibles without bevelled cutting edges (Figure 3a); metasoma cylindrical and parallel sided for most of its length, usually at least twice as long as wide (Figure 4a) [if metasoma not distinctly parallel sided, then clypeus with small median tubercle on apical edge (see Figure 7a)]..... 3
- Mandibles with a complete or partial bevelled cutting edge in the emargination between at least two teeth (Figure 3b) (excluding *M. montivaga*, which has no cutting edges but which has a metasoma that is distinctly tapering towards apex); metasoma somewhat flattened dorsoventrally, widest at terga 2 and 3 and tapering towards apex (Figure 4b) [excluding members of the subgenus *Sayapis*, which have distinct cutting edges on mandibles]..... 6
- 3 (2) Body large (> 20 mm), mesosoma with yellowish-brown pubescence (Figure 5a); clypeus very narrow medially, less than ¼ as wide as long, leaving a large space visible even when mandibles are closed (Figure 6a) ..... *M. (Callomegachile) sculpturalis* Smith
- Body smaller (< 14 mm), pubescence white (Figure 5b); clypeus much wider medially, unmodified (Figure 6b) ..... 4
- 4 (3) Clypeus with apical edge with a small median tubercle (Figure 7a)..... *M. (Pseudomegachile) ericetorum* Lepelletier
- Clypeus with apical edge bituberculate medially, with a distinct space between tubercles (Figure 7b)..... 5
- 5 (4) Tergum 5 without white apical fascia (Figure 8a); QC-MB..... *M. (Chelostomoides) campanulae* (Robertson)
- Tergum 5 with white apical fascia (Figure 8b); BC ..... *M. (Chelostomoides) angelarum* Cockerell
- 6 (2) Sterna 2-5 with dense, white apical fasciae of short hairs beneath the pale scopal hairs (Figure 9a); tergum 2 with an opaque, ovate fovea laterally (Figure 10a)..... 7
- Sterna 2-5 without apical fasciae beneath scopal hairs (Figure 9b); tergum 2 uniformly polished and punctate laterally, without trace of an opaque, ovate fovea (Figure 10b)..... 8
- 7 (6) Clypeus with apical margin angulate medially (Figure 11a); sterna 5 and 6 and apex of sternum 4 with scopal hairs black (Figure 12a) ..... *M. (Eutricharaea) apicalis* Spinola
- Clypeus with margin straight or nearly so (Figure 11b); sternum 6 with scopal hairs black, sternum 5 with few black hairs laterally, sternum 4 without black hairs (Figure 12b)..... *M. (Eutricharaea) rotundata* (Fabricius)
- 8 (6) Gena in posteroventral view with a prominent robust process protruding downward (Figure 13a)..... *M. (Sayapis) pugnata* Say
- Gena in posteroventral view uniformly convex, without process (Figure 13b)..... 9
- 9 (8) Terga without white apical fasciae, terga 1 and 2 usually covered with dense, white pubescence, conspicuously contrasting with the entirely black pubescence on terga 3-6 (Figure 14a)..... 10
- Terga with pale apical fasciae (Figure 14b), sometimes reduced and limited to lateral edges of more apical terga, but terga 3-6 not entirely black (Figure 14c)..... 12
- 10 (9) Mandible in lateral view parallel from base to a length subequal to width, then tapering to apex (Figure 15a); inner mandibular tooth broadly truncate (Figure 16a) ..... *M. (Xanthosarus) gemula* Cresson
- Mandible in lateral view tapering gradually but continuously from base to apex (Figure 15b); inner mandibular tooth rounded and narrower (Figure 16b) AND/OR with a small excision at its apex (Figure 16c) ..... 11

- 11 (10) Mesosoma ventrally and coxae with pubescence entirely pale (Figure 17a); clypeus with a well-defined, median impunctate line for its entire length (Figure 18a); inner mandibular tooth without a small excision at apex (Figure 19a) ..... *M. (Xanthosarus) circumcincta* (Kirby)
- Mesosoma ventrally and coxae with pubescence dark (Figure 17b); clypeus without, or usually with a poorly defined median impunctate line (Figure 18b) sometimes more pronounced (Figure 18c); inner mandibular tooth with a small excision at apex (Figure 19b) ..... *M. (Xanthosarus) melanophaea* Smith
- 12 (9) Mandible 5-dentate, with the 4<sup>th</sup> tooth approximately parallel-sided throughout its length; oblique emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth much deeper than emargination between 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Figure 20a)..... 13
- Mandible 3- (Figure 20b), 4- (Figure 20c) or 5-dentate, **BUT** if 5-dentate, then 4<sup>th</sup> tooth strongly tapered from base to apex; the emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth subequal to or more shallow than emargination between 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Figure 20d) ..... 16
- 13 (12) Emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth about three times as wide as width of 4<sup>th</sup> tooth at midlength, the emargination broadly semi-circular in shape (Figure 21a); sternum 6 with apical border thickened, weakly upcurved and extending a little beyond the apical tergum (Figure 22a); body larger (length  $\geq$  15 mm) ..... *M. (Xanthosarus) fortis* Cresson
- Width of emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth subequal or at most twice as wide as the 4<sup>th</sup> tooth at midlength, the emargination tapering and angled towards inner mandibular edge (Figure 21b); sternum 6 with apical border not thickened or upcurved, not extending beyond apical margin of tergum 6 (Figure 22b); body smaller (length  $\leq$  13 mm)..... 14
- 14 (13) Metasomal terga with white apical fasciae broad (i.e.,  $\geq$  1/4 tergal width) and dense, usually not interrupted medially; terga 1 and 2 with pubescence dense and white (Figure 23a) [southern SK-AB] ..... *M. (Xanthosarus) dentitarsus* Sladen
- Metasomal terga with fasciae less dense and usually interrupted medially on the more basal terga; terga 1 and 2 with pubescence less dense and yellowish (Figure 23b)..... 15
- 15 (14) Black pubescence USUALLY occupying posterior half of mesoscutum and extending to scutellum (Figure 24a); tergum 2 with discal pubescence USUALLY black in apical half; tergum 6 with intermixture of black and pale pubescence (Figure 25a); usually found west of the 100<sup>th</sup> meridian, but occasionally present as far east as ON..... *M. (Xanthosarus) perihirta* Cockerell
- Black pubescence scarcely occupying half of mesoscutum and USUALLY NOT extending to the scutellum (Figure 24b); tergum 2 with discal pubescence entirely pale or almost so; tergum 6 with mostly pale pubescence (Figure 25b); usually found east of the 100<sup>th</sup> meridian, but occasionally present as far west as AB .. *M. (Xanthosarus) latimanus* Say
- 16 (12) Third mandibular tooth without a trace of bevelled cutting edge extending into the emargination between 2<sup>nd</sup> and 3<sup>rd</sup> teeth (4<sup>th</sup> tooth may be reduced, thus appearing 4-dentate) (Figure 26a) ..... *M. (Megachile) montivaga* Cresson
- Third mandibular tooth with a bevelled cutting edge extending from outer margin and usually occupying at least half the emargination between 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Figure 26b), though a small angle may be present between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth, thus appearing 4-dentate (see Figure 51a) ..... 17
- 17 (16) Inner mandibular tooth broadly truncate (Figure 27a) ..... *M. (Xanthosarus) frigida* Smith
- Inner mandibular tooth rounded or acutely angulate (Figure 27b)..... 18
- 18 (17) Mandible 5-dentate (Figure 28a)..... 19
- Mandible 3- (Figure 28b) or 4-dentate (Figure 28c) ..... 22
- 19 (18) Sternum 6 with black scopal hairs, contrasting with the pale scopal hairs on sterna 1-5 (Figure 29a)..... *M. (Megachile) lapponica* Thomson

-	Sterna with uniformly pale hairs throughout (except occasionally at the extreme apical rim of sternum 6) (Figure 29b).....	20
20 (19)	Tergum 6 with short, uniformly appressed brown hairs throughout its median length (Figure 30a); clypeal margin with semicircular emarginations on each side of the broad median protuberance and small sublateral tubercle; clypeus laterally with well-defined, polished and impunctate areas along apical margin (Figure 31a) ..	<i>M. (Megachile) inermis</i> Provancher
-	Tergum 6 with numerous long, erect hairs over entire surface scattered among the appressed hairs (Figure 30b); clypeus with apical margin approximately truncate to weakly emarginate medially, without sublateral emarginations, and without polished impunctate areas on lateral margins (Figure 31b).....	21
21 (20)	Tergum 6 with pubescence with some hairs conspicuously golden among the black hairs (Figure 32a) .....	<i>M. (Megachile) relativa</i> Cresson
-	Tergum 6 with pubescence uniformly black (Figure 32b).....	<i>M. (Megachile) centuncularis</i> (Linnaeus)
22 (18)	Mandible 4-dentate, without a deep emargination extending from inner (4 <sup>th</sup> ) tooth to 2 <sup>nd</sup> tooth (i.e., a small 3 <sup>rd</sup> tooth is visible) (Figure 33a).....	23
-	Mandible 3-dentate with a deep emargination extending from inner (3 <sup>rd</sup> ) tooth to second tooth (Figure 33b) [except <i>M. umatillensis</i> , which has a slight angle present between 2 <sup>nd</sup> and inner (3 <sup>rd</sup> ) teeth, thus appearing 4-dentate (see Figure 51a)].....	37
23 (22)	Sternum 6 distinctly extending beyond tergum 6 with apex curved sharply upward, the upcurved apical rim bare and polished (Figure 34a).....	<i>M. (Argyropile) parallela</i> Smith
-	Sternum 6 not clearly extending beyond tergum 6 and apex not curved upward, apical margin usually fringed with hairs (Figure 34b).....	24
24 (23)	Emargination between inner (4 <sup>th</sup> ) and 3 <sup>rd</sup> teeth approximately semicircular, its greatest depth subequally distant between the two teeth (Figure 35a).....	25
-	Emargination between inner (4 <sup>th</sup> ) and 3 <sup>rd</sup> teeth distinctly oblique, greatest depth much closer to inner (4 <sup>th</sup> ) tooth than to 3 <sup>rd</sup> tooth (Figure 35b) .....	33
25 (24)	Clypeus with apical margin evenly truncate, without prominent tubercles or emargination (Figure 36a) .....	26
-	Clypeus with apical margin with prominent tubercles and emargination (Figures 36b, 36c).....	32
26 (25)	Mandible with emargination between inner (4 <sup>th</sup> ) and 3 <sup>rd</sup> teeth with an angulation appearing as a weakly developed 5 <sup>th</sup> tooth (Figure 37a); tergum 6 weakly concave to straight in lateral view, with short, uniformly appressed brown hairs throughout its length medially (Figure 38a).....	27
-	Mandible with emargination between the inner (4 <sup>th</sup> ) and 3 <sup>rd</sup> teeth without angulation (Figure 37b); tergum 6 distinctly concave in lateral view with numerous long, erect hairs scattered among the appressed hairs (Figure 38b) .....	28
27 (26)	Tergum 6 weakly concave in lateral view; sternum 6 with scopal hairs entirely black, sterna 1-5 with scopal hairs white (Figure 39a) .....	<i>M. (Litomegachile) gentilis</i> Cresson
-	Tergum 6 straight in lateral view; sternum 6 with only a few black hairs, sterna 1-5 with scopal hairs yellow (Figure 39b).....	<i>M. (Litomegachile) mendica</i> Cresson
28 (26)	Sternum 6 with scopal hairs mostly pale (Figure 40a).....	<i>M. (Litomegachile) brevis</i> Say
-	Sternum 6 with scopal hairs entirely black (Figure 40b) .....	29
29 (28)	Metasoma in dorsal view with numerous stout, erect, black hairs laterally on terga 2-6 (Figure 41a).....	<i>M. (Litomegachile) texana</i> Cresson
-	Metasoma in dorsal view with stout, erect, black hairs laterally on at most terga 4-6 (Figure 41b).....	30

- 30 (29) Tergum 6 with scattered dark, erect hairs among the appressed pale tomentum (Figure 42a).....  
 ..... *M. (Litomegachile) lippiae* Cockerell  
 - Tergum 6 with little or no appressed pale hairs, pubescence entirely brown to black (Figure 42b)..... 31
- 31 (30) Tergum 6 distinctly concave in profile (Figure 43a); sometimes smaller (9-12 mm).....  
 ..... *M. (Litomegachile) onobrychidis* Cockerell  
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 ..... *M. (Litomegachile) coquilletti* Cockerell
- 32 (25) Lateral clypeal tubercles approximately parallel-sided, greatly protracted anteromedially and curved downward subapically (Figure 44a); legs, including tarsi, entirely dark (Figure 45a)..... *M. (Sayapis) fidelis* Cresson  
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- 33 (24) Scopa entirely black (Figure 46a)..... *M. (Megachiloides) subnigra* Cresson  
 - Sterna 2-4 and usually basal half of sternum 5 with white scopal hairs (Figure 46b)..... 34
- 34 (33) Clypeus polished, the punctures minute and obscure (Figure 47a)..... *M. (Megachiloides) casadae* Cockerell  
 - Clypeus quite distinctly and usually closely punctate (Figure 47b)..... 35
- 35 (34) Terga 2-5 with carina of basal grooves strongly elevated and projected posteriorly (often permitting mites to inhabit the space beneath) (Figure 48a); tergum 6 strongly concave in lateral view (Figure 49a).....  
 ..... *M. (Xanthosarus) addenda* Cresson  
 - Terga 2-4 with carina of basal grooves distinct, but weakly elevated and not projected posteriorly to from space beneath, tergum 5 with carina scarcely, or not perceptible (Figure 48b); tergum 6 weakly concave to straight in lateral view (Figure 49b)..... 36
- 36 (35) Tergum 5 polished and shiny between the fine punctures, punctures separated by 3-4 pd in apical half (Figure 50a)..... *M. (Megachiloides) wheeleri* Mitchell  
 - Tergum 5 not polished, with rather close punctures, punctures separated by  $\leq 1$  pd (Figure 50b).....  
 ..... *M. (Megachiloides) manifesta* Cresson
- 37 (22) Mandibles with a slight angle between 2<sup>nd</sup> and inner (3<sup>rd</sup>) teeth, the inter-space occupied by a cutting edge (Figure 51a)..... *M. (Megachiloides) umatillensis* (Mitchell)  
 - Mandibles with two distinct and approximate apical teeth, and a very long cutting edge between 2<sup>nd</sup> and inner (3<sup>rd</sup>) teeth (Figure 51b)..... 38
- 38 (37) Tergum 6 closely punctate, punctures separated by  $\leq 3$  pd; tergum 5 and 6 with erect white bristles laterally (Figure 52a) [tergum 6 occasionally with a few black bristles]; body smaller (9-10 mm).....  
 ..... *M. (Megachiloides) sublaurita* Mitchell  
 - Tergum 6 shiny and sparsely punctate, punctures separated by 5-10 pd; terga 5 and 6 with lateral, erect bristles entirely black (Figure 52b); body larger (13 mm)..... *M. (Megachiloides) anograe* Cockerell
- 39 (1) Body large ( $> 20$  mm), mesosoma with yellowish-brown pubescence (Figure 53a); apical half of clypeus and supraclypeal area with long pale yellowish pubescence, rest of face with black pubescence (Figure 54a).....  
 ..... *M. (Callomegachile) sculpturalis* Smith  
 - Body smaller ( $< 12$  mm), mesosoma with pubescence mostly pale yellow to white (Figure 53b); face with pubescence entirely pale (Figure 54b)..... 40
- 40 (39) Sternum 4 almost entirely hidden (Figure 55a)..... 41  
 - Sternum 4 exposed, visible (Figure 55b)..... 42



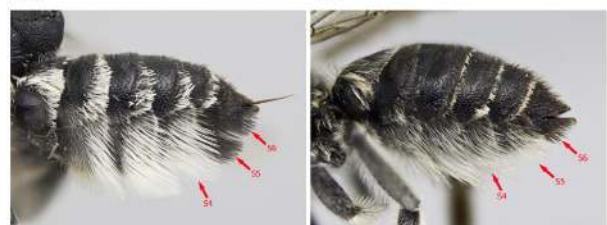
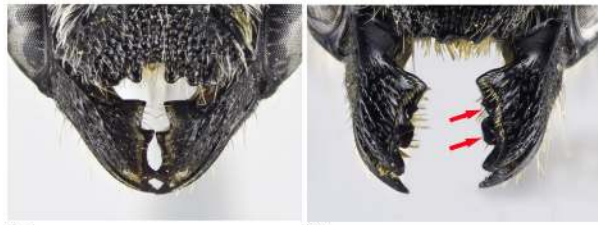
41 (40)	Front coxa with short, simple pale hairs that do not obscure the small spine (Figure 56a); BC	<i>M. (Chelostomoides) angularum</i> Cockerell
-	Front coxa with long, mostly plumose pale hairs that partly hide the small spine (Figure 56b); QC-MB	<i>M. (Chelostomoides) campanulae</i> (Robertson)
42 (40)	Front leg unmodified, with basitarsus slender and simple, usually uniformly black (Figure 57a)	43
-	Front leg greatly modified, with basitarsus dilated and excavated along anterior margin, usually conspicuously coloured white to yellowish (Figure 57b) [except <i>M. gemula</i> in which basitarsus mostly black (Figure 57c)].	59
43 (42)	Tergum 2 with opaque, ovate fovea laterally (Figure 58a)	44
-	Tergum 2 uniformly punctate and polished throughout, without trace of opaque, ovate area laterally (Figure 58b)	45
44 (43)	Tergum 3 with opaque, ovate fovea laterally (Figure 59a)	<i>M. (Eutricharaea) apicalis</i> Spinola
-	Tergum 3 without opaque, ovate fovea laterally (Figure 59b)	<i>M. (Eutricharaea) rotundata</i> (Fabricius)
45 (43)	Front coxal spine absent (Figure 60a), <u>OR</u> spine developed as a weak protuberance no longer than wide, with a minute but dense tuft of setae (Figure 60b)	46
-	Front coxal spine well developed, much longer than wide at its base (Figure 60c)	50
46 (45)	Front coxa without spine (Figure 61a); clypeus <u>OFTEN</u> with a single small median tubercle on apical margin beneath the pubescence (Figure 62a) (excluding <i>M. centuncularis</i> which lacks median tubercle)	47
-	Front coxa with a small spine surmounted by a dense but short tuft of setae (Figure 61b); clypeus without a small median tubercle on apical margin beneath the pubescence (Figure 62b) although a larger median protuberance may be present (Figure 62c)	49
47 (46)	Clypeus without a prominent median tubercle on apical margin (Figure 63a); outer tarsal claw much more rounded than the inner claw (Figure 64a)	<i>M. (Megachile) centuncularis</i> (Linnaeus)
-	Clypeus with a prominent median tubercle on apical margin (Figure 63b); inner and outer tarsal claws equally sharp (Figure 64b)	48
48 (47)	a) First submarginal cell with vein r subequal to vein Rs of the second submarginal cell (Figure 65a); hypostomal tubercle short (Figure 66a); hypostomal concavity shallow and not well defined (pubescence must be removed to see the last two features) (Figure 67a)	<i>M. (Megachile) relativa</i> Cresson
-	First submarginal cell with vein r shorter than vein Rs of the second submarginal cell (Figure 65b); hypostomal tubercle more prominent and wider at base (Figure 66b); hypostomal concavity deeper and well defined (Figure 67b)	<i>M. (Megachile) lapponica</i> Thomson
49 (46)	Mandible with distance from apex of middle tooth to apex of inner tooth nearly twice as great as to apex of outer tooth (Figure 68a); lateral ocellus much nearer to compound eye than to vertex (Figure 69a)	<i>M. (Megachile) inermis</i> Provancher
-	Mandible with distance from apex of middle tooth to the apices of inner and outer teeth subequal (Figure 68b); lateral ocellus subequally distant to vertex and to compound eye (Figure 69b)	<i>M. (Megachile) montivaga</i> Cresson
50 (45)	Mandible 3-dentate (Figure 70a)	51
-	Mandible 4-dentate (Figure 70b)	58
51 (50)	Tergum 5 without an apical fascia (Figure 71a)	52
-	Tergum 5 with an apical fascia, though this may be worn in older specimens and reduced to lateral margins (Figure 71b)	53

- 52 (51) Terga 4 and 5 with punctures separated with distinct, polished interspaces that are 2-4 pd in width (Figure 72a);  
widespread..... *M. (Litomegachile) mendica* Cresson
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..... *M. (Litomegachile) gentilis* Cresson
- 53 (51) Front tarsomeres 2-4 yellowish, conspicuously contrasting with the black basitarsus (Figure 73a) ..... 54
- Front tarsomeres 2-4 dark, not contrasting with basitarsus (Figure 73b)..... 55
- 54 (53) Mandible with lower process present (Figure 74a); tergum 6 with white tomentum anterior to carina [this may  
be worn in older specimens, though traces should be present] (Figure 75a) .....  
..... *M. (Litomegachile) coquilletti* Cockerell
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75b) ..... *M. (Pseudomegachile) ericetorum* Lepeletier
- 55 (53) Tergum 6 with postmedian transverse carina deeply emarginate medially (Figure 76a)..... 56
- Tergum 6 with postmedian transverse carina weakly emarginate medially, emargination sometimes scarcely  
distinguishable from the irregular lateral crenulations (Figure 76b) ..... 57
- 56 (55) Metasomal dorsal surface with considerable admixture of black pubescence (Figure 77a)  
..... *M. (Litomegachile) texana* Cresson
- Metasomal dorsal surface with slight, if any, admixture of black pubescence (Figure 77b)  
..... *M. (Litomegachile) lippiae* Cockerell
- 57 (55) Tergum 6 with white tomentum dense and conspicuous medially, concealing most of the surface beneath  
(Figure 78a)..... *M. (Litomegachile) brevis* Say
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(Figure 78b)..... *M. (Litomegachile) onobrychidis* Cockerell
- 58 (50) Front coxa with long pale pubescence, without a patch of red bristles anterior to the spine (Figure 79a); tergum  
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80a)..... *M. (Argyropile) parallela* Smith
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..... *M. (Xanthosarus) addenda* Cresson
- 59 (42) Middle basitarsus with ventral surface strongly protuberant and polished; middle tibia without an apical spur  
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- 60 (59) Mesepisternum with a slender polished spine just in front of middle coxa (Figure 82a)  
..... *M. (Xanthosarus) dentitarsus* Sladen
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- 61 (60) Middle basitarsus with protuberance on ventral surface narrow and keel-shaped (Figure 83a)  
..... *M. (Xanthosarus) perihirta* Cockerell
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obscured by dentations (Figure 84b)..... 63
- Tergum 6 with postmedian transverse carina rounded or obtusely angulate medially (Figure 84c) ..... 69

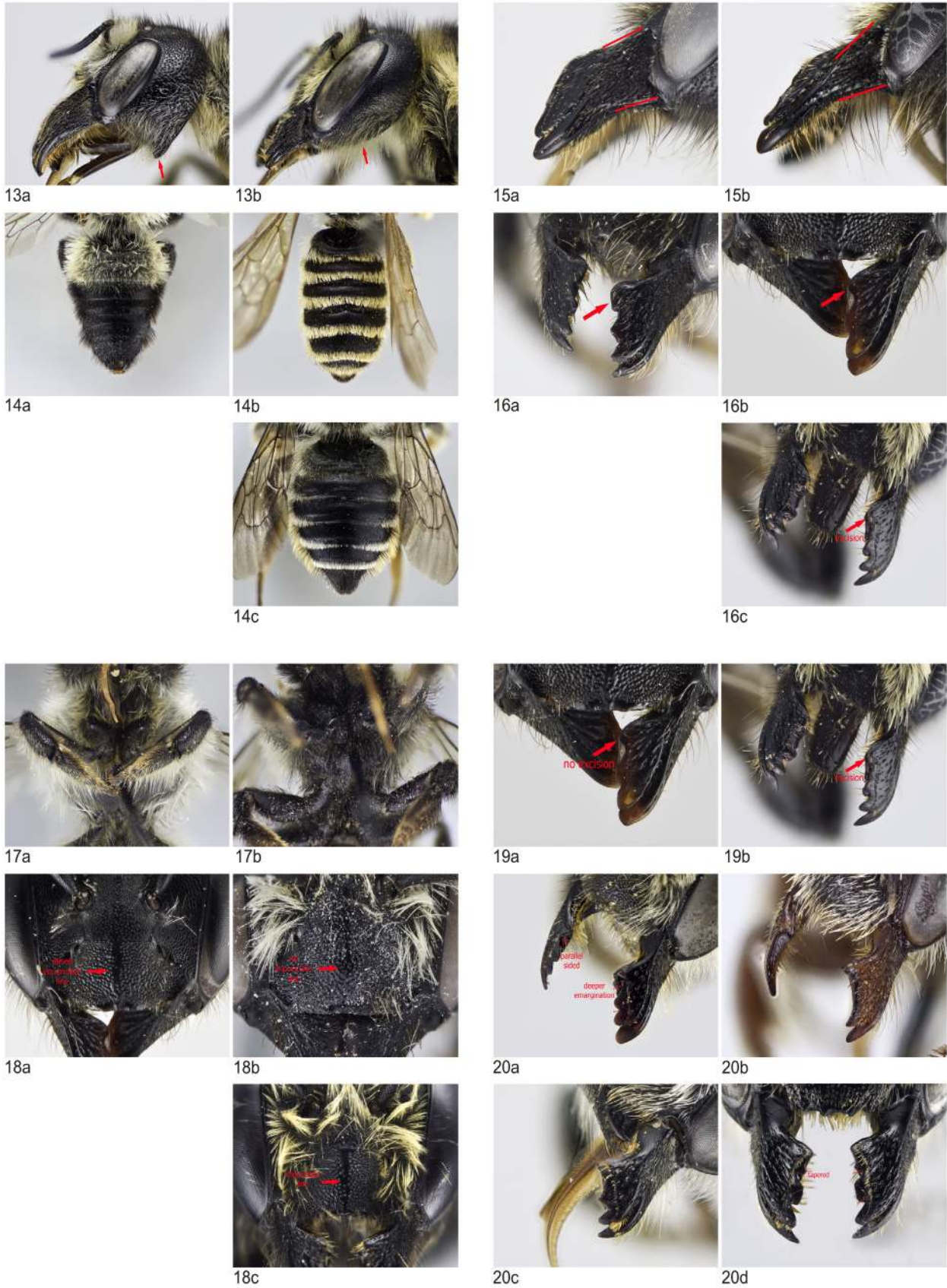
- 63 (62) Mandible 4-dentate (Figure 85a); tarsal claw rounded basally, without a small basal tooth (Figure 86a); metasoma robust, USUALLY lacking apical fascia on tergum 5 (Figure 87a)..... 64
- Mandible 3-dentate (Figure 85b); tarsal claw with a small basal tooth or angulation (Figure 86b); metasoma elongate, USUALLY with well-developed fasciae on terga 2-5 (Figure 87b)..... 67
- 64 (63) Front femur with apical third with a sharp, longitudinal, dorsolateral carina (Figure 88a), anterior surface of basal half with two longitudinal brown bars on yellowish background (Figure 89a); tergum 5 without pale apical fascia, tergum 6 with carina deeply and widely emarginate (Figure 90a).....  
.....*M. (Xanthosarus) frigida* Smith
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- 65 (64) Apical rim of front tibia with a strongly flattened and rounded tubercle projecting posteriorly (Figure 91a) .....  
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- Apical rim of front tibia with a short and strongly tapered spine (Figure 91b)..... 66
- 66 (65) Front tarsus mostly brown to black (Figure 92a); tergum 5 without apical fascia (Figure 93a).....  
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- 67 (63) Tergum 5 without white apical fascia (Figure 94a); front basitarsus with boat-shaped dilation on anterior side greatly elongated apically and extending to apex of 3<sup>rd</sup> tarsomere (Figure 95a) .....  
.....*M. (Sayapis) mellitarsis* Cresson
- Tergum 5 with white apical fascia (Figure 94b); front basitarsus with boat-shaped dilation on anterior side extending at most as far as the middle of 2<sup>nd</sup> tarsomere (Figure 95b and 95c)..... 68
- 68 (67) Front basitarsus with brush of short, dark bristles that does not extend beyond its basal third (Figure 96a) and apical third of boat-shaped dilation entirely covered on the outer side with dense appressed hairs (Figure 97a)..  
.....*M. (Sayapis) pugnata* Say
- Front basitarsus with brush of dark bristles extending nearly to apex (Figure 96b) and apical third of boat-shaped dilation mostly bare and polished (Figure 97b) .....*M. (Sayapis) fidelis* Cresson
- 69 (62) Mandible with basal process truncate apically (Figure 98a).....*M. (Xanthosarus) fortis* Cresson
- Mandible with basal process pointed apically (Figure 98b)..... 70
- 70 (69) Hind tarsomeres quadrate, smooth and shiny (Figure 99a); mesepisternum with a prominent, flattened, triangular carina-like protuberance just behind the front coxa (Figure 100a) .....  
.....*M. (Megachiloides) wheeleri* Mitchell
- Hind tarsomeres subtriangular, broader apically, with some pubescence (Figure 99b); mesepisternum without protuberance (Figure 100b) or with carina just behind front coxa, smoothly rounded (Figure 100c)..... 71
- 71 (70) Mesepisternum with carina just behind front coxa distinct, smoothly rounded (Figure 101a) .....  
.....*M. (Megachiloides) manifesta* Cresson
- Mesepisternum without a carinate protuberance just behind front coxa (Figure 101b)..... 72
- 72 (71) Pubescence of mid and hind legs mostly black (Figure 102a) .....*M. (Megachiloides) subnigra* Cresson
- Pubescence of legs largely pale (Figure 102b)..... 73
- 73 (72) Tergum 5 without white apical fascia (Figure 103a).....*M. (Megachiloides) anograe* Cockerell
- Tergum 5 with white apical fascia (Figure 103b)..... 74

- 74 (73) Surface of clypeus beneath the dense pubescence shining, the punctures minute and obscure, apical edge straight and narrowly impunctate (Figure 104a) [pubescence must be removed to see these characters].....  
.....*M. (Megachiloides) casadae* Cockerell
- Surface of clypeus beneath the dense pubescence covered with fine densely crowded punctures, apical edge produced and broadly impunctate (Figure 104b) [pubescence must be removed to see these characters]..... 75
- 75 (74) Apical flagellomere broadly expanded, rounded, about as broad as long (Figure 105a; body smaller (10-12mm))  
.....*M. (Megachiloides) sublaurita* Mitchell
- Apical flagellomere not expanded, almost twice as long as broad (Figure 105b); body larger (13-15mm)  
.....*M. (Megachiloides) umatillensis* (Mitchell)









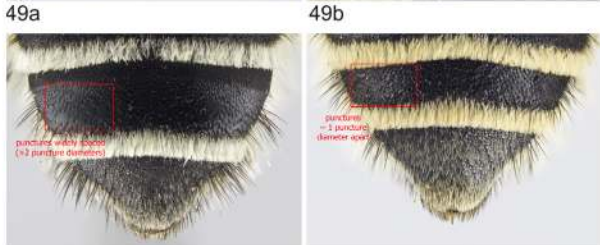














53a

53b



56a

56b



54a

54b



57a

57b



55a

55b



57c



58a

58b



60c

61a



59a

59b



61b

62a



60a

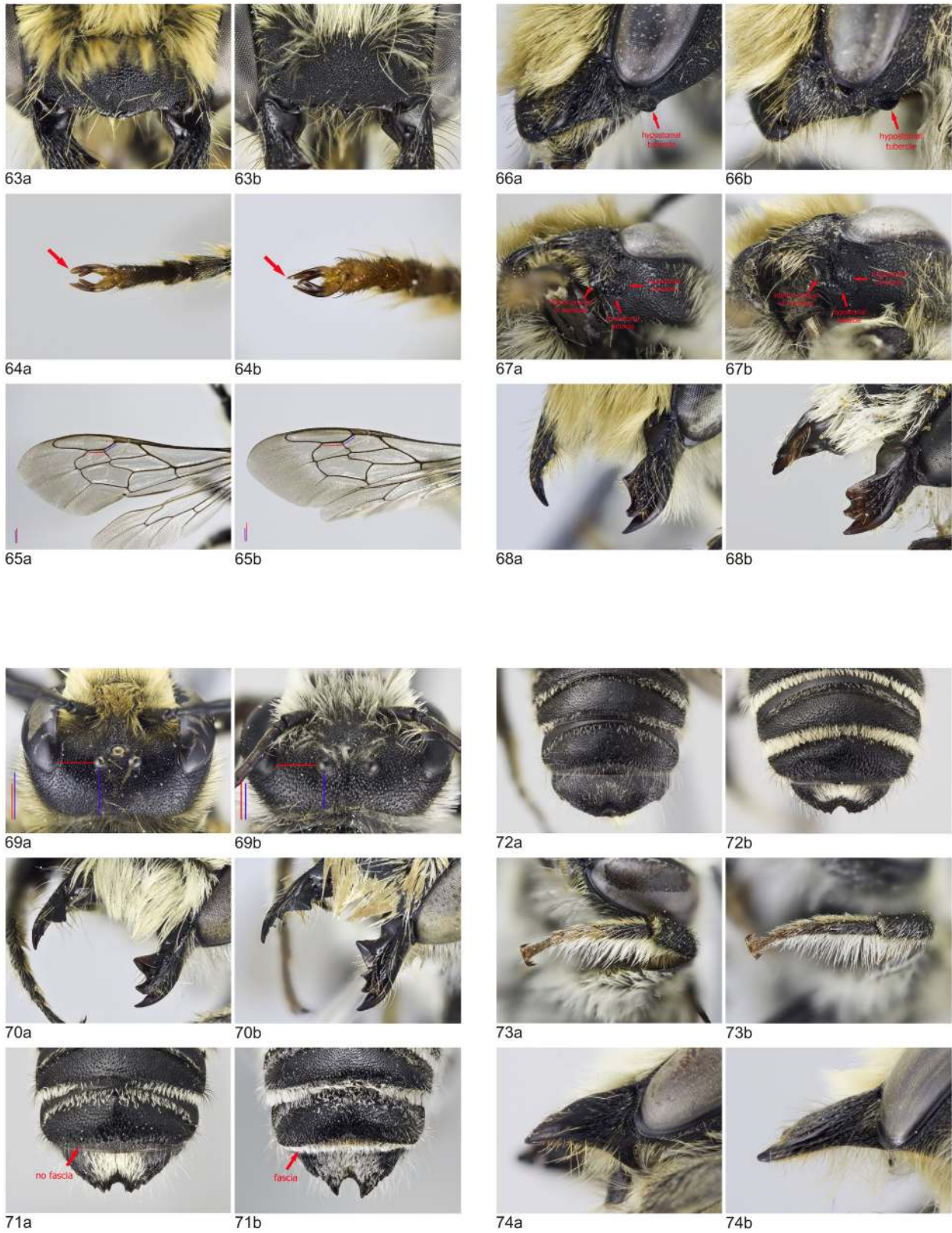
60b

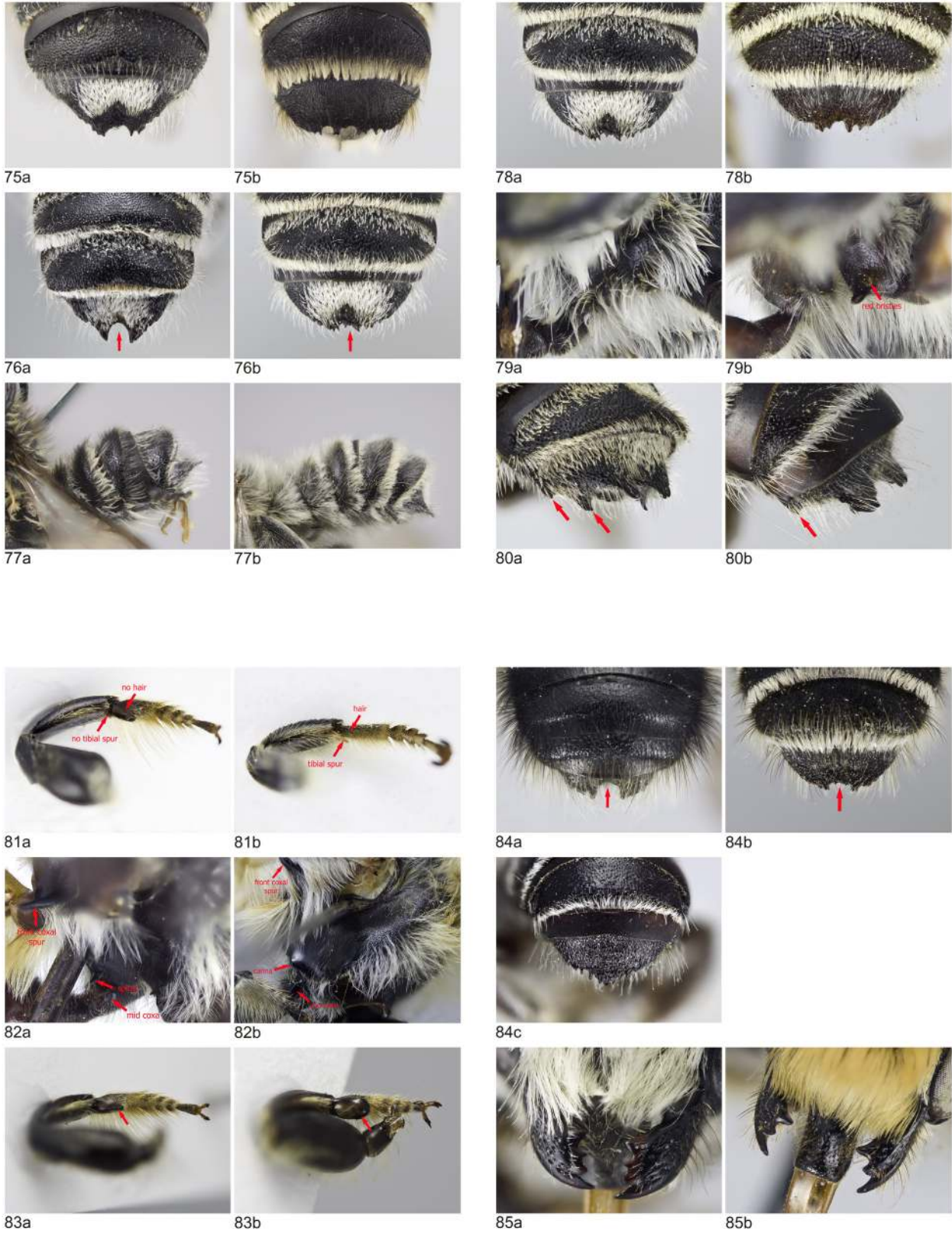


62b

62c

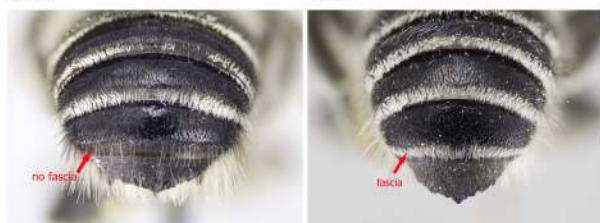














## Species Descriptions

### 1. *Megachile (Argyropile) parallela* Smith, 1853

*Megachile parallela* Smith, 1853. Cat. Hym. Brit. Mus. 1: 191 (♂).

*Megachile facunda* Cresson, 1872. Trans. Amer. Entomol. Soc. 4: 266 (♂).

*Megachile sexdentata* Robertson, 1895. Trans. Amer. Entomol. Soc. 22: 125 (♂).

*Megachile verbesinae* Cockerell, 1908a. Ann. Mag. Nat. Hist. (8) 1: 264 (♀).

*Megachile (Argyropile) parallela* var. *rita* Mitchell, 1937a. Trans. Amer. Entomol. Soc. 63: 53 (♀).

*Megachile parallela tulariana* Mitchell, 1937a. Trans. Amer. Entomol. Soc. 63: 53 (♀).

*Megachile (Argyropile) asteriae* Mitchell, 1943. Pan-Pacific Entomol. 19: 13 (♀).

*Megachile (Argyropile) parallela reta* Mitchell, 1943. Pan-Pacific Entomol. 19: 16 (♀) (misspelling of *M. parallela rita*).

**Diagnosis.** The female of *M. parallela* is distinct, and can be recognized by apex of S6, which has a bare, slightly upturned rim projecting slightly beyond the dense fringe of short, dark hairs. The male of *M. parallela* is recognized by the combination of 4-dentate mandibles, unmodified front legs, two pairs of prominent teeth on the apical margin of T6 (below the carina), and the absence of red bristles on the front coxa. They are most similar to *M. addenda*. The male of *M. addenda* lacks the two pairs of prominent teeth on the apical margin of T6, and has red bristles on the front coxa.

**FEMALE:** Length 13-14 mm.

**Head.** 1) compound eyes slightly convergent below; distance from lateral ocelli to compound eyes subequal to distance to vertex, 2) clypeal margin straight, with a rather narrow, slightly produced, median area that is shiny and impunctate, with very small but distinct median tubercle, 3) mandibles 4-dentate, with long cutting edge between 3<sup>rd</sup> and 4<sup>th</sup> teeth and much shorter one between 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure M1), 4) gena subequal to compound eye in width, 5) punctures deep and distinct, but quite fine and close on vertex and gena, face below ocelli finely and densely punctate beneath dense pubescence, on supraclypeal area and clypeus deep, distinct, quite close, with shining interspaces especially medially on clypeus, 6) pubescence white, rather short but dense on face below level of median ocellus, sparse on clypeus and supraclypeal area, with median sparse white patch between lateral ocellus and vertex, dense and white on gena, somewhat more elongate below, vertex with scattered short black pubescence laterally, 7) F1

longer than broad (3:2) and longer than pedicel, which is quadrate, subequal in length to remaining flagellomeres.

**Mesosoma.** 1) pubescence pale and quite dense laterally and posteriorly, though not obscuring the surface of mesoscutum, entirely pale on scutellum, 2) mesoscutum dull, punctures very fine and quite close, more so laterally, slightly separated medially, surface tessellate; scutellum and axilla very densely and finely punctate; pleura finely and closely punctate, somewhat more coarsely below, becoming fine and densely crowded above; propodeum smooth but dull, with minute and rather vague punctures separated by interspaces of 1-2 pd, triangle dull and impunctate, 3) front tarsus slender; mid basitarsus broad apically, anterior apical margin narrowly produced; tarsomeres 2 and 3 very narrow at base, dilated apically, with the anterior apical angle slender and produced; hind basitarsus long and broad, subequal to hind tibia, and nearly equaling it in length, spurs pale yellow, 4) tegula somewhat shining, very minutely and closely punctate throughout, 5) wings subhyaline, faintly clouded apically, veins brownish-black.

**Metasoma.** 1) T2 and T3 distinctly and narrowly grooved across base, basal margin of groove distinct but not carinate, T4 faintly impressed toward base, more conspicuously so laterally, basal margin not distinct; T1-T5 with apical margins narrowly depressed, densely pale fasciate; T1 with copious, elongate, entirely pale yellowish/whitish pubescence, T2 with discal pubescence very short and dense, black laterally, somewhat longer and pale at centre of disc, T3-T5 with pubescence entirely black, very short, and quite dense; punctures of terga fine and very close throughout, becoming densely crowded laterally on more basal terga, somewhat deeper and more distinct apically; T6 nearly straight in profile, with few short, suberect hairs, apical half densely pale tomentose, surface very finely and densely punctate, 2) S6 narrowly rounded at tip, with short, black scopal hairs, sparse apically, the apex with bare, slightly upturned lip projecting slightly beyond the dense fringe of short, dark hairs; scopa otherwise white, punctures slightly separated and fine on more basal sterna, coarser apically.

**MALE:** Length 12-13 mm.

**Head.** 1) compound eyes slightly convergent below; lateral ocelli somewhat closer to eyes than margin of vertex (4:4.5), 2) apical margin of clypeus beneath pubescence with a rather narrow, slightly produced impunctate area that is emarginate medially with a rather small but distinct median tubercle, 3) mandibles obscurely 4-dentate, lower process very narrow, quite elongate, subbasal in position 4) gena subequal to compound eye in width, 5) punctures

deep and distinct, fine and close on vertex and gena adjacent to eye margin, more widely separated along posterior margin; face below ocelli and clypeal surface very finely and closely punctate beneath the pubescence, **6**) pubescence largely pale, copious and dense on face below ocelli and on clypeus, creamy to snowy white, often somewhat more yellowish and less dense on vertex and gena, becoming longer on gena below, **7**) F1 slightly longer than broad (5:4), longer than pedicel, but slightly shorter than remaining flagellomeres, which are longer than broad (3:2), apical flagellomere more elongate (4.5:2).

**Mesosoma.** **1**) pubescence dense and pale laterally and posteriorly, though not concealing surface beneath, mesoscutum and scutellum with shorter and somewhat more sparse, erect, yellowish-white hairs, **2**) mesoscutum dull, very densely tessellate, punctures minute and obscure; scutellum distinctly punctate, punctures minute, densely crowded; pleura with fine, close punctures below, densely crowded above; propodeum somewhat shining, minutely punctate with interspaces >1 pd, triangle dull, impunctate, **3**) front coxal spine small, slender, acute, largely obscured by white pubescence; all basitarsi slender and simple, front tarsus elongate and slender, with short but dense, posterior, white fringe; mid tibial spur short but well developed, **4**) tegula shiny, minutely and closely punctate anteriorly, punctures more sparse posteriorly, **5**) wings subhyaline, faintly clouded apically, veins brownish-black.

**Metasoma.** **1**) T2-T5 depressed basally, basal margins distinct but not definitely carinate, apical margins of terga deeply depressed at least laterally, more deeply and completely on the more apical terga, densely pale fasciate, T1 and T2 with discal pubescence entirely yellowish-white, copious, long and erect, T3-T5 with pubescence sparse, very short, erect; T4 and T5 with transverse, basal, tomentose fasciae, quite broad on T5; T1 and T2 with punctures minute, densely crowded, becoming somewhat more distinct and coarse but still close on T3-T5, slightly separated and elongate toward apical margin of T5; basal area of T6 smooth, impunctate with distinct carinate rim, area apical to this densely tomentose, obscuring the surface, very minutely and closely punctate, apical carina rounded, margins faintly crenulate, with deep semicircular median emargination, slightly impressed medially just before the emargination, median teeth of apical margin erect, conspicuous, rather narrowly carinate, tips subtruncate, much closer to the more acute, lateral teeth than to each other; T7 narrowly produced medially, tip very slightly incised, **2**) S1-S4 exposed, S2-S4 shining, very finely and closely punctate basally, less so on apical terga, S2-S4 deeply

grooved basally, apical margins strongly depressed, rims narrowly yellowish-hyaline, fringed with long, pale hairs forming thin apical fringe, discs of sterna with sparse pale pubescence.

**Genitalia.** Plate 2, Figure G1.

**Discussion.** Relatively common in western Canada, especially in mixed prairie regions (Hobbs and Lilly (1954). This species is a ground nester (Table 1). Gonzalez and Griswold (2007) recently revised the subgenus *Argyropile*.

**Distribution:** Southern SK to BC (see Map 1).

## 2. *Megachile (Callomegachile) sculpturalis* Smith, 1853

*Megachile sculpturalis* Smith, 1853. Cat. Hym. Brit. Mus. 1: 181 (♀).

**Diagnosis.** The large size (19-25 mm), striking yellowish-brown pubescence of the mesosoma, and darkened wings will distinguish both sexes of this species from all other *Megachile* in Canada. The female of *M. sculpturalis* has 4-dentate mandibles and lacks cutting edges in the mandibular interspaces. The male can also be recognized by the row of conspicuous black spatulate hairs along posterior margin of the front tarsomeres.

**FEMALE:** Length 21-25 mm.

**Head.** **1**) compound eyes greatly divergent below; lateral ocelli very much nearer eyes than margin of vertex (1:2), and placed well below supraorbital line, **2**) clypeus extremely short and thickened apically, the outer face little if any longer medially than the thickened edge, margin with distinct crenulations and tubercles that extend onto clypeal surface, with a distinctly raised impunctate median line extending across supraclypeal area to median ocellus, **3**) mandibles 4-dentate, the 3<sup>rd</sup> tooth small and located medially between 2<sup>nd</sup> and 4<sup>th</sup> teeth, without cutting edges (Plate 1, Figure M2), **4**) gena nearly twice as wide as compound eye (7:4), hind margin of gena with a distinct carina, **5**) vertex with punctures fine and close to subrugose, becoming relatively coarse and more separated on gena above, larger and more irregular below, face below ocelli densely rugosopunctate, protuberant between antennae, punctures of supraclypeal area quite coarse and distinct but very close, clypeus with very fine, densely crowded punctures medially, these becoming coarse and more distinct laterally with shiny interspaces, **6**) pubescence black on face and gena, short

and dense in paraocular area, with a small linear series of yellowish brown hairs just above lateral edges of clypeus and on lower surface of gena, pubescence very short and sparse on gena above and on vertex, **7**) F1 broader than long (3.5:2), shorter than pedicel and F2, which are quadrate, remaining flagellomeres slightly longer than broad (4:3.5), apical flagellomere almost twice as long as broad.

**Mesosoma.** **1**) entirely covered with dense, yellowish-brown pubescence, longer on pleura and propodeal area, becoming shorter on mesoscutum, sparse on central disc, not at all concealing the surface beneath, **2**) mesoscutum closely punctate to subrugose, punctures slightly separated (<1 pd) only in centre of disc, those of scutellum and axilla uniformly very close; pleura dull beneath the pubescence, very closely punctate above, becoming coarsely rugose below; propodeum somewhat smoother but dull, quite densely and finely punctate, triangle smooth and impunctate, surface dull, becoming coarsely striate at base, **3**) all basitarsi somewhat shorter and narrower than their tibiae, **4**) tegula reddish-brown, uniformly covered with exceedingly minute and rather close punctures, **5**) wings darkened throughout, more so within marginal cell, veins brownish-black.

**Metasoma.** **1**) elongate and parallel-sided, T2 and T3 deeply grooved across base, less so on T4 and T5, basal margin of grooves carinate, apical margin of terga depressed; T1 with pubescence concolourous with mesosoma, T2 with pale basal fascia arising from carinate rim, apical fascia whitish laterally but becoming dark medially, T3-T6 with apical fasciae black; discal pubescence entirely black, limited to basal area of terga; T6 with short, erect black pubescence; punctures on T1 fine and shallow, on T2 and T3 large and coarse, with large shiny interspaces, becoming finer apically, and subrugose basally, on T4 and T5 the punctures much finer than preceding terga, on T6 with punctures very fine and close throughout; T6 with apical margin rounded, **2**) S6 rounded; S1 and S2 with golden scopal hairs, S3-S6 uniformly covered with black scopal hairs; punctures coarse and sparse on all sterna; apical margins somewhat depressed.

**MALE:** Length 19-22 mm.

**Head.** **1**) compound eyes slightly diverging below; lateral ocelli much closer to eyes than margin of vertex (2:3), **2**) clypeal margin beneath pubescence emarginated medially, with a prominent tubercle on either side of emargination, and emarginate lateral to these, **3**) mandibles 3-dentate, lower process large, broadly truncate and densely pubescent, curved ventrally, **4**) gena

slightly broader than compound eye (6:5), with a large, shining and impunctate concavity below, lower margin of concavity produced to form a conspicuous ridge just below base of mandible, hind margin of gena carinate, outer margin of concavity with a row of dense, elongate black pubescence, **5**) vertex with punctures coarse and close to subrugose, becoming coarser and more separated on gena above, larger and more irregular below; face below ocelli densely rugosopunctate, punctures of supraclypeal area very fine and distinct but very close, clypeus coarsely rugosopunctate, with shiny interspaces medially, **6**) head with copious, erect, black pubescence on vertex, just below median ocellus, on paraocular area, and basally on clypeus, yellowish pubescence largely obscuring surface on supraclypeal area, with elongate downwardly directed yellow hairs apically on clypeus, gena with sparse yellowish-white pubescence along carinate rim becoming dense and elongate below along hypostomal carina and on lower edge of basal mandibular process, **7**) F1 twice as broad as long, and subequal in length to pedicel, remaining flagellomeres much longer than F1 and pedicel combined, about twice as long as broad, apical flagellomere more elongate (4:1.5).

**Mesosoma.** **1**) entirely covered with dense, yellowish-brown pubescence, longer on the pleura and propodeal area, becoming shorter on mesoscutum, sparse on central disc, not concealing the surface beneath, short and erect on legs with scattered black hairs on hind edge of front and mid tarsi, **2**) punctures of mesoscutum fine and close, slightly separated only in centre, densely crowded otherwise, those of scutellum more coarse, punctures on axilla uniformly fine and close; pleura shiny, punctures rather coarse but close, becoming irregular ventrally; lateral faces of propodeum somewhat smoother, punctures shallow, fine and separated by >1 pd, triangle rather dull, impunctate, **3**) front coxal spine wide and elongate, apical 1/3 curved anteriorly, with densely plumose, elongate yellow hairs on dorsal edge, anterior surface of coxa bare and somewhat shining with sparse punctures and short subappressed yellow hairs; mid tibial spur well developed; front tarsomeres reddish-brown and very slightly expanded, with a row of conspicuous black spatulate hairs along posterior margin, front basitarsus slightly excavated; mid and hind basitarsi slender and simple, largely dark, **4**) tegula brownish-black, uniformly and closely covered with fine punctures, **5**) wings darkened throughout, more so apically and within marginal cell, veins brownish-black.

**Metasoma.** **1**) T2 and T3 deeply and widely grooved across base, less so on T4 and T5, basal margin of grooves on T2 and T3 carinate, apical margin of T2-T4 strongly depressed, less so on T5; pubescence of T1



concolourous with mesosoma, apical fascia of T2 whitish laterally but becoming dark medially, apical fasciae of remaining terga black; discal pubescence entirely black, confined almost entirely to basal depression; T5 and T6 with short, erect black pubescence; T1 with punctures fine and shallow, T2 and T3 with punctures large and coarse medially with large shiny interspaces, becoming finer and rugosopunctate apically, and subrugose basally; T4 with punctures much finer than preceding terga, T5 even more so with punctures of uniform size and spacing across tergum, T6 vertical in orientation, with punctures very fine and close throughout, carina slightly upturned, evenly rounded with a very slight median emargination, deep median depression basal to carina, **2)** S1 finely and sparsely punctate basally, smooth and almost impunctate apically with broad hyaline margin, S2-S4 very coarsely and irregularly punctate laterally, becoming finer to rugose medially, S2 with broad, depressed yellowish-hyaline apical margin with fascia of pale hairs laterally, darkening medially, S3 and S4 depressed basally, S3 with apical margin less broad than preceding segment, that of S4 becoming wide medially, S1-S4 with a median patch of short, dense, erect pubescence.

**Genitalia.** Plate 2, Figure G2.

**Discussion.** An adventive species first observed in Canada in 2002 (Magnum and Sumner 2003; Paiero and Buck 2003) and the only member of subgenus *Callomegachile* in North America (Michener 2007). This species was first reported in North America by Magnum and Brooks (1997). Like members of the subgenera *Chelostomoides* and *Pseudomegachile* (see below), this species uses plant resins instead of cut leaf pieces for nest construction. This species nests in cavities in wood (Table 1).

**Distribution.** This species has been collected in southern ON (Toronto, Guelph) and Montreal, QC (Gibbs and Sheffield 2009), but is expected to spread throughout southern Canada (Hinojosa-Díaz *et al.* 2005) (see Map 2).

### 3. *Megachile (Chelostomoides) angularum* Cockerell, 1902

*Megachile angularum* Cockerell, 1902. South. Calif. Acad. Sci. Bull. 1: 70 (♀).

**Diagnosis.** The female of *M. angularum* can be recognized by the combination of the parallel sided metasoma, mandibles which lack cutting edges, and the complete apical white fasciae on T1-T5. They are most similar to *M. campanulae*. Females of *M. campanulae*

lack the apical white fascia on T5. The male of *M. angularum* can be recognized by the combination of three visible metasomal sterna, having 9-10 punctures between lateral ocelli and edge of vertex, the conspicuous front coxal spine, and T4 and T5 with conspicuous, very short and erect dark hairs. They are most similar to *M. campanulae*. Males of *M. campanulae* have only 4-5 punctures between lateral ocelli and edge of vertex, a reduced front coxal spine which is concealed by the dense, white pubescence, and T4 and T5 with conspicuous, long and erect pale hairs.

**FEMALE:** Length 10-11 mm.

**Head.** **1)** compound eyes slightly converging below; lateral ocelli subequally distant from eyes and margin of vertex, **2)** clypeal margin with a deep quadrate median emargination between two prominent tubercles, denticulate towards lateral margin, **3)** mandibles distinctly 4-dentate, without cutting edge (Plate 1, Figure M3), **4)** gena subequal to compound eye in width, **5)** punctures of vertex coarse, deep and distinct, slightly and uniformly separated (<1 pd), those on gena not quite as coarse but considerably closer; frons quite coarsely and very closely punctate, fine and densely crowded on paraocular area, supraclypeal area with some narrow, shining spaces medially, but punctures coarse and deep, becoming very close laterally, clypeus very closely and coarsely punctate, becoming somewhat more finely and more obscurely so toward apical margin medially, **6)** pubescence pale on head, rather short and sparse, whitish and somewhat more copious on face around antennae, on inner orbits and on gena below, becoming sparse on clypeus, gena above and on vertex where it is somewhat more yellowish, **7)** F1 broader than long (1.5:1), about half as long as pedicel and subequal in length to F2, remaining flagellomeres subquadrate to very slightly longer than broad, apical flagellomere more elongate (3:2).

**Mesosoma.** **1)** pubescence short, sparse and entirely white laterally and posteriorly, longer below and on lateral edges of propodeum, quite dense around pronotal lobes, very short, sparse and entirely pale on mesoscutum, whitish and somewhat more erect and elongate on scutellum, **2)** mesoscutum and scutellum coarsely, deeply and closely punctate throughout, interspaces very narrow but shining, punctures somewhat more widely spaced on scutellum, finer and very close on axilla; pleura somewhat shining between coarse, deep and rather irregular punctures below, these becoming densely crowded anteriorly; propodeum somewhat smoother but dull, with fine, shallow punctures that are well spaced medially, triangle dull and impunctate, rugosostriate

along basal margin, **3**) all basitarsi somewhat narrower and shorter than their tibiae, spurs yellow, **4**) tegula minutely and closely punctate, **5**) wings hyaline basally, becoming faintly clouded apically, veins black.

**Metasoma.** **1**) elongate and parallel-sided; T2-T4 with deep, transverse, basal grooves, largely filled with white tomentum, basal margins distinctly and sharply carinate, apical margins of terga depressed at extreme sides but not medially, the apical, white fasciae complete on T1-T5, though sometimes becoming narrow medially; T1 with rather thin, erect, pale pubescence, lateral angles densely white tomentose; discal pubescence of T2-T6 extremely sparse, entirely pale, hardly evident; T5 weakly grooved toward base but basal margin not at all distinct, and apical margin depressed only toward sides; tergal punctures quite deep and distinct, variable in size and spacing, rather coarse and sparse medially on each tergum, becoming somewhat closer laterally and toward apical margin, quite fine and close over most of T1, rather uniformly coarse and close on T5; T6 vertical, nearly straight in lateral view, with an abrupt, apical lip, largely covered with pale, subappressed hairs that obscure the surface slightly, **2**) S6 covered with short scopal hairs that are pale toward base but become darker toward apex; scopal hairs otherwise yellowish-white, the sterna rather uniformly, closely, deeply and rather coarsely punctate, apical margins narrowly depressed and very narrowly hyaline.

**MALE:** Length 8-9 mm.

**Head.** **1**) compound eyes very slightly convergent below; lateral ocelli subequally distant from eyes and margin of vertex, **2**) clypeal margin with two tubercles on each side of mid-line; punctures of clypeus very coarse and contiguous, becoming somewhat finer and closer toward apical margin, **3**) mandibles 3-dentate, lower process broadly triangular, median in position, **4**) gena slightly narrower than compound eye (5:7), shallowly excavated just below base of mandible, **5**) vertex shining, punctures small but coarse, deep and close, separated by less than 1 pd, with 9-10 punctures between lateral ocelli and edge of vertex, with a narrow impunctate area approximately 1 pd wide at upper edge of compound eye, punctures becoming slightly finer and closer on gena; frons coarsely and very closely and deeply punctate, becoming finely rugose laterally and over supra-clypeal area, **6**) pubescence of head mostly pale, rather short and sparse on gena and vertex, becoming quite copious and plumose around antennae and over lower part of face, largely hiding surface, longer on gena below, very dense and shorter on lower surface on mandible and lower process, vertex with very short, erect and scattered dark

hairs, **7**) F1 broader than long (1.5:1), slightly shorter than pedicel, about half as long as remaining flagellomeres, which are longer than broad (1.5:2), apical flagellomere more elongate (2:1).

**Mesosoma.** **1**) pubescence rather short, sparse, entirely white laterally and posteriorly, quite dense around pronotal lobes, very short and sparse on mesoscutum, becoming somewhat more erect and elongate on scutellum, **2**) punctures of mesoscutum coarse, deep and close, slightly separated over most of surface, but interspaces very much narrower than diameter of punctures, interspaces on scutellum somewhat more distinct (1 pd), but fine and very close on axilla; pleura below somewhat shining between coarse and deep punctures, the punctures becoming finer and closer above; propodeum laterally somewhat smoother but with very fine, shallow and close punctures, these becoming well spaced medially, face of triangle somewhat more velvety, impunctate, rugosostriate basally, **3**) front coxal spine reduced, its height equal to basal width, not concealed by the short, white pubescence; front tarsus entirely dark, tarsomeres 1-3 moderately dilated and slightly concave below, with some elongate, pale brownish hairs along anterior margin, but the usual posterior fringe absent, a long cluster of intertwined setae at base of posterior margin of basitarsus; spurs yellow, ; mid and hind tarsi slender and simple, **4**) tegula minutely and closely punctate, **5**) wings subhyaline basally, becoming faintly clouded apically, veins black.

**Metasoma.** **1**) T2-T5 deeply grooved across base, and with white fasciae, basal margins quite distinctly carinate, apical margins yellowish-hyaline, quite deeply depressed across entire width of terga, apical white fascia evident only toward extreme sides of T1, fasciae on T2 and T3 limited to a few hairs; T1 with rather copious, elongate, white pubescence, discal pubescence of T2-T3 very sparse and obscure, hardly evident, entirely pale, T4 and T5 with more conspicuous, very short and erect dark hairs; punctures deep, distinct and rather coarse, rather uniformly separated, interspaces not much exceeding diameter of punctures, these slightly coarser at extreme sides than in centre, T1 and T5 more finely and closely punctate, T6 with smaller punctures with no interspaces; T6 vertical with a rather dense, basal, white fascia, otherwise quite densely covered with short, suberect, dark tomentum, with a few more elongate, black hairs, carina very obscure, with a rounded median emargination, elevated but very slightly on each side above surface of tergum, median teeth of apical margin broadly carinate and very low, largely obscured by dense, white tomentum, very much nearer the acute, lateral teeth than to each other; T7 transverse, not at all produced medially, **2**) S1-

S3 exposed, S4 retracted, entirely hidden but unmodified; sterna quite closely and deeply punctate throughout, S2 and S3 somewhat swollen on each extreme side; apical margins depressed with dense, long, white pubescence, disc of S3 with white subappressed pubescence.

**Genitalia.** Plate 2, Figure G3.

**Discussion.** This species is a cavity nester and can be trap-nested (Barthell *et al.* 1998; Frankie *et al.* 1998) (Table 1). Like other members of the subgenus it collects resins and gums for nest construction and thus lacks the cutting edges between the mandibular teeth (Michener 1962).

**Distribution.** Southern BC (see Map 3).

#### 4. *Megachile (Chelostomoides) campanulae* (Robertson, 1903)

*Oligotropus campanulae* Robertson, 1903. Trans. Amer. Entomol. Soc. 29: 171 (♀, ♂).

*Oligotropus wilmingtani* Mitchell, 1924. J. Elisha Mitchell Sci. Soc. 40: 156 (♀).

*Megachile (Chelostomoides) campanulae* var. *wilmingtani* Mitchell, 1937. Trans. Amer. Entomol. Soc. 63: 384, 385, 391 (♀, ♂).

**Diagnosis:** The female of *M. campanulae* can be recognized by the combination of the parallel sided metasoma, mandibles which lack cutting edges, and by T5 entirely lacking an apical fascia. They are most similar to *M. angularum*. Females of *M. angularum* have a white apical fascia on T5. The male of *M. campanulae* can be recognized by the combination of only three visible metasomal sterna, only 4-5 punctures between lateral ocelli and edge of vertex, the front coxal spine reduced and concealed by the dense, white pubescence, and T4 and T5 with conspicuous, long and erect pale hairs. They are most similar to *M. angularum*. Males of *M. angularum* have 9-10 punctures between lateral ocelli and edge of vertex, a visible front coxal spine, T4 and T5 with conspicuous, very short and erect dark hairs.

**FEMALE:** Length 10-12 mm.

**Head.** 1) compound eyes subparallel to slightly converging below; lateral ocelli very slightly nearer eyes than margin of vertex (4:5), 2) clypeal margin with a pair of distinct tubercles, one on each side of midline, denticulate towards lateral margin, 3) mandibles distinctly 4-dentate, without cutting edges (Plate 1, Figure M4), 4) gena subequal to compound eye in width, 5)

punctures of vertex coarse, deep and distinct, uniformly and slightly separated, those on gena not quite as coarse but considerably closer, frons quite coarsely and very closely punctate, fine and densely crowded on paraocular area, supraclypeal area with some narrow, shining spaces medially, but punctures coarse and deep, becoming very close laterally, clypeus very closely and coarsely punctate, becoming somewhat more finely and more obscurely so toward apical margin medially, 6) pubescence pale on head, rather short and sparse, whitish and more copious on face around antennae, on inner orbits and on gena below, becoming sparse on clypeus, gena above and on vertex where it is somewhat more yellowish, 7) F1 broader than long (2:1), about half as long as pedicel and subequal to F2, F3 quadrate, remaining flagellomeres slightly longer than broad (2:1.7), apical flagellomere more elongate (3:2).

**Mesosoma.** 1) pubescence short, sparse and entirely white laterally and posteriorly, quite dense around pronotal lobes, very short, sparse and entirely pale on mesoscutum, whitish and somewhat more erect and elongate on scutellum, 2) mesoscutum and scutellum coarsely, deeply and closely punctate throughout, interspaces very narrow but shining, finer and very close on axilla; pleura somewhat shining between coarse, deep punctures, these becoming densely crowded anteriorly; lateral faces of propodeum somewhat smoother but dull, with very close, fine, shallow punctures, face of triangle more velvety, punctures very shallow, sparse and irregular, 3) all basitarsi somewhat narrower and shorter than their tibiae, spurs yellow, 4) tegula minutely and closely punctate, 5) wings hyaline basally, becoming faintly clouded apically, veins black.

**Metasoma.** 1) elongate and parallel-sided, T2-T4 with deep, transverse, basal grooves, filled to a considerable degree with white tomentum, basal margins distinctly and sharply carinate, apical margins depressed at extreme sides but not medially, the apical, white fasciae evident only toward extreme sides, T4 with apical fascia complete but rather narrow medially; T1 with rather sparse, erect, pale pubescence, lateral angles densely white tomentose; discal pubescence of the T2-T5 extremely sparse, entirely pale, hardly evident; T5 faintly grooved toward base but basal margin not at all distinct, apical margin depressed only toward sides and entirely lacking the apical fascia; punctures quite deep and distinct, variable in size and spacing, rather coarse and sparse medially on each tergum, becoming somewhat closer laterally and toward apical margin, quite fine and close over most of T1, rather uniformly coarse and close on T5; T6 nearly straight in profile, with an abrupt, apical lip, largely covered with pale, subappressed hairs which obscure the surface, 2) S6

covered with short scopal hairs that are pale toward base but become darker toward apex; scopal hairs otherwise yellowish-white, the sterna rather uniformly, closely, deeply and rather coarsely punctate, apical margins narrowly depressed and very narrowly hyaline.

**MALE:** Length 8-9 mm.

**Head.** 1) compound eyes very slightly convergent below; lateral ocelli subequally distant from eyes and margin of vertex, 2) clypeal margin with two robust tubercles on each side of mid-line; punctures of clypeus very coarse and contiguous, becoming somewhat finer toward apical margin, 3) mandibles 3-dentate, lower process broadly triangular, median in position, 4) gena slightly narrower than compound eye (5:7), shallowly excavated just below base of mandible, 5) vertex shining, punctures coarse, deep and rather sparse, interspaces of one to slightly less than 1 pd (with 4-5 punctures between lateral ocelli and edge of vertex), becoming slightly finer and closer on gena; frons coarsely and very closely and deeply punctate, becoming finely rugose laterally and over supraclypeal area, 6) pubescence of head entirely pale; rather short and sparse on gena and vertex, becoming quite copious and plumose around antennae and over lower part of face, largely hiding surface, longer still on gena below, very dense and shorter on lower surface on mandible and lower process, 7) F1 broader than long (2:1), about half as long as pedicel, and 1/3 as long as remaining flagellomeres which are longer than broad (1.5:2), apical flagellomere more elongate (2:1).

**Mesosoma.** 1) pubescence rather short, sparse, entirely white laterally and posteriorly, quite dense around pronotal lobes, very short and sparse on mesoscutum, becoming somewhat more erect and elongate on scutellum, 2) punctures of mesoscutum coarse, deep and close, slightly separated over most of surface, but interspaces very much narrower than diameter of punctures, those on scutellum somewhat more separated, interspaces equaling 1 pd, but fine and very close on axilla; pleura somewhat shining below between coarse and deep punctures, these becoming finer and closer above; propodeum laterally somewhat smoother but with very fine, shallow and close punctures, face of triangle somewhat more velvety, punctures more minute, sparse and vague, 3) front coxal spine reduced to a very obscure, blunt tubercle, coxa densely white pubescent; front tarsus entirely dark, tarsomeres 1-3 slightly dilated and slightly concave but barely excavated below, with some elongate, brownish hairs along anterior margin, but the usual posterior fringe completely lacking, a long cluster of intertwined setae at base of posterior margin of basitarsus; mid tibial spur well developed; mid and hind tarsi slender

and simple, spurs yellow, 4) tegula minutely and closely punctate, 5) wings subhyaline basally, becoming faintly clouded apically, veins black.

**Metasoma.** 1) T2-T5 deeply grooved across base, and with white fasciae, basal margins quite distinctly carinate, apical margins yellowish-hyaline, quite deeply depressed laterally but only slightly so medially, T1-T3 with apical, white fasciae evident only toward sides; T1 with rather copious, elongate, white pubescence, discal pubescence of T2 and T3 very sparse, short and obscure, hardly evident, entirely pale, that of T4 and T5 more conspicuous, longer and erect, and pale; punctures deep, distinct and rather coarse, rather uniformly separated, interspaces not much exceeding 1 pd, these slightly coarser at extreme sides than in centre, T1 and T5 more finely and closely punctate, T6 with smaller punctures with no interspaces, especially medially; T6 vertical, with a rather dense, basal, white fascia, otherwise quite densely covered with short, suberect, pale tomentum that darkens medially, with a few more elongate, blackish hairs, carina obscure, with a rounded median emargination, elevated but very slightly on each side above surface of tergum, median teeth of apical margin broadly carinate and very low, largely obscured by dense, white tomentum, very much nearer the acute, lateral teeth than to each other; T7 transverse, not at all produced medially, 2) S1-S3 exposed, S4 retracted, entirely hidden but unmodified; sterna quite closely and deeply punctate throughout, S2 and S3 somewhat swollen on each extreme side, apical margins depressed and densely long, white pubescent.

**Genitalia.** Plate 2, Figure G4.

**Discussion.** This species is a cavity nester and can be trapped (Baker *et al.* 1985) (Table 1). Like other members of the subgenus it collects resins and gums for nest construction (Medler 1966), and thus lacks the cutting edges between the mandibular teeth (Michener 1962). Immature stages and nest structure were illustrated by Baker *et al.* (1985), who also found the cleptoparasitic bee *Stelis (Dolichostelis) louisae* Cockerell in its nests. This cleptoparasite species is known to be associated with the subgenus *Chelostomoides* (Parker and Bohart 1979).

**Distribution:** Southern QC and ON (see Map 4).

### 5. *Megachile (Eutricharaea) apicalis* Spinola, 1808

*Megachile apicalis* Spinola, 1808. Insect. Ligur. 2: 259 (♀).

*Megachile mixta* Costa, 1863. Atti accad. Sci. fis. Napoli. 1(2): 44 (♀).



*Megachile dimidiativentris* Dours, 1873. Rev. Mag. Zool. (3) 1: 300 (♀).

*Megachile massiliensis* Pérez, 1902. Proc.-verb. Soc. linn. Bordeaux 57: 121 (♂).

*Megachile virginiana* Mitchell, 1926. Trans. Amer. Entomol. Soc. 52: 113 (♀).

**Diagnosis.** The female of *M. apicalis* can be recognized by the combination of dense, white apical fasciae on the metosomal sterna (i.e., beneath the scopa), the dull, impunctate fovea-like patches found laterally on T2, the apical edge of clypeus being angulate medially, and the scopa being black apically and laterally on S4, entirely so on S5 and S6. It is most similar to *M. rotundata*. Females of *M. rotundata* have a nearly straight clypeal margin, and the scopa entirely pale on S4 with some pale hairs basally on S5. The male of *M. apicalis* is recognized by the dull, lateral, impunctate areas of both T2 and T3, and the mostly dark tarsomeres (which may be yellowish basally). It is most similar to *M. rotundata*. Males of *M. rotundata* have the dull, lateral, impunctate areas only on T2, and tarsomeres 4 and 5 largely yellow.

**FEMALE:** Length 8-9 mm.

**Head.** 1) compound eyes slightly convergent below; lateral ocelli subequally distant from eyes and margin of vertex, 2) clypeus with apical margin angulate medially, surface of apical angulation shiny and impunctate, 3) mandibles 4-dentate, but margin of 4<sup>th</sup> tooth very slightly angulate, thus approaching a 5-dentate condition, with a cutting edge between 3<sup>rd</sup> and 4<sup>th</sup> teeth (Plate 1, Figure M5), 4) gena narrower than compound eye (5:7), 5) punctures of vertex fine and close but quite deep and distinct, becoming somewhat more shallow and obscure on gena, irregularly so below; frons densely rugose, supraclypeal area largely impunctate medially, closely and rather coarsely punctate on each side, clypeus with a wide and distinct, shining and impunctate median line, punctures on lateral edges rather coarse and densely crowded, 6) pubescence white, rather short on face, rather dense around antennae and on face laterally, sparse, erect and rather elongate on vertex, hairs yellowish with dark hairs intermixed; pubescence of gena short above, somewhat more elongate below, 7) F1 and F2 quadrate and subequal in length, slightly shorter than pedicel, which is longer than broad (2:1.5), remaining flagellomeres slightly longer, but almost quadrate, apical flagellomere longer than broad (5:3).

**Mesosoma.** 1) pubescence short, white laterally and posteriorly, quite dense around pronotal lobes and behind wing bases, very short and almost entirely lacking on mesoscutum, scutellum with more elongate,

erect hairs along posterior edge, 2) dorsal surface densely punctate throughout, punctures rather coarse in centre, lateral faces of pleura somewhat shining, with punctures somewhat shallower but contiguous, becoming somewhat finer and crowded above, larger and sparser below, propodeum somewhat more shining, punctures irregular, minute and vague, triangle somewhat shiny and impunctate, becoming somewhat rugose basally, 3) all basitarsi shorter and somewhat narrower than their tibiae, spurs yellow, 4) tegula brownish-black, with only a few, scattered, minute and obscure punctures, 5) wings subhyaline, veins black.

**Metasoma.** 1) disc of T2 with a dull, sublateral, impunctate area, fovea-like, distinct from remaining surface of disc; apical margins of T2-T5 rather abruptly depressed laterally but not medially, with entire, whitish, apical fasciae that are quite dense laterally, narrow medially; T1 with sparse, elongate, whitish pubescence that is denser laterally, T2-T4 with very short, black discal pubescence, T2-T6 with conspicuous, black hairs evident on each side in dorsal view, T6 nearly straight in profile, with numerous, suberect, black hairs evident on disc, without pale tomentum; punctures fine and close on the more basal terga, T3-T5 with punctures quite deep, distinct, and well separated, fine and close to rugose on apical edge; T6 surface very finely and quite densely punctate, 2) scopa entirely pale on S2 and S3, pale basally but more or less black apically and laterally on S4, entirely black on S5 and S6; the more basal sterna very closely and rather finely punctate, punctures becoming somewhat more coarse and sparse on the apical sterna; apical margins narrowly depressed, distinctly white fasciate beneath scopa.

**MALE:** Length 6-8 mm.

**Head.** 1) compound eyes convergent below; lateral ocelli subequally distant from eyes and margin of vertex, 2) median third of clypeal margin slightly incurved, 3) mandibles 3-dentate, lower process slender and acute, subbasal in position, 4) gena considerably narrower than compound eye (3:4), 5) punctures of vertex very close, rather fine but deep and distinct, becoming somewhat finer and more shallow on gena; face below ocelli rather finely rugosopunctate, clypeus very finely and densely rugose, 6) pubescence of face and vertex pale yellow to white, dense around antennae and over lower portion of face, supraclypeal area with very dense, subappressed, upwardly directed hairs that completely hide surface, clypeal pubescence more erect, slightly down curved at tips, but largely obscuring surface, that on vertex sparse and erect, yellowish-white on gena above, becoming white, very long and dense below, 7) F1 broader than long



(1.5:1), slightly shorter than pedicel which is quadrate, remaining flagellomeres longer than broad (5:4), apical flagellomere slender and elongate (7:3).

**Mesosoma.** **1)** pubescence yellowish-white, quite dense laterally and posteriorly, slightly sparser on mesoscutum, not obscuring surface beneath, pubescence more elongate and erect on scutellum, **2)** dorsal surface dull, surface densely and finely rugosopunctate, punctures of pleura somewhat coarser but densely crowded; propodeum rather smooth, with only exceedingly minute, sparse punctures, triangle dull and impunctate, **3)** front coxal spine spatulate, rather broad and quite short, densely white pubescent posteriorly, coxa rather densely white pubescent laterally but largely bare toward inner side, no red bristles evident; front tarsus slender and simple, with a very short but rather dense, posterior fringe, tarsomeres largely dark, yellowish at base; front tibia largely black, and front femur largely black on posterior face, apical half of anterior face quite conspicuously yellowish-brown, lower margin only obscurely carinate and yellow not invading margin of posterior face; mid tibial spur well developed, mid and hind tarsi slender and simple, spurs yellow, **4)** tegula brownish-black, minutely and closely punctate, **5)** wings subhyaline, somewhat clouded apically, veins black.

**Metasoma.** **1)** disc of T2 and T3 with dull sublateral, impunctate areas; T3 and T5 with basal grooves very shallow, subcarinate with basal fasciae arising from under the edge of the carina; apical margins of T2-T5 rather deeply depressed laterally but not medially, with dense, complete, whitish or yellowish fasciae; T1 with copious, erect, entirely pale pubescence, becoming very dense laterally, disc of T2 rather densely covered with suberect, pale hairs that do not hide surface, T3 and T4 with shorter, more obscure, suberect pale pubescence; punctures of terga close medially, fine on T2 and somewhat coarser on T3 and T4; T5 densely pale tomentose across base, with suberect, somewhat darker hairs apically, apical margin deeply depressed laterally but not in centre, punctures rather irregular but quite coarse and close, apical margin without fascia; T6 very densely pale tomentose, largely hiding surface, carina very low and irregularly crenulate, median emargination small and obscure, apical margin without distinct median teeth, and lateral angles very obscure; T7 transverse, flattened, not at all produced medially, **2)** S1-S4 exposed, finely and rather closely punctate, punctures becoming very fine apically on S4, S2 and S3 quite deeply depressed apically, yellowish hyaline, with quite dense fringes of rather elongate, white hairs.

**Genitalia.** Plate 2, Figure G5.

**Discussion.** At least three species of the subgenus *Eutricharaea* Thompson have been introduced into the western Hemisphere (Michener 2007); both of our species are of Eurasian origin. First reported as established in North America by Cooper (1984), here we report this species for Canada for the first time; a series of specimens were collected in BC: Mt. Kruger (49.0296N; 119.4926W; 415 m), Osoyoos, Okanagan-Similkameen Reg. Dist., 29.vii.2008; L.R. Best. *Megachile apicalis* nests in pre-existing cavities, and can be trap-nested (Barthell *et al.* 1998) (Table 1). Trostle and Torchio (1994) detailed the nesting and development.

**Distribution.** Southern BC (see Map 5).

## 6. *Megachile (Eutricharaea) rotundata* (Fabricius, 1793)

*Apis rotundata* Fabricius, 1793. Entom. system. 2: 332 (♂).

*Apis pacifica* Panzer, 1798. Faunae Ins. German. 55: 16 (♀).

*Megachile imbecilla* Gerstaecker, 1869. Stettin. Entomol. Ztg. 30: 359 (♀).

**Diagnosis:** The female of *M. rotundata* can be recognized by the combination of dense, white apical fasciae on the metasomal sterna (i.e., beneath the scopa), the dull, impunctate fovea-like patches laterally on T2, a nearly straight clypeal margin, and the scopa entirely pale on S4 with some pale hairs basally on S5. It is most similar to *M. apicalis*. Females of *M. apicalis* have the apical edge of clypeus angulate medially, and the scopa black apically and laterally on S4, and entirely so on S5 and S6. The male of *M. rotundata* is recognized by the dull, lateral, impunctate areas on T2 only, and tarsomeres 4 and 5 largely yellow. They are most similar to *M. apicalis*. Males of *M. apicalis* have dull, lateral, impunctate areas on both T2 and T3, and mostly dark tarsomeres (which may be yellowish basally).

**FEMALE:** Length 8-9 mm.

**Head.** **1)** compound eyes very slightly convergent below; lateral ocelli subequally distant from eyes and margin of vertex, **2)** clypeal margin nearly straight, with very shallow and rather short emarginate area on each side of the central impunctate edge, **3)** mandibles 4-dentate, with cutting edge between 3<sup>rd</sup> and 4<sup>th</sup> teeth, margin of 4<sup>th</sup> tooth very slightly angulate (Plate 1, Figure M6), **4)** gena narrower than compound eye (4:7), **5)** punctures of vertex fine and close but quite deep and distinct, becoming somewhat more shallow and obscure on gena,

irregularly so below; frons densely rugose, supraclypeal area closely and rather coarsely punctate on each side, with some shining, impunctate spaces apically in centre, clypeus with a very narrow, obscure, shining and sparsely punctate median line, punctures on each side rather coarse and densely crowded, **6**) pubescence yellowish-white, rather short on face, rather dense around antennae and on paraocular area, sparse, erect and rather elongate on vertex, with dark hairs intermixed; pubescence of gena more whitish, short above, somewhat more elongate below, **7**) F1 and F2 quadrate and subequal in length, slightly shorter than pedicel, which is longer than broad (2:1.5), remaining flagellomeres slightly longer, but almost quadrate, apical flagellomere longer than broad (5:3).

**Mesosoma.** **1**) pubescence short, white laterally and posteriorly, quite dense around pronotal lobes and behind wing bases, more yellowish, very short and inconspicuous on mesoscutum, scutellum with more elongate, erect, yellowish hairs, **2**) dorsal surface densely punctate throughout, punctures rather coarse in centre, lateral faces of pleura somewhat shining, with punctures somewhat shallower but contiguous, becoming somewhat finer and crowded above, larger and sparser below, propodeum somewhat more shining, punctures irregular, minute and vague, triangle dull and impunctate, becoming somewhat rugose basally, **3**) all basitarsi shorter and somewhat narrower than their tibiae, spurs yellow, **4**) tegula brownish-black with only a few, scattered, minute and obscure punctures, **5**) wings subhyaline, veins black.

**Metasoma.** **1**) disc of T2 with a dull, sublateral, impunctate area, fovea-like, distinct from remaining surface of disc; T2-T5 with apical margins rather abruptly depressed laterally but not medially, with entire, whitish, apical fasciae that are quite dense laterally, narrow medially; T1 with rather copious but sparse, elongate, whitish pubescence that becomes rather dense laterally, T2-T4 with very short, black, discal pubescence, T2-T6 with conspicuous, black hairs evident on each side in dorsal view, T6 nearly straight in profile, with numerous, suberect, black hairs evident on disc, without pale tomentum; punctures fine and close on the more basal terga, punctures of T3-T5 quite deep, distinct, and well separated; T6 surface very finely and quite densely punctate, **2**) scopa entirely pale on S2-S4, S5 with scopal hairs pale basally, but more or less black apically and laterally, entirely black on S6; the more basal sterna very closely and rather finely punctate, punctures becoming somewhat more coarse and sparse on the more apical sterna; apical margins narrowly depressed, distinctly white fasciate beneath scopa.

**MALE:** Length 6-8 mm.

**Head.** **1**) compound eyes convergent below; lateral ocelli subequally distant from eyes and margin of vertex, **2**) median third of clypeal margin slightly incurved, **3**) mandibles 3-dentate, lower process slender and acute, subbasal in position, **4**) gena considerably narrower than compound eye (3:4), **5**) punctures of vertex very close, rather fine but deep and distinct, these becoming somewhat finer and more shallow on gena; face below ocelli rather finely rugosopunctate, clypeus very finely and densely rugose, **6**) pubescence of face and vertex yellow, dense around antennae and over lower portion of face, supraclypeal area with very dense, subappressed, upwardly directed hairs that completely hide surface, clypeal pubescence more erect, slightly down curved at tips, but largely obscuring surface, that on vertex sparse and erect, yellowish on gena above, becoming white, very long and dense below, **7**) F1 about as long as broad, and subequal in length to pedicel, remaining flagellomeres longer than broad (5:3), apical flagellomere slender and elongate (7:3).

**Mesosoma.** **1**) pubescence whitish, quite dense laterally and posteriorly, yellowish or whitish on mesoscutum, more elongate and erect on scutellum, **2**) dorsal surface dull, surface densely and finely rugosopunctate, punctures of pleura somewhat coarser but densely crowded; propodeum rather smooth, with only exceedingly minute, sparse punctures, triangle dull and impunctate, **3**) front coxal spine spatulate, rather broad and quite short, densely white pubescent posteriorly, coxa rather densely white pubescent laterally but largely bare toward inner side, no red bristles evident; front tarsus slender and simple, with a very short but rather dense, posterior fringe, tarsomeres 2 and 3 yellow at base, 4 and 5 largely yellow; front tibia dark, and front femur largely dark on posterior face, apical half of anterior face quite conspicuously yellow, lower margin only obscurely carinate and yellow not invading margin of posterior face; mid tibial spur well developed, mid and hind tarsi slender and simple, spurs yellow, **4**) tegula brownish-black, minutely and closely punctate, **5**) wings subhyaline, somewhat clouded apically, veins black.

**Metasoma.** **1**) disc of T2 with dull sublateral, impunctate areas; basal grooves of T3 and T4 very shallow, subcarinate with a basal fasciae arising from under the edge of the carina; apical margins of T2-T5 rather deeply depressed laterally but not medially, with dense, complete, whitish or yellowish fasciae; T1 with copious, erect, entirely pale pubescence, becoming very dense laterally, disc of T2 rather densely covered with suberect, pale hairs that do not hide surface, T3 and T4 with shorter,

more obscure, suberect pubescence, which is dark at least in part; punctures of terga close medially, fine on T2 and somewhat coarser on T3 and T4, T5 densely pale tomentose across base, with suberect, somewhat darker hairs apically, apical margin deeply depressed laterally but not in centre, punctures rather irregular but quite coarse and close, apical margin not fasciate; T6 very densely pale tomentose, largely hiding surface, carina very low and irregularly crenulate, median emargination very obscure, apical margin without distinct median teeth, and lateral angles very obscure; T7 transverse, flattened, not at all produced medially, **2**) S1-S4 exposed, finely and rather closely punctate, punctures becoming very fine apically on S4, S2 and S3 quite deeply depressed apically, yellowish hyaline, with quite dense fringes of rather elongate, white hairs.

**Genitalia.** Plate 2, Figure G6.

**Discussion.** Although its presence in the Maritime Provinces may be a result of its ongoing commercial release for pollination of lowbush blueberry (Javorek 1996; see Sheffield 2008), trap-nest surveys in NS (Sheffield *et al.* 2008) have recovered *M. rotundata* in areas outside of the range of this crop. Therefore, it may have established naturally or from previous introductions in the province prior to the 1990's. Its cold-hardiness probably limits its natural distribution in Canada (Kronic 1971; Kronic and Salt 1971; Sheffield 2008), and distributional records in more northern areas are probably a reflection of where it has been released for agricultural purposes: alfalfa pollination in the west and lowbush blueberry in the east. This species is a cavity nester, and accepts trap nests (Table 1). Pitts-Singer and Cane (2011) provide a comprehensive review of the management history of this important commercial pollinator; Trostle and Torchio (1994) discussed its nesting behaviour and development.

**Distribution.** Introduced into Atlantic Canada as a pollinator of lowbush blueberry, established populations in NS, and from southern QC-BC (see Map 6). Also used in NL, though not established.

### 7. *Megachile (Litomegachile) brevis* Say, 1837

*Megachile brevis* Say, 1837. Boston J. Nat. Hist. 1: 407 (♂, ♀).

*Megachile lanuginosa* Smith, 1853. Cat. Hym. Brit. Mus. 1: 190 (♀, ♂).

?*Megachile nupta* Cresson, 1872. Trans. Amer. Entomol. Soc. 4: 268 (♀).

*Megachile perbrevis* Cresson, 1878. Trans. Amer.

Entomol. Soc. 7: 127 (♂).

**Diagnosis.** The female of *M. brevis* can be recognized by the combination of 4-dentate mandibles with the emargination between inner and 3rd teeth being approximately semicircular (i.e., its greatest depth subequally distant between the two teeth), T6 being distinctly concave in lateral view, and S6 with scopal hairs mostly pale. They are most similar to *M. coquilletti* and *M. onobrychidis*. Females of *M. coquilletti* and *M. onobrychidis* have the scopa on S6 entirely black. The male of *M. brevis* can be recognized by the combination of simple and dark front tarsi, front coxa possessing a small spine, 3-dentate mandibles, T5 with a white apical fascia, T6 with transverse carina weakly emarginate medially, with the surface above carina with white tomentum dense and conspicuous medially, concealing most of the surface beneath. They are most similar to *M. coquilletti* and *M. onobrychidis*. Males of *M. coquilletti* have yellow front tarsomeres 2-4. Males of *M. onobrychidis* have the surface of T6 above the carina largely visible, with very little white tomentum.

**FEMALE:** Length 9-12 mm.

**Head.** **1**) compound eyes slightly convergent below; lateral ocelli subequally distant from eyes and margin of vertex, **2**) clypeal margin nearly straight, median third narrowly shining and impunctate, **3**) mandibles 4-dentate, with an incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, complete between the 3<sup>rd</sup> and 4<sup>th</sup> teeth (Plate 1, Figure M7), **4**) gena slightly narrower than compound eye (3:4), **5**) punctures deep, distinct and rather coarse, more separated between eyes and ocelli, on clypeus and supra-clypeal area medially, closer between ocelli, across upper part of face and frons, and on lateral margins of clypeus, finer and more shallow and vague on gena, **6**) pubescence white, rather copious around antennae and inner orbits, on gena, especially below, largely black on vertex, **7**) F1 very slightly longer than broad, subequal in length to pedicel and to remaining flagellomeres, apical flagellomere more elongate (3:7).

**Mesosoma.** **1**) pubescence white, rather copious laterally and posteriorly, mesoscutum with interspersed black pubescence, less so on scutellum, **2**) punctures of mesoscutum close, moderately coarse, slightly separated across disc medially, those on axilla and scutellum somewhat closer and finer, shallow and rather densely crowded on pleura, propodeum somewhat smoother, punctures very fine, shallow and indistinct, triangle dull and impunctate, **3**) mid and hind basitarsi nearly as broad as their tibiae, spurs yellowish, **4**) tegula minutely and rather closely punctate, **5**) wings subhyaline, becoming



faintly clouded along apical margin, veins black.

**Metasoma.** 1) T2-T5 shallowly grooved and depressed toward basal margin, weakly carinate, apical margins more abruptly depressed laterally, rims very narrowly yellowish-hyaline; T1 with copious, elongate, erect, whitish pubescence, discal pubescence of T2 somewhat shorter and entirely whitish, that on T3-T5 black in part just basal to apical fasciae, T2-T5 with entire, whitish, apical fasciae; punctures close and fine on T1 and T2, somewhat more widely separated on T3-T5, dense on T6; T6 distinctly concave in profile, with rather abundant, erect pubescence, blackish toward base becoming pale apically, 2) scopa yellowish-white, including S6, which is well covered with scopal hairs, apical margin of S6 with a dense fringe of short, brownish hairs; sterna quite coarsely and closely punctate, narrowly yellowish-hyaline apically.

**MALE:** Length 7-9 mm.

**Head.** 1) compound eyes slightly convergent below; lateral ocelli very slightly nearer eyes than margin of vertex (5:6), 2) clypeal margin nearly straight, but median area impunctate and very slightly incurved, 3) mandibles 3-dentate, lower process acute, subbasal in position, 4) gena narrower than compound eye (5:8), 5) punctures deep and distinct, but not very coarse, rather close across vertex, more separated ( $\leq 1$  pd) laterally and between eyes and ocelli, becoming very fine, close and obscure on the more shining gena, rather coarse and quite closely crowded on frons, but becoming minute and densely crowded on supraclypeal and paraocular areas beneath pubescence, upper half of clypeus with distinct, rather coarse and slightly separated punctures evident, these becoming minute and densely crowded apically where surface is obscured by pubescence, 6) pubescence largely pale on head, pubescence quite copious and erect around antennae, on paraocular area, and on clypeus apically, elongate and quite copious on gena below, somewhat sparser but erect on vertex, 7) F1 about as long as broad, and slightly shorter than pedicel, remaining flagellomeres longer than broad (3:2), apical flagellomere more elongate, twice as long as broad.

**Mesosoma.** 1) pubescence entirely pale, elongate and quite copious laterally and posteriorly, somewhat sparser but erect dorsally, 2) punctures quite deep, distinct and close over most of mesoscutum and scutellum, relatively fine, slightly separated along mid-line of scutellum, quite densely crowded and fine on pleura, propodeum somewhat more shining, triangle dull and impunctate, 3) front coxal spine well developed but rather short, subacute, quite densely long pubescent; mid tibial spur

well developed; all basitarsi much narrower than their tibiae, spurs yellowish-brown, 4) tegula minutely and rather closely punctate, 5) wings subhyaline, veins brownish-black.

**Metasoma.** 1) T2-T5 quite deeply depressed toward basal margin, with a distinct carinate rim, apical margins narrowly and abruptly depressed, more deeply so laterally except on T4, margins narrowly yellowish-hyaline, with yellowish-white fasciae; sparse pale tomentum basally on T2-T5, pale discal pubescence copious and erect on T1 and T2, somewhat shorter but erect and rather conspicuous on T3-T5; T1 and T2 very closely and finely punctate, punctures more distinctly separated and somewhat coarser on T3 and T4, quite coarse and close over T5, T6 whitish tomentose in large part dorsally, carina with a small, median emargination that is obscured by the irregular, more lateral crenulations, median teeth of apical margin nearer lateral teeth than to each other, 2) S1-S4 exposed, apical margins depressed and yellowish-hyaline, conspicuously fringed with elongate, pale hairs, interrupted medially on S4, punctures close and fine on S1 and S2, somewhat coarser and more widely separated on S3 and S4.

**Genitalia.** Plate 2, Figure G7.

**Discussion.** This species is very similar to *M. coquilletti* and *M. onobrychidis*, but in Canada, the latter two are recorded only from BC, whereas *M. brevis* is widespread from NB west to southern BC. *Megachile onobrychidis* is often considered a subspecies of *M. brevis*, to which it is closely related, but is recognized here as a valid species based on 5.47% sequence divergence in CO1 and subtle but consistent morphological differences outlined above. Though not recorded from Canada, divergence levels in CO1 also indicate that *M. pseudobrevis* Say from the southeastern USA is a distinct species, as first suggested by Michener (1947), a view supported by other authors (e.g., Hall and Ascher 2011). Therefore, it is not included as a synonym of *M. brevis*. This species nests in hollow plant stems and in soil (Table 1).

**Distribution.** Widespread in southern Canada from NB-BC (see Map 7). Ivanochko (1979) reported a specimen from NS, but this could not be found. Extensive surveys of bees (see Sheffield 2006; Sheffield *et al.* 2003; 2008) failed to document its presence in that province.

## 8. *Megachile (Litomegachile) coquilletti* Cockerell, 1915

*Megachile mendica coquilletti* Cockerell, 1915. Ann. Mag. Nat. Hist. (8) 15: 535 (♂).

**Diagnosis.** The female of *M. coquilletti* can be recognized by the combination of 4-dentate mandibles with the emargination between inner and 3<sup>rd</sup> teeth being approximately semicircular (i.e., its greatest depth subequally distant between the two teeth), T6 being weakly concave in lateral view, and S6 with scopal hairs entirely black. They are most similar to *M. brevis* and *M. onobrychidis*. Females of *M. brevis* are typically smaller, have T6 strongly concave in lateral view, and have mostly pale scopal hairs on S6. Females of *M. onobrychidis* are somewhat smaller, and have T6 strongly concave in lateral view. The male of *M. coquilletti* can be recognized by the combination of simple, yellow front tarsomeres 2-4, front coxa possessing a small spine, 3-dentate mandibles with lower process present, T5 with a white apical fascia, T6 with the surface above carina with white tomentum dense and conspicuous medially, concealing most of the surface beneath. They are most similar to *M. brevis* and *M. onobrychidis*, and less so to *M. ericetorum*. Males of *M. brevis* and *M. onobrychidis* have entirely dark front tarsomeres. Males of *M. onobrychidis* have the surface of T6 above the carina largely visible, with very little white tomentum. Males of *M. ericetorum* are larger, have mandible without a lower process, and T6 without white tomentum above to carina.

**FEMALE:** Length 11-12 mm.

**Head.** 1) compound eyes slightly convergent below, lateral ocelli very slightly nearer edge of vertex than eyes (4.5:6), 2) clypeal margin smooth and entire, 3) mandibles distinctly 4-dentate, with an incomplete cutting edge between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth, complete between 3<sup>rd</sup> and 4<sup>th</sup> teeth (Plate 1, Figure M8), 4) gena slightly narrower than compound eye (7:9), 5) punctures fine and close on face, rather shallow on gena, deeper but rather fine and close on vertex medially, more irregular sized but still close on vertex laterally, quite coarse on clypeus, close laterally, more distinct near centre, coarse and quite sparse on supraclypeal area, 6) pubescence relatively short and white on head, dense around base of antennae and paraocular area, more elongate on gena below, black or brown on vertex in part, 7) F1 slightly longer than broad (2:1.5), slightly longer than pedicel and F2, which is quadrate, remaining flagellomeres longer than broad (5:4), apical flagellomere more elongate, almost twice as long as broad.

**Mesosoma.** 1) pubescence short and white, more dense and plumose around wing base, thinly subappressed around periphery of mesoscutum and scutellum, with inconspicuous black or brown pubescence intermixed on mesoscutum medially, 2) punctures deep but rather fine and close on mesoscutum, very slightly more coarse and sparse medially, fine and close over most of scutellum and on pleura above, becoming rather coarse and close on pleura below, propodeum finely and closely punctate, triangle dull, smooth and impunctate, 3) mid and hind basitarsi slightly narrower and shorter than their tibiae, spurs yellow, 4) tegula black, finely and closely punctate throughout, pale pubescent anteriorly, 5) wings subhyaline, slightly clouded apically, the veins black.

**Metasoma.** 1) T2 and T3 rather deeply grooved across base, the grooves on T4 and T5 more shallow but distinct, basal depressions subcarinate; apical margins of T2-T5 slightly depressed laterally, but very slightly so medially, T6 slightly concave in profile; punctures fine over most of metasoma, minute and close basally, quite distinctly separated but not sparse on T5, fine and densely crowded on T6; pubescence mostly black or brown on apical portion of discs of T3-T5, otherwise white on T1 and T2, T1-T5 with entire white apical fasciae, narrower on the more basal segments; T6 with both the erect hairs and appressed apical tomentum brown or black, 2) scopa white to pale yellow, black on S6; punctures coarse and close on basal sterna, becoming slightly more separated on apically sterna, quite sparse on S6.

**Male:** Length 9-12 mm.

**Head.** 1) compound eyes slightly convergent below; lateral ocelli subequally distant from eyes and edge of vertex, 2) clypeal margin shiny and impunctate, with a rather broad and shallow median incurved area, 3) mandible 3-dentate, lower process of mandible slender, acute, subbasal in position, 4) gena subequal to compound eye in width, 5) punctures close and quite fine on face, close but shallower on gena, close and rather fine medially on vertex, slightly more coarse laterally, 6) pubescence pale yellow or whitish on head, very copious and long on face below level of median ocellus, entirely concealing surface below, sparse on vertex and gena, becoming elongate below, 7) F1 about as long as broad, and subequal in length to pedicel, about half as long as remaining flagellomeres, which are longer than broad (2.5:2), apical flagellomere more elongate, twice as long as broad.

**Mesosoma.** 1) pubescence relatively long but not dense, pale yellow or whitish, an elongate pale fringe on posterior edge of front leg (trochanter to tarsi), 2) punctures close

and quite fine on mesoscutum and scutellum, very slightly separated in centre of disc and anteriorly on mesoscutum, very fine and close on pleura, propodeum shiny with fine and more sparse punctures, especially medially, triangle somewhat dull and impunctate, **3**) front coxal spine short but rather robust, subacute, somewhat obscured by pubescence; front femur polished yellowish to red on anterior face, dark on posterior face, the upper face more or less reddened; front tibia largely dark, slightly reddened on the two inner faces; front basitarsus black, but the tarsomeres beyond this distinctly yellowish-red, hind basitarsus very long and narrow, especially apically, less than half as broad as its tibia, spurs pale yellow, **4**) tegula shiny but finely punctate throughout, **5**) wings subhyaline basally, slightly clouded apically, the veins black.

**Metasoma.** **1**) T2-T5 quite deeply grooved across base, margin of basal groove with a distinct carina, apical margins of T4 and T5 abruptly and quite deeply depressed, distinctly depressed only at the sides of T2 and T3; T6 vertical in position, the carina quite conspicuous, with a deep semicircular median emargination, finely and irregularly denticulate on each side, the median carinate teeth of apical margin of segment triangularly pointed and slightly nearer the small lateral teeth than to each other; T7 visible, triangular, slightly protuberant and pointed medially; punctures very fine and close on metasoma basally, becoming more coarse deep and distinct on T4 and T5, punctures very fine and close on T6, these obscured by the dense pale tomentum; pubescence pale yellow or whitish on basal segments, with no dark admixture, more or less blackish on T4 and T5 apically, but entirely pale on T6, T4 and T5 with rather conspicuous white tomentum basally, T2-T4 with entire white apical fasciae, that on T5 evident only at the extreme sides, **2**) S1-S4 exposed; apical margins depressed and yellowish-hyaline, conspicuously fringed with elongate, pale hairs except medially on S4; punctures close and fine on S1 and S2, somewhat coarser and more widely separated on S3 and S4.

**Genitalia.** Plate 2, Figure G8.

**Discussion.** *Megachile coquilletti* was originally described as a subspecies of *M. mendica*, but Mitchell (1935a) noted that it seemed more closely related to the *M. brevis* group. This species nests in cavities, and apparently accepts trap-nests (Table 1).

**Distribution.** Uncommon in Canada; it is found only in southern BC (see Map 8).

## 9. *Megachile (Litomegachile) gentilis* Cresson, 1872

*Megachile gentilis* Cresson, 1872. Trans. Amer. Entomol. Soc. 4: 267 (♂).

*Megachile palmarum* Perkins, 1899. Fauna Hawaii. 1: 114 (♂, ♀).

*Megachile murinella* Cockerell, 1908a. Ann. Mag. Nat. Hist. (8) 1: 263 (♀).

**Diagnosis.** The female of *M. gentilis* can be recognized by the combination of 4-dentate mandibles, with the emargination between inner and 3<sup>rd</sup> teeth with an angulation (appearing as a weakly developed 5<sup>th</sup> tooth), T6 being weakly concave in lateral view, and S6 with scopal hairs entirely black, S1-S5 with scopal hairs white. They are most similar to *M. mendica*. The female of *M. mendica* has T6 straight in lateral view, S6 with only a few black hairs, and S1-S5 with scopal hairs yellow. The male of *M. gentilis* can be recognized by the combination of simple and dark front tarsi, front coxa possessing a small spine, 3-dentate mandibles, T5 lacking a white apical fascia, and T4 and T5 with punctures close with interspaces indistinct. They are most similar to *M. mendica*. The male of *M. mendica* has T4 and T5 with punctures separated with distinct, polished interspaces that are separated by 2-4 pd.

**FEMALE:** Length 11-12 mm.

**Head.** **1**) compound eyes convergent below; lateral ocelli slightly closer to margin of vertex than eyes (4:5), **2**) clypeal margin straight and entire, **3**) mandibles 4-dentate, incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, complete between 3<sup>rd</sup> and 4<sup>th</sup> teeth, but emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth angulate medially, thus approaching a weakly developed 5<sup>th</sup> tooth (Plate 1, Figure M9), **4**) gena narrower than compound eye (4:5), **5**) punctures deep and distinct, rather fine, quite close but not crowded across vertex, becoming more fine, shallow and close on gena, more punctatorugose on frons, clypeus shining, punctures well separated medially, becoming quite close on each side, supraclypeal area shining medially, with a distinct impunctate area in lower half, **6**) pubescence whitish, quite copious and rather elongate around antennae and paraocular area, more elongate, but sparse on gena below, becoming shorter and rather sparser above, clypeus very sparsely pubescent, pubescence of vertex and adjacent to ocelli black, **7**) F1 subequal in length to pedicel and F2, remaining segments slightly longer than broad (2.5:2), apical segment more elongate (3.5:2).

**Mesosoma.** **1**) pubescence short and sparse dorsally, not concealing surface, more dense and elongate, and entirely



pale laterally and posteriorly, copious around pronotal lobe and at base of wing, mesoscutum largely with short, erect, black pubescence, scutellum with intermixture of pale and black pubescence, scutello-mesothoracic suture with some very fine, obscure, pale tomentum, **2)** mesoscutum and scutellum rather dull, punctures in general fine, crowded, and contiguous, slightly separated in centre of scutellum, quite densely crowded on axilla, somewhat coarser on pleura below, propodeum somewhat smoother with finer punctures and larger interspaces (1-2 pd), triangle dull and impunctate, **3)** mid and hind basitarsi slightly narrower than their tibiae, spurs yellow, **4)** tegula brownish-black, minutely and rather sparsely punctate, **5)** wings sub-hyaline, veins brownish-black.

**Metasoma.** **1)** T2-T5 shallowly grooved across base, basal margin of the groove slightly carinate and complete, apical margins narrowly depressed laterally, but only slightly medially, narrowly white fasciate, discal pubescence short, erect, rather dense, entirely black on T3-T5, with a few black hairs apically on T2 in some specimens, T1 with rather thin but long and erect, entirely pale pubescence, without a distinct apical fascia; terga shining, T2-T5 with punctures fine and well separated medially, with shiny interspaces 1-2 pd apically on disc, becoming somewhat closer laterally; T6 slightly concave in lateral view, with erect, black hairs basally, with some sparse, elongate, erect hairs visible laterally on T5 and T6 in dorsal view, surface very densely and finely punctate and more or less covered with fuscous, appressed tomentum, **2)** S6 covered with black scopal hairs, S5 with some black scopal hairs at sides apically in some specimens, scopa otherwise white; S1 and S2 quite closely, uniformly punctate, S3-S5 more coarsely and sparsely so, apical margins very narrowly yellowish-hyaline.

**MALE:** Length 9-11 mm.

**Head.** **1)** compound eyes convergent below; distance from lateral ocelli to margin of vertex subequal to distance to eyes, **2)** clypeal margin nearly straight, but median third very slightly produced, shining and impunctate, very slightly incurved, **3)** mandible 3-dentate, lower process triangular, basal in position, **4)** gena slightly narrower than compound eye (4:5), **5)** punctures deep and distinct, rather fine, slightly separated on vertex laterally, with shiny interspaces, becoming somewhat finer and more shallow and vague on gena, densely crowded below ocelli, entire face around and below antennae densely and finely punctate, almost rugose beneath dense pubescence which completely hides surface, clypeus densely and finely punctate throughout, with narrow but distinctly shining interspaces beneath dense pubescence, **6)** pubescence of

face yellowish-white, quite copious and elongate below level of median ocellus, that on gena white and more sparse, very elongate below, becoming shorter above, somewhat more yellowish and elongate on vertex, with a few, intermixed dark hairs on vertex, **7)** F1 about as long as broad and subequal in length to pedicel, half as long as F2 and remaining flellomeres, which are longer than broad (5:3), apical flagellomere more elongate (4:1.5).

**Mesosoma.** **1)** pubescence greyish-white, more elongate laterally and posteriorly, especially around pronotal lobe and wing base, shorter and very sparse on mesoscutum, whitish and much more elongate on ventral surface and legs, **2)** mesoscutum dull, punctures rather fine and densely crowded except in apical half in centre where they are slightly separated, those on axilla and scutellum densely crowded; pleura dull, subrugose, punctures closely crowded; propodeum somewhat shiny, much smoother, with sparse, shallow and obscure punctures, triangle rather dull and impunctate, **3)** front coxal spine short, but well developed, triangular, partially concealed by dense, long pubescence; mid tibial spurs rather short but well developed; all basitarsi much narrower than their respective tibiae, spurs yellow, **4)** tegula reddish-brown, shining, very minutely and sparsely punctate, **5)** wings subhyaline, veins brownish-black.

**Metasoma.** **1)** T2-T5 rather deeply grooved toward base, with a distinct carina, T4 and T5 with narrow pale tomentum arising from beneath basal carina, apical margins very narrowly depressed, especially laterally, very narrowly yellowish-hyaline; T1 and T2 with punctures fine and close, contiguous, somewhat coarser and well separated medially on T3 and T4, becoming slightly closer laterally, T5 with punctures close, large and elongate; apical margin of T4 depressed across entire width; T5 with apical margin very deeply and narrowly depressed, T2-T4 with complete, pale apical fasciae, narrowed medially on T2 and T3, T5 not fasciate; T6 with dense, pale tomentum medially, carina with a deep, evenly rounded emargination, margin on each side very minutely crenulate, median teeth of apical margin slightly nearer each other than to lateral teeth; T7 broadly triangular **2)** S1-S4 exposed, apical margins of S2-S4 depressed with hyaline margins; S4 slightly, but widely produced medially, S2 and S3 with punctures fine and close with shiny interspaces <1 pd, S4 with punctures very sparse, the disc shining; S1 well covered with white elongate pubescence, discal pubescence of S2-S4 very thin, scarcely visible, S2-S3 with dense white apical fasciae, S4 with fascia laterally.

**Genitalia.** Plate 2, Figure G9.

**Discussion.** This species, common in the northwestern United States was first recorded in Canada by Scudder (1996) from one specimen, but has subsequently been collected in ongoing surveys in southern British Columbia (L.R. Best; unpublished data). *Megachile gentilis* accepts trap-nests (Kim 1992) (Table 1); its occurrence in the Hawaiian Islands as an adventives species (Snelling 2003) suggests that it nests in mobile materials such as twigs and/or wood, as suggested for other adventive *Megachile* (Cane 2003; Sheffield *et al.* 2010).

**Distribution.** This species is known from southern BC (see Map 9).

#### 10. *Megacile (Litomegachile) lippiae* Cockerell, 1900

*Megachile cleomis* var. *lippiae* Cockerell, 1900. Ann. Mag. Nat. Hist. (7) 6: 15 (♀, ♂).

**Diagnosis.** The female of *M. lippiae* can be recognized by the combination of 4-dentate mandibles with the emargination between inner and 3<sup>rd</sup> teeth being approximately semicircular (i.e., its greatest depth subequally distant between the two teeth), T6 distinctly concave in lateral view with intermixed short, erect black pubescence, and silvery-white appressed pubescence in apical half, when present, only T5 and T6 with stout, erect, black hairs visible laterally in dorsal view, S6 with scopal hairs entirely black. They are most similar to *M. texana*, less so to *M. brevis*, *M. coquilletti* and *M. onobrychidis*. Females of *M. texana* have numerous stout, erect, black hairs laterally on T2-T6 (visible in dorsal view). Females of *M. brevis* are generally smaller, and have pale scopal hairs on S6. Females of *M. coquilletti* and *M. onobrychidis* have no appressed pale hairs on T6. The male of *M. lippiae* can be recognized by the combination of 3-dentate mandibles, simple, dark front tarsi, front coxa possessing a small spine, dorsal surface of mesosoma with slight, if any, admixture of black pubescence, T5 with a white apical fascia, T6 with the transverse carina deeply emarginate medially. They are most similar to *M. texana*. Males of *M. texana* typically have the dorsal surface of mesosoma and metasoma with a considerable admixture of black pubescence.

**FEMALE:** Length 12-14 mm.

**Head.** 1) compound eyes slightly convergent below; distance between lateral ocelli and vertex subequal to distance to eyes, 2) clypeal margin straight and simple, 3) mandibles distinctly 4-dentate, incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, complete between 3<sup>rd</sup> and 4<sup>th</sup> teeth (Plate 1, Figure M10), 4) gena narrower than compound

eye (2.5:3), 5) punctures quite deep and distinct, rather fine, well separated across vertex, becoming somewhat more fine, shallow, close and obscure on gena, very close and deep on frons, very fine and densely crowded beneath dense pubescence on paraocular area, separated on clypeus medially, and well separated on supraclypeal area medially, with a large impunctate area, becoming somewhat closer laterally, 6) pubescence whitish, rather short but dense around antennae and paraocular area, more sparse on gena below, becoming somewhat shorter and sparser above, short, erect and mostly black on vertex, on upper margin of eyes, and on frons, 7) F1 about as long as broad, slightly longer than pedicel, slightly shorter in length to remaining flagellomeres, which are longer than broad (3:2), apical segment elongate, about twice as long as broad.

**Mesosoma.** 1) pubescence white, short but rather dense laterally and posteriorly, more dense around pronotal lobe and base of wing, becoming short and sparse over most of mesoscutum and scutellum, with dark admixture; scutello-mesothoracic suture with fine, pale tomentum, 2) mesoscutum dull, punctures rather fine and close, becoming very close to subrugose anterolaterally and along posterior margin; punctures slightly separated in median area of scutellum, becoming finer and densely crowded laterally and on axilla; pleura very finely and densely punctate above, becoming somewhat more coarsely and distinctly so below; propodeum somewhat smoother, punctures very minute, close and obscure, triangle dull and impunctate, 3) mid and hind basitarsi nearly as broad and about as long as their tibiae, spurs yellowish, 4) tegula dark brown, shining between fine, sparse punctures, with short white pubescence anteriorly, 5) wings subhyaline, faintly clouded in marginal cell, veins brownish-black.

**Metasoma.** 1) T2-T5 with complete, transverse, basal grooves, basal margin of each distinctly carinate, apical margins rather deeply depressed laterally, less so medially, margins very narrowly hyaline and completely white fasciate, fasciae slightly narrowing medially; T1 with pale, elongate, somewhat sparse pubescence, T2-T5 with discal pubescence short but erect, slightly more elongate medially on disc of T2, and entirely pale, mostly pale on disc of T3 and T4, T4 occasionally with a few elongate black hairs laterally, T5 with pale, erect short hairs basally, becoming black in apical half with more elongate black hairs laterally, T6 with intermixed short, erect black pubescence, and silvery-white appressed pubescence in apical half, laterally with elongate black hairs; punctures fine, very close on T1-T3, becoming more separated on T4 and T5, with shining interspaces ≤ 1 pd; T6 distinctly concave in profile, punctures very fine

and densely crowded, **2)** S6 with black scopal hairs, with a dense, apical fringe of very short, blackish hairs, scopa otherwise yellowish-white, S5 on some specimens with a few black hairs laterally on apical edge; sterna closely and deeply punctate, very finely so on the more basal sterna, becoming more coarse and sparse on the apical sterna.

**MALE:** Length 11-13 mm.

**Head.** **1)** compound eyes slightly convergent below; lateral ocelli slightly nearer eyes than margin of vertex (4:5), **2)** clypeal margin very slightly produced medially, this area narrowly polished and impunctate, very slightly incurved, **3)** mandibles 3-dentate, lower process, narrowly triangular, basal in position, **4)** gena slightly narrower than compound eye (7:9), **5)** punctures deep and distinct, rather coarse and well separated laterally on vertex; becoming finer, closer and more obscure on gena, those on frons close, coarse and contiguous to subrugose, paraocular and supraclypeal areas finely and densely rugose beneath dense pubescence, basal half of clypeus coarsely and closely punctate, punctures separate medially by  $\leq 1$  pd, punctures becoming minute and dense toward apical margin, **6)** pubescence around antennae and over lower half of face white, dense and quite elongate, more snowy-white and copious on gena below, becoming sparse above, with black hairs intermixed on vertex, **7)** F1 about as long as broad and subequal in length to pedicel, shorter than F2 which is longer than broad (3:2), remaining segments slightly longer (3.5:2), apical segment more elongate (4:1.5).

**Mesosoma.** **1)** pubescence short, entirely pale laterally and posteriorly, shorter and more sparse on central area of mesoscutum, **2)** punctures of mesoscutum close and rather coarse, very close on scutellum and densely crowded on axilla; pleura with punctures densely crowded, propodeum somewhat more shining, with shallow and rather vague punctures evident, well separated ( $> 1$ pd), triangle somewhat dull and impunctate, **3)** front coxal spine rather short but well developed, narrowly rounded apically, densely long and pale pubescent posteriorly; spurs yellowish, mid tibial spurs short but well developed; all basitarsi relatively slender and short, **4)** tegula reddish-brown, very minutely and quite closely punctate, **5)** wings subhyaline, somewhat darkened apically, veins brownish-black.

**Metasoma.** **1)** T1-T5 rather deeply grooved across base, basal margin of groove conspicuously carinate, the margin hyaline, with narrow pale tomentum arising from carina, apical margins of terga narrowly depressed, deeply so toward sides, across entire width of the more

apical terga, with entire, white fasciae which are dense laterally, quite narrow or interrupted medially on T2 and T3; discal pubescence pale, elongate, quite erect and conspicuous on T1, shorter on T2-T5, blackish toward apical margin of T5; punctures fine and close on T1 and T2, more distinctly separated on T3 and T4, rather coarse and somewhat elongate apically on T5, apical margins of discs of T4 and T5 considerably overhanging depressed apical rims laterally; T6 quite broadly and densely whitish tomentose above, carina with a deep, semicircular, median emargination, margins on each side subentire, median teeth of apical margin considerably nearer lateral teeth than to each other, **2)** S1-S4 exposed, shining, rather sparsely and coarsely punctate on the more basal sterna, becoming more sparse on the more apical sterna, apical margins depressed, yellowish-hyaline, discal pubescence pale and sparse, not hiding the surface, S2 and S3 quite densely pale fasciate.

**Genitalia.** Plate 2, Figure G10.

**Discussion.** This species is very similar to *M. texana*, and has previously been considered a synonym of that species (i.e., as *M. cleomis*; see *M. texana*). However, in addition to being generally paler, *M. lippiae* shows 2.59% divergence in CO1 from *M. texana*. *Megachile lippiae*, like *M. texana*, is probably a ground nesting species (Table 1).

**Distribution.** From southern ON-BC, though more common in the west (see Map 10).

### 11. *Megachile (Litomegachile) mendica* Cresson, 1878

*Megachile mendica* Cresson, 1878. Trans. Amer. Entomol. Soc. 7: 126 (♀).

*Megachile mendica snowi* Mitchell, 1927. Psyche 34: 113 (♀).

**Diagnosis.** The female of *M. mendica* can be recognized by the combination of 4-dentate mandibles, with the emargination between inner and 3<sup>rd</sup> teeth with an angulation (appearing as a weakly developed 5<sup>th</sup> tooth), T6 being nearly straight in lateral view, S6 with scopal hairs mostly pale, and S1-S5 with scopal hairs yellow. They are most similar to *M. gentilis*. The female of *M. gentilis* has T6 slightly concave in lateral view, S6 with entirely black scopal hairs, and S1-S5 with scopal hairs white. The male can be recognized by the combination of simple and dark front tarsi, front coxa possessing a small spine, 3-dentate mandibles, T5 lacking a white apical fascia, and T4-T5 with punctures separated with distinct, polished interspaces that are separated by 2-4



pd.. They are most similar to *M. gentilis*. The male of *M. gentilis* has T4-T5 with punctures close with interspaces indistinct.

**FEMALE:** Length 11-13 mm.

**Head.** 1) compound eyes very slightly convergent below; lateral ocelli subequally distant from eyes and margin of vertex, 2) clypeal margin straight and entire, 3) mandibles 4-dentate, with an incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, complete between 3<sup>rd</sup> and 4<sup>th</sup> teeth, but emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth slightly angulate, thus approaching a weakly developed 5<sup>th</sup> tooth occupying proximal half of the emargination (Plate 1, Figure M11), 4) gena narrower than compound eye, (3:4), 5) punctures deep and distinct, rather fine, quite close but not crowded across vertex, becoming more fine, shallow and close on gena, frons more rugose, clypeus and supra-clypeal area shining, punctures well separated medially, becoming quite close on each side, 6) pubescence whitish, quite copious and rather elongate around antennae and paraocular area, on gena below, becoming rather sparse above, pubescence of vertex black, 7) F1 subequal in length to pedicel and F2, remaining flagellomeres slightly longer than broad (2.5:2), apical flagellomere more elongate (3.5:2).

**Mesosoma.** 1) pubescence mostly pale, rather sparse laterally and posteriorly, hardly concealing surface, mesoscutum and scutellum largely black pubescent, 2) mesoscutum and scutellum rather dull, punctures fine and crowded, slightly separated anteriorly in centre of mesoscutum, quite densely crowded on axilla, scutellum and pleura above, propodeum somewhat smoother with finer punctures and larger interspaces (1-2 pd), triangle dull and impunctate, 3) mid and hind basitarsi slightly narrower than their tibiae, spurs pale yellow, 4) tegula minutely and rather closely punctate, 5) wings subhyaline, veins black.

**Metasoma.** 1) T2-T5 shallowly grooved across base, basal margin of the groove slightly carinate and complete, apical margins narrowly depressed laterally but not medially, narrowly white fasciate, fasciae more or less interrupted on the more basal terga, discal pubescence short, erect, rather dense, entirely black on T2-T5, T1 with rather sparse but long and erect, entirely pale pubescence, without a distinct apical fascia; terga shining, punctures fine and well separated medially, becoming somewhat closer laterally; T6 straight in profile, with no erect hairs evident, but some erect, rather sparse pubescence evident toward sides in dorsal view, surface very densely and finely punctate and more or less covered with brown, appressed tomentum, 2) S6 rather sparsely covered

with scopal hairs, the more apical of these black, scopa otherwise yellow; S1 and S2 quite closely, uniformly punctate, S3-S5 more coarsely and sparsely so, apical margins very narrowly yellowish-hyaline.

**MALE:** Length 8-10 mm.

**Head.** 1) compound eyes slightly convergent below; distance from lateral ocelli to margin of vertex subequal to distance to eyes, 2) clypeal margin nearly straight, but median third very slightly produced, shining and impunctate, very slightly incurved, 3) mandible 3-dentate, lower process triangular, basal in position, 4) gena very slightly narrower than compound eye, 5) punctures deep and distinct, rather fine, slightly separated across vertex, becoming somewhat finer and more shallow and vague on gena, densely crowded on frons, entire face around and below antennae densely and finely rugose beneath dense pubescence that completely hides surface, clypeus densely and finely punctate throughout, 6) pubescence of face yellowish-white, that on gena greyish-white, quite copious and elongate below, becoming somewhat more yellowish and with a few, intermixed, dark hairs on vertex, 7) F1 about as long as broad and subequal in length to pedicel, half as long as F2 and remaining flagellomeres, which are longer than broad (5:3), apical flagellomere more elongate (4:1.5).

**Mesosoma.** 1) pubescence greyish-white laterally and posteriorly, becoming somewhat more yellowish, with a few intermixed dark hairs on mesoscutum, 2) mesoscutum dull, punctures rather fine and densely crowded except in apical half in centre where they are slightly separated, those on axilla and scutellum very densely crowded; pleura dull, subrugose, punctures closely crowded; propodeum somewhat smoother, with close minute, shallow and obscure punctures, triangle dull and impunctate, 3) front coxal spine well developed, quite slender and elongate, densely long pubescent posteriorly; mid tibial spur rather short but well developed; all basitarsi much narrower than their respective tibiae, spurs yellow, 4) tegula shining, very minutely and rather closely punctate, 5) wings subhyaline, veins more brownish-black.

**Metasoma.** 1) T2-T4 rather deeply grooved toward base, with a distinct carina and narrow pale tomentum arising from carina, apical margins very narrowly depressed, especially laterally, very narrowly yellowish-hyaline; punctures of T1 and T2 very fine and close, uniform, somewhat coarser and well separated medially on T3 and T4, becoming slightly closer laterally, apical margin of T4 depressed across entire width; T5 with pale tomentum across base, apical margin very deeply and narrowly depressed, T5 not fasciate, punctures elongate basal to

apical depression, rather coarse and close apically; T6 densely pale tomentose medially, carina with a deep, evenly rounded emargination, margin on each side very minutely crenulate, median teeth of apical margin fully as near each other as each one is to the lateral tooth, **2**) S1-S4 exposed, apical margins of S2-S4 depressed with hyaline margins; punctures fine and close with shiny interspaces <1 pd, S1 well covered with white elongate pubescence, discal pubescence of S2-S4 very sparse, hardly visible, S2 and S3 with white apical fasciae, S4 without fascia.

**Genitalia.** Plate 2, Figure G11.

**Discussion.** *Megachile mendica* is a common eastern species. It nests in soil, but has also been reported accepting trap-nests (Table 1). Baker *et al.* (1985) provide illustrations for the immature stages.

**Distribution:** Eastern Canada in QC and ON and BC in the west (see Map 11).

## 12. *Megachile (Litomegachile) onobrychidis* Cockerell, 1908

*Megachile onobrychidis* Cockerell, 1908a. Ann. Mag. Nat. Hist. (8) 1: 266 (♂).

*Megachile perbrevis onobrychidis* Cockerell, 1914. Ann. Mag. Nat. Hist. (8) 13: 431.

**Diagnosis.** The female of *M. onobrychidis* can be recognized by the combination of 4-dentate mandibles with the emargination between inner and 3<sup>rd</sup> teeth being approximately semicircular (i.e., its greatest depth subequally distant between the two teeth), T6 being distinctly concave in lateral view, and S6 with scopal hairs black. They are most similar to *M. brevis* and *M. coquilletti*. Females of *M. brevis* have the scopa on S6 mostly pale. Females of *M. coquilletti* have T6 weakly concave in lateral view. The male can be recognized by the combination of simple and dark front tarsi, front coxa possessing a small spine, 3-dentate mandibles, T5 with a white apical fascia, T6 with transverse carina weakly emarginate medially, with the surface above carina mostly dark, with very little white tomentum. They are most similar to *M. brevis* and *M. coquilletti*. Males of both of these species have dense white tomentum on T6 above carina, concealing most of the surface beneath. Males of *M. coquilletti* have yellow front tarsi.

**FEMALE:** Length 9-12 mm.

**Head.** **1**) compound eyes slightly convergent below;

lateral ocelli slightly closer to margin of vertex than eyes (4:4.5), **2**) clypeal margin nearly straight, median third narrowly shining and impunctate, **3**) mandibles 4-dentate, with an incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, complete between 3<sup>rd</sup> and 4<sup>th</sup> teeth (Plate 1, Figure M12), **4**) gena slightly narrower than compound eye (3:4), **5**) punctures deep, distinct and rather coarse, slightly more separated between eyes and ocelli and on clypeus and supra-clypeal area medially, closer between ocelli, across upper part of face, frons and lateral margins of clypeus, finer and more shallow and vague on gena, **6**) pubescence white, rather copious around antennae and paracocular area, and on gena, especially below, largely black on vertex, **7**) F1 as long as broad, subequal in length to pedicel and remaining flagellomeres, apical flagellomere more elongate (3:7).

**Mesosoma.** **1**) pubescence white, rather copious laterally and posteriorly, scutum-mesoscutum with interspersed black pubescence, less so on scutellum, **2**) punctures of mesoscutum close, moderately coarse throughout, those on axilla and scutellum somewhat closer and finer, shallow and rather densely crowded on pleura, propodeum somewhat smoother, punctures very fine, shallow and indistinct, triangle relatively dull and impunctate, **3**) mid and hind basitarsi nearly as broad as their tibiae, spurs yellowish, **4**) tegula minutely and rather closely punctate, **5**) wings subhyaline, becoming faintly clouded along apical margin, veins black.

**Metasoma.** **1**) T2-T5 shallowly grooved or depressed toward basal margins, apical margins more abruptly depressed laterally, rims very narrowly yellowish-hyaline; T1 with copious, elongate, erect, whitish pubescence, discal pubescence of T2 somewhat shorter but entirely whitish, that on T3-T5 black in part just basal to apical fasciae, T2-T5 with entire, whitish, apical fasciae; punctures close and fine on T1 and T2, somewhat more widely separated on T3-T5, dense on T6; T6 distinctly concave in profile with a distinct apical lip, with rather abundant, erect black pubescence, without pale tomentum, **2**) scopa yellowish-white on S2-S5, entirely black on S6, usually with a few black hairs in the scopa of S5 laterally or apically, apical margin of S6 with a dense fringe of short, more brownish hairs; sternal plates quite coarsely and closely punctate, narrowly yellowish-hyaline apically.

**MALE:** Length 7-9 mm.

**Head.** **1**) compound eyes slightly convergent below; distance from lateral ocelli to eyes subequal to distance to margin of vertex, **2**) clypeal margin nearly straight, but impunctate median area very slightly in-curved, surface

obscured by a dense, elongate, white pubescence, **3**) mandibles conspicuously 3-dentate, lower process acute, subbasal in position, **4**) gena slightly narrower than compound eye (4:5), **5**) punctures deep and distinct with shiny interspaces <1 pd laterally on vertex, rather close medially on vertex and between eyes and ocelli, becoming very fine, close and obscure on the more shining gena, rather coarse and quite closely crowded on frons, but becoming minute and densely crowded on supraclypeal area and paraocular area beneath pubescence, but upper half of clypeus with distinct, rather coarse and quite close punctures evident, these becoming minute and densely crowded apically where surface is obscured by pubescence, **6**) pubescence largely pale yellow to white on head, quite copious and erect around antennae, on sides of face and on clypeus apically, elongate and quite copious on gena below, somewhat sparser but erect and quite copious on vertex, **7**) F1 about as long as broad, and shorter than pedicel, remaining flagellomeres longer than broad (3:2), apical flagellomere narrow and elongate, twice as long as broad.

**Mesosoma.** **1**) pubescence largely pale, with only a few yellowish hairs interspersed on mesoscutum, elongate and quite copious laterally and posteriorly, somewhat thinner but erect and quite copious on dorsal surface, **2**) punctures quite deep, distinct and close over most of mesoscutum and scutellum, relatively fine, slightly separated along mid-line of scutellum, quite densely crowded and fine on pleura, propodeum somewhat more shining, triangle dull and impunctate, **3**) front coxal spine well developed but rather short, subacute, quite densely long pubescent; all basitarsi much narrower than their tibiae, spurs yellowish-brown, **4**) tegula minutely and rather closely punctate, **5**) wings subhyaline, veins brownish-black.

**Metasoma.** **1**) T2-T5 quite deeply depressed toward basal margin, T3-T5 with a basal fasciae of subappressed white hairs; apical margins narrowly and abruptly depressed, more deeply so laterally, margins narrowly yellowish-hyaline, with whitish fasciae; discal pubescence copious and erect on T1 and T2, somewhat shorter but erect and rather conspicuous on T3-T5, yellowish, becoming darker laterally on T3-T5; T1 and T2 very closely and finely punctate, punctures more distinctly separated and somewhat coarser on T3 and T4, quite coarse and close over T5; T6 with very sparse, whitish tomentose area hardly obscuring surface, carina with a small, median emargination that is obscured by the irregular, more lateral crenulations, median teeth of apical margin nearer lateral teeth than to each other, **2**) S1-S4 exposed, apical margins depressed and yellowish-hyaline, conspicuously fringed with elongate, pale hairs; punctures close and

fine on S1 and S2, somewhat coarser and more widely separated on S3 and S4.

**Genitalia.** Plate 2, Figure G12.

**Discussion.** Although *M. onobrychidis* is often considered a subspecies of *M. brevis*, to which it is closely related, it is recognized here as a valid species based on 5.47% sequence divergence in COI, and morphological differences outlined above (see *M. brevis*). This species probably nests in the ground (Table 1).

**Distribution.** Uncommon in Canada and found only in southern BC (see Map 12).

### 13. *Megachile (Litomegachile) texana* Cresson, 1878

*Megachile texana* Cresson, 1878. Trans. Amer. Entomol. Soc. 7: 125 (♂ only).

*Megachile generosa* Cresson, 1878. Trans. Amer. Entomol. Soc. 7: 125 (♀).

*Megachile cleomis* Cockerell, 1900. Ann. Mag. Nat. Hist. (7) 6: 13 (♀ only).

*Megachile pruinosa* Friese, 1903. Ztschr. System. Hym. Dipt. 3: 246 (♀, ♂) (preoccupied).

*Megachile schismatura* Cockerell, 1908a. Ann. Mag. Nat. Hist. (8) 1: 267 (♂).

*Megachile vernonensis* Cockerell, 1912. Can. Entomol. 44: 354 ("♀" = ♂).

**Diagnosis.** The female of *M. texana* can be recognized by the combination of 4-dentate mandibles with the emargination between inner and 3<sup>rd</sup> teeth being approximately semicircular (i.e., its greatest depth subequally distant between the two teeth), T6 distinctly concave in lateral view with intermixed short, erect black pubescence, and silvery-white appressed pubescence in apical half, numerous stout, erect, black hairs laterally on T2-T6 (visible in dorsal view), and S6 with scopal hairs entirely black. They are most similar to *M. lippiae*. Females of *M. lippiae* are typically paler; the stout, erect, black hairs on the metasoma restricted to the apical terga when present. The male can be recognized by the combination of 3-dentate mandibles, simple, dark front tarsi, front coxa possessing a small spine, dorsal surface of mesosoma with a considerable admixture of black pubescence. They are most similar to *M. lippiae*. Males of *M. lippiae* typically have the dorsal surface of mesosoma with a slight, if any, admixture of black pubescence.

**FEMALE:** Length 11-14 mm.



**Head.** 1) compound eyes slightly convergent below; distance between lateral ocelli and vertex subequal to distance to eyes, 2) clypeal margin straight and simple, 3) mandibles distinctly 4-dentate, with an incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, complete between 3<sup>rd</sup> and 4<sup>th</sup> teeth (Plate 1, Figure M13), 4) gena slightly narrower than compound eye (5:6), 5) punctures quite deep and distinct, rather fine, well separated across vertex, becoming somewhat more fine, shallow, close and obscure on gena, very close and deep on frons, very fine and densely crowded on paracocular area beneath dense pubescence, separated on clypeus medially, and well separated on supraclypeal area medially, with a large impunctate area, becoming somewhat closer laterally, 6) pubescence whitish, rather short but dense around antennae and paracocular area, on gena below, becoming somewhat short and sparser above, black on vertex, 7) F1 longer than broad (3:1.5), almost twice as long as pedicel and F2, which are subquadrate, remaining flagellomeres slightly longer than broad (2:1.5), apical flagellomere elongate, about twice as long as broad.

**Mesosoma.** 1) pubescence white, short but rather dense laterally and posteriorly, black over most of mesoscutum and scutellum, scutello-mesothoracic suture with some very fine, obscure, pale tomentum, and mesoscutum with some whitish pubescence anteriorly, 2) mesoscutum dull, punctures rather fine, irregular, well separated in centre, becoming very close anterolaterally and along posterior margin; punctures slightly separated in median area of scutellum, becoming finer and densely crowded laterally and on axilla; pleura very finely and densely punctate above, becoming somewhat more coarsely and distinctly so below; propodeum somewhat smoother, punctures very minute, close and obscure, triangle dull and impunctate, 3) mid and hind basitarsi nearly as broad and about as long as their tibiae, spurs yellowish, 4) tegula very minutely and closely punctate, 5) wings subhyaline, faintly clouded apically, veins black.

**Metasoma.** 1) T2-T5 with complete, transverse, basal grooves, basal margin of each distinctly carinate, apical margins rather deeply depressed laterally, less so medially, margins very narrowly hyaline and completely white fasciate, fasciae narrow medially, becoming broader and dense laterally; discal pubescence short but erect, entirely black, T1 with some blackish pubescence laterally on disc, otherwise relatively pale, apical fascia very thin but complete; punctures fine, very close on T1 and T2, becoming more distinctly separated on T3-T5, somewhat coarser and more sparse toward apical margin of each plate; T6 distinctly concave in profile, with abundant, erect pubescence evident, largely black with the more apical pubescence subappressed and pale,

punctures very fine and densely crowded, 2) S6 rather well covered with black scopal hairs, with a dense, apical fringe of very short, black hairs, scopa otherwise yellowish-white, becoming black apically on S5; sterna closely and deeply punctate, very finely so on the more basal plates, becoming more coarse and sparse on the more apical plates.

**MALE:** Length 10-12 mm.

**Head.** 1) compound eyes slightly convergent below; lateral ocelli slightly nearer eyes than margin of vertex (7:8), 2) clypeal margin very slightly produced medially, narrowly polished and impunctate, very slightly incurved, 3) mandibles 3-dentate, basal process triangular, subbasal in position, 4) gena subequal to compound eye in width, 5) punctures deep and distinct, rather coarse and well separated across vertex; becoming finer, closer and more obscure on gena, coarse and contiguous on frons, paracocular area and supraclypeal area finely and densely rugose beneath dense pubescence, basal half of clypeus coarsely and closely punctate, punctures separate medially by  $\leq 1$  pd, becoming minute and dense toward apical margin, 6) pubescence around antennae and over lower half of face white, dense and quite elongate, more snowy-white and copious on gena below, becoming sparse above, black on vertex, 7) F1 about as long as broad and subequal in length to pedicel, shorter than F2, which is longer than broad (3:2), remaining flagellomeres slightly longer (3.5:2), apical flagellomere more elongate (4:1.5).

**Mesosoma.** 1) pubescence white laterally and posteriorly, black on central area of mesoscutum, with a few, erect, black hairs on scutellum, 2) punctures of mesoscutum close and rather coarse, slightly separated only in median area of disc, very close on scutellum and densely crowded on axilla; pleura dull, punctures densely crowded, propodeum somewhat more shining, with shallow and rather vague punctures evident, well separated ( $> 1$  pd), triangle somewhat shiny and impunctate, 3) front coxal spine rather short but well developed, narrowly rounded apically, densely long pubescent posteriorly; spurs yellowish, mid tibial spur short but well developed; all basitarsi relatively slender and short, 4) tegula very minutely and quite closely punctate, 5) wings subhyaline, somewhat darkened apically, veins black.

**Metasoma.** 1) T1-T5 rather deeply grooved across base, basal margin of groove conspicuously carinate, with narrow pale tomentum arising from carina, apical margins narrowly depressed across entire width of the more apical terga, more so laterally, with entire, white fasciae that are dense laterally, quite narrow or interrupted

medially; discal pubescence pale, elongate, quite erect and conspicuous on T1, shorter on the following segments, black toward apical margin of each; punctures fine and close on T1 and T2, more distinctly separated on T3 and T4, rather coarse and somewhat closer on T5, apical margins of discs of T4 and T5 considerably overhanging the depressed apical rims laterally; T6 quite broadly and densely whitish tomentose above, carina with a deep, semicircular, median emargination, margins on each side subentire, median teeth of apical margin considerably nearer lateral teeth than to each other, 2) S1-S4 exposed, shining, rather closely and coarsely punctate on the more basal plates, becoming rather sparse on the more apical plates, apical margins depressed, yellowish-hyaline, discal pubescence copious but sparse, not hiding the surface, quite densely fasciate on S2 and S3.

**Genitalia.** Plate 2, Figure G13.

**Discussion.** This common species is very similar to *M. lippiae*, both morphologically and based on CO1 divergence levels of 2.59%. Krombein (1953) and Eickwort *et al.* (1981) discussed the nesting biology of this soil-nesting species (Table 1).

**Distribution:** Common throughout southern Canada from QC-BC (see Map 13).

#### 14. *Megachile (Megachile) centuncularis* (Linnaeus, 1758)

*Apis centuncularis* Linnaeus, 1758. Syst. Nat., Ed. 10: 575 (♀).

*Apis rotundata* Fabricius, 1787. Mant. Insect. 1: 303 (♂).

*Megachile parvula* Lepeletier, 1841. Hist. Nat. Insect. Hymen. 2: 340 (♀).

*Megachile infragilis* Cresson, 1878. Trans. Amer. Entomol. Soc. 7: 127 (♂).

*Megachile appia* Nurse, 1903. Ann. Mag. Nat. Hist. 11: 546.

*Megachile leoni* Titus, 1906. Proc. Entomol. Soc. Wash. 7: 150 (♀).

*Perezia maura* Ferton, 1914. Ann. Soc. Entomol. France 83: 233 (intersex).

*Megachile centuncularis theryi* Cockerell, 1931. Ann. Mag. Nat. Hist. (10) 7: 274.

*Megachile centuncularis nesiotica* Mavromoustakis, 1953. Ann. Mag. Nat. Hist. (12) 6: 779.

**Diagnosis.** The female of *M. centuncularis* can be recognized by the combination of 5-dentate mandibles with an incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, entirely pale scopa, and T6 with pubescence entirely

black. They are most similar to *M. lapponica* and *M. relativa*. The female of *M. lapponica* has black scopal hairs on S6. The female of *M. relativa* has T6 with conspicuous, erect golden hairs among the black hairs. The male can be recognized by the combination of simple and dark front tarsi, front coxa without spine, 3-dentate mandibles with the teeth equally spaced, clypeus without a prominent median tubercle on apical margin, and the outer tarsal claw much more rounded than the inner claw. They are most similar to *M. lapponica* and *M. relativa*. The males of these two species have a prominent median tubercle on apical margin of clypeus, and inner and outer tarsal claws that are equally sharp.

**FEMALE:** Length 10-11 mm.

**Head.** 1) compound eyes slightly convergent below; lateral ocelli slightly nearer margin of vertex than eyes (5:6), 2) clypeus rather strongly convex, apical margin straight, narrowly shining and impunctate medially, 3) mandibles distinctly 5-dentate, with an incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure M14), 4) gena subequal to compound eye in width, 5) punctures rather coarse, but shallow, becoming slightly separated (< 1 pd) on vertex laterally, somewhat closer medially, and closely crowded on frons, becoming fine, close and obscure on gena; punctures rather coarse and well separated on clypeus and supraclypeal area medially, becoming close laterally and along upper margin of clypeus, 6) pubescence quite elongate around antennae and on lower paraocular area and on clypeus, hardly obscuring surface, largely yellowish, but with some darker hairs in region of ocelli and on vertex laterally, 7) F1 longer than broad (2:1.5), longer than pedicel, slightly longer than F2, subequal in length to remaining flagellomeres, which are slightly longer than broad (2:1.7), apical flagellomere elongate (7:3).

**Mesosoma.** 1) pubescence largely yellowish, quite copious laterally and posteriorly, dorsal surface somewhat more sparsely pubescent, 2) punctures of mesoscutum coarse, close and distinct, not very deep, slightly separated only in centre of disc, scutellum and axilla with densely crowded punctures; punctures of pleura rather shallow, quite close and coarse, surface rather dull, propodeum somewhat more shining, punctures minute and rather close and obscure, triangle shiny and impunctate, 3) mid and hind basitarsi nearly as broad as their tibiae, but considerably shorter, spurs yellow, 4) tegula shining, with very fine and rather close punctures anteriorly, almost impunctate in posterior half, 5) wings subhyaline, faintly clouded apically, veins brown-black.

**Metasoma.** 1) T2-T4 with complete, transverse grooves that are submedian near centre, somewhat nearer basal margin at sides, punctures fine, rather well separated medially, becoming somewhat closer laterally, those on apical portions of discs somewhat closer than those on basal side of grooves, apical margins not at all depressed medially, somewhat depressed toward sides where there are quite densely white fasciate; T5 not grooved, punctures slightly separated, rather fine and irregular, apical margins slightly depressed, with a complete white fascia; discal pubescence suberect, rather dense, entirely pale on T1 and T2, short, black and erect on T3-T5, but with yellowish hairs evident at sides as viewed from above, T6 very slightly concave in profile, with abundant, erect and rather elongate, black hairs evident, surface very finely, closely and deeply punctate across base, these becoming very fine, densely crowded and obscure toward the apex, 2) S6 largely bare and shining, with a subapical fringe of elongate hairs, and a more nearly apical fringe of shorter hairs, apex produced slightly beyond this fringe, yellowish-hyaline; scopa orange-yellow, sterna closely, quite uniformly punctate, punctures very fine on the more basal segments, becoming quite coarse and close on the more apical sterna.

**MALE:** Length 8-9 mm.

**Head.** 1) compound eyes subparallel to slightly converging below; lateral ocelli subequally distant from eyes and margin of vertex, 2) clypeal margin nearly straight, very slightly and narrowly produced medially, though hardly tuberculate, 3) mandibles distinctly 3-dentate, basal process triangular, subbasal in position, 4) gena subequal to compound eye in width, 5) punctures deep and distinct, slightly separated on vertex toward each side, rather finely crowded on frons; gena very finely and quite closely punctate, minutely and densely crowded over lower part of face and clypeus, 6) pubescence yellowish, quite dense and elongate around antennae and over face below, rather short but faintly yellowish and quite copious on gena below, black on vertex and on gena above, 7) F1 about as long as broad, longer than pedicel, and shorter than remaining flagellomeres, which are longer than broad (5:3), apical flagellomere slender and more elongate, twice as long as broad.

**Mesosoma.** 1) pubescence largely yellowish laterally and posteriorly, dorsal surface somewhat more sparsely pubescent with intermixtures of black hairs on mesoscutum and scutellum, 2) mesoscutum closely, rather coarsely and distinctly punctate throughout, punctures densely crowded laterally and over scutellum and axilla, very close on pleura; propodeum somewhat shining, smooth, punctures minute and quite close

posteriorly, triangle shiny and impunctate, somewhat rugosostriate along basal margin, 3) all basitarsi slender and simple, much shorter than their tibiae; spurs yellow, middle spur well developed, outer tarsal claws much more rounded than the inner ones, which are pointed, 4) tegula somewhat yellowish-brown, shining, minutely and rather closely punctate, 5) wings subhyaline, veins black.

**Metasoma.** 1) T2 and T3 with basal transverse depressions; T1-T4, quite closely and regularly punctate, apical margins slightly depressed laterally; discal pubescence erect and pale on T1 and T2, dark in part on T3-T5, base of T5 with a rather large patch of appressed, yellowish tomentum, apical margin depressed, densely yellowish fasciate; T6 shining, with minute and very close punctures and scattered, more or less distinct, well separated nodules, the carina only slightly produced, very shallowly emarginate apically, median teeth of apical margin carinate and broad, lateral teeth very low and subacute, 2) S1-S4 exposed, yellowish-hyaline apically, S1-S3 with rather dense fringes of pale yellowish hair, discs sparsely pale pubescent; punctures close and rather fine on the more basal terga, becoming somewhat coarser but still close apically.

**Genitalia.** Plate 2, Figure G14.

**Discussion.** Although historically considered holarctic in distribution (which is confirmed by DNA barcoding), the lack of specimens of *M. centuncularis* from northwestern North America is atypical for a holarctic species (see Map 14). Recent study of an unrelated bee species with a similar range has demonstrated that the North American populations resulted from an introduction (Zayed *et al.* 2007), the same may be true for *M. centuncularis*. Further studies to confirm the status of this species in North America are warranted. *Megachile centuncularis* is a cavity nester, and accepts trap-nests (Table 1), has a second generation in some parts of its range in Canada (C.S. Sheffield, pers. obs. in NS).

**Distribution:** Widespread in southern Canada from NS-BC (see Map 14).

### 15. *Megachile (Megachile) inermis* Provancher, 1888

*Megachile simplex* Provancher, 1882. Nat. Canad. 13: 229. (♂) (preoccupied).

*Megachile inermis* Provancher, 1888. Addit. Corr. Faune Entomol. Canada, Hym. pg. 323 (♂).

*Megachile simplicissima* Dalla Torre, 1896. Cat. Hym. 10: 449 (replacement name for *M. simplex* Provancher, 1882, not Smith, 1853).



*Megachile sapellonis* Cockerell, 1900. Ann. Mag. Nat. Hist. (7) 6: 7 (♀).

*Megachile temporalis* Friese, 1903. Ztschr. System. Hym. Dipt. 3: 247 (♂) (♀ misdetermination).

*Megachile decipiens* Lovell and Cockerell, 1907. Psyche 14: 19 (♂).

**Diagnosis.** The female of *M. inermis* can be recognized by the combination of 5-dentate mandibles with an incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, clypeal margin with a slight but rather broad median protuberance, broad vertex, the gena being wider than the compound eye, and the entirely pale scopa. They are most similar to *M. centuncularis*, *M. lapponica* and *M. relativa*, all of which have the lateral ocelli nearer margin of vertex than eyes. The male can be recognized by the combination of simple and dark front tarsi, front coxal spine represented by a low dentiform tubercle that is hidden by pubescence, 3-dentate mandibles with the 2<sup>nd</sup> tooth much nearer the apical tooth than the 3<sup>rd</sup> tooth. They are most similar to *M. montivaga*. Males of *M. montivaga* have mandibles with three equally spaced teeth.

**FEMALE:** Length 15-20 mm.

**Head.** **1)** compound eyes parallel to slightly converging below; lateral ocelli considerably nearer eyes than margin of the very broad vertex (10:7), **2)** clypeal margin with a slight but rather broad median protuberance delineated by a narrow but rather deep semicircular emargination on each side, with small sublateral tubercles; margin at extreme sides with an oblique, subapical groove beyond which the surface is shining and impunctate, **3)** mandibles 5-dentate, with an incomplete cutting edge between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure M15), **4)** gena wider than compound eye (4:3), **5)** vertex shining, punctures shallow but distinct, variable in size, rather close medially, becoming more sparse laterally, especially between ocelli and eyes; punctures on gena minute, slightly separated and quite evenly distributed; frons rather coarsely rugosopunctate, supraclypeal area and clypeus shining and sparsely punctate medially, punctures becoming rather close and quite deep on lateral margins, **6)** pubescence sparse, not at all obscuring the surface, most dense around antennae and lower paraocular area, elongate and pale on gena below, but still rather sparse, becoming shorter and sparser above, with erect and elongate black hairs on vertex, between ocelli, and to some degree between antennae, **7)** F1 longer than broad (3:2), about twice as long as pedicel, subequal in length to remaining flagellomeres, apical flagellomere more elongate, twice as long as broad.

**Mesosoma.** **1)** pubescence pale and rather dense laterally

and posteriorly; mesoscutum and scutellum with shorter but erect and conspicuous black pubescence, becoming pale peripherally, **2)** mesoscutum with punctures quite deep and distinct with very small interspaces, becoming densely crowded laterally and anteriorly; scutellum rather dull, punctures closely crowded and rather fine, very fine and dense on axilla; pleura somewhat shining below between fine and close but slightly separated punctures, these becoming very fine and quite densely crowded above; propodeum somewhat more shining and smooth, punctures fine and close, triangle somewhat shiny and impunctate, **3)** front coxa with a small but distinct tubercle; mid and hind basitarsi somewhat shorter and narrower than their tibiae, spurs reddish, **4)** tegula somewhat shining, smooth and impunctate in large part, but with some very minute, rather close punctures anteriorly and on inner sides, **5)** wings subhyaline, veins yellowish-brown.

**Metasoma.** **1)** T2-T5 with complete but rather shallow subbasal grooves, basal margins quite distinct and somewhat carinate, apical margins of terga narrowly depressed, whitish fasciate, the fasciae more or less interrupted on the more basal terga, pubescence of T1 elongate and rather copious, entirely whitish, discs of following terga with short but erect, rather conspicuous hairs, these blackish on each disc apically, to some degree pale toward base, punctures very fine or minute, slightly separated, rather obscure, becoming slightly coarser and closer at extreme sides; T6 nearly straight in profile, with short, largely black suberect hairs, surface very densely and finely punctate and rather densely covered with very fine appressed dark tomentum that does not hide surface, **2)** S6 well covered with pale scopal hairs, with a dense, apical fringe of very short hairs; scopa otherwise pale yellowish, the sterna closely and deeply punctate, finely so on the more basal segments, becoming rather coarse apically, apical margins narrowly yellowish-hyaline.

**MALE:** Length 11-15 mm.

**Head.** **1)** compound eyes subparallel; lateral ocelli much nearer eyes than margin of the very broad vertex, **2)** clypeal margin nearly straight, with a very slight, median protuberance, densely covered with elongate, pale hairs, margin at extreme sides with an oblique, subapical groove beyond which the surface is shining and impunctate, **3)** mandible 3-dentate, distance from the apex of the middle tooth to the apex of inner tooth nearly twice as great as that to the apical tooth, lower process elongate, rather broadly carinate, subbasal in position; **4)** gena wider than compound eye (5:4), **5)** punctures of vertex rather fine and shallow, quite close medially, becoming rather well separated and irregular between eyes and ocelli, close

and fine on gena, frons more closely rugosopunctate, punctures becoming very fine and densely crowded on supraclypeal area, somewhat finer and crowded over most of clypeus, excluding the lateral areas of apical edge, which is shiny and impunctate, **6**) pubescence quite copious, dense and elongate around antennae and over lower part of face, on gena below, becoming somewhat sparser but still quite elongate on vertex, with a few dark hairs intermixed with generally pale pubescence on vertex, **7**) F1 longer than broad (3:2.5), about twice as long as pedicel, shorter than remaining flagellomeres, which are longer than broad (3.5:2), apical flagellomere more elongate, twice as long as broad.

**Mesosoma.** **1**) pubescence quite copious, dense and elongate laterally and posteriorly, becoming somewhat sparser but still quite elongate dorsally, with a few dark hairs intermixed with generally pale pubescence of mesoscutum, **2**) punctures rather fine and close over most of mesoscutum, densely crowded elsewhere; very fine and densely crowded on axilla; pleura rather smooth, punctures very fine and quite close; propodeum somewhat smoother but rather dull, with fine and close punctures, surface largely obscured by pubescence, triangle somewhat shiny and impunctate, **3**) coxal spine represented by a low dentiform tubercle that is hidden by pubescence; all basitarsi much shorter and narrower than their tibiae, the apical tarsomeres becoming more or less reddish; spurs yellowish-brown, mid tibial spur short but well developed, outer tarsal claws much more rounded than the inner ones, which are pointed, **4**) tegula shining, with sparse irregular minute punctures, **5**) wings subhyaline, veins yellowish-brown.

**Metasoma.** **1**) T2-T4 rather deeply grooved basally, grooves complete, their basal margins somewhat carinate, apical margins of terga rather abruptly depressed, especially toward sides, rather densely white fasciate, but fasciae rather widely interrupted medially on T2 and T3, complete on T4 and T5; T1 and T2 with rather elongate, entirely pale, erect pubescence, discal pubescence of T3 and T4 suberect, largely black; T3-T5 more or less densely fasciate across base; punctures very minute and well separated throughout, T6 somewhat shining, surface very minutely and rather closely, shallowly punctate, deeply depressed just before the carina medially, the carina rather broadly and shallowly emarginate medially, entire laterally, median teeth of apical margin absent, lateral teeth small but distinct and acute; T7 clearly evident, transverse, rather short, the broad, dorsal area rather broadly excavated and shining, apical margin blunt, **2**) S1-S4 exposed, yellowish-hyaline apically, margined with rather dense fringes of pale yellowish hair, discs sparsely pale pubescent; punctures close and rather

fine on the more basal terga, becoming somewhat coarser but still close apically.

**Genitalia.** Plate 2, Figure G15.

**Discussion.** This is one of our largest species, and is common and routinely collected in trap-nests and other pre-existing cavities, though it will excavate into rotting logs (Table 1). Stephen (1956) discussed the biology of this species.

**Distribution:** Widespread from NF, NS-BC, and into the subarctic (see Map 15).

## 16. *Megachile (Megachile) lapponica* Thomson, 1872

*Megachile lapponica* Thomson, 1872. Hym. Scand. 2: 227.

*Megachile nivalis* Friese, 1903. Ztschr. System. Hym. Dipt. 3: 246. (♀). **NEW SYNONYMY**

*Megachile melanopyga amaguella* Cockerell, 1924. Ann. Mag. Nat. Hist. (9) 13: 602 (♂).

*Megachile lapponica baicalica* Cockerell, 1928. Ann. Mag. Nat. Hist. (10) 1: 355 (♀) (preoccupied).

*Megachile lapponica var kurbati* Cockerell, 1928. Ann. Mag. Nat. Hist. (10) 1: 356 (♀).

*Megachile lapponica fuscifrons* Cockerell, 1930. Entomol. 63: 184 (*Nom. nov. Megachile lapponica baicalica* Cockerell, 1928).

*Megachile (Anthemois) santiamensis* Mitchell, 1934. Trans. Amer. Entomol. Soc. 59: 311. (♀). **NEW SYNONYMY**

*Megachile lapponica ishikawai* Hirashima and Maeta, 1974. Kontyu 42: 170 (♀).

**Diagnosis.** The female of *M. lapponica* can be recognized by the combination of 5-dentate mandibles, and T6 with scopa black. They are most similar to *M. centuncularis* and *M. relativa*. The females of these species have entirely pale scopa. The male of *M. lapponica* can be recognized by the combination of simple and dark front tarsi, front coxa without spine, 3-dentate mandibles with the teeth equally spaced, clypeus with a prominent median tubercle on apical margin, the inner and outer tarsal claws that are equally sharp, the first submarginal cell with vein r shorter than vein Rs of the second submarginal cell, more prominent hypostomal tubercle and a deep, well defined hypostomal concavity. They are most similar to *M. centuncularis*, *M. inermis* and *M. relativa*. Males of *M. centuncularis* lack a median tubercle on the clypeus, and have the outer tarsal claw much more rounded than the inner claw. Males of *M. inermis* have 3-dentate mandibles with the 2<sup>nd</sup> tooth much

closer to the apical tooth than the inner tooth. Males of *M. relativa* have the first submarginal cell with vein r subequal to vein Rs of the second submarginal cell, and a less prominent hypostomal tubercle and a more shallow, less defined hypostomal concavity.

**FEMALE:** Length 9-12 mm.

**Head.** **1)** compound eyes very slightly convergent below; lateral ocelli nearer margin of vertex than eyes (4:5), **2)** clypeal margin nearly straight, obscurely crenulate and slightly emarginated medially, **3)** mandibles 5-dentate, with an incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure M16), **4)** gena slightly broader than compound eye (7:9), **5)** punctures on vertex rather fine and shallow, to some degree separated, but rather irregular, becoming slightly more coarse and close on gena, frons more rugosopunctate, supraclypeal area rugosopunctate laterally but with shining interspaces medially, clypeus with rather shallow but quite close punctures, **6)** pubescence whitish, more or less erect and copious around antennae and on gena though hardly obscuring surface; clypeus with pale hairs more yellowish, vertex and area surrounding ocelli, and upper gena adjacent to eye margin with erect but rather sparse black pubescence, **7)** F1 longer than broad (2:1), twice as long as pedicel, and longer than remaining flagellomeres, which are slightly longer than broad (2:1.7), apical flagellomere more elongate, about twice as long as broad.

**Mesosoma.** **1)** pubescence whitish and rather copious on laterally and posteriorly, and on upper segments of legs, becoming yellow on apical segments, the mesoscutum and scutellum with erect but rather thin and sparse, black pubescence, **2)** mesoscutum shining medially, the punctures quite shallow and rather coarse, with distinct interspaces, becoming densely crowded laterally and anteriorly, those on scutellum and axilla somewhat finer and very close, slightly separated on scutellum medially; pleura somewhat shining below, punctures shallow and rather coarse, slightly separated, becoming closely crowded above where the surface is dull; propodeum smooth and somewhat shining, punctures fine and evenly spaced, triangle shiny and impunctate, **3)** mid and hind basitarsi slightly shorter and narrower than tibiae, spurs yellow, **4)** tegula very finely and obscurely punctate anteriorly, shiny and with shallow and sparse punctures in posterior half, **5)** wings subhyaline, veins black.

**Metasoma.** **1)** T2-T4 with shallow, subbasal grooves, their basal margins faintly carinate, apical margins depressed laterally but not medially, these lateral areas quite densely whitish fasciate; discal pubescence erect and black on T3-T5, apically on T2, more copious,

elongate and entirely white on T1; punctures of T1 fine, well separated but not sparse, somewhat coarser and irregular on the more apical terga, T5 with a shallow, subbasal groove laterally with basal margin faintly carinate, apical margin of T5 depressed and whitish fasciate across entire width, T6 straight in profile, with a few, robust, erect, but rather short dark hairs evident, **2)** S6, and S5, at least apically, sparsely covered with black scopal hairs and with an apical fringe of very short dark hairs; scopa otherwise yellow; the sterna closely, deeply and rather finely punctate basally, punctures becoming somewhat more sparse apically, apical margin of each sternum very narrowly yellowish-hyaline.

**MALE:** Length 9-12 mm.

**Head.** **1)** compound eyes slightly convergent below; distance between lateral ocelli and vertex subequal to distance to eyes, **2)** clypeal margin nearly straight on either side of a distinct but small median tubercle, **3)** mandible 3-dentate, lower process rather narrow, subtruncate apically, subbasal in position, **4)** gena broader than compound eye (4:3), **5)** punctures fine, slightly separated across vertex posteriorly, sparse between lateral ocelli and eye, becoming close on gena above and densely crowded or rugosopunctate below; face below ocelli rather coarsely rugosopunctate, becoming finely so below antennae and on clypeus; hypostomal depression well defined, hypostomal tubercle long and relatively prominent, broadly interrupting hypostomal carina, **6)** pubescence golden, becoming paler on lower part of gena, quite long and copious around antenna and lower part of face, on gena below, vertex with an admixture of pale and black pubescence, **7)** F1 longer than broad (2.5:2), longer than pedicel, slightly shorter than remaining flagellomeres, which are longer than broad (3:2), apical flagellomere more elongate, twice as long as broad.

**Mesosoma.** **1)** pubescence golden, becoming paler and quite long and copious laterally and posteriorly, mesoscutum and scutellum with more or less intermixed light and dark hairs that are quite long and erect but sparse, **2)** mesoscutum dull, punctures close, shallow, not very coarse, slightly separated only in centre of disc; punctures of scutellum slightly separated along mid-line, but otherwise quite uniformly close, those on axilla much finer and densely crowded; pleura dull, punctures shallow, quite close and poorly-defined; propodeum relatively smooth and shining, with the fine punctures evenly spaced, triangle shiny and impunctate, **3)** basitarsi quite short and slender; mid tibial spur short but well developed, **4)** tegula brownish, shining, rather uniformly, minutely and rather closely punctate, **5)** wings subhyaline, veins brown, vein r of first submarginal cell



shorter than vein Rs of second submarginal cell.

**Metasoma.** 1) T2-T4 shallowly grooved or depressed across base, basal margin of grooves not distinctly carinate, apical margins depressed only toward sides, depressed medially only on T4 and T5, pale apical fasciae evident at extreme sides of the more basal terga, more or less complete on T4 and T5, discal pubescence rather sparse, largely black but with pale hairs evident toward sides, length of discal pubescence exceeding apical margin of all terga when viewed laterally, T1 covered with copious, elongate, whitish pubescence; punctures very fine, surface shining, punctures close and fine on T2, quite sparse on T3 and T4, becoming somewhat coarser laterally, but still well separated, T5 with somewhat closer and coarser punctures throughout; T6 shining, carina very low, broadly and shallowly incurved medially, punctures fine and close above carina, separated by 1 pd, becoming somewhat more coarse and sparse laterally, inner teeth of apical margin broadly carinate, widely separated, relatively near the short, acute, lateral teeth; T7 quite prominent, broad and short, with a deep excavation on dorsal surface, 2) S1-S4 exposed, closely but rather obscurely punctate, apical margins of S2-S4 broadly yellowish-hyaline and with thin, apical fringes of pale hairs.

**Genitalia.** Plate 2, Figure G16.

**Discussion.** This is the first report of the synonymy of *M. nivalis* with *M. lapponica*, based on both morphological similarities and CO1, thus making this one of three species of *Megachile* with a Holarctic distribution. The male of *M. lapponica* can only be distinguished with certainty from *M. relativa* by examining the genitalia (see Sheffield and Westby 2007; as *M. nivalis*). This species is a cavity nest and accepts trap-nests (Table 1).

**Distribution.** Widespread in Canada from NB-BC, though much more common in montane and boreal areas of the west (see Map 16).

### 17. *Megachile (Megachile) montivaga* Cresson, 1878

*Megachile montivaga* Cresson, 1878. Trans. Amer. Entomol. Soc. 7: 124 (♀, ♂).

*Megachile helianthi* Cockerell, 1908a. Ann. Mag. Nat. Hist. (8) 1: 259 (♀).

**Diagnosis.** The female of *M. montivaga* can be recognized by the combination of 5-dentate mandibles without cutting edges (often appearing 4-dentate), T6 distinctly concave in profile with few erect hairs visible except laterally, and an entirely pale scopa. They are most

similar to *M. ericetorum*. The female of *M. ericetorum* has distinct 4-dentate mandibles, and the apical edge of clypeus with a small median tubercle. The male of *M. montivaga* can be recognized by the combination of simple and dark front tarsi, front coxal spine represented by an acute, dentiform tubercle, 3-dentate mandibles with the teeth equally spaced, clypeus without a prominent median tubercle on apical margin, and T6 being rather strongly protuberant medially. They are most similar to *M. inermis*. The males *M. inermis* have 3-dentate mandibles with the 2<sup>nd</sup> tooth much nearer the apical tooth than the 3<sup>rd</sup> tooth.

**FEMALE:** Length 11-13 mm.

**Head.** 1) compound eyes very slightly convergent below; lateral ocelli slightly nearer eyes than margin of vertex (7:9), 2) clypeus slightly convex, apical margin nearly straight and impunctate medially, 3) mandibles obscurely 5-dentate, the 4<sup>th</sup> tooth a slight angulation between 3<sup>rd</sup> and 5<sup>th</sup> teeth, with no cutting edges (Plate 1, Figure M17), 4) gena subequal to compound eye in width, 5) punctures of vertex deep and distinct, close, though more separated laterally, becoming somewhat more shallow and close on gena, finer and more densely crowded on frons and paraocular area, supraclypeal area and clypeus with a shining, medial impunctate band, punctures becoming quite deep, distinct and close laterally, 6) pubescence of head mostly pale, rather copious but short around antennae, paraocular area, and gena below; vertex with long sparse pale hairs along posterior margin, with dark hairs in ocellar triangle and below median ocellus extending onto vertex laterally, 7) F1 longer than broad (2:1.5), slightly longer than pedicel and F2, which is quadrate, remaining flagellomeres subquadrate to very slightly longer than broad, apical flagellomere more elongate (5:3).

**Mesosoma.** 1) pubescence almost entirely pale, rather copious but not obscuring the surface, short laterally and posteriorly; mesoscutum and scutellum with sparse pubescence, mostly pale, with an intermixture of dark pubescence anteriorly on mesoscutum, 2) punctures of mesoscutum quite close, deep, distinct, slightly separated in centre of disc; punctures of scutellum finer than on mesoscutum, slightly separated medially, becoming crowded laterally, very fine and densely crowded on axilla; punctures of pleura distinctly but not widely separated below, rather deep and distinct, becoming somewhat finer and very close above; propodeum relatively smooth and somewhat shining with well spaced shallow punctures, triangle impunctate, somewhat shiny, 3) basitarsi of all legs somewhat narrower and shorter than their tibiae, spurs yellowish-brown, 4) tegula very

finely and rather closely punctate, becoming impunctate along outer margins, **5)** wings lightly infuscated, veins black.

**Metasoma.** **1)** T2-T4 quite deeply grooved across base, basal margins of grooves somewhat carinate, T5 with a similar, very shallow groove that is poorly defined medially; apical margins depressed only toward sides on T2 and T3, quite deeply depressed across entire width of T4 and T5, quite densely white fasciate, the fasciae more or less interrupted on the more basal terga; discs of terga somewhat shining, finely and rather sparsely punctate medially, becoming somewhat closer only at extreme sides, but punctures basal to grooves somewhat closer and deeper, although finer; discal pubescence relatively elongate, sparse and entirely pale on T1, very short, fine and erect on remaining terga, black apically on T3, entirely so on T4 and T5; T6 distinctly concave in profile, with few erect hairs visible except laterally, surface very finely and closely punctate, punctures becoming inevident apically, surface very finely white tomentose toward apex, **2)** S6 with scattered scopal hairs toward base, but quite bare over apical half, with an apical fringe of very short, pale hairs; scopa otherwise pale yellow; sterna closely, deeply and finely punctate on the more basal segments, becoming somewhat more sparse and coarse apically, apical margins very narrowly yellowish-hyaline.

**MALE:** Length 9-11 mm.

**Head.** **1)** compound eyes slightly convergent below; lateral ocelli slightly nearer margin of vertex than eyes (5:6), **2)** clypeal margin nearly straight, a few crenulations medially, **3)** mandible 3-dentate, lower process sharply acute, subbasal in position, **4)** gena slightly broader than compound eye (8:7), **5)** punctures of vertex rather fine, deep and distinct, close medially, but somewhat more widely separated laterally, those on gena uniformly close and fine, somewhat coarser and slightly separated on frons just below median ocellus, otherwise very fine and densely crowded over most of face, slightly separated only in centre of clypeus and along its upper margin, very fine and dense apically, **6)** pubescence entirely pale on head, pale yellow to white and quite dense around antennae and over lower half of face, on gena below, becoming rather short above, becoming rather short and sparse on vertex, with a few shorter, inconspicuous, darker hairs evident on vertex and upper inner margin of compound eyes, **7)** F1 about as long as broad, longer than pedicel, shorter than remaining flagellomeres, which are slightly longer than broad (2.5:2), apical flagellomere elongate, about twice as long as broad.

**Mesosoma.** **1)** pubescence entirely pale, rather short and sparse dorsally, dense and white laterally and posteriorly, **2)** mesoscutum dull, punctures quite shallow, not very coarse, slightly separated medially, becoming closer anteriorly and posteriorly, uniformly close and fine on scutellum, and very fine and crowded on axilla; pleura dull, punctures fine and uniformly crowded; propodeum somewhat smoother, shining, with fine, well-spaced punctures, triangle dull and impunctate, **3)** front coxal spine represented by an acute, dentiform tubercle, legs somewhat reddened, basitarsi much shorter and narrower than their respective tibiae, mid tibial spur rather short but well developed, spurs yellow, **4)** tegula yellowish-brown, minutely and rather closely punctate, **5)** wings subhyaline, veins brownish-black.

**Metasoma.** **1)** T2-T4 with complete, transverse, basal grooves, basal margin of these rather distinctly carinate, apical margins rather deeply depressed laterally but not medially, depressed areas white fasciate; T1 with rather long, erect, entirely whitish pubescence, that on T2 very short but evident, discal pubescence on T3-T5 mostly sparse, short and erect black hair, T5 with sparse, erect and rather elongate, pale hairs in addition to dark hairs; T1 very closely and finely punctate, punctures becoming successively more distinct and somewhat more coarse on the more apical terga, well separated but not sparse on T5, T6 dull, punctures fine and densely crowded except across the narrow base, rather strongly protuberant medially, carina with a shallow, median emargination and slightly, irregularly crenulate on each side, median teeth of apical margin carinate, much nearer the acute, slender, lateral teeth than to each other; T7 clearly evident, short, transverse, quite deeply concave just basal to margin, **2)** S1-S4 exposed, punctures quite close and rather fine, apical margins of S2-S4 abruptly and quite deeply depressed, clear hyaline, rather conspicuously fringed with elongate, whitish hairs except medially on S4.

**Genitalia.** Plate 2, Figure G17.

**Discussion.** Unlike other members of the subgenus *Megachile* in North America, females of *M. montivaga* collect flower petals instead of leaves for nest cell construction. Although reported to accept trap-nests (Baker *et al.* 1985), this seems to be an uncommon event (e.g., Ivanochko 1979; Sheffield *et al.* 2008) and the bee may preferentially nest in soil (Table 1). Uncommon compared to most members of the subgenus *Megachile*. The synonymy of *M. helianthi* (from Colorado) with *M. montivaga* is recent (Scott *et al.* in press, via pers. comm. with John Ascher, American Museum of Natural History).

**Distribution:** Found throughout southern Canada, from NS-BC (see Map 17).

### 18. *Megachile (Megachile) relativa* Cresson, 1878

*Megachile (Megachile) relativa* Cresson, 1878. Trans. Amer. Entomol. Soc. 7: 126 (♀).

*Megachile (Xanthosarus) exclamans* Viereck, 1916. Bull. Conn. State Geol. Nat. Hist. Survey 22: 743 (♀).

*Megachile aspera* Mitchell, 1924. Jour. Elisha Mitchell Sci. Soc. 40: 158 (♀).

**Diagnosis.** The female of *M. relativa* can be recognized by the combination of 5-dentate mandibles, entirely pale scopa, and T6 with erect, golden pubescence. They are most similar to *M. centuncularis* and *M. lapponica*. The female of *M. centuncularis* has T6 with pubescence entirely black. The female of *M. lapponica* has black scopal hairs on S6. The male can be recognized by the combination of simple and dark front tarsi, front coxa without spine, 3-dentate mandibles with the teeth equally spaced, clypeus with a prominent median tubercle on apical margin, the inner and outer tarsal claws that are equally sharp, the first submarginal cell with vein r subequal to vein Rs of the second submarginal cell, and a less prominent hypostomal tubercle and a more shallow, less defined hypostomal concavity. They are most similar to *M. centuncularis*, *M. inermis* and *M. lapponica*. Males of *M. centuncularis* lack a median tubercle on the clypeus, and have the outer tarsal claw much more rounded than the inner claw. Males of *M. inermis* have 3-dentate mandibles with the 2<sup>nd</sup> tooth much closer to the apical tooth than the inner tooth. Males of *M. lapponica* have the first submarginal cell with vein r shorter than vein Rs of the second submarginal cell, more prominent hypostomal tubercle and a deep, well defined hypostomal concavity. Males of *M. relativa* can only be distinguished with certainty from *M. lapponica* by examining the genitalia (see Discussion under *M. lapponica*).

**FEMALE:** Length 9-12 mm.

**Head.** 1) compound eyes slightly convergent below; lateral ocelli nearer margin of vertex than eyes (5:6), 2) clypeal margin nearly straight, obscurely crenulate and slightly emarginated medially, 3) mandibles 5-dentate, with an incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure M18), 4) gena slightly broader than compound eye (7:6), 5) punctures on vertex rather fine and shallow, to some degree separated, but rather irregular, becoming slightly more coarse and close on gena, frons more rugosopunctate, supraclypeal area

rugose laterally but with shining interspaces medially, clypeus with rather shallow but quite close punctures, 6) pubescence whitish, more or less erect and copious around antennae and on gena though hardly obscuring surface; clypeus with intermixture of pale and darker hairs, vertex and area surrounding ocelli with erect, rather sparse, black pubescence, 7) F1 longer than broad (2:1), twice as long as pedicel, and longer than remaining flagellomeres, which are slightly longer than broad (2:1.7), apical flagellomere more elongate, about twice as long as broad.

**Mesosoma.** 1) pubescence whitish and rather copious on mesosoma laterally and posteriorly and on upper segments of legs, becoming yellow on apical segments, the mesoscutum and scutellum with erect, rather sparse, black pubescence, 2) mesoscutum shining medially, the punctures quite shallow and rather coarse, with distinct interspaces, becoming densely crowded laterally and anteriorly, those on scutellum and axilla somewhat finer and very close, slightly separated on scutellum medially; pleura somewhat shining below, punctures shallow and rather coarse, slightly separated, becoming closely crowded above where the surface is dull; propodeum smooth and somewhat shining, punctures vague and fine, triangle shiny and impunctate, 3) mid and hind basitarsi slightly shorter and narrower than their tibiae, spurs yellow, 4) tegula very finely and obscurely punctate anteriorly, with shallow and sparse punctures in posterior half, 5) wings subhyaline, veins black.

**Metasoma.** 1) T2-T4 with shallow, subbasal grooves, their basal margins faintly carinate, apical margins of terga depressed laterally but not medially, quite densely whitish fasciate laterally, discal pubescence erect and black, more copious, elongate and entirely white on T1; punctures of T1 fine, well separated but not sparse, somewhat coarser and irregular on the more apical terga, T5 with a shallow, subbasal groove laterally, with basal margin of groove faintly carinate, apical margin of T5 depressed and whitish fasciate across entire width, T6 straight in profile, with a few, robust, erect, but rather short hairs, surface rather densely covered with yellowish, appressed tomentum, 2) S6 sparsely covered with scopal hairs and with an apical fringe of very short yellow hairs; scopa otherwise yellow; the sterna closely, deeply and rather finely punctate basally, punctures becoming somewhat more sparse on the plates apically, apical margin of each sternum very narrowly yellowish-hyaline.

**MALE:** Length 8-10 mm.

**Head.** 1) compound eyes slightly convergent below;



lateral ocelli slightly nearer to eye than margin of vertex (6:5), **2**) clypeal margin nearly straight, with a distinct and rather robust median tubercle, **3**) mandible 3-dentate, lower process rather narrow, subtruncate apically, subbasal in position, **4**) gena somewhat broader than compound eye (8:7), **5**) punctures rather fine, slightly separated across vertex posteriorly, rather sparse between ocelli and eyes, becoming more regularly close on gena above, densely crowded or rugosopunctate below; frons and supra-clypeal area rather coarsely rugosopunctate, becoming finely so below antennae and over clypeus, hypostomal tubercle short, hypostomal concavity shallow and not well defined, **6**) pubescence whitish, quite long and copious around antennae and lower part of face and on gena below; vertex with more or less intermixed light and dark hairs that are quite long and erect but rather sparse, black hairs present along inner margin of eyes and around ocelli, **7**) F1 longer than broad (3:2), twice as long as pedicel, slightly shorter than to subequal in length to remaining flagellomeres, which are longer than broad, apical flagellomere more elongate, twice as long as broad.

**Mesosoma.** **1**) pubescence whitish, quite long and copious laterally and posteriorly; mesoscutum and scutellum with more or less intermixed light and dark hairs that are quite long and erect but rather sparse, **2**) mesoscutum rather dull, punctures close, rather shallow, not very coarse, slightly separated only in centre of disc; punctures of scutellum slightly separated along mid-line, but otherwise quite uniformly close, those on axilla much finer and densely crowded; pleura rather dull, punctures shallow, quite close and rather vague; propodeum relatively smooth and shining, punctures fine and well spaced medially, triangle shiny and impunctate, **3**) basitarsi quite short and slender, the more apical tarsomeres to some degree yellowish; mid tibial spur short but well developed, **4**) tegula shining, rather uniformly, minutely and rather closely punctate in anterior half, punctures becoming sparse posteriorly, **5**) wings subhyaline, veins black, vein r of first submarginal cell normally subequal to vein Rs of second submarginal cell.

**Metasoma.** **1**) T2-T4 shallowly grooved or depressed across base, basal margin of grooves not distinctly carinate, apical margins of terga depressed only toward sides, depressed medially only on T4 and T5, pale apical fasciae evident at extreme sides of the more basal terga, more or less complete on T4 and T5, discal pubescence rather sparse and short, largely pale, but with dark hairs evident toward sides on all except T1, which is covered with quite copious, elongate, whitish pubescence; punctures very fine, surface shining, rather close on T2 barely evident on T1, quite sparse on T3 and T4, becoming

somewhat coarser laterally, but still well separated, T5 with somewhat closer and coarser punctures throughout; T6 shining, carina very low, broadly and shallowly incurved medially, punctures fine and close above carina, becoming somewhat more coarse and sparse laterally, median teeth of apical margin broadly carinate, widely separated, relatively near to the short, acute, lateral teeth; T7 quite prominent, broad and short, with a deep excavation on dorsal surface, **2**) S1-S4 visible, closely but rather vaguely punctate, apical margins of S2-S4 broadly yellowish-hyaline and with thin, apical fringes of pale hairs, which is interrupted medially on S4.

**Genitalia.** Plate 2, Figure G18.

**Discussion.** *Megachile relativa* is one of the the most common members of the genus in Canada; it is commonly collected in trap-nests (Table 1), and is often found nesting in commercial nests of *M. rotundata* (pers. obs.). The cold-hardiness of this species was previously studied by Kronic and Salt (1971).

**Distribution.** Widespread throughout Canada from NS-BC, and into the western subarctic (see Map 18).

### 19. *Megachile (Megachiloides) anograe* Cockerell, 1908

*Megachile anograe* Cockerell, 1908a. Ann. Mag. Nat. Hist. 8: 261 (♀).

*Megachile laurita* Mitchell, 1927. Psyche 34: 115 (♀).

NEW SYNONYMY.

*Megachile laurita semilaurita* Mitchell, 1927. Psyche 34: 116 (♀). NEW SYNONYMY.

*Megachile (Xeromegachile) alamosana* Mitchell, 1934. Trans. Amer. Entomol. Soc. 59: 329 (♂). NEW SYNONYMY.

**Diagnosis.** The female of *M. anograe* can be recognized by the combination of 3-dentate mandibles, relatively large body size (12-13 mm), and the shiny, sparsely punctate surface of T5 and T6 (with shiny interspaces of 3-4 pd). They are most similar to *M. sublaurita* and *M. umatillensis*. The female of *M. sublaurita* is generally smaller (9-10 mm), and has T5 and T6 more densely punctate. The female of *M. umatillensis* has a 4-dentate mandible. The male of *M. anograe* is recognized by the combination of conspicuously pale coloured and greatly modified front legs, a rounded postmedian transverse carina on T6, and T5 lacking a white, apical fascia. They are most similar to *M. sublaurita* and *M. umatillensis*, and less so to *M. fortis*, *M. wheeleri*, *M. manifesta*, and *M. subnigra*, all of which have a white, apical fascia on

T5.

**Female:** Length 12-13 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli subequally distant from eyes and edge of vertex, 2) clypeal margin nearly straight, slightly thickened and narrowly impunctate medially, 3) mandible 3-dentate, the two apical teeth approximate, with a very long cutting edge between 2<sup>nd</sup> and inner tooth (Plate 1, Figure M19), 4) gena slightly wider than compound eye (9:7), 5) punctures fine and close on vertex and gena above, most of face below ocelli, and on clypeus basally, becoming more coarse in apical half of clypeus, more shallow and sparse on gena below, 6) pubescence entirely white on head, sparse on most surfaces, hardly concealing surface except around base of antennae, 7) F1 longer than broad (5:4) and longer than pedicel and F2, which is very slightly broader than long, remaining flagellomeres quadrate, apical flagellomere longer than broad (4:2.5).

**Mesosoma.** 1) pubescence relatively short, thin and entirely white, more elongate laterally and posteriorly, copious around pronotal lobe and at wing base, 2) punctures relatively coarse and close on mesoscutum and scutellum, with shiny interspaces present, especially medially on mesoscutum, scutellum with a thin but distinct impunctate area medially, punctures relatively coarse, deep and sparse on pleura, propodeum shiny with punctures fine and sparse, triangle shiny and impunctate, very slightly rugose along basal margin, 3) mid and hind basitarsi distinctly shorter and narrower than their tibiae, 4) tegula reddish, finely punctate, becoming more sparse in posterior half, 5) wings hyaline, very slightly clouded apically, the veins reddish-brown.

**Metasoma.** 1) T2-T5 very slightly depressed basally, with an indistinct carinate rim, and depressed somewhat apically; T6 triangular in dorsal aspect, narrowly subtruncate apically with the sides straight, straight in profile with abundant dark erect hair visible; all terga shining, punctures minute and close on T1 and T2, becoming increasingly sparse but also fine to T5 with shiny interspaces 3-4 pd in width, somewhat less sparse on T6; T1-T5 with white apical fasciae, dense on the more apical terga, narrower medially on the more basal ones, pubescence entirely white on T1 and T2, T3-T5 with dark hairs on apical half of disc; T5 and T6 with black pubescence laterally, 2) scopa white, entirely black on S5-S6 (most specimens); punctures fine and close on basal sterna, becoming coarse and more sparse apically, with shiny interspaces.

**Male:** Length 10-11 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli subequally distant from eyes and edge of vertex, 2) clypeal margin slightly produced, shallowly emarginate medially, apical rim of emargination narrowly shiny and impunctate, 3) mandible 3-dentate, the 2<sup>nd</sup> tooth much closer to the apical tooth than the inner one, lower process triangular, acute, subbasal in position, 4) gena slightly wider than compound eye, 5) punctures fine, shallow, but rather close on gena, becoming deeper and more distinctly separated on vertex and between lateral ocelli and eyes, with shiny interspaces  $\leq 1$  pd, fine and close on face below median ocellus, including clypeus and supraclypeal area, fine interspaces shiny though hidden beneath dense pubescence, 6) pubescence entirely pale yellowish-white on head, dense and elongate on face below median ocellus, on clypeus and supraclypeal area, sparser but elongate on gena below, and medially on vertex, pubescence of vertex laterally and along upper margin of eye sparse, short, and erect, 7) F1 about as long as broad, slightly longer than pedicel, subequal in length to F2, which is quadrate, the remaining flagellomeres slightly longer than broad (4:3), apical flagellomere flattened and broadly dilated.

**Mesosoma.** 1) pubescence copious and entirely pale on dorsal surface, more elongate on propodeum, with dense white tufts at edges of pronotal lobe and behind wing base, pale on legs, the front tarsal fringe pale and long, with dark tipped hairs on the underside, mid tarsal fringe pale, long and conspicuous, 2) punctures fine and close, very slightly separated near centre of mesoscutum, more so on scutellum medially, and on pleura, propodeum with fine well spaced punctures, triangle smooth, shiny and impunctate, 3) front coxal spine narrowly triangular, broader at base, with a patch of reddish bristles on outer half of base, tip with a very small patch of pubescence, elongate, pale pubescence on posterior surface, coxal surface otherwise bare; front femur dark on outer surfaces, yellowish-brown above, otherwise yellowish with lower margin rounded and carinate, front tibia mostly yellowish, with small darker areas on outer face, apex yellowish, with a series of stiff, black bristles, front tarsus yellowish and slightly dilated, front basitarsus slightly narrower than its tibia, the anterior margin excavated, basal half of inner rim of excavation with dark, short bristles, tarsomeres 2-4 with a dark spot ventrally, mid and hind tarsi dark brown, hind basitarsus very short, less than half as long as its tibia, narrowed apically, outer surface of hind basitarsus shiny, with sparse, long pubescence, 4) tegula reddish-brown, shiny, finely and sparsely punctate, 5) wings subhyaline, the veins brownish-black.

**Metasoma.** 1) terga slightly depressed basally, basal margin of depression slightly carinate, terga more deeply depressed apically; carina of T6 entire, slightly irregularly crenulate, produced medially into a rounded to broadly triangular point that points downward, the apical margin with pronounced carinate median teeth, the lateral teeth small but distinct; T7 conspicuous, produced medially into an acute spine; punctures minute, shallow and close ( $\leq 1$  pd) on basal terga, but becoming very sparse on the shining, more apical terga, T6 shining, sparsely punctate; pubescence sparse and entirely dark brown to black on discs of T3-T6, copious and entirely pale on T1 and T2, complete, but sparse white apical fasciae on T1-T4, T5 lacking fascia, 2) S1-S4 visible, apical margins depressed and hyaline, discs shiny and sparsely punctate.

**Genitalia.** Plate 2, Figure G19.

**Discussion.** This species is uncommon in southern Alberta, and Hobbs and Lilly (1954) thought it too rare to be an important alfalfa pollinator. Melanistic forms (i.e., *Megachile laurita*, *M. laurita semilaurita*) occur in the western United States, though have not been recorded from Canada. *Megachile laurita* and *M. laurita semilaurita* show no divergence in CO1 sequence from *M. anograe* collected throughout its range, and other than the completely black scopa (and dark pubescence in other areas), show no other morphological differences from *M. anograe* and are thus placed into synonymy. The type specimens of the newly synonymised species were examined. This species nests in the ground (Table 1).

**Distribution:** Southern AB, east of the Rocky Mountains (see Map 19).

## 20. *Megachile (Megachiloides) casadae* Cockerell, 1898

*Megachile casadae* Cockerell, 1898. Ann. Mag. Nat. Hist. (7) 1: 127 (♂).

*Megachile populi* Cockerell, 1900. Ann. Mag. Nat. Hist. (7) 6: 17 (♀).

*Megachile opuntiarum* Cockerell, 1906a. Ann. Mag. Nat. Hist. (7) 17: 229 (♀).

*Megachile austinensis* Mitchell, 1927. Psyche 34: 105 (♀).

**Diagnosis.** The female of *M. casadae* is distinct and can be recognized by the combination of 4-dentate mandibles with the emargination between inner and 3<sup>rd</sup> teeth distinctly oblique, the greatest depth much closer to inner tooth, and the clypeal surface which is shiny and sparsely punctate. The male of *M. casadae* is also distinct, and

is recognized by the combination of conspicuously pale coloured and greatly modified front legs, a rounded postmedian transverse carina on T6, T5 with a white apical fascia, and the clypeal surface which is shiny and sparsely punctate. Other members of the subgenus *Megachiloides* in Canada have a densely punctate clypeus in both sexes.

**Female:** Length 12-14 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli slightly closer to edge of vertex than to eyes (5:6), 2) clypeal margin straight, shining and broadly impunctate, slightly impressed just above the edge, 3) mandible 4-dentate, with an incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, complete between 3<sup>rd</sup> and inner teeth, emargination between inner and 3<sup>rd</sup> teeth distinctly oblique with greatest depth in emargination much closer to the inner tooth than to 3<sup>rd</sup> tooth (Plate 1, Figure M20), 4) gena subequal to compound eye in width, 5) punctures very fine and close on most of face, clypeus and supraclypeal area shiny and sparsely punctate, especially medially, punctures becoming more coarse and distinct laterally, punctures fine and close on vertex, becoming more sparse (1pd) along upper inner eye margin, shallow on gena, 6) pubescence short and dense on face around antennae, white to pale yellow on face and gena, yellowish-brown on vertex, 7) F1 slightly longer than broad (4:3), longer than pedicel and F2, which is quadrate, subequal in length to remaining flagellomeres, apical flagellomere more elongate (2:1).

**Mesosoma.** 1) pubescence dense and rather short, white on pleura, propodeum, mesoscutum anteriorly, scutellum, and legs, brownish, short and erect on most of mesoscutum, 2) punctures very close and fine laterally on mesoscutum and scutellum, with shiny interspaces of 1 pd (or slightly more) medially; punctures of pleura and propodeum fine and close ( $< 1$  pd), triangle somewhat shiny and impunctate, 3) mid and hind basitarsi distinctly shorter than their tibiae, hind basitarsus about as wide as tibia, spurs yellow, 4) tegula black, finely punctate throughout, anterior margin pubescent, 5) wings subhyaline, slightly clouded apically, the veins black.

**Metasoma.** 1) T2-T5 depressed basally with a distinct, complete carinate rim, terga somewhat more deeply depressed apically; T6 in dorsal aspect only slightly concave at sides, rounded apically, straight to very slightly concave in profile; punctures minute and very close on T1, becoming more distinct but still quite close on T2 and T3, becoming more sparse ( $\geq 1$  pd) on T4 and T5, fine and crowded on T6; pubescence white on T1, T2-T5 with erect blackish pubescence, T6 with some black pubescence basally, with silvery tomentum apically,



T2-T5 with entire white apical fasciae, these narrower on the more basal terga, broad, dense and conspicuous on the more apical ones, **2**) scopa black on S6 except at base, otherwise yellowish-white, punctures coarse and close, becoming slightly more separated on more apical sterna.

**Male:** Length 12-14 mm.

**Head.** **1**) compound eyes subparallel to slightly convergent below; lateral ocelli subequally distant from eyes and edge of vertex, **2**) clypeal margin straight, **3**) mandible 3-dentate, with 2<sup>nd</sup> tooth much closer to apical tooth than inner tooth, the lower process very robust, subbasal in position, **4**) gena slightly wider than compound eye (7:5), lower margin of lower concavity produced into a carina-like projection with a apical tuft of yellowish-brown hair, **5**) punctures fine and close on head, slightly separated (1 pd) on vertex near ocelli and adjacent to upper eye margin, becoming shallow on gena, clypeus with fine, sparse punctures, interspaces shining (1-2 pd), apical margin narrowly impunctate, **6**) pubescence pale yellowish-brown and sparse on vertex, becoming white below with no dark admixture, very long and dense on clypeus, pointing downward, that on supraclypeal area and around antennae shorter and pointing upward, more sparse on gena, **7**) F1 quadrate, subequal in length to pedicel, shorter than F2 and remaining flagellomeres which are longer than broad (3:2), apical flagellomere flattened and somewhat dilated.

**Mesosoma.** **1**) pubescence long, pale yellow on mesoscutum, becoming long and dense below, fading to white with no dark admixture, tarsal fringes long, white, the front tarsal fringe with brownish-black hairs ventrally, **2**) punctures fine and close throughout, slightly separated (1 pd) medially on mesoscutum and scutellum and propodeum, triangle rather dull and impunctate, **3**) front coxal spine narrow, about twice as long as broad, slightly bowed anteriorly, coxal surface polished, with a small patch of reddish setae at base of spine; front femur widely dilated, the lower margin distinctly bisinuate basally, anterior and posterior faces of front femur and tibia with polished yellowish-red areas, otherwise dark, front tarsus pale yellow, the posterior margin beneath with black areas; front tarsus slightly dilated, basitarsal margins subparallel, subequal to tibia in width, the anterior margin; mesosternum neither carinate nor spined anteriorly; hind basitarsus subequal in length to tarsomeres 2-4 combined, much longer than wide, and much shorter than tibia, spurs yellow, **4**) tegula yellowish-brown, finely punctate, **5**) wings subhyaline, the veins yellowish-brown.

**Metasoma.** **1**) T2-T6 depressed basally with strong

carinate rim, strongly depressed apically; carina of T6 broadly triangular with fine irregular denticulations, apical margin with carinate median teeth much nearer less prominent lateral teeth than each other; T7 robust, produced medially into a spine-like projection which is longer than basal width; punctures minute and close on basal terga, becoming slightly more coarse and sparse to T5, the more apical terga shining with interspaces 1 pd, T6 more coarsely punctate; discal pubescence sparse and entirely pale on T1 and T2, dense and elongate on T1; T3-T5 with mostly black erect hairs in apical half, entire whitish apical fasciae on T2-T5, with long white, dense hairs below carina of T6, **2**) S1-S4 visible, punctures fine with shiny interspaces, apical margins depressed and hyaline, disc with very short, fine pale pubescent, scarcely visible, more elongate laterally, with long white apical fasciae on lateral margins of S2-S4.

**Genitalia.** Plate 2, Figure G20.

**Discussion.** This is the first record of this species in Canada. Two female specimens were collected in pan traps at Onefour, Alberta (N49 09.37, W110 16.397, 900m), one on 20.vii.2010, the second on 29.vii.2010; N. de Silva collector. Like other *Megachiloides*, this species is probably a ground nester (Table 1).

**Distribution:** Southern AB (see Map 20).

## 21. *Megachile (Megachiloides) manifesta* Cresson, 1878

*Megachile manifesta* Cresson, 1878. Trans. Amer. Entomol. Soc. 7: 122 (♂).

*Megachile chrysothamni* Cockerell, 1908a. Ann. Mag. Nat. Hist. (8) 1: 262 (♀).

**Diagnosis.** The female of *M. manifesta* can be recognized by the combination of 4-dentate mandibles with the emargination between inner and 3<sup>rd</sup> teeth distinctly oblique, the greatest depth much closer to inner tooth, T5 with rather close punctures (separated by  $\leq 1$  pd) and dull interspaces. It is most similar to *M. wheeleri*. Females of *M. wheeleri* have T5 with punctures separated by 3-4 pd in apical half, the interspaces polished and shiny. The male of *M. manifesta* is recognized by the combination of conspicuously pale coloured and greatly modified front legs, a rounded postmedian transverse carina on T6, T5 with a white apical fascia, hind tarsomeres that are broad apically and pubescent; mesepisternum with a low, smoothly rounded carina just behind front coxa. They are most similar to *M. wheeleri*, *M. subnigra*, *M. anograe* and *M. sublaurita*. Males of *M. wheeleri* have quadrate hind

tarsomeres, and the mesepisternum with a prominent, flattened, triangular carina-like protuberance just behind the front coxa. Males of *M. subnigra*, *M. anograe* and *M. sublaurita* do not have a carinate protuberance behind front coxa.

**Female:** Length 11-12 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli subequally distant from eyes and edge of vertex, 2) clypeal margin straight, shining and broadly impunctate, slightly impressed just above the edge, 3) mandible 4-dentate, with an incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, complete between 3<sup>rd</sup> and inner teeth, emargination between inner and 3<sup>rd</sup> teeth distinctly oblique with greatest depth in emargination much closer to the inner tooth than to 3<sup>rd</sup> tooth (Plate 1, Figure M21), 4) gena subequal to compound eye in width, 5) punctures very fine and close on most of face, and on clypeus basally, becoming more coarse and distinctly separated in apical half, separated medially on supraclypeal area, fine and close on vertex, shallow on gena, 6) pubescence short and dense on face around antennae, white to pale yellow on face and gena, brownish on vertex, 7) F1 slightly longer than broad (4:3), longer than pedicel and F2, which is quadrate, subequal in length to remaining flagellomeres, apical flagellomere more elongate (4:1.5).

**Mesosoma.** 1) pubescence dense and short, white on pleura, propodeum, mesoscutum anteriorly, scutellum, and legs, brownish on most of mesoscutum, 2) punctures very close and fine on mesoscutum, scutellum, and pleura, slightly more separated on propodeum, triangle somewhat shiny and impunctate, 3) mid and hind basitarsi distinctly shorter and narrower than their tibiae, spurs yellow, 4) tegula black, finely punctate throughout, anterior margin pubescent, 5) wings subhyaline, slightly clouded apically, the veins black.

**Metasoma.** 1) only the apical terga very slightly depressed basally with no trace of a carinate rim, terga somewhat more deeply depressed apically; T6 in dorsal aspect only slightly concave at sides, rounded apically, straight to very slightly concave in profile, with abundant black erect hair; punctures minute and very close on T1, becoming more distinct but still quite close on the more apical terga, fine and crowded on T6; pubescence white on T1, T2-T5 with erect blackish pubescence, T6 with silvery tomentum apically, T2-T5 with entire white apical fasciae, these narrower on the more basal terga, broad, dense and conspicuous on the more apical ones, 2) scopa black on S6 and apically on S5, otherwise white, punctures coarse and close, becoming slightly more separated on more apical sterna.

**Male:** Length 11-12 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli subequally distant from eyes and edge of vertex, 2) clypeal margin straight, 3) mandible 3-dentate, with 2<sup>nd</sup> tooth much closer to apical tooth than inner tooth, the lower process very robust, subbasal in position, 4) gena very slightly wider than compound eye (8:7), lower margin of lower concavity produced into a carina-like projection with a apical tuft of hair, 5) punctures fine and close on head, slightly separated on vertex laterally, becoming shallow on gena, face below ocelli finely rugosopunctate, clypeus finely and closely punctate over entire surface, 6) pubescence pale yellow above, becoming paler below, with no dark admixture, very long and dense on clypeus, pointing downward, that on supraclypeal area shorter and pointing upward, 7) F1 slightly longer than broad (6:5) and slightly longer than pedicel, subequal in length to F2, remaining flagellomeres longer than broad (5:4), apical flagellomere flattened and somewhat dilated.

**Mesosoma.** 1) pubescence long, pale yellow above, fading to white below, with no dark admixture, tarsal fringes white, the front tarsal fringe with hairs tipped with brown, yellowish-brown beneath, 2) punctures fine and very close, no interspaces, propodeum with punctures finer with shiny interspaces of 1-2 pd, triangle shiny and impunctate, 3) front coxal spine very broad and flat, spatula-like, slightly bowed anteriorly, coxal surface polished, with neither setae nor pubescence; front femur widely dilated, the lower margin distinctly bisinuate basally, anterior face of front femur and posterior face of front tibia with polished yellowish-red areas, otherwise dark, front tarsus pale yellow, the posterior margin beneath with some brownish areas; front tarsus dilated, except basitarsus basally, narrower than tibia, expanded apically, the anterior margin deeply excavated, the resulting scale protruding nearly to tip of tarsomere 2; mesosternum neither carinate nor spined anteriorly; hind baistarsus subequal in length to tarsomeres 2-4 combined, much longer than wide, and much shorter than tibia, spurs yellow, 4) tegula yellowish-brown, finely punctate, 5) wings subhyaline, slightly clouded apically, the veins yellowish-brown.

**Metasoma.** 1) T2-T5 only slightly depressed basally, with a carinate rim, strongly depressed apically; carina of T6 with fine irregular denticulations, slightly angled medially, apical margin with carinate median teeth much nearer less prominent lateral teeth than each other; T7 robust, produced medially into a short spine-like projection; punctures minute and close on basal terga, becoming slightly more coarse and sparse to T5, the more apical terga shining, T6 more coarsely punctate; discal

pubescence sparse and entirely pale, dense and elongate on T1; T2-T5 with entire whitish apical fasciae, **2**) S1-S4 visible, punctures fine with shiny interspaces, apical margins depressed and hyaline, disc with very short, fine pale pubescent, scarcely visible, more elongate laterally, with long white apical fasciae on lateral margins of S2-S4.

**Genitalia.** Plate 2, Figure G21.

**Discussion.** Hobbs and Lilly (1954) indicate this species as a visitor to alfalfa flowers, but suggest that it has been often confused (e.g., Sladen 1918) with the much more common *M. wheeleri*. *Megachile manifesta* is a ground nesting species (Table 1).

**Distribution:** Found in southern AB (see Map 21).

## 22. *Megachile (Megachiloides) sublaurita* Mitchell, 1927 NEW COMBINATION

*Megachile laurita sublaurita* Mitchell, 1927. Psyche 34: 117 (♀).

*Megachile (Megachiloides) subanograe* Mitchell, 1934. Trans. Amer. Entomol. Soc. 59: 344 (♀). NEW SYNONYMY.

**Diagnosis.** The female of *M. sublaurita* can be recognized by the combination of 3-dentate mandibles, smaller body size (9-10 mm), and more closely punctate T5 and T6. They are most similar to *M. anograe* and *M. umatillensis*. The female of *M. anograe* is generally larger (12-13 mm), with T5 and T6 shiny and sparsely punctate (with shiny interspaces of 3-4 pd). The female of *M. umatillensis* has a 4-dentate mandible. The male of *M. sublaurita* is recognized by the combination of a conspicuously pale coloured and greatly modified front leg, rounded postmedian transverse carina on T6, T5 with a white, apical fascia, mandible with basal process pointed apically, hind tarsomeres subtriangular (i.e., broader apically) and pubescent, mesepisternum without protuberance, pubescence of legs largely pale, apical flagellomere broadly flattened. They are most similar to *M. casadae*, *M. anograe* and *M. umatillensis*; less so to *M. fortis*, *M. wheeleri*, *M. manifesta*, and *M. subnigra*. The male of *M. casadae* has the clypeal surface shiny and sparsely punctate. The male of *M. anograe* has T5 without a white, apical fascia. The male of *M. umatillensis* has the apical flagellomere unmodified. The male of *M. fortis* is very large, and has the mandible with basal process broadly truncate. The male of *M. wheeleri* has the hind tarsomeres quadrate, smooth and shiny, and the mesepisternum with a prominent, flattened, triangular

carina-like protuberance just behind the front coxa. The male of *M. manifesta* has the mesepisternum with a smoothly rounded carina just behind the front coxa. The male of *M. subnigra* has the pubescence of the legs primarily black.

**Female:** Length 9-10 mm.

**Head.** **1**) compound eyes subparallel; lateral ocelli subequally distant from eyes and edge of vertex, **2**) clypeal margin nearly straight, thickened and impunctate medially, slightly outcurved, **3**) mandible 3-dentate, the two apical teeth approximate, with a long cutting edge between 2<sup>nd</sup> and inner teeth (Plate 1, Figure M22), **4**) gena subequal to compound eye in width, **5**) punctures fine and close on vertex medially, and most of face below ocelli, and on clypeus basally, becoming more coarse apically, more coarse and sparse on gena below, on vertex laterally and between compound eyes and ocelli, interspaces  $\leq 1$  pd, **6**) pubescence entirely white on head, sparse on most surfaces, hardly concealing surface beneath except around base of antennae, **7**) F1 longer than broad (2:1.5), subequal in length to pedicel, distinctly longer than F2, which is slightly broader than long, remaining flagellomeres subquadrate, apical flagellomere more elongate (3.5:2).

**Mesosoma.** **1**) pubescence sparse and entirely white, more elongate laterally and posteriorly, copious around pronotal lobe and wing base, **2**) punctures relatively coarse and close on mesoscutum and scutellum, with shiny interspaces  $\leq 1$  pd present medially on mesoscutum, scutellum with a distinct impunctate area medially, punctures relatively coarse, deep and sparse on pleura, propodeum shiny with punctures fine and sparse, triangle shiny and impunctate, **3**) mid and hind basitarsi distinctly shorter and narrower than their tibiae, hind spurs brown, the front and middle ones yellowish, **4**) tegula yellowish-red, finely punctate, becoming more sparse in posterior half, **5**) wings hyaline, very slightly clouded apically, the veins reddish-brown.

**Metasoma.** **1**) T2-T5 very slightly depressed basally, without a distinct carinate rim, depressed somewhat apically; T6 triangular in dorsal aspect, narrowly subtruncate apically with the sides straight, straight in profile with abundant erect hair visible; all of the terga shining; punctures minute and close on T1 and T2, becoming increasingly sparse but also fine to T5, somewhat less sparse on T6; pubescence entirely white on T1-T4, T5 and T6 with sparing black pubescence laterally, T1-T5 with white apical fasciae, dense on the more apical terga, narrower medially on the more basal ones, **2**) scopa white, entirely black on S5 and S6;



punctures fine and close on basal sterna, becoming coarse and more spaced apically, with shiny interspaces.

**Male:** Length 10-11 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli subequally distant from eyes and edge of vertex, 2) clypeal margin produced medially, projection shiny and impunctate, 3) mandible 3-dentate, the 2<sup>nd</sup> tooth much closer to the apical tooth than the inner one, lower process acute, subbasal in position, 4) gena equal to compound eye in width, 5) punctures fine, shallow, but rather close on gena, becoming deeper and more distinctly separated on vertex and between lateral ocelli and eyes, fine and close on face below median ocellus, clypeus shiny, punctures fine and well separated (>1 pd), 6) pubescence almost entirely white on head, dense and elongate on face below median ocellus, on clypeus and supraclipeal area, gena below, and medially on vertex, vertex laterally and along upper margin of eye with sparse, short, and erect black pubescence, 7) F1 about as long as broad, subequal in length to pedicel and F2, which is quadrate, the remaining flagellomeres slightly longer than broad (4:3), apical flagellomere flattened and broadly dilated.

**Mesosoma.** 1) pubescence entirely pale on dorsal surface and propodeum, with dense white tufts at edges of pronotal lobe and behind wing base, pale on legs, the front tarsal fringe pale and long, with dark tipped hairs on the underside, mid tarsal fringe pale, long and conspicuous, 2) punctures fine and distinctly separated near centre of mesoscutum, more so on scutellum medially, becoming more crowded on pleura, propodeum with fine well spaced punctures, triangle smooth and impunctate, 3) front coxal spine narrow and elongate, broader at base, with a patch of reddish bristles on outer half of base, sparse elongate pubescence on undersurface, coxal surface otherwise bare; front femur dark on outer surface, otherwise yellowish with lower margin rounded and carinate, front tibia dark on outer face except for the yellowish apex, front tarsus yellowish and slightly dilated, front basitarsus distinctly narrower than its tibia, the anterior margin excavated, tarsomeres 2 and 3 with a dark spot ventrally, mid and hind tarsi dark red, hind basitarsus very short and narrow, less than half as long as its tibia, 4) tegula dark red, shiny, finely and sparsely punctate, 5) wings subhyaline, the veins dark brown.

**Metasoma.** 1) terga slightly depressed basally, but without carina, more deeply depressed apically; carina of T6 entire, slightly irregularly crenulate, produced medially into a triangular point that points downward, the apical margin with pronounced carinate median teeth, the lateral teeth inconspicuous; T7 conspicuous, produced

medially into an acute spine; punctures minute, shallow and close on metasoma basally, but becoming quite sparse on the shining, more apical terga, T6 more finely and closely punctate; pubescence sparse and entirely pale on discs of T2-T5, copious on T1, T5 with pale tomentum basally, complete white apical fasciae on T1-T5, 2) S1-S4 visible, apical margins depressed and hyaline, discs shiny and sparsely punctate, apical fringe of long white hairs on S1-S3, absent medially on S4.

**Genitalia.** Plate 2, Figure G22.

**Discussion.** This species has been collected only rarely in Canada, although it is much more common in the United States. The male is described here for the first time. Like *M. anograe* and *M. subnigra*, this species has pale and melanistic forms which show no differentiation in CO1 sequences. The pale form (i.e., *M. subanograe*) is much more common and widespread in North America, and is the only form occurring in Canada. This species nests in the ground (Table 1).

**Distribution.** Southern AB, east of the Rocky Mountains (see Map 22).

### 23. *Megachile (Megachiloides) subnigra* Cresson, 1879

*Megachile subnigra* Cresson, 1879. Trans. Amer. Entomol. Soc. 7: 208 (♀, ♂).

*Megachile (Xeromegachile) angelica* Mitchell, 1934. Trans. Amer. Entomol. Soc. 59: 318 (♂).

*Megachile (Xeromegachile) blaisdelli* Mitchell, 1934. Trans. Amer. Entomol. Soc. 59: 336 (♀).

*Megachile (Xeromegachile) moschata* Mitchell, 1934. Trans. Amer. Entomol. Soc. 59: 338 (♀).

**Diagnosis.** The female of *M. subnigra* is distinct; this is the only species in Canada with entirely black scopa. The male of *M. subnigra* is distinct, and is recognized by the combination of conspicuously pale coloured and greatly modified front legs, a rounded postmedian transverse carina on T6, mesepisternum without protuberance; T5 with a white apical fascia, hind tarsomeres that are broad apically, and legs mostly black pubescent.

**Female:** Length 11-12 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli subequally distant from eyes and edge of vertex, 2) clypeal margin straight, slightly thickened and shining, 3) mandible 4-dentate, with an incomplete cutting edge between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth, complete between the 3<sup>rd</sup> and inner teeth, emargination between the inner and 3<sup>rd</sup>

teeth distinctly oblique with the greatest depth in the emargination much closer to the inner tooth than to the 3<sup>rd</sup> tooth (Plate 1, Figure M23), **4**) gena slightly broader than compound eye (7:6), **5**) punctures close and fine, slightly separated on vertex laterally, finely rugosopunctate on face below median ocellus with an obscure, narrow, shiny impunctate line on frons and supraclypeal area, somewhat more coarse and distinct on lower portion of clypeus, **6**) pubescence of face black and erect, scarcely obscuring surface beneath, paraocular often with patches of elongate, white pubescence, **7**) F1 longer than broad (2:1.5), and longer than pedicel and F2, which are quadrate, remaining flagellomeres slightly longer than broad, apical flagellomere elongate (3:2).

**Mesosoma.** **1**) pubescence short, white on mesoscutum, scutellum, upper parts of pleura, with long, dense white tufts on pronotal lobe and behind wing base, pubescence otherwise black, scarcely obscuring surface, entirely dark on legs, **2**) punctures close and fine on dorsal surface, slightly more separated on pleura, more shallow and sparse ( $> 1$  pd) on propodeum, triangle smooth and impunctate, **3**) hind basitarsus expanded medially, slightly narrower and shorter than its tibia, **4**) tegula reddish-brown, shiny with sparse, minute punctures, **5**) wings subhyaline, slightly darker apically, the veins brownish-black.

**Metasoma.** **1**) terga at most slightly depressed basally, T2-T4 with a subcarinate basal rim, slightly depressed apically on T2-T4, T2 with pale apical fascia, fasciae of T3 and T4 with a few white hairs on lateral margins, T6 straight in profile with visible erect pubescence; punctures minute and close on metasoma basally, becoming quite sparse on the shining apical terga, but rather close on T6; pubescence white on T1 and T2, otherwise black, a few black hairs at extreme sides of T2 which is otherwise white pubescent, **2**) scopa entirely black, punctures fine and close on basal sterna, becoming coarser and more sparse on apical sterna, sterna with narrow hyaline rims.

**Male:** Length 10-11 mm.

**Head.** **1**) compound eyes subparallel; lateral ocelli slightly nearer eyes than edge of vertex (5:6), **2**) clypeal margin entire, though slightly produced medially, this area shiny and impunctate, **3**) mandible 3-dentate, the 2<sup>nd</sup> tooth much closer to the apical tooth than the inner one, lower process acute, subbasal in position, **4**) gena slightly broader than compound eye (5:4), **5**) punctures fine, shallow, but rather close on gena, becoming deeper and more distinctly separated on vertex and between lateral ocelli and eyes, fine and close on face below median ocellus, slightly separated in basal half of clypeus, **6**)

pubescence entirely white on head, dense and elongate on face below median ocellus, on clypeus and supraclypeal area, gena below, and medially on vertex, **7**) F1 about as broad as long, slightly longer than pedicel and subequal in length to F2, the remaining flagellomeres slightly longer than broad (5:4), apical flagellomere flattened and broadly dilated.

**Mesosoma.** **1**) pubescence white on dorsal surface and propodeum, with dense long white tufts on pronotal lobe and behind wing base, becoming dark on pleura below level of wing, pale on front coxa and most of front femur; entirely black on mid and hind legs, the mid tarsal fringe brown, long and conspicuous; front tarsal fringe white above, blackish toward base and beneath, **2**) punctures fine and slightly separated throughout, but more distinctly separated near centre of mesoscutum and on scutellum medially, well separated on pleura above, becoming more crowded below, propodeum with fine punctures separated by about 1 pd, triangle smooth and impunctate, **3**) front coxal spine flattened, broadly triangular with acute point, broad at base, with a patch of reddish bristles on outer half of base, coxal surface otherwise bare; front femur mostly dark, the polished anterior face becoming dark red, with lower margin distinctly keeled apically, front tibia dark on outer face except for the yellowish apex, largely yellowish-red apically on the other two faces; front tarsus yellowish and dilated, but distinctly narrower than its tibia, the anterior margin deeply excavated, tarsomeres 2 and 3 with a dark spot ventrally, hind basitarsus very short, about half as long as its tibia, **4**) tegula black, shiny, finely and sparsely punctate, **5**) wings subhyaline, slightly clouded apically, the veins dark brown.

**Metasoma.** **1**) terga only slightly depressed basally but without carina, rather deeply depressed apically, carina of T6 slightly irregularly crenulate, produced medially into a triangularly pointed projection, the apical margin with carinate median teeth that are slightly nearer the lateral teeth than to each other; T7 conspicuous, produced medially into an acute spine; punctures minute and close on metasoma basally, but becoming quite sparse on the shining, more apical terga, T6 more finely and closely punctate; pubescence white on T1 and T2, though some specimens with black hairs laterally on the disc of T2, with lateral apical fasciae of white hairs, pubescence entirely black on T3-T6, though T3 of some specimens with reduced lateral apical fascia of white hairs, **2**) S1-S4 visible, apical margins depressed and hyaline, closely punctate basally, becoming sparser on S3-S4, apical fasciae of long dark hairs on lateral margins becoming shorter medially, discs thinly pubescent with shorter black hairs.

**Genitalia.** Plate 2, Figure G23.

**Discussion.** As with *M. anograe* and *M. sublaurita*, this species occurs in both pale and melanistic forms; only the melanistic form has been found in Canada. This species probably nests in the ground (Table 1).

**Distribution:** Southern BC (see Map 23).

**24. *Megachile (Megachiloides) umatillensis* (Mitchell, 1927)**

*Megachiloides umatillensis* Mitchell, 1927. Psyche 34: 118 (♂, ♀)

**Diagnosis.** This is a distinct species. The female of *M. umatillensis* can be recognized by the extremely long tongue, and also by the combination of 4-dentate mandibles (the third tooth a small angle interrupting the long cutting edge between 2<sup>nd</sup> and inner teeth), and the large body size (13-15 mm). They are most similar to *M. anograe*. The female of *M. anograe* is generally smaller (12-13 mm), has a shorter tongue which is typical in length to most *Megachile* in Canada, and has a distinctly 3-dentate mandible. The male of *M. umatillensis* also has a long tongue and larger body size (13 mm), and is further recognized by the combination of an unmodified apical flagellomere, conspicuously pale coloured and greatly modified front leg, rounded postmedian transverse carina on T6, T5 with a white, apical fascia, mandible with basal process pointed apically, hind tarsomeres subtriangular (i.e., broader apically) and pubescent, mesepisternum without protuberance, pubescence of legs largely pale. They are most similar to *M. casadae* and *M. anograe*; less so to *M. fortis*, *M. wheeleri*, *M. manifesta*, *M. sublaurita* and *M. subnigra*, all of which have a shorter tongue and the apical flagellomere which is flattened and dilated to some degree.

**Female:** Length 13-15 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli subequally distant from eyes and edge of vertex, 2) clypeal margin nearly straight, slightly thickened and narrowly impunctate medially, 3) mandible 4-dentate, the two apical teeth approximate, the 3<sup>rd</sup> tooth a small angle interrupting the long cutting edge between 2<sup>nd</sup> and inner teeth (Plate 1, Figure M24), 4) gena slightly wider than compound eye (6:5), 5) punctures fine and close on vertex and most of face below ocelli, on clypeus basally, becoming more coarse and slightly more sparse apically, and on lower half of gena, 6) pubescence white on most

of head, with short, erect black hairs across vertex, pubescence sparse on most surfaces including clypeus, hardly concealing surface beneath, becoming longer and dense on face below median ocellus, 7) F1 longer than broad (3:2), subequal in length to pedicel, distinctly longer than F2, which is slightly broader than long, remaining flagellomeres subquadrate to slightly longer than broad, apical flagellomere more elongate, about twice as long as broad.

**Mesosoma.** 1) pubescence sparse and entirely pale, more elongate laterally and posteriorly, copious around pronotal lobe and wing base, 2) punctures relatively coarse and close on mesoscutum and scutellum, with dull interspaces  $\leq 0.5$  pd, slightly more separated ( $\leq 1$  pd) medially on mesoscutum, punctures relatively coarse, and close on pleura, propodeum dull with punctures fine and shallow, triangle dull and impunctate, 3) mid and hind basitarsi distinctly shorter and narrower than their tibiae, hind spurs brown, the front and middle ones yellowish, 4) tegula reddish, finely punctate throughout, densely pale pubescent on apical half, 5) wings hyaline, very slightly clouded apically, the veins reddish-brown.

**Metasoma.** 1) T2-T5 very slightly depressed basally, with a distinct carinate rim, depressed somewhat apically; T6 triangular in dorsal aspect, subtruncate apically, straight to very slightly concave in profile with abundant erect hair visible; terga somewhat shining; punctures minute, close ( $<0.5$  pd) and rather shallow on T1-T3, becoming increasingly deeper, coarser and more sparse ( $\leq 1$  pd) to T5, somewhat less sparse on T6; pubescence entirely pale on T1 and T2, T3 with some dark pubescence medially, pale basally, T4-T6 mostly black pubescent, with a few scattered pale hairs laterally, T1-T5 with entire white apical fasciae, 2) scopa white, entirely black on S6; punctures fine and close on basal sterna, becoming coarse and more spaced apically, with shiny interspaces.

**Male:** Length 13-14 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli closer to eyes than to edge of vertex (4:5), 2) clypeal margin straight, 3) mandible 3-dentate, the 2<sup>nd</sup> tooth median in position, lower process acute, subbasal in position, 4) gena subequal to slightly broader (5:6) than compound eye, 5) punctures fine, shallow, but rather close on gena, becoming deeper on vertex and between lateral ocelli and eyes, fine and close on face below median ocellus, 6) pubescence almost entirely white on head, dense and elongate on face below median ocellus, on clypeus and supra-clypeal area, and medially on vertex, vertex laterally and along upper margin of eye with sparse, short, and erect dark brownish-black pubescence, gena



with pubescence shorter and more sparse, depression on lower area adjacent to mandible with a tuft of short, dense, yellowish-brown hair, **7**) F1 slightly longer than broad, and slightly longer than pedicel which is about as long as broad, and shorter than the remaining flagellomeres, which are slightly longer than broad (3:2), apical flagellomere unmodified, much longer than broad (5:2).

**Mesosoma.** **1**) pubescence long and entirely pale on dorsal surface and propodeum, with dense white tufts at edges of pronotal lobe and behind wing base, pale on legs, the front tarsal fringe pale and long, with thickened dark hairs on the underside, mid tarsal fringe pale, long and conspicuous, **2**) punctures fine and close dorsally on mesoscutum and scutellum, distinctly separated ( $\leq 1$  pd) on centre of mesoscutum, becoming more crowded on pleura, propodeum with fine well spaced punctures, triangle smooth, dull and impunctate, **3**) front coxal spine narrow and elongate, with a patch of reddish bristles at base, sparse elongate pubescence on undersurface, with a dense tuft of pale hair at tip of spine, coxal surface otherwise largely bare; front femur dark with lower margin rounded, front tibia dark except for the yellowish apex, front tarsus yellowish-brown and dilated, front basitarsus distinctly narrower than its tibia, the anterior margin excavated, tarsomeres with dark areas ventrally, mid and hind tarsi dark, hind basitarsus very short and narrow, less than half as long as its tibia, **4**) tegula dark red, shiny, finely and sparsely punctate throughout, apical half with white pubescence, **5**) wings subhyaline, the veins reddish-brown.

**Metasoma.** **1**) terga deeply depressed basally, with a distinct carina, apical margin deeply depressed; carina of T6 entire, slightly irregularly crenulate, produced medially into a triangular point that points downward, the apical margin with pronounced carinate median teeth, the lateral teeth subtriangular, small, but conspicuous; T7 conspicuous, produced medially into an acute triangle; punctures minute, shallow and close on T1 and T2, more sparse (1 pd) on T3, becoming larger and elongate on T4 and T5, especially on apical 1/3, T6 more closely punctate, punctures becoming subrugose apically; pubescence sparse and entirely pale on discs of T2-T5, copious on T1, T5 with pale tomentum basally, complete white apical fasciae on T1-T5, **2**) S1-S4 visible, apical margins depressed, S3 and S4 with surface apical to depression rugose, apical edges narrowly hyaline, widely so on S4, discs rather dull and sparsely punctate, punctures of S4 fine, shallow, and sparse, apical fringe of long white hairs on S1-S3, narrowed medially on S3, absent medially on S4.

**Genitalia.** Plate 2, Figure G24.

**Discussion.** This is the first record of this species in Canada, the single male specimen collected in southern British Columbia on June 23, 2010 (Haynes Lease Ecological Reserve; S. Elwell, collector), though the type locality is in adjacent Washington state (Camp Umatilla). *Megachile umatillensis* was one of three species (with *M. oenotherae* Mitchell and *M. amica* Cresson) originally placed in the subgenus *Megachiloides* (Mitchell 1936); Mitchell (1924) originally considered *Megachiloides* a genus with *M. oenotherae* the only species. He later (Mitchell 1934) added *M. amica*, *M. umatillensis*, but also *M. laurita* (= *M. anograe*), *M. anograe*, and three undescribed species; these were later added to *Derotropis* (Mitchell 1936). All three *Megachiloides sensu stricto* possess a long tongue in both sexes, and all are considered oligoleges of the plant genus *Oenothera* (Mitchell 1924, 1936; Bohart and Youssef 1972). This species nests in the ground (Table 1).

**Distribution.** Southern BC (see Map 24).

## 25. *Megachile (Megachiloides) wheeleri* Mitchell, 1927

*Megachine wheeleri* Mitchell, 1927. Psyche 34: 107 (♀).  
*Megachile spokaneensis* Mitchell, 1927. Psyche 34: 109 (♂).

**Diagnosis.** The female of *M. wheeleri* can be recognized by the combination of 4-dentate mandibles with the emargination between inner and 3<sup>rd</sup> teeth distinctly oblique, the greatest depth much closer to inner tooth, T5 with punctures separated by 3-4 pd in apical half, the interspaces polished and shiny. They are most similar to *M. manifesta*. Females of *M. manifesta* have T5 with rather close punctures (separated by  $\leq 1$  pd) and dull interspaces. The male of *M. wheeleri* is distinct, and is recognized by the combination of conspicuously pale coloured and greatly modified front legs, a rounded postmedian transverse carina on T6, T5 with a white apical fascia, quadrate, smooth and shiny hind tarsomeres, and the mesepisternum with a prominent, flattened, triangular carina-like protuberance just behind the front coxa.

**Female:** Length 12-13 mm.

**Head.** **1**) compound eyes subparallel; lateral ocelli slightly nearer edge of vertex than to eyes (4:5), **2**) clypeal margin straight, shining and impunctate, slightly impressed just above edge, **3**) mandible 4-dentate, with an complete cutting edge between 3<sup>rd</sup> and 4<sup>th</sup> teeth, incomplete between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, emargination

between the inner and 3<sup>rd</sup> teeth distinctly oblique with the greatest depth in the emargination much closer to the inner tooth than to the 3<sup>rd</sup> tooth (Plate 1, Figure M25), **4)** gena slightly wider than compound eye (9:7), **5)** punctures quite close and fine on face, and on clypeus above apical impressed area, on vertex medially, shallow on gena, slightly more coarse and sparse on vertex laterally with a few irregular punctures adjacent to upper edge of compound eyes, **6)** pubescence white, elongate on face and gena though hardly obscuring surface, mostly brown on vertex though becoming pale on hind margin, **7)** F1 longer than broad (2:1.3), slightly longer than pedicel, F2 and F3, subequal in length to following flagellomeres, which are just slightly longer than wide, apical flagellomere elongate (3.5:2).

**Mesosoma.** **1)** pubescence white laterally and posteriorly, and on legs, brown in large part on mesoscutum, the scutellum with a few scattered dark hairs in the otherwise white pubescence, **2)** punctures close and fine on most of mesosoma, more coarse and distinctly separated in centre of mesoscutum, shallow but distinct on pleura and propodeum, triangle shiny and impunctate, **3)** hind basitarsus slightly narrower and distinctly shorter than its tibia, spurs yellow, **4)** tegula reddish-brown, shiny and finely punctate, **5)** wings subhyaline, slightly clouded apically, the veins black.

**Metasoma.** **1)** T2 and T3 depressed basally with a subcarinate basal rim, the more apical terga only very slightly depressed basally, terga somewhat more deeply depressed apically, T6 slightly concave at sides in dorsal aspect, rounded apically, straight in profile; punctures very minute and close on basal terga, becoming quite sparse, but still minute to T5, which is polished, punctures fine and close on T6; pubescence white on T1 and T2, discal pubescence black on T3-T5, longer on the more apical terga, T6 with abundant erect black hairs visible in profile, with silvery tomentum apically, T2-T5 with entire white apical fasciae, narrow on the more basal terga, but broad, dense and conspicuous on the more apical ones, **2)** scopa white, black on S6 and apically on S5 (occasionally entirely so); punctures coarse and close on sterna, apical margins wide and impunctate.

**Male:** Length 10-11 mm.

**Head.** **1)** compound eyes slightly converging below; lateral ocelli subequally distant from eyes and edge of vertex, **2)** clypeal margin straight and impunctate, **3)** mandible 3-dentate, the lower process very robust, subbasal in position, **4)** gena subequal to compound eye in width, lower margin of lower concavity produced into a carina-like projection with a apical tuft of hair, **5)**

punctures fine and shallow on gena, becoming deeper on vertex laterally with distinct shiny interspaces, closer on vertex medially and over entire head, fine and close on clypeus under the dense pubescence, **6)** pubescence entirely yellowish-white, with no dark admixture, long and very dense on face below ocelli, sparser on gena below and on vertex, sparse on gena, **7)** F1 slightly longer than broad (2:1.5), slightly longer than pedicel, subequal to F2 and the remaining flagellomeres, which are very slightly longer than broad, apical flagellomere flattened and dilated, flagellomeres reddish beneath.

**Mesosoma.** **1)** pubescence entirely yellowish-white, with no dark admixture, tarsal fringes white, the front ones tipped with brown, and yellowish-brown beneath, **2)** punctures fine and close over entire dorsal surface of mesosoma, slightly separated on scutellum medially and on pleura above, propodeum with punctures more shallow but still close, triangle somewhat shiny and impunctate, **3)** front coxal spine very broad and flat, spatulate, slightly bowed anteriorly, the surface of the coxa polished, with neither setae nor pubescence; front femur widely dilated, the lower margin distinctly bisinuate basally, anterior face polished yellowish-red, posterior face of front tibia polished yellowish-red, otherwise dark; front tarsus dilated, pale yellow, margined posteriorly beneath with brown, the basitarsus basally narrower than its tibia, but expanded apically, the anterior margin deeply excavated, the resulting scale protruding almost to tip of tarsomere 2; mid and hind legs dark, the apical tarsomeres more or less reddish-brown, middle tarsomeres of hind leg quadrate, the apical one considerably thickened, the basitarsus short, subequal to the second and third tarsomeres combined, outer surface shiny, impunctate and lacking pubescence; mesosternum with a flattened, carina-like spine just posterior to each front coxa, spurs yellow, **4)** tegula dark reddish-brown, closely punctate throughout, **5)** wings subhyaline, slightly clouded apically, the veins black.

**Metasoma.** **1)** T2-T5 only slightly depressed basally, but quite strongly so apically with a distinct subcarinate rim basal to fasciae; carina of T6 entire and down-turned, with coarse and irregular denticulations, apical margin with carinate median teeth that are much nearer the obscure lateral angles than to each other, T7 robust, produced medially into a short triangular projection; punctures minute and close on metasoma basally, becoming slightly more coarse, sparse, and irregular apically on discs to T5, the more apical terga shining, T5 with a well define depression extending medially across disc apical to the basal carinate rim, T6 more coarsely punctate with a basal depression with carinate rim; pubescence entirely yellowish-white on all terga, T2-T5 with entire whitish

apical fasciae, **2**) S1-S4 exposed, S1 with robust, raised, medially produced projection with a subcarinate median ridge that runs to basal margin of disc, S4 slightly emarginate medially; apical margins of S2-S4 slightly depressed with narrow hyaline margins; punctures on discs close and fine on basal sterna, more separated apically; apical edges with sparse white pubescence that is more elongate laterally, discs very sparsely pale pubescent, hairs scarcely visible.

**Genitalia.** Plate 2, Figure G25.

**Discussion.** Hobbs and Lilly (1954) suggest his species is the most common *Megachile* in the mixed prairie region, and the most common member of the subgenus *Megachiloides* in western Canada. It is often found associated with gum weed (*Grindelia squarrosa*) (Hobbs and Lilly 1954). This species nests in the ground (Table 1), though interestingly, Gordon (2000) found that *M. wheeleri* used trap-nests which were at ground level and those which were buried and positioned at an angle similar to natural (i.e., excavated) nesting tunnels, but not in trap-nests at 1m above the ground.

**Distribution.** Southern SK and AB (see Map 25).

## 26. *Megachile (Pseudomegachile) ericetorum* Lepeletier, 1841

*Megachile ericetorum* Lepeletier, 1841. Hist. Nat. Insect. Hymen. 2: 341 (♀, ♂).

*Megachile cristata* Dufour, 1841. Mem. Acad. Sci. Inst. Fr. 7: 420.

*Megachile fasciata* Smith, 1844. Zoologist 2: 694 (♀).

*Megachile rufitarsis* Smith, 1844. Zoologist 2: 695 (♂) (preoccupied).

*Megachile pyrina* Nylander, 1852. Notis. Sällsk. fauna et flora Fenn. Förh. 2: 275 (♀, ♂) (preoccupied).

*Megachile senex* Smith, 1853. Cat. Hym. Brit. Mus. 1: 160.

*Megachile tsingtauensis* Strand, 1915. Entomol. Mit. 4: 75.

*Chalicodoma (Pseudomegachile) ericetorum euroa* Tkalčů, 1988. Věst. Českoslov. spol. zool. 52 (1): 49.

*Chalicodoma (Pseudomegachile) ericetorum melaleuca* van der Zanden, 1989. Entomol. Abh. Staatliches Mus. Tierk. Dresden. 53(6): 72.

*Chalicodoma (Pseudomegachile) ericetorum oraniensis* van der Zanden, 1989. Entomol. Abh. Staatliches Mus. Tierk. Dresden. 53(6): 72.

**Diagnosis.** The female of *M. ericetorum* can be recognized by the combination of 4-dentate mandibles

which lack cutting edges, and clypeus with apical edge with a small median tubercle. They are most similar to *M. montivaga*. Females of *M. montivaga* lack the median tubercle on the clypeus, and have 5-dentate mandibles. The male of *M. ericetorum* can be recognized by the combination of combination of simple, yellow front tarsi, 3-dentate mandibles lacking lower process, T5 with a white apical fascia, and T6 without white tomentum above to carina. They are most similar to *M. coquilletti*. Males of *M. coquilletti* are typically smaller, and have T6 with the surface above carina with white tomentum dense and conspicuous medially, concealing most of the surface beneath.

**Female:** Length 14-16 mm.

**Head.** **1**) compound eyes subparallel to slightly convergent below; lateral ocelli nearer eyes than edge of vertex (3:4), **2**) clypeal margin entire, with a small but distinctive median tubercle, **3**) mandible distinctly 4-dentate, without a cutting edge (Plate 1, Figure M26), **4**) gena slightly broader than compound eye (8:7), **5**) punctures fine and close over entire head, shallower but still close on gena, close, almost rugose on frons, supraclypeal area with a distinct median impunctate area in apical half, clypeus with coarser punctures medially, with an small medial impunctate area in basal half, **6**) pubescence long and pale yellow on face around antennae and paracocular area, clypeus mostly bare, with a few elongate hairs laterally, sparser and more elongate on gena below, becoming shorter above, with some short, dark, erect hairs intermixed on vertex and along outer edge of upper eye, **7**) F1 subequal in length to pedicel and slightly longer than F2, which is quadrate, remaining flagellomeres slightly longer than broad, apical flagellomere longer than broad (3.5:2).

**Mesosoma.** **1**) pubescence yellowish-white, elongate laterally and posteriorly, more elongate on pleura, brownish hairs on mesoscutum medially and scutellum, short and thin, hardly concealing surface, **2**) punctures fine and close over most of dorsal surface, pleura finely and closely punctate, propodeum with fine, shallow punctures which are separated by about 1 pd, triangle dull and impunctate, **3**) basitarsi shorter and slightly narrower than their tibiae, spurs yellowish, **4**) tegula reddish-brown, smooth and sparsely punctate, with short, sparse, pale pubescence in apically, **5**) wings hyaline, slightly darker in marginal cell, the veins brown.

**Metasoma.** **1**) narrow and elongate, somewhat parallel-sided, though T1 narrower than T2-T5; T2-T5 rather deeply grooved basally, grooves with a distinct carinate rim, rather deeply depressed apically, T6 rounded to



almost truncate in dorsal aspect, almost straight in profile; punctures fine and very close over most of the terga, but becoming slightly more coarse on T5; T1 with elongate yellowish pubescence, T2-T5 with conspicuous entire dense pale yellowish apical fasciae, discal pubescence rather sparse, and entirely yellowish on T2 and T3, with darker hairs apically on T4, and on disc of T5, becoming yellowish laterally, T6 entirely covered with pale yellowish pubescence, becoming rather dense and appressed apically, **2**) scopa entirely yellow; S6 rounded, uniformly covered with scopal hairs, with yellowish apical fringe of short hairs, punctures coarse and close, becoming slightly more spaced on apical sterna.

**Male:** Length 13-16 mm.

**Head.** **1**) compound eyes very slightly convergent below; lateral ocelli nearer eye than edge of vertex (3:56), **2**) clypeal margin slightly produced medially into a small but distinct tubercle, **3**) mandible 3-dentate, lacking lower process, **4**) gena subequal to compound eye in width, with a concavity at lower angle densely covered with long yellow pubescence, **5**) punctures fine and close over most of head, including on clypeus and supra-clypeal area, slightly separated laterally on frons, **6**) pubescence elongate and copious, white to pale yellow on face below median ocellus and on lower margin of gena, sparse on gena above and on vertex, though vertex usually with some intermixture of short, erect black hairs, which extend to upper hind eye margin and between lateral ocelli, **7**) F1 about as broad as long and subequal in length to pedicel, following flagellomeres considerably longer than broad (3:2), the apical flagellomere elongate, about twice as long as broad.

**Mesosoma.** **1**) pubescence entirely white to pale yellow, elongate and dense laterally and posteriorly, becoming shorter and more sparse dorsally, surface visible, front tarsal fringe entirely pale pubescent, **2**) punctures fine and close on mesoscutum, scutellum, and pleura, propodeum smooth and more sparsely punctate, triangle somewhat dull and impunctate, **3**) front coxal spine short but distinct, rather narrow with a rounded tip, with short, erect, dense reddish pubescence on anterior surface of spine, coxa sparsely pale pubescent, surface shining with sparse but distinct punctures; front basitarsus narrow, pale brownish basally, becoming yellow apically, tarsomeres yellowish, tarsomere 2 with a dark spot ventrally, mid and hind basitarsi dark, slender and relatively long, but shorter than their tibiae, spurs yellowish-brown, **4**) tegula brownish, shiny and sparsely punctate, with sparse yellow pubescence uniformly covering surface, **5**) wings hyaline, slightly darker in marginally cell, the veins brownish-black.

**Metasoma.** **1**) parallel-sided, T2-T5 with basal depressions with carinate rims, depressed apically, margin impunctate and hyaline, T6 vertical in orientation, disc finely and densely punctate, carinate rim with deep median emargination, this possibly obscured by the irregular, sometimes deep lateral crenulations, apical margin of T6 without teeth, T7 broadly rounded to truncate, with short but distinct apical spine; punctures fine, close and contiguous on T1-T5, with narrow but shining interspaces  $\leq 1$  pd; pubescence pale yellow, elongate, somewhat sparse on T1, T2, a basally on T3, T4-T6, and apical half of T3 with elongate, black discal pubescence; T3-T5 with entire, whitish apical fasciae, fascia very narrowed medially but entire on T2, **2**) S1-S4 exposed, S2-S4 with wide hyaline apical rims, S3 and S4 distinctly emarginate medially; sterna with rather fine and close punctures, S1-S3 with short, sparse pale pubescence on discs, S1-S4 with more dense, elongate pale hairs laterally.

**Genitalia.** Plate 2, Figure G26.

**Discussion.** Only recently recorded in the Western Hemisphere (Sheffield *et al.* 2010), and known from a single female collected in St. Catharines, ON. There is no indication that this species has established in North America. *Megachile ericetorum* nests in pre-existing cavities, and accepts trap nests (Table 1). A brief account of its biology is presented by Sheffield *et al.* (2010).

**Distribution:** St. Catharines, ON (see Map 26).

## 27. *Megachile (Sayapis) fidelis* Cresson, 1878

*Megachile fidelis* Cresson, 1878. Trans. Amer. Entomol. Soc. 7: 120 (♀, ♂).

*Megachile fidelis concinnula* Cockerell, 1899. Entomologist 32: 158 (♀).

**Diagnosis.** The female of *M. fidelis* is distinct and can be recognized by conspicuous, spatulate protuberances at each side of the clypeus. The male of *M. fidelis* can be recognized by the combination of 3-dentate mandibles, T5 with white apical fascia, and the front basitarsus with a brush of dark bristles extending nearly to apex, with boat-shaped dilation mostly bare and polished in apical third and extending at most as far as the middle of 2<sup>nd</sup> tarsomere. They are most similar to *M. mellitarsis* and *M. pugnata*. Males of *M. mellitarsis* have T5 without white apical fascia, the front basitarsus with boat-shaped dilation elongated apically and extending to apex of 3<sup>rd</sup> tarsomere, and bright reddish brown tarsi which contrast

the black tibiae and femora. Males of *M. pugnata* have the front basitarsus with brush of short, dark bristles reduced, not extending beyond its basal third, and apical third of boat-shaped dilation entirely covered on the outer side with dense appressed hairs.

**Female:** Length 11-13 mm.

**Head.** 1) compound eyes slightly convergent below; lateral ocelli slightly nearer eyes than edge of vertex (3:4), 2) clypeus flat above, with a conspicuous, spatulate protuberance at each side, the margin between these excavated, polished and impunctate, with a median carinate spine-like projection, 3) mandible 4-dentate, with an incomplete cutting edge between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure M27), 4) gena slightly broader than compound eye (9:8), 5) punctures fine and very close over entire head, separated medially in apical half of supraclypeal area and on clypeus basally, punctures of clypeus more coarse and distinctly separated apically, 6) pubescence long and pale yellow over most of head, paler on gena with some hairs short and subappressed along outer edge of eye, pubescence brown on vertex, 7) F1 subequal in length to both the pedicel and F2, remaining flagellomeres quadrate to slightly longer than broad, apical flagellomere longer than broad (3.5:2).

**Mesosoma.** 1) pubescence yellowish, short and thin, hardly concealing surface, more elongate on pleura, longer brownish hairs on mesoscutum medially and scutellum, with appressed/subappressed pale hairs, pubescence more dense and plumose adjacent to tegula and on pronotal lobe, 2) punctures fine and very close, almost rugose, over most of dorsal surface, pleura finely and closely punctate, propodeum with fine, shallow punctures which are separated by about 1 pd, triangle dull and impunctate, 3) basitarsi slightly shorter and slightly narrower than their tibiae, spurs reddish-brown, 4) tegula reddish-brown, almost entirely impunctate in apical half, 5) wings transparent, darker apically, the veins reddish-brown.

**Metasoma.** 1) narrow and elongate, somewhat parallel-sided; T2-T4 deeply grooved basally with a distinct carinate rim, rather deeply depressed apically, T6 more or less rounded in dorsal aspect, in profile slightly convex due to abrupt, shelf-like apical lip; punctures fine and very close over most of the terga, but becoming slightly more coarse on T5; T1-T5 with conspicuous entire dense pale yellowish apical fasciae, discal pubescence somewhat brownish medially on T2-T5, becoming yellowish laterally, T6 entirely covered with pale yellowish tomentum, with no dark admixture, 2) S6 rounded, uniformly covered with scopal hairs, scopa entirely pale

yellow; punctures coarse and close, becoming more wide spaced on apical sterna.

**Male:** Length 10-12 mm.

**Head.** 1) compound eyes very slightly convergent below; lateral ocelli slightly nearer edge of vertex than eyes (5:6), 2) clypeal margin impunctate with a broad shallow median emargination, 3) mandible 3-dentate, lower process acute, submedian in position, 4) gena subequal to compound eye in width, with a large, bare concavity at lower angle, the lower margin of which is produced into a flat triangular spine, 5) punctures fine and close over most of head, but more distinctly separated on vertex laterally, shallow on gena, 6) pubescence white to pale yellow on most of head, but vertex usually with some intermixture of brown hairs, 7) F1 broader than long (2:1.5) and subequal in length to pedicel, following flagellomeres considerably longer than broad (3:2), the apical flagellomere elongate (4.5:2) and slightly flattened, antennae reddish beneath.

**Mesosoma.** 1) pubescence entirely white to pale yellow; front basitarsal scale fringed for entire length on inner anterior margin with short black pubescence, the posterior fringe white, tipped with brown beneath, 2) punctures fine and close over most of mesoscutum, shallower on scutellum, propodeum smooth and sparsely punctate, triangle impunctate, 3) front coxa bare and shining anteriorly, with a pair of stout red bristles in front of the slender, moderately long spine; front femur slender; front tarsus dilated and flattened, yellowish except for the dark apical tarsomere, tarsomeres 2 and 3 each with a dark spot ventrally, front basitarsus produced anteriorly into a very large, reddish-brown, and deeply concave scale that is produced apically nearly to the tip of tarsomere 2, mid and hind basitarsi slender and relatively long, spurs yellow, 4) tegula reddish-brown, shiny and nearly impunctate, 5) wings transparent, darker apically, the veins reddish-brown.

**Metasoma.** 1) parallel-sided, T3-T5 depressed apically, margin impunctate and hyaline, T3-T5 with basal depressions with carinate rims, T6 basally horizontal in orientation, impunctate with carinate rim, remaining face of tergum vertical in orientation, carina of T6 with a small but usually deep, circular median emargination, more or less crenulate laterally, with a median pit above the emargination, apical margin of T6 with teeth hardly evident, T7 rounded apically; punctures fine and close on basal terga, becoming more distinct and deep but still rather close on apical terga, minute and densely crowded on T6; pubescence white to pale yellow on T1 and most of T2, T3-T6 with intermixtures of black and whitish or

yellowish discal pubescence; T2-T5 with entire, white or yellowish, apical fasciae, T4-T5 with basal tomentum arising from under carina, **2)** S1-S4 exposed, S2-S4 with wide hyaline apical rims, S4 slightly emarginate medially; discs shiny with rather fine and close punctures, sparsely pale pubescent on discs of sterna, with elongate pale hairs along apical rims.

**Genitalia.** Plate 2, Figure G27.

**Discussion.** This distinct species accepts trap-nests (Barthell *et al.* 1998; Frankie *et al.* 1998) (Table 1). Although probably polylectic, this species is commonly collected on *Helianthus* flowers (Hurd *et al.* 1980).

**Distribution.** Southern BC (see Map 27)

### 28. *Megachile (Sayapis) mellitarsis* Cresson, 1878

*Megachile mellitarsis* Cresson, 1878. Trans. Amer. Entomol. Soc. 7: 121 (♂).

*Megachile terrestris* Cockerell, 1908a. Ann. Mag. Nat. Hist. (8) 1: 260 (♀) (preoccupied).

*Megachile geophila* Cockerell, 1908b. Can. Entomol. 40: 460 (replacement name for *M. terrestris* Cockerell, 1908a, not Schrottky, 1902).

**Diagnosis.** The female of *M. mellitarsis* can be recognized by the combination of the clypeus with apical margin with prominent triangular tubercles, and the bright reddish brown tarsi which contrast the black tibiae and femora. The male of *M. mellitarsis* can be recognized by the combination of 3-dentate mandibles, T5 without white apical fascia, the front basitarsus with boat-shaped dilation elongated apically and extending to apex of 3<sup>rd</sup> tarsomere, and the bright reddish brown tarsi which contrast the black tibiae and femora. They are most similar to *M. fidelis* and *M. pugnata*, both which have T5 with white apical fascia and have the boat-shaped dilation extending at most as far as the middle of 2<sup>nd</sup> tarsomere.

**Female:** Length 11-14 mm.

**Head.** **1)** compound eyes slightly convergent below; lateral ocelli subequally distant from eyes and edge of vertex, **2)** clypeal margin with a moderately deep, rounded emargination on each side of medially produced apical rim, with lateral prominences triangularly produced, apical rim shiny and impunctate, **3)** mandible 4-dentate, with an incomplete cutting edge between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure M28), **4)** gena broader than compound eye (5:3), **5)** punctures fine and crowded over

entire head, slightly separated on vertex laterally, shiny and impunctate areas on clypeus adjacent to tentorial pits, **6)** pubescence relatively long, whitish on gena, partially concealing surface, becoming pale yellow on vertex and laterally, and on clypeus, more dense on face around antennae, supraclypeal area, and paraocular area (in some specimens, whitish hair over entire head), **7)** F1 slightly longer than broad (3:2.3), longer than pedicel, which is about as long as broad, and very slightly longer than F2, which is slightly longer than broad, remaining flagellomeres longer than broad (3:2), apical flagellomere slightly more elongate (3.5:2).

**Mesosoma.** **1)** pubescence whitish to pale yellow, with no dark admixture, equally long and dense over entire surface, including laterally, below and on propodeum, but surface of discs entirely visible, **2)** punctures fine and crowded, propodeum with fine, shallow punctures which are separated by 1 pd, triangle dull and impunctate, **3)** hind basitarsus distinctly shorter and slightly narrower than its tibia, spurs and all tarsi pale reddish-brown, contrasting with the otherwise dark leg segments, **4)** tegula uniformly punctured throughout, **5)** wings transparent yellowish, more brownish apically, the veins reddish-brown.

**Metasoma.** **1)** elongate and parallel-sided; T2-T4 deeply grooved basally and quite deeply depressed apically, T6 slightly convex in profile to the rather abrupt apical lip; punctation very fine, crowded basally, but becoming more distinct to T5, very fine and crowded on T6; T1-T5 with rather conspicuous entire whitish apical fasciae, pubescence on discs pale yellow, **2)** S6 rounded; scopa entirely pale yellowish; punctures coarse and close on basal sterna, becoming more wide spaced on apical sterna, well spaced medially on S6.

**Male:** Length 11 mm.

**Head.** **1)** compound eyes slightly convergent below; lateral ocelli subequally distant from eyes and edge of vertex, **2)** clypeal margin slightly outcurved, faintly crenulate medially with a shiny, impunctate apical rim, **3)** mandible 3-dentate, lower process acute, submedian in position, **4)** gena subequal to compound eye in width; with a bare shallow, shiny concavity at lower angle, the lower margin of which is produced into a flattened triangular spine with an apical tuft of hair, **5)** punctures very fine and close over most of head, but quite distinctly separated on vertex laterally, **6)** pubescence entirely pale, without dark admixture, more yellowish on vertex, elongate on clypeus and supraclypeal area, hiding the surface, **7)** F1 about as long as broad, and subequal in length to pedicel, and shorter than remaining flagellomeres, which are longer than broad (3:2), apical flagellomere flattened and



quite broadly dilated.

**Mesosoma.** **1)** pubescence entirely pale, front tarsal fringe white, tipped with golden-brown beneath, **2)** punctures very fine and close over most surfaces, propodeum with punctures well spaced medially (> 2 pd), triangle smooth and impunctate, **3)** front coxa bare anteriorly, with three or four contiguous long suberect red bristles just in front of long slender spine, spine with short appressed red bristles in apical half; front femur slender and black; front tibia black except for yellowish apical tip; front tarsus yellow, broadly dilated and flattened, tarsomere 2 with a dark spot ventrally, the basitarsus slightly shorter than the two following tarsomeres combined, but its anterior margin produced into an extremely large and deeply hollowed scale that is narrowly produced apically nearly to the tip of tarsomere 3, the inner margin broadened apically so it overlies the concavity in part, the outer margin slightly flexed at this point; mid and hind tibiae black except apically, mid and hind tarsi reddish-brown, spurs yellow, **4)** tegula rather smooth in posterior half, finely punctate anteriorly, **5)** wings yellowish-hyaline, more distinctly clouded apically, the veins reddish-brown.

**Metasoma.** **1)** parallel-sided, T3-T5 distinctly depressed apically, more so toward sides; carina of T6 with median emargination small to inconspicuous, often obscured by irregular spines or crenulations at each side, a deep pit just above carina, apical margin of T6 with no evident median or lateral teeth; T7 rounded to slightly triangular apically with a concavity just above apex; punctures very fine and close on basal terga, deeper and more distinct on the more shiny apical terga, but still rather close, T6 finely rugosopunctate; discal pubescence pale to yellowish, sparse and slightly darker on apical terga, T2-T4 with narrow entire white apical fasciae, fascia lacking on T5, **2)** S1-S4 exposed, rather dull but very minutely and regularly punctate, punctures well separated, apical margin depressed and yellowish-hyaline, that of S4 very slightly incurved across median area, apical margins with long pale hairs especially laterally, though hardly forming fasciae, discal pubescence sparse and pale, not obscuring surface.

**Genitalia.** Plate 2, Figure G28.

**Discussion.** This distinct species is uncommon in Canada, restricted to southern BC. Little has been reported on its biology, including on its nesting preferences (Table 1).

**Distribution:** Southern BC (see Map 28)

## 29. *Megachile (Sayapis) pugnata* Say, 1837

*Megachile pugnatus* Say, 1837. Boston Jour. Nat. Hist. 1: 408 (♂, ♀).

*Megachile scrobiculata* Smith, 1853. Cat. Hym. Brit. Mus. 1: 191 (♂).

*Megachile bucephala* Smith, 1853. Cat. Hym. Brit. Mus. 1: 193 (♀).

*Megachile disparilis* Cresson, 1872. Trans. Amer. Entomol. Soc. 4: 264 (♂).

*Megachile lucrosa* Cresson, 1872. Trans. Amer. Entomol. Soc. 4: 267 (♀).

*Gnathocera cephalica* Provancher, 1882. Nat. Canad. 13: 233 (♀).

*Megachile temporalis* Friese, 1903. Ztschr. System. Hym. Dipt. 3: 247 (♀ only).

*Megachile pugnata pomonae* Cockerell, 1916. Ann. Mag. Nat. Hist (8) 17: 278 (♀).

**Diagnosis.** The female of *M. pugnata* is distinct and can be recognized by the prominent robust process on the lower edge of the gena. The male of *M. pugnata* can be recognized by the combination of 3-dentate mandibles, T5 with white apical fascia, front basitarsus with brush of short, dark bristles reduced, not extending beyond its basal third, and apical third of boat-shaped dilation entirely covered on the outer side with dense appressed hairs. They are most similar to *M. fidelis* and *M. mellitarsis*. Males of *M. mellitarsis* have T5 without white apical fascia, and the front basitarsus with boat-shaped dilation elongated apically and extending to apex of 3<sup>rd</sup> tarsomere. Males of *M. fidelis* have the front basitarsus with brush of dark bristles extending nearly to apex, with boat-shaped dilation mostly bare and polished in apical third.

**FEMALE:** Length 12-18 mm.

**Head.** **1)** compound eyes slightly divergent below; lateral ocelli very much nearer eyes than margin of vertex (5:7), **2)** clypeus extremely short and very much thickened apically, about as long or only slightly longer medially than the thickened apical edge, margin with a rather broad, median, truncate protuberance and a pair of more lateral tubercles, **3)** mandibles very broad apically, obscurely 5-dentate, the 4<sup>th</sup> tooth very low and rounded, not acute like remaining teeth, with a small incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure 29), **4)** gena nearly twice the width of compound eye (8:5), with a conspicuous, flattened, subtriangular process opposite lower end of eye, **5)** vertex rather dull, punctures very fine and close, becoming relatively coarse and more separated on gena above, larger and more irregular below, lower surface of gena apical to process broadly

shining and impunctate; frons densely rugosopunctate, conspicuously protuberant between antennae, punctures of supraclypeal area quite coarse and distinct but very close, with a small impunctate area along apical edge; clypeus with very fine, densely crowded punctures medially, becoming coarse and more distinct laterally, shiny and impunctate below margin, **6**) pubescence white on face and gena, short but rather dense on paraocular area, more yellowish on clypeus and on lower surface of gena, very short and sparse on gena above, vertex with quite conspicuous, erect, black pubescence that does not hide surface, **7**) F1 quadrate, subequal in length to pedicel and F2, remaining flagellomeres slightly longer than broad (3:2), apical flagellomere more elongate (4:2.5).

**Mesosoma.** **1**) pubescence rather short, quite dense, white laterally and posteriorly, pubescence of mesoscutum largely black, sparse and erect, becoming pale across anterior margin, scutellum with somewhat more elongate, black hairs, with a few paler hairs toward posterior margin, **2**) mesoscutum finely and closely punctate, punctures slightly separated only in centre, those of scutellum and axilla uniformly very fine and close; pleura dull, very closely punctate, more coarsely so below and finer above; propodeum somewhat smoother but dull and quite densely pubescent, punctures close but minute and vague, triangle dull and impunctate, **3**) all basitarsi somewhat shorter and narrower than their tibiae, apical segments of legs somewhat reddish-brown, **4**) tegula almost impunctate, a few minute and rather close punctures anteriorly, **5**) wings subhyaline basally, becoming somewhat infuscated apically, veins brownish-black.

**Metasoma.** **1**) elongate and parallel-sided, T2-T4 more or less deeply grooved across base, less so on T5, basal margin of grooves carinate, apical margin of terga rather deeply depressed, with dense, entire, whitish fasciae; pubescence of T1 whitish, rather copious and elongate, becoming dense at sides, with some shorter, more apical, brown hairs; discal pubescence T2-T6 very short, erect and quite dense, entirely black; punctures of terga very fine and close throughout; apical margin of T6 rather abruptly upturned, rather narrowly rounded, surface very densely and finely punctate, pubescence suberect and entirely black, **2**) S6 subtriangular, with narrow slightly emarginated apex, S6 uniformly covered with short, blackish scopal hairs; scopa otherwise pale yellow, the more basal sterna finely and closely punctate, punctures becoming more coarse and sparse on the more apical sterna, apical margins somewhat depressed, distinctly yellowish-hyaline.

**MALE:** Length 11-13 mm.

**Head.** **1**) compound eyes subparallel; lateral ocelli subequally distant from eyes and margin of vertex, **2**) clypeal margin beneath pubescence nearly straight, with very shallow, median and sublateral emarginate areas, **3**) mandibles quite slender, 3-dentate, lower process triangularly acute, covered with white pubescence, submedian in position, **4**) gena wider than compound eye (9:7), with a shining, impunctate, concave area ventrally, its lower margin forming a conspicuous and rather slender process just below base of mandible, **5**) vertex and gena rather dull, punctures very fine and densely crowded, face dull, densely and finely rugosopunctate beneath dense pubescence, **6**) face with copious, erect, yellowish-white pubescence largely obscuring surface below level of ocelli, gena with white pubescence, rather short above, becoming dense and elongate below, vertex sparsely pubescent with erect and elongate brownish hairs, yellowish at lateral margin, **7**) F1 slightly broader than long (2:1.5), longer than pedicel, and shorter than F2, which is slightly longer than broad (2.5:2), remaining flagellomeres longer than broad (3:2), apical flagellomere very slightly dilated, more elongate (4.5:2).

**Mesosoma.** **1**) pubescence white, rather short and dense laterally and posteriorly, mesoscutum with quite copious, erect and elongate brownish hairs, becoming whitish anteriorly, scutellum with whitish pubescence, **2**) punctures of mesoscutum fine and close, slightly separated only in centre, densely crowded otherwise, those of scutellum and axilla uniformly fine and slightly separated; pleura dull, punctures rather shallow but very close, becoming densely crowded above; propodeum somewhat smoother, punctures shallow, very fine and close, triangle rather dull, impunctate, **3**) front coxal spine very slender and elongate, anterior surface of coxa bare and somewhat shining, with a patch of 4 or 5 elongate, reddish bristles just before base of spine; mid tibial spur well developed; front tarsus bright yellow, basitarsus enormously expanded anteriorly and apically, very deeply excavated, inner basal margin of excavation with a short fringe of brown hairs not extending beyond its basal third, the hairs otherwise entirely pale yellowish, the basitarsal scale extending fully to tip of tarsomere 2, the more posterior part of tarsomere 2 much shorter than that of 1 and 3, posterior fringe pale yellow, quite dense and elongate, more or less brownish beneath; outer surface of front tibia and posterior surface of front femur black, other surfaces more or less yellowish-brown; mid and hind basitarsi slender and simple, largely dark, the more apical tarsomeres becoming more yellowish-brown, spurs yellow, **4**) tegula yellowish-brown, shining, impunctate except in anterior half, **5**) wings subhyaline, veins brownish.

**Metasoma.** **1)** T2-T5 rather shallowly depressed across base, their basal margin distinct and carinate, T4 with a dense basal fascia of appressed yellow hairs arising from below the carinate lip (this often hidden under apical margin of T3); apical margin narrowly depressed on the more basal segments, becoming quite broad, more or less yellowish-hyaline and narrowly white fasciate, fasciae quite dense and conspicuous on T4 and T5; T1, and T2 basomedially with copious, elongate, pale pubescence, but T2 also with some shorter, more apical, brownish pubescence, discal pubescence of T3 and T4 short, erect, quite copious and entirely black, that on T5 largely black, but more erect and elongate; punctures of terga very fine and close throughout; dorsal surface of T6 vertical, very densely and finely rugosopunctate, carina rather short but distinct, with small, more or less rounded, median emargination, median teeth of apical margin very low, carinate, much closer to lateral angles than to each other, but these lateral angles not at all spinose; T7 rather robust, obscurely angulate medially, but not produced, **2)** S1-S4 exposed, rather dull but very minutely and regularly punctate, punctures quite close but not crowded, apical margin depressed and yellowish-hyaline, that of S4 very slightly incurved across median area, apical margins with long pale hairs, though hardly forming fasciae, discal pubescence sparse and pale, not obscuring surface.

**Genitalia.** Plate 2, Figure G29.

**Discussion.** This common species is one of the most distinct and easily recognizable *Megachile* in Canada. It accepts trap nests (Medler 1964; Sheffield *et al.* 2008) (Table 1). Tepedino and Frohlich (1982) and Frohlich and Parker (1983) detail much of its biology. It is a floral specialist on *Helianthus* and has shown much promise as a manageable pollinator of sunflower (Tepedino and Frohlich 1982; Parker and Frohlich 1983). Divergence levels in CO1 (2.66%) suggest that the southwestern form of this species (*M. pugnata pomonae*) may be a distinct species, though further study is required.

**Distribution:** This is the most widespread member of the subgenus *Sayapis*; it occurs in southern Canada from NS-BC, extending north to southern NT and YT (see Map 29).

### 30. *Megachile (Xanthosarus) addenda* Cresson, 1878

*Megachile addenda* Cresson, 1878. Trans. Amer. Entomol. Soc. 7: 124 (♀, ♂).

*Megachile manumuskin* Viereck, 1902. Can. Entomol. 34: 328 (♀, ♂).

**Diagnosis.** The female of *M. addenda* can be recognized by the combination of 4-dentate mandibles with the emargination between inner (4<sup>th</sup>) and 3<sup>rd</sup> teeth distinctly oblique (i.e., greatest depth much closer to inner tooth than to 3<sup>rd</sup> tooth, T2-T5 with carina of basal grooves strongly elevated and projected posteriorly, and T6 strongly concave in lateral view. They are most similar to members of the subgenus *M. manifesta* and *M. wheeleri*, which have T2-T4 with carina of basal grooves distinct, but weakly elevated and not projected posteriorly to from space beneath, T5 with carina scarcely or not perceptible, and T6 weakly concave to straight in lateral view. The male of *M. addenda* is recognized by the combination of 4-dentate mandibles, unmodified front legs, and has red bristles on the front coxa. They are most similar to *M. parallela*. The male of *M. parallela* has two pairs of prominent teeth on the apical margin of T6 (below the carina), and has no red bristles on the front coxa.

**FEMALE:** Length 11-14 mm.

**Head.** **1)** compound eyes subparallel to slightly convergent below; lateral ocelli slightly nearer eyes than to margin of vertex (5:6), **2)** clypeal margin very slightly incurved and finely crenulate, **3)** mandibles 4-dentate, with an incomplete cutting edge between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, almost complete between 3<sup>rd</sup> and 4<sup>th</sup> teeth, 4<sup>th</sup> tooth narrowly rounded or subacute (Plate 1, Figure M30), **4)** gena slightly broader than compound eye (7:6), **5)** vertex shining, punctures fine, slightly separated across posterior margin, becoming more minute and separated lateral to ocelli, considerably closer and finer on gena; frons finely rugosopunctate, punctures somewhat separated on supra-clypeal area medially and on mid-line of clypeus, becoming quite close and fine laterally, **6)** pubescence white, rather dense and elongate around antennae and over lower half of face, on gena below, becoming sparse but still white on gena above, vertex with considerable rather short, erect, black pubescence, **7)** F1 quadrate to just slightly longer than broad, subequal in length to pedicel and F2, remaining flagellomeres slightly longer than broad (2.3:2), apical flagellomere more elongate, almost twice as long as broad.

**Mesosoma.** **1)** pubescence white, rather dense and elongate laterally and posteriorly, becoming sparse but still white on periphery of mesoscutum with considerable, rather short, erect black pubescence across disc, somewhat more elongate on scutellum, **2)** mesoscutum shining, punctures fine, well separated in centre ( $\geq 1$  pd) but close to almost crowded elsewhere, those on scutellum somewhat more sparse, very fine and close on axilla; pleura quite densely punctate beneath copious



pubescence; propodeum smoother, somewhat shining, only vaguely and minutely punctate, triangle impunctate, smooth and shiny, **3)** front and mid basitarsi quite broad, slightly narrower but very much shorter than their tibiae, hind basitarsus nearly equaling hind tibia in length and breadth, spurs yellowish-brown, **4)** tegula shining, with scattered, very minute and slightly separated punctures, **5)** wings subhyaline basally, becoming faintly infuscated apically, veins brownish-black.

**Metasoma.** **1)** T2-T5 with transverse, very deep, complete grooves occupying nearly half of each disc, basal margin of grooves sharply and conspicuously carinate, apical margins of terga quite abruptly but narrowly depressed, occupied by dense, entire, white, apical fasciae; T1 with more erect, loose pubescence that is white laterally, more or less brown medially, discal pubescence of T2-T6 short but copious, entirely black; punctures on the more basal terga very fine and quite close, becoming slightly more distinct and separated but still close on the more apical terga; T6 distinctly concave in profile, with abundant, erect, blackish pubescence over most of disc, but the more apical hairs becoming densely appressed, **2)** S6 with a somewhat bare, shining, median, apical area, with a short dense fringe of black hairs apically; S6 and apical edge of S5 with black scopal hairs, scopa otherwise yellowish-white; the sterna very closely and finely punctate on basal segments, becoming somewhat more coarse and sparse apically, apical margins of the sterna narrowly yellowish-hyaline.

**MALE:** Length 10-13 mm.

**Head.** **1)** eyes subparallel; lateral ocelli slightly nearer eyes than margin of vertex (4:5), **2)** clypeal margin straight, slightly crenulate, **3)** mandible 4-dentate, 3<sup>rd</sup> tooth very low and inconspicuous, lower process narrow, elongate, and subacute, basal in position, **4)** gena slightly broader than compound eye (6:5), **5)** punctures of vertex fine but distinct, rather close medially, becoming more widely separated laterally ( $\leq 1$  pd), very close and fine on gena, becoming crowded below; frons with densely crowded punctures, those on supraclypeal area and sides of face minute and densely crowded beneath dense pubescence, considerably coarser but close on clypeus dorsally, becoming minute and densely crowded apically, **6)** pubescence quite copious and elongate, yellowish-white on face and clypeus, white and quite dense on gena, vertex with some erect, more or less brown pubescence intermixed with pale long hairs, **7)** F1 about as long as broad, and subequal to pedicel, remaining flagellomeres longer than broad (3:2), apical flagellomere more elongate (5:2).

**Mesosoma.** **1)** pubescence quite copious and elongate, yellowish-white laterally and posteriorly, mesoscutum with pale pubescence anteriorly, but with a patch of brownish hairs across posterior half, scutellum with a few brown hairs intermixed among the pale ones, **2)** mesoscutum rather closely but distinctly punctate, punctures slightly separated medially, especially in anterior half, becoming close laterally and posteriorly, scutellum somewhat more finely but quite closely punctate, separated medially, punctures on axilla very fine and crowded; pleura dull, with densely crowded punctures beneath copious pubescence; propodeum smooth and somewhat shining, with only very minute, well spaced and obscure punctures, triangle dull and impunctate, slightly rugose basally, **3)** front coxal spine well developed, rather short, quite slender, acute at tip, coxa with an obscure patch of short, decumbent, reddish-brown hairs at base of spine; middle spur short but well developed; all basitarsi short, simple and narrow, front and mid tarsi rather prominently white fringed posteriorly, spurs more brownish-black, **4)** tegula shining, minutely and quite closely punctate, **5)** wings subhyaline, veins brown.

**Metasoma.** **1)** T2-T5 with complete, basal, transverse grooves, basal margin of each conspicuously carinate, apical margins of terga deeply depressed, conspicuously and densely white fasciate, pubescence of T1 and basal grooves of T2-T4 whitish, the more apical discal pubescence of T2-T5 erect and black; punctures of all terga minute, rather well separated but not sparse, becoming quite close toward depressed margins; T6 somewhat shining, largely bare, with only very fine, erect hairs, very finely and closely punctate, carina consisting of a pair of rounded, irregularly crenulate lobes delimiting a broad, rounded emargination, median teeth of apical margin hardly evident, lateral teeth small and acute but distinct; T7 acutely pointed medially, **2)** S1-S4 exposed, surface shining, very minutely and rather closely punctate, apical margins narrowly yellowish-hyaline, S1-S3 rather densely fringed with long, white hairs, discs of sterna sparsely white pubescent.

**Genitalia:** Plate 2, Figure G30.

**Discussion.** *Megachile addenda* is a distinct member of subgenus *Xanthosarus*, prompting Mitchell to make it the monotypic member of the subgenus *Addendella* (Mitchell 1980). However, the characters used to key both sexes of *Addendella* by Mitchell (see Mitchell (1980), page 24) are in disagreement with published descriptions; females do have a distinct but incomplete cutting edge in the third interspace (see Mitchell (1962), Figure 43, page 133 and Figure M29 below), and males do have

reddish-brown bristles at the base of each front coxal spine (see description in Mitchell (1962) and above). Although relatively uncommon in Canada, this species is considered an important and potentially manageable pollinator of cranberry in the United States (Cane *et al.* 1996). *Megachile addenda* is a ground nesting species (Table 1).

**Distribution:** Primarily eastern, recorded from QC and ON (see Map 30).

### 31. *Megachile (Xanthosarus) circumcincta* (Kirby, 1802)

*Apis circumcincta* Kirby, 1802. Monogr. Apum Angl., 2: 235 (♀).

*Megachile giliae* Cockerell, 1906b. Bull. Amer. Mus. Nat. Hist. 22: 452 (♂). **NEW SYNONYMY.**

*Megachile circumcincta* var. *lactescens* Cockerell, 1928. Ann. Mag. Nat. Hist. (10) 1: 355 (♀).

*Megachile circumcincta* var. *griseohirta* Alfken, 1929. Ark. Zool. 20A: 7 (♀).

*Megachile circumcincta* var. *insidiosa* Benoist, 1940. Ann. Soc. Entomol. France 109: 49 (♂,♀).

*Megachile (Macromegachile) circumcincta ozbeki* Tkalčú, 1977. Věst. cs. Spolec. zool. 41: 235 (♂,♀).

*Megachile (Delomegachile) circumcincta numidica* Tkalčú, 1988. Věst. cs. Spolec. zool. 52: 57 (♀).

*Megachile (Macromegachile) circumcincta etnaensis* van der Zanden, 1989. Entomol. Abh. Mus. Tierkd. Dresden 53(6): 73 (sex).

*Megachile (Xanthosarus) circumcincta chinensis* Wu, 2006. Fauna Sinica, Insecta 44: 302 (♂,♀) (preoccupied; not *Megachile chinensis* Radoszkowski, 1874).

**Diagnosis.** The female of *M. circumcincta* can be recognized by the combination of the metasoma, which lacks pale apical fasciae on the terga, giving a distinctive pattern of all pale hairs (T1 and T2) and black hairs (T3-T6) in dorsal view, the mandible tapering gradually but continuously from base to apex in lateral view, with the inner mandibular tooth rounded and narrower, and the pale pubescence on the ventral surface of the mesosoma. They are most similar to *M. gemula* and *M. melanophaea*. Females of *M. gemula* have the upper and lower margins of the mandible parallel in lateral view from the base to a length subequal to width prior to tapering, and the broadly truncate inner mandibular tooth. Females of *M. melanophaea* have the inner mandibular tooth with a small excision at its apex, and dark pubescence ventrally on the mesosoma. The male of *M. circumcincta* can be recognized by the combination of 4-dentate mandibles,

the front basitarsus largely pale in colour, dilated and excavated along the anterior margin, the apical rim of front tibia with a short and strongly tapered spine, and T5 with a pale apical fascia. They are most similar to *M. gemula* and *M. melanophaea*. Males of *M. gemula* have the front basitarsus dilated and excavated along the anterior margin, but with the colour mostly black (i.e., not conspicuously pale coloured), and lack a pale apical fasciae on T5. Males of *M. melanophaea* have the apical rim of front tibia with a strongly flattened and rounded tubercle projecting posteriorly.

**FEMALE:** Length 10-13 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli nearer margin of vertex than to eye (4:5.5), 2) clypeal margin straight, but very finely crenulate with a small central crenulation, apical rim impunctate and shiny, 3) mandibles 4-dentate, with a complete cutting edge between the 3<sup>rd</sup> and inner teeth, inner tooth rounded and narrow (Plate 1, Figure M31), mandible with upper and lower margins in lateral view tapering gradually and evenly from base, 4) gena broader than compound eye (9:7), 5) punctures of vertex quite deep and distinct, rather fine, close medially, becoming well separated laterally, fine and close on gena above, more crowded and minute below; frons dull and densely rugose, supraclypeal area shining, punctures fine and slightly separated, clypeus with a raised impunctate line extending from top to bottom margin, ending at a central crenulation, punctures otherwise close and fine, 6) pubescence elongate and yellowish-white around antennae and lower part of face, clypeus with hairs entirely brown medially with a few pale hairs on lateral margins, vertex with erect, elongate, pale hairs intermixed with shorter, brown hairs, pubescence becoming largely brownish on gena and on inner margin of compound eyes, 7) F1 narrow, and longer than broad (2:1), longer than pedicel and remaining flagellomeres, F2 and F3 quadrate, remaining flagellomeres slightly longer than broad (2:1.5).

**Mesosoma.** 1) pubescence copious, elongate, yellowish-white laterally and posteriorly, and entirely pale on underside of mesosoma and on legs; mesoscutum with long, erect pubescence that is pale anteriorly, with brownish hairs intermixed across posterior half, pubescence long, erect and mostly pale on scutellum, 2) mesoscutum shining, punctures quite deep and distinct, moderately coarse, sparser in centre of disc, becoming close laterally; scutellum with fine and rather sparse punctures on mid-line but becoming rather closely punctate on each side, punctures of axilla very fine and crowded; pleura dull, punctures fine and very close, becoming minute and crowded above; propodeum

smooth but dull, with only exceedingly vague, shallow and minute punctures, triangle dull and impunctate, **3**) mid and hind basitarsi about as broad as their tibiae, but somewhat shorter, spurs yellowish, **4**) tegula smooth, with only exceedingly minute punctures anteriorly, **5**) wings subhyaline, veins brownish-black.

**Metasoma.** **1**) T2 and T3 shallowly depressed across base, scarcely grooved, basal margin evident but not sharply carinate, apical margins of T2-T4 very shallowly but rather broadly depressed, entirely lacking fasciae; discal pubescence of T1, T2 and basally of T3 long, erect, and entirely pale, quite long, erect and entirely black on most of T3, T4-T6, T6 nearly straight in profile, with golden subappressed pubescence; median punctures of basal terga exceedingly minute and quite sparse, becoming closer laterally, sparser and larger on T3-T6; T6 densely and finely punctate throughout, **2**) S6 covered with scopal hairs, these becoming somewhat sparse toward apex, which is fringed with short hairs; scopa largely reddish, often tinged with brown toward base; the more basal sterna closely and rather finely punctate, somewhat more widely separated apically on the apical sterna.

**Male:** Length 10-11 mm.

**Head.** **1**) compound eyes very slightly convergent below; lateral ocelli subequally distant from eyes and edge of vertex, **2**) clypeal margin straight, but with a few minute median crenulations, **3**) mandible 4-dentate, outer margin regularly curved in dorsal view, without a median angle, lower process acute, subbasal in position, **4**) gena slightly broader than compound eye (7:5), lower margin of lower concavity produced into a low carina-like projection, **5**) punctures fine and close on gena, on vertex medially, on face below median ocellus and on clypeus, somewhat more coarse and sparse on vertex laterally and between lateral ocelli and eyes, **6**) pubescence white or pale yellow on head, copious on face below ocelli, with a few inconspicuous dark hairs on vertex laterally and behind eyes, short and sparse on gena, which have a pair of lines of short white hairs along lower margin, **7**) F1 slightly longer than broad (5:4), longer than pedicel and F2, and about as long as remaining flagellomeres, apical flagellomere flattened and somewhat dilated.

**Mesosoma.** **1**) pubescence white or pale yellow on mesosoma and legs, front tibia with a few short dark hairs anteriorly and with elongate dark hairs basally on front femur, front tarsal fringe white, yellowish beneath, mid and hind basitarsi with rather distinct fringes of long white hairs, **2**) punctures fine and close on mesoscutum, slightly separated medially in anterior half, fine and close

on scutellum and pleura, propodeum with fine but close punctures, triangle smooth and dull, **3**) front coxal spine flattened, apically rounded, fully twice as long as broad, coxa bare anteriorly, with a rather large dense patch of short reddish-brown bristles in front of spine; front femur apically slightly keeled beneath, black on posterior face, yellowish to reddish on upper face, the anterior face more yellowish, often with a thin dark stripe along lower margin, at least toward the base; front basitarsus dilated and flattened, black on outer face except for yellow apex, yellowish to reddish on the other two faces; front tarsomeres yellow, a dark spot ventrally on tarsomere 2, the basitarsus subequal to tarsomeres 2-4 in length, very slightly broader apically than at base, the anterior margin with a rather shallow excavation, the apex only slightly produced; mid and hind basitarsi about twice as long as broad, spurs yellowish, **4**) tegula reddish-brown, closely and finely punctate anteriorly, becoming sparser in posterior half, **5**) wings subhyaline, the veins brown.

**Metasoma.** **1**) T2-T5 very slightly depressed basally, basal ridge of T4-T5 present but hardly carinate, carina of T6 with small but distinct median emargination, apical margin with distinct median teeth that are slightly closer to obscure lateral teeth than to each other, T7 with acute spine; apical margins of T3-T5 depressed, T4-T5 with more or less obscure white apical fasciae, and T3 with a trace of one toward sides; punctures minute and close on terga, somewhat more sparse toward T5, slightly closer on T6; pubescence white or pale yellowish on T1-T3, T4-T5 with rather long conspicuous dark pubescence on discs, T6 with pubescence sparse and pale below carina, **2**) S1-S4 visible; apical margins depressed and narrowly hyaline, S4 more broadly so; sterna finely and closely punctate basally, becoming slightly more spaced on apical sterna; discs of sterna very sparsely pale pubescent, becoming more elongate laterally, apical margins of S1-S3 with thin pale fasciae.

**Genitalia.** Plate 2, Figure G31.

**Discussion:** *Megachile giliae* is synonymised here for the first time with *M. circumcincta* of the Old World. Mitchell (1935b) made note of the similarity of *M. giliae* to the Palearctic species, though hesitated to synonymise the two because the female was unknown. The synonymy made here was facilitated by the discovery of the female and the subsequent CO1 sequence match to the Old World species. Genitalia and other morphological characters were examined and matched among specimens examined from both the New and Old World. This species is a ground nester (Table 1).

**Distribution:** Holarctic; western Canada, and into



subarctic areas of western NT, YT and Alaska (see Map 31).

### 32. *Megachile (Xanthosarus) dentitarsus* Sladen, 1919

*Megachile diligens* Sladen, 1918. Agr. Gaz. Canada 5: 125 (♂, ♀) (preoccupied).

*Megachile dentitarsus* Sladen, 1919, Can. Entomol. 51: 85 (replacement name for *M. diligens* Sladen, 1918).

**Diagnosis.** The female of *M. dentitarsus* can be recognized by the combination of 5-dentate mandibles, with the 4<sup>th</sup> tooth approximately parallel-sided throughout its length, with an oblique emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth which is much deeper than emargination between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, the relatively dense and conspicuous white metasomal fasciae, and the absence of dark pubescence on the mesosoma. They are most similar to *M. latimanus*, *M. perihirta* and *M. fortis*. Females of *M. latimanus* and *M. perihirta* have the metasomal terga with fasciae less dense and usually interrupted medially on the more basal terga, and much dark pubescence on the mesosoma. Females of *M. fortis* have the emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth about three times as wide as width of 4<sup>th</sup> tooth at midlength, with the emargination broadly semi-circular in shape, and is generally much larger. The male of *M. dentitarsus* can be recognized by the combination of pale, highly modified front legs, lack of a mid-tibial spur, mid basitarsus bearing a large, quadrate, ventral protuberance, and the small sharp spines on the mesosternum. They are most similar to *M. latimanus* and *M. perihirta*. Males of *M. perihirta* have the mid basitarsus bearing a keel-shaped protuberance. Males of both species lack the small sharp spines on the mesosternum, being represented by low carinae.

**Female:** Length 13-14 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli slightly nearer edge of vertex than eyes (4: 4.5), 2) clypeal margin straight, faintly and irregularly crenulate, apical rim slightly thickened and shiny, 3) mandibles 5-dentate, with 4<sup>th</sup> tooth approximately parallel-sided throughout its mid-length; deep oblique emargination between the 3<sup>rd</sup> and 4<sup>th</sup> teeth much deeper than emargination between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, width of emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth about twice width of the 4<sup>th</sup> tooth at midlength, shallow but distinct emargination between 4<sup>th</sup> and 5<sup>th</sup> teeth, with complete cutting edges between 3<sup>rd</sup> and 4<sup>th</sup> and 4<sup>th</sup> and 5<sup>th</sup> teeth, incomplete between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure M32), 4) gena slightly broader than compound eye (4:3.5), 5) punctures fine and close, but relatively shallow on gena and vertex medially, with shiny interspaces apparent laterally, somewhat more

coarse but close on clypeus except for an indefinite median impunctate line; sparse on supraclypeal area, especially medially, 6) pubescence white on head, dense below median ocellus and around antennae to margin of eye, long and sparse on lower gena, vertex with brown hair laterally, clypeus sparsely pubescent, 7) F1 longer than broad (5:3) and longer than pedicel and F2, which is about as long as broad, remaining flagellomeres slightly longer than broad (3:2), apical flagellomere more elongate, twice as long as broad.

**Mesosoma.** 1) pubescence white, copious though hardly concealing the surface, shorter dorsally, mesoscutum occasionally with a transverse median brownish patch, 2) punctures close and rather fine on dorsal surface, but more coarse and distinct in centre of mesoscutum and scutellum, fine and close on pleura and propodeum, triangle rather dull and impunctate, 3) basitarsi of mid and hind legs slightly narrower than their tibiae, hind basitarsus almost as long as its tibia, spurs yellow, 4) tegula deep reddish-brown, somewhat shining, but with exceedingly minute and close punctures, pubescent anteriorly, 5) wings hyaline basally, faintly clouded apically, the veins brownish-black.

**Metasoma.** 1) terga hardly depressed basally, apical margins of T2-T5 depressed; punctures minute, close on basal terga but becoming more distinct and separate to T5, close on T6; pubescence white on T1 and T2, T3-T5 with some black pubescence on discs, on T6 entirely white, erect basally, more or less appressed apically, T2-T5 with quite broad and dense white apical fasciae, entire except on T2, 2) scopa bright yellowish-white, somewhat paler basally, S6 with a narrow row of stiff, short bristles on rounded apical edge; punctures fine and close on basal sterna, becoming slightly more sparse on apical ones.

**Male:** Length 12-13 mm.

**Head.** 1) compound eyes very slightly convergent below; lateral ocelli slightly nearer eyes than edge of vertex (7:8), 2) clypeal margin produced medially, impunctate with a few minute indentations medially, 3) mandible 3-dentate, lower margin of mandible straight between the apical tooth and apex of basal lower process, lower edge amber in colour, lower basal process quite narrow and elongate, apex obliquely acute, densely pubescent on inner surface, 4) gena broader than compound eye (4:3), with a concave, shelf-like tubercle at lower margin that receives tip of the lower mandibular process when closed, 5) punctures close and fine on gena and vertex medially, on face below ocelli, and on clypeus below the dense pubescence, more coarse and slightly more sparse on vertex laterally, 6) pubescence entirely pale

yellow, bright in some specimens, with no evident dark admixture, elongate and dense on face below ocelli, less copious on vertex, becoming short and sparse on gena, which have a pair of lines of short white hairs along lower margin adjacent to the densely white pubescent tubercle at lower edge of gena, **7)** F1 about as long as broad, and very slightly longer than pedicel, considerably shorter than remaining flagellomeres, which are longer than broad (3:2), apical flagellomere more elongate, twice as long as broad.

**Mesosoma.** **1)** pubescence entirely pale yellow, almost white in some specimens, front tarsal fringes whitish, more yellowish basally and beneath, dark brown at tip; mid tarsal fringe long and thin, entirely pale yellow, **2)** punctures close and fine over entire surface, propodeum with surface more shiny, punctures more shallow and well spaced ( $> 1\text{pd}$ ), especially medially, triangle shiny and impunctate, **3)** front coxal spine flattened, robust and rather long, tip triangularly pointed, coxal surface bare; front femur with a keel on lower margin apically that is obscured by dense pubescence of posterior face, reddish-brown except for dark apical portion of the posterior face; front tibia largely reddish-brown, but outer face dark basally and yellow apically; front tarsus yellow, front basitarsus subequal in length to tarsomeres 2-4 combined, about equally as broad at apex as at base, and but slightly produced apically; middle femur swollen, the lower surface flattened and slightly concave, mid tibia rather slender and slightly curved, lacking the usual apical spur, basitarsus with a subquadrate obtuse protuberance beneath; hind tibia slightly curved, anterior margin of its basitarsus rounded; mesosternum with a small slender acute spine anterior to each mid coxa, spurs yellow, **4)** tegula yellowish anteriorly, becoming darker posteriorly, with punctures fine and evenly dispersed, **5)** wings subhyaline, slightly clouded apically, veins reddish-brown to black.

**Metasoma.** **1)** T2-T5 depressed basally with the edge distinctly though not strongly carinate, apical margins of T3-T5 quite distinctly depressed, that of T2 only toward the sides, disc of T6 vertical, the carina short, with a small median emargination that is often vague and indefinite, finely denticulate or crenulate on each side, median teeth on apical edge distinct, much nearer lateral teeth than to each other, T7 with a very minute median triangularly pointed projection; punctures minute and close on basal terga, becoming somewhat more distinct and sparse on the shining discs of T4 and T5, minute, shallow and close on T6; pubescence on discs of terga entirely pale yellow, whitish in some specimens, with no evident dark admixture, copious on T1 and T2, the apical fasciae narrow but complete on T3-T5, narrow medially on T2,

**2)** S1-S4 exposed, apical margins slightly depressed and more or less hyaline; punctures of sterna fine and relatively close; pubescence entirely pale, sparse and rather long on discs, arranged apically into a long fringe, medially interrupted on S4.

**Genitalia.** Plate 2, Figure G32.

**Discussion.** This species is a ground nester (Hobbs and Lilly 1954; Bohart 1957) (Table 1) and visits several forage crops including alfalfa and red clover in the prairies (Hobbs 1957; Hobbs *et al.* 1961).

**Distribution:** Southern SK and the southern half of AB (see Map 32).

### 33. *Megachile (Xanthosarus) fortis* Cresson, 1872

*Megachile fortis* Cresson, 1872. Trans. Amer. Entomol. Soc. 4: 262 (♂).

*Megachile emoryi* Cockerell, 1904. Entomologist 37: 7 (♀).

*Megachile fortis* var. *vestali* Cockerell, 1913. Ann. Mag. Nat. Hist. (8) 11: 530 (♂).

**Diagnosis.** The female of *M. fortis* can be recognized by the combination of 5-dentate mandibles, with the 4<sup>th</sup> tooth approximately parallel-sided throughout its length, with an oblique emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth which is much deeper than emargination between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, the width of emargination between the 3<sup>rd</sup> and 4<sup>th</sup> teeth broadly semi-circular in shape, the apical border of S6 being thickened and weakly upcurved, extending slightly beyond the apical tergum. They are most similar to *M. dentitarsus*, *M. latimanus* and *M. perihirta*. Females of these species have the width of emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth subequal or at most twice as wide as the 4<sup>th</sup> tooth at midlength, the emargination tapering and angled towards inner mandibular edge, and S6 with apical border not thickened or upcurved, not extending beyond apical margin of T6. The male of *M. fortis* is distinct from all other *Megachile* by the truncate, basal mandibular tooth. In addition, and like males of the subgenus *Megachiloides*, the postmedian transverse carina on T6 is rounded or obtusely angulate medially (not deeply emarginate as in other *Xanthosarus*).

**FEMALE:** Length 16-18 mm.

**Head.** **1)** compound eyes parallel; lateral ocelli nearer eyes than margin of vertex (4:5), **2)** apical rim of clypeus shiny and impunctate, slightly incurved medially, with a few minute crenulations laterally, **3)** mandibles

5-dentate, width of emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth about three times as great as the width of the 4<sup>th</sup> tooth at midlength, shallow but distinct emargination between 4<sup>th</sup> and 5<sup>th</sup> teeth, with complete cutting edges between 3<sup>rd</sup> and 4<sup>th</sup> and 4<sup>th</sup> and 5<sup>th</sup> teeth, and an incomplete one between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure M33), **4**) gena subequal to compound eye in width, **5**) vertex and gena very finely and closely punctate throughout, frons rather finely and closely punctate, the supraclypeal area more densely rugose, clypeus finely and densely punctate along upper margin with an incomplete median impunctate line basally, but punctures becoming more coarse, deep and distinct and at least slightly separated toward apical margin, **6**) pubescence of head entirely pale yellowish, rather short and quite dense around antennae and paraocular area, more whitish and elongate on gena below, becoming sparse and more yellowish above, that on vertex rather short but erect, **7**) F1 longer than broad (3:2), longer than pedicel, subequal in length to remaining flagellomeres, apical flagellomere more elongate (5.5:2).

**Mesosoma.** **1**) pubescence entirely pale, pleura and posterior face of propodeum with quite dense, rather short, pale yellowish pubescence, that on dorsal surface somewhat brighter yellow, rather short but copious, partially decumbent medially on mesoscutum, **2**) surface very dull, uniformly very densely and finely rugosopunctate, propodeum somewhat more shining laterally, with minute, shallow, close and vague punctures, triangle dull and impunctate, **3**) basitarsi only slightly shorter than their tibiae, mid and hind basitarsi nearly as broad as their tibiae, spurs yellowish-brown, **4**) tegula somewhat shining, with exceedingly minute and very close punctures, pubescent anteriorly, **5**) wings subhyaline, very faintly clouded apically, veins black.

**Metasoma.** **1**) T2 and T3 quite deeply grooved across base, basal margin of groove quite distinctly carinate, T4 shallowly depressed across base but hardly grooved, T5 hardly depressed across base and without a definite, basal, carina-like margin, apical margins of T1-T5 somewhat depressed, yellowish-hyaline, densely fringed with short, yellowish pubescence forming conspicuous, transverse and entire fasciae; discal pubescence of T1 copious, elongate, pale yellow, that on T2 somewhat shorter, and very short and less conspicuous on T3-T5; punctures very fine and quite densely crowded, uniform on the more basal terga, becoming slightly coarser toward apical margin of T5, T6 nearly straight in profile, with only a very few, short, erect hairs toward the base, T6 with punctures across base very fine, densely crowded but rather distinct, becoming indistinct apically, apical half covered with yellowish, appressed hairs that obscure the surface, **2**) S6 rather uniformly covered with pale, rather short, scopal

hairs, apically with a rather prominent, thickened margin that is bare, weakly up curved and extending a little beyond the apical tergum, scopa otherwise pale yellow; sternal plates closely punctate.

**MALE:** Length 14-15 mm.

**Head.** **1**) compound eyes parallel; lateral ocelli considerably nearer eyes than margin of vertex (7:5), **2**) clypeal margin nearly straight beneath dense pubescence, with a small, median shiny protuberance, **3**) mandibles 3-dentate, lower process extremely broad, truncate, basal in position, **4**) gena subequal to compound eye in width, slightly excavated below, this area fringed with dense, yellowish, rather short hairs, **5**) vertex and gena quite uniformly, finely and densely punctate, lower portions of face in large part very finely and closely punctate beneath dense pubescence that completely hides surface, **6**) pubescence of face and vertex yellowish, dense below level of antennae, rather elongate on vertex medially, becoming shorter, more inconspicuous laterally, very sparse and short on gena, becoming somewhat paler and more dense along lower margin, **7**) F1 about as long as broad, almost twice as long as pedicel, and shorter than remaining flagellomeres, which are longer than broad (2:1.5), apical flagellomere very broadly dilated.

**Mesosoma.** **1**) pubescence rather dense, not very elongate, pale yellowish on pleura and propodeum, somewhat deeper yellow and rather short and erect but not hiding dorsal surface, **2**) mesoscutum and scutellum dull, with very fine, densely crowded punctures, those on pleura minute and densely crowded, propodeum somewhat more shining, with close but rather vague and indistinct punctures, triangle dull and impunctate, **3**) front coxal spine robust, rather acutely pointed apically, broad at base, with a large transverse patch of suberect, reddish-brown bristles at base, coxa otherwise largely bare; front tarsus pale yellow, rather broadly dilated, about equal to tibia, but anterior margin only very obscurely or shallowly excavated, posterior fringe dense, about equal in length to breadth of each tarsomere, whitish toward apical tarsomere, more yellowish-brown at base, outer face of front tibia black, with apical margin yellowish, other two faces more reddish-brown, and posterior face of front femur black, with lower margin carinate and yellowish, other faces largely yellowish-brown, densely fringed posteriorly with yellowish hairs that are elongate toward base; mid tibial spurs well developed; middle basitarsus slightly narrower, considerably shorter than tibia, with a much elongated, yellowish, posterior fringe; hind femur somewhat swollen, hind basitarsus about half the length of its tibia, **4**) tegula very minutely and closely punctate, anterior part quite densely pubescent, **5**) wings



subhyaline, very faintly clouded apically, veins black.

**Metasoma.** 1) T2 and T3 quite deeply depressed at base, T4 and T5 more shallowly so, basal margin of depressions distinct, carinate, apical margins of terga uniformly, rather deeply depressed, very deeply so on T4 and T5, the discs overhanging the depressed rims, with dense, entire, yellowish, apical fasciae on T2-T5; T1 with copious, elongate, yellowish pubescence, apical fringe rather obscure, discal pubescence of T2-T5 erect, conspicuous, entirely pale, but not obscuring the fasciae, T5 more or less bare apically, punctures very fine and close throughout, minute on the more basal terga, becoming somewhat more irregular on T5 apically, T6 rather densely tomentose, very closely and finely punctate beneath the pubescence, with a slight median ridge, and slightly depressed on each side, the carina slightly down curved and truncate, with no median emargination, median apical teeth broadly carinate, much nearer the very small lateral angles than to each other; T7 angulate medially, 2) S1-S4 very finely, uniformly and closely punctate, discal surfaces sparsely pubescent, apical margins of S1-S3 depressed, yellowish-hyaline, quite densely fasciate, the fasciae much broader laterally, S4 not conspicuously fringed but with a quite distinct, median, carinate and acute tubercle.

**Genitalia.** Plate 2, Figure G33.

**Discussion.** This is our largest indigenous *Megachile*, and one of the most uncommon in Canada. *Megachile fortis* is considered to be a specialist of *Helianthus* and nests in the ground (Neff and Simpson 1991) (Table 1). Fischer (1956) gave an account of the morphology and reproductive mechanisms of the male.

**Distribution.** Southern MB-BC (see Map 33).

### 34. *Megachile (Xanthosarus) frigida* Smith, 1853

*Megachile frigida* Smith, 1853. Cat. Hym. Brit. Mus. 1: 193 (♂).

*Megachile monardarum* Cockerell, 1900. Ann. Mag. Nat. Hist. (7) 6: 11 (♀).

*Megachile (Delomegachile) vidua* var. *appalachensis* Mitchell, 1935b. Trans. Amer. Entomol. Soc. 61: 205 (♀, ♂).

*Megachile (Delomegachile) frigida appalachensis* Mitchell, 1962. North Carolina Agricult. Exper. Stat. Tech. Bull. 152: 134.

**Diagnosis.** The female of *M. frigida* is distinct and can be recognized by the broadly truncate inner mandibular

tooth. The male of *M. frigida* is distinct and can be recognized by the combination of the front legs, which are pale and broadly expanded with two longitudinal brown bars on the yellowish anterior side of the front femur, and the prominent carina on the mesopleura just below and behind wing base, the carina concave and scoop-like ventrally with a yellowish-hyaline rim.

**FEMALE:** Length 12-15 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli equally distant from eyes and margin of vertex, 2) clypeal margin very shallowly incurved, the narrow median area very slightly produced, narrowly shining and impunctate, 3) mandibles 4-dentate, with incomplete cutting edges between the 2<sup>nd</sup> and 3<sup>rd</sup> and 3<sup>rd</sup> and 4<sup>th</sup> teeth, 4<sup>th</sup> tooth broadly truncate (Plate 1, Figure M34), 4) gena considerably wider than compound eye (4:3), 5) punctures of vertex relatively coarse and distinct, quite close medially, becoming well separated laterally between eyes and ocelli, gena minutely and quite closely punctate throughout; frons densely rugosopunctate, becoming very finely so on paraocular area, supraclypeal area more or less shining medially, punctures minute and vague, becoming close and rather deep laterally, clypeus with a median, impunctate line, punctures quite close and deep on each side, 6) pubescence yellowish-white and rather copious around antennae and over lower half of face, on gena below, vertex with brownish, erect pubescence, a quite dense line of erect brown hairs above anterior ocellus and below lateral ocelli, 7) F1 about as long as broad, and slightly longer than pedicel and F2, which is slightly broader than long (2.5:2), remaining flagellomeres longer than broad (3:2), apical flagellomere more elongate (4:2).

**Mesosoma.** 1) pubescence yellowish-white and rather copious laterally and posteriorly, mesoscutum and scutellum with extensive areas of erect, brown hairs, mesoscutum rather narrowly pale pubescent anteriorly, 2) punctures of mesoscutum and scutellum quite deep and distinct, close in large part, slightly separated only in centre of mesoscutum, close throughout on scutellum and fine and densely crowded on axilla; pleura rather dull, punctures very close, rather coarse below, becoming fine and densely crowded above; propodeum somewhat smoother and more shining, with only very vague and minute punctures, triangle somewhat shiny and impunctate, 3) hind basitarsus somewhat narrower and shorter than its tibia, fore and mid basitarsi much shorter than their tibiae, spurs yellowish-brown, 4) tegula shining, with minute punctures separated by > 1 pd, 5) wings subhyaline, veins brown.

**Metasoma.** 1) T2-T4 shallowly grooved across base, basal margin of grooves only very slightly carinate, T5 with only a subcarinate basal impression, apical margins of terga rather narrowly and slightly depressed laterally, with whitish fasciae laterally, fasciae entire on T4 and T5, discal pubescence of T1 and T2 copious, erect and entirely pale, T3-T5 with conspicuous, erect and rather elongate blackish pubescence; punctures of terga minute, slightly separated medially, becoming slightly coarser laterally on the more apical terga; T6 nearly straight in profile, with abundant, rather short, erect, black pubescence and with rather dense, subappressed, brown hairs, 2) S6 rather well covered with yellowish hairs, these becoming somewhat more sparse toward apex, which is densely fringed with short dark hairs; scopa otherwise golden yellow, the more basal sterna very closely and finely punctate, the punctures becoming somewhat more coarse and sparse toward apex, apical margins of each sterna rather narrowly yellowish-hyaline.

**MALE:** Length 11-15 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli subequally distant from eyes and margin of vertex, 2) clypeal margin nearly straight, slightly crenulate medially, 3) mandibles distinctly 4-dentate, with upper margin quite strongly flexed, lower margin somewhat angulate medially, margin straight from this to tip of acute lower process, which is basal in position, outer edge of mandibles brownish, 4) gena much broader than compound eye (8:5), lower margin with an acute, robust tubercle just below base of mandible, 5) punctures of vertex very fine and densely crowded medially, becoming slightly more coarse and distinct laterally, minute and densely crowded on gena, somewhat more coarsely rugosopunctate on frons, but very fine and densely crowded beneath pubescence on clypeus, supraclypeal area and paraocular area, 6) pubescence copious, yellowish and very dense around antennae and lower half of face, supraclypeal hairs directed upward, clypeal hairs outward and downward; gena with very short and rather sparse pale hairs, and a pair of slightly oblique lines of dense, white pubescence just above tubercle, pubescence becoming more erect and elongate on vertex, 7) F1 about as long as broad, just slightly longer than pedicel, and shorter than remaining flagellomeres, which are slightly longer than broad (3:2.5), apical flagellomere almost twice as long as preceding segment and quite broadly dilated.

**Mesosoma.** 1) pubescence yellowish-white laterally and posteriorly, dorsal surface with somewhat more copious, elongate, pale yellowish hairs, with no evident dark admixture, 2) punctures of mesoscutum, scutellum,

axilla and pleura very fine and densely crowded, propodeum somewhat smoother, with close, minute and vague punctures, triangle shiny and impunctate; mesopleura with a prominent carina with a yellowish-hyaline rim just below and behind wing base, carina concave and scoop-like ventrally, 3) front coxal spine narrow and elongated, pubescent posteriorly only at base of spine, coxa with a dense patch of reddish setae at base of spine, and dense, white pubescence laterally; front tarsus broadly dilated and deeply excavated, entirely yellow, conspicuously broader than tibia, with a broad, yellowish, posterior fringe; tibia rather narrowly yellow at apex, otherwise brownish on outer surface; posterior margin of front femur brown, sharply carinate above but otherwise largely pale yellowish-brown and subcarinate below, lower surface toward base with a pair of conspicuous, longitudinal, brownish, integumental stripes, conspicuously fringed posteriorly with longer hairs toward base; mid and hind tarsi relatively short and narrow, mid tarsi densely pale tomentose, hind tarsi with an elongate, prominent, anterior fringe, spurs yellow in large part, 4) tegula yellowish-brown, somewhat shining, very minutely and closely punctate, 5) wing subhyaline, veins brownish-black.

**Metasoma.** 1) T2-T4 shallowly grooved across base but not carinate; apical margins depressed laterally, with pale, apical fasciae at sides of T2 and T3, and a complete one on T4, T5 at most inconspicuously fasciate apically; T1 and T2 and base of T3 with copious, elongate, erect, pale yellowish pubescence, T4-T6 and apex of T3 with largely brownish pubescence; punctures fine and quite close but not crowded throughout; T6 shining, very finely or minutely, closely punctate, carina rather low and not very broad, with a rather shallow but wide median, emargination, entire on each side; median teeth of apical margin rather broadly carinate, somewhat nearer to each other than to lateral angles, lateral teeth not evident; T7 acute medially, barely evident, 2) S1-S4 exposed, the surface shining, with exceedingly minute and fine punctures, apical margins rather narrowly depressed and yellowish-hyaline, largely bare.

**Genitalia.** Plate 2, Figure G34.

**Discussion.** *Megachile frigida* is a common species. It excavates nests into rotting logs (Stephen 1956) but also accepts trap-nests (Jenkins and Matthews 2004) (Table 1). Details of nesting biology and architecture are provided by Stephen (1956) and Jenkins and Matthews (2004).

**Distribution.** Widespread in Canada from NS-BC, extending well into subarctic areas (see Map 34).

**35. *Megachile (Xanthosarus) gemula* Cresson, 1878**

*Megachile gemula* Cresson, 1878. Trans. Amer. Entomol. Soc. 7: 118 (♂ only).

*Megachile avara* Cresson, 1878. Trans. Amer. Entomol. Soc. 7: 123 (♂).

*Megachile carbonaria* Cresson, 1879. Trans. Amer. Entomol. Soc. 7: 208 (♀) (preoccupied).

*Megachile vancouveriensis* Provancher, 1888. Addit. Corr. Faune Entomol. Canad. Hym. p 424 (♂).

*Megachile cressonii* Dalla Torre, 1896. Cat. Hym. 10: 427 (replacement name for *M. carbonaria* Cresson, 1879, not Smith, 1853).

*Megachile albula* Lovell and Cockerell, 1907. Psyche 14: 18 (♂).

*Megachile vandykei* Cockerell, 1925. Proc. Calif. Acad. Sci. (4) 14: 205 (♀).

*Megachile (Delomegachile) gemula* var. *fulvogemula* Mitchell, 1935. Trans. Amer. Entomol. Soc. 56: 185 (♀).

**Diagnosis.** The female of *M. gemula* can be recognized by the combination of the metasoma, which lacks pale apical fasciae on the terga, giving a distinctive pattern of all pale hairs (T1 and T2) and black hairs (T3-T6) in dorsal view, the upper and lower margins of the mandible parallel in lateral view from the base to a length subequal to width prior to tapering, and the broadly truncate inner mandibular tooth. They are most similar to *M. circumcincta* and *M. melanophaea*, both which have the mandible tapering gradually but continuously from base to apex in lateral view, and the inner mandibular tooth rounded and narrower and/or with a small excision at its apex. The male of *M. gemula* is distinct, being the only species in Canada with the front basitarsus dilated and excavated along the anterior margin, but with the colour mostly black (i.e., not conspicuously pale coloured). It is further distinguished by lacking apical fascia on T5.

**FEMALE:** Length 12-15 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli subequally distant from eyes and margin of vertex, 2) clypeal margin nearly straight to slightly emarginate medially, with a short, median area that is narrowly shining and impunctate, 3) mandibles 4-dentate, with an incomplete cutting edge between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth, complete between 3<sup>rd</sup> and 4<sup>th</sup> teeth, inner tooth broadly truncate, mandible with upper and lower margins parallel in lateral view from base to a length subequal to width prior to tapering (Plate 1, Figure M35), 4) gena slightly broader than compound eye (5:4.5), 5) vertex somewhat shining, punctures rather fine, quite close medially, becoming somewhat more widely separated laterally (≤

1 pd), minute and close on gena; frons with moderately coarse, contiguous punctures, becoming minutely and closely punctate laterally, supraclypeal area somewhat shining and sparsely punctate medially, becoming close laterally, somewhat separated medially on clypeus, approaching an obscure to distinct impunctate band in some specimens, becoming quite densely crowded but rather coarse on each side, 6) pubescence of head above pale in part, brown or blackish hairs over lower half of face, intermixed on supraclypeal area, and along inner margin of compound eyes, on gena medially and above, vertex with some very short, dark hairs and long, erect, pale hairs, 7) F1 longer than broad (3:2) and longer than pedicel and slightly longer than F2, which is quadrate, remaining flagellomeres longer than broad (4:3), apical flagellomere elongate, almost twice as long as broad.

**Mesosoma.** 1) pubescence pale, rather dense and elongate laterally and posteriorly, becoming brown ventrally, mesoscutum and scutellum covered quite densely with rather long, pale yellowish or whitish hairs, with varying amounts of brownish hairs intermixed over posterior half of mesoscutum; front femur with long pale hair on outer surface, legs otherwise with short black pubescent, outer face of mid basitarsus with more brownish pubescence, 2) punctures of mesoscutum and scutellum quite deep and distinct, not very coarse, rather well separated medially but otherwise quite close or densely crowded, very fine and close on axilla; pleura rather dull, with rather fine and densely crowded punctures; propodeum somewhat smoother but dull, punctures hardly evident, triangle dull and impunctate, 3) mid and hind basitarsi rather broad but distinctly shorter than their tibiae, front tarsi rather short and slender, spurs more yellowish-brown, 4) tegula somewhat shining, very minutely and closely punctate throughout, 5) wings sub-hyaline, becoming faintly infuscated apically, veins brownish.

**Metasoma.** 1) T2-T4 shallowly grooved across base, basal margins of the grooves quite distinct but not carinate, T4 with a basal impression but not a definite groove; apical margins shallowly depressed; all terga lacking fasciae; discal pubescence of T1 and T2 erect, entirely pale, but rather sparse, that on T4-T6 and apex of T3 erect, rather dense but short, entirely black; surface of terga shining, punctures minute, slightly separated in large part, becoming close toward sides; T6 straight in profile, with abundant, erect, blackish hairs, 2) S6 rather well covered with dark scopal hairs, bare in part toward tip, with a dense fringe of short, brownish hairs; scopa otherwise entirely black, basal sterna very closely and finely punctate, but punctures somewhat more widely separated on the more apical sterna, apical margins very narrowly yellowish-hyaline.



**MALE:** Length 8-11 mm.

**Head.** 1) compound eyes slightly convergent below; lateral ocelli subequally distant from eyes and margin of vertex, 2) clypeal margin nearly straight, with a very small, median emargination between two tubercles, 3) mandibles distinctly 4-dentate, lower process acute, very broadly triangular with a broad base, basal in position, 4) gena subequal to compound eye in width, somewhat excavated below lower end of eye, lower margin of this produced as a prominent, carinate tubercle, 5) punctures of vertex quite deep and distinct, rather coarse, slightly separated laterally, becoming closer on gena above, but more densely and irregularly rugose below, frons with relatively coarse, close, nearly contiguous punctures, paraocular and supraclypeal areas becoming densely and very finely rugose, punctures of clypeus beneath pubescence rather coarse and quite close above, becoming very fine and densely crowded below, 6) pubescence copious, elongate and yellowish-white on face and clypeus, somewhat more white and quite copious on gena below, vertex with long erect but somewhat sparser, mostly black pubescence that extends on vertex laterally and on upper part of gena, becoming shorter but extending 2/3 down inner margin of compound eye, 7) F1 about as long as broad, subequal in length to pedicel, shorter than F2 which is slightly longer than broad (2.5:2), remaining flagellomeres longer than broad (3:2), apical flagellomere very slightly dilated.

**Mesosoma.** 1) pubescence whitish laterally and posteriorly, dorsal surface with elongate, erect but somewhat sparser pubescence, with a few dark hairs intermixed, 2) mesoscutum quite closely, deeply and distinctly punctate throughout, punctures of scutellum slightly finer but very close, and axilla with very fine, densely crowded punctures; pleura rather dull, punctures very close, rather coarse below, becoming fine above; propodeum somewhat smoother but dull, with only exceedingly minute and vague punctures evident, triangle dull and impunctate, 3) front coxal spine rather short but erect and rather slender, subacute, surface of coxa with a small patch of short, reddish setae just anterior to the spine; front basitarsus somewhat dilated and quite deeply excavated, largely black, becoming somewhat yellowish along posterior margin, following tarsomeres yellow along posterior margin, tarsomeres 1-3 with a prominent posterior fringe of elongate, white hairs, mid tibial spurs rather short but distinct, mid and hind basitarsi much narrower and shorter than their tibiae, 4) tegula somewhat shining, very minutely and closely punctate, 5) wings subhyaline, veins brownish.

**Metasoma.** 1) T2-T4 shallowly depressed at base, but

hardly grooved, basal margin abrupt but not carinate, apical margins of terga rather broadly depressed, more so laterally, T2 and T3 with obscure, whitish, apical fasciae at sides, a more complete one on T4; T1 and T2 with rather elongate but sparse, erect, pale pubescence, discal pubescence on T3 and T4 rather elongate, pale basally, becoming blackish apically and largely black on T5, pubescence of T6 sparse, long, and largely pale; punctures of all terga very fine, well separated or sparse medially, becoming somewhat closer at extreme sides; T5 not fasciate, punctures minute and well separated throughout, T6 closely and minutely punctate above, carina consisting of a pair of triangular, sublateral, carina-like lobes that form a rounded, median, emarginate area, median teeth of apical margin subacute, quite distinct but carinate, much more widely separated from each other than to the obscure, lateral angles, which are scarcely produced as definite teeth; T7 short, but rather broad and transverse, not at all angulate medially, but with an apical tuft of elongate pubescence, 2) S1-S4 exposed, shining, very minutely and generally quite sparsely punctate, apical margins depressed, more or less yellowish-hyaline, but not at all fasciate, the sterna largely bare.

**Genitalia.** Plate 2, Figure G35.

**Discussion.** *Megachile gemula* is a common ground-nesting species (Table 1). Further work may suggest that the colour variants *M. gemula cressonii* and *M. gemula fulvogemula* are additional distinct western species (the range of the latter extending into southern BC); females of these forms show consistent colour differences, though males are difficult to distinguish from the nominal form. Almost 2% divergence in CO1 separates individuals of *M. gemula* from these forms, which show little difference from each other.

**Distribution.** Widespread in Canada from NS-BC, extending well into the subarctic (see Map 35).

### 36. *Megachile (Xanthosarus) latimanus* Say, 1823

*Megachile latimanus* Say, 1823. West. Quart. Rptr. 2: 81 (♂).

*Megachile femorata* Smith, 1853. Cat. Hym. Brit. Mus. 1: 188 (♂).

*Megachile acuta* Smith, 1853. Cat. Hym. Brit. Mus. 1: 192 (♀).

*Megachile vidua* Smith, 1853. Cat. Hym. Brit. Mus. 1: 192 (♀).

**Diagnosis.** The female of *M. latimanus* can be recognized by the combination of 5-dentate mandibles, with the 4<sup>th</sup>

tooth approximately parallel-sided throughout its length, with an oblique emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth which is much deeper than emargination between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, the metasomal terga with fasciae less dense and usually interrupted medially on the more basal terga, the black pubescence of mesoscutum scarcely occupying half of surface and usually not extending to the scutellum, T2 with discal pubescence entirely pale or almost so, T6 with mostly pale pubescence, and by the absence of a distinct median impunctate area on the clypeus. They are most similar to *M. dentitarsus* and *M. perihirta*. Females of *M. dentitarsus* have relatively dense and conspicuous white metasomal fasciae, and the absence of dark pubescence on the mesosoma. Females of *M. perihirta* have the black pubescence of mesoscutum usually occupying the posterior half and extending to scutellum, T2 with discal pubescence usually black in apical half, T6 with intermixture of black and pale pubescence, and a distinct median impunctate area on the clypeus. The male of *M. latimanus* can be recognized by the mid-tibial spur being absent, and the mid basitarsus bearing a large, quadrate, ventral protuberance, and the low carinae on the mesosternum. They are most similar to *M. dentitarsus* and *M. perihirta*. The male of *M. dentitarsus* has small sharp spines on the mesosternum. Males of *M. perihirta* have the mid basitarsus bearing a keel-shaped protuberance.

**FEMALE:** Length 13-14 mm.

**Head.** 1) compound eyes slightly converging below; lateral ocelli nearer margin of vertex than eyes (5.5:7), 2) clypeal margin straight, minutely and rather sparsely denticulate, 3) mandibles 5-dentate, the 4<sup>th</sup> tooth approximately parallel-sided throughout its mid-length; deep oblique emargination between the 3<sup>rd</sup> and 4<sup>th</sup> teeth much deeper than the emargination between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth, width of emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth subequal or at most two times the width of the 4<sup>th</sup> tooth at midlength, with complete cutting edges between 3<sup>rd</sup> and 4<sup>th</sup> and 4<sup>th</sup> and 5<sup>th</sup> teeth, incomplete between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure M36), 4) gena slightly broader than compound eye, 5) punctures of vertex deep and distinct, rather fine, close medially, becoming very slightly separated laterally, minute, close and obscure on gena; frons densely rugosopunctate, somewhat smoother or very minutely rugose laterally beneath the pubescence, supraclypeal area shining medially, with scattered, rather fine but deep and distinct punctures, clypeus with rather deep, distinct and fine, closely crowded punctures throughout, without a distinct median impunctate area, 6) pubescence around and on face below pale yellowish, quite copious but not very long, somewhat longer and sparser and entirely yellowish on gena below, becoming

shorter above, vertex with considerable, somewhat shorter but erect and conspicuous black pubescence, 7) F1 about as long as broad, slightly longer than pedicel, and subequal in length to F2, remaining flagellomeres longer than broad (5:4), apical flagellomere more elongate, twice as long as broad.

**Mesosoma.** 1) pubescence quite dense and copious laterally and posteriorly, mesoscutum with considerable, somewhat shorter but erect and conspicuous black pubescence in posterior half of disc, scutellum with pubescence entirely pale, 2) mesoscutum and scutellum very finely, closely and quite deeply punctate throughout; pleura very finely and densely punctate beneath the pubescence, propodeum somewhat more shining and smooth, posterior face with minute, rather close, vague punctures, 3) mid and hind basitarsi nearly as broad as their tibiae, hind basitarsus nearly equal to its tibia in length, spurs pale yellow, 4) tegula rather dull, minutely and very closely punctate, 5) wings subhyaline, faintly clouded apically, veins brownish-black.

**Metasoma.** 1) T2-T4 shallowly depressed across base, basal margin of depressions distinct but scarcely carinate, apical margins of terga rather narrowly depressed, yellowish fasciate; discal pubescence of T1 and T2 long, erect and quite copious, entirely pale yellowish (some specimens may have some dark hairs apically on T2), short and yellowish toward base, black apically on T3 and T4, and black over most of T5, punctures of terga very minute but rather close, becoming very close at sides; T6 very slightly concave in profile, with well scattered suberect hairs visible, most of which are pale yellowish, subappressed and rather dense; punctures very fine and densely crowded throughout, 2) S6 rather well covered with yellowish scopal hairs, but these becoming somewhat sparse apically, with a dense fringe of short hairs apically, scopa otherwise yellowish-orange in color; the more basal sterna very finely and densely punctate, punctures becoming slightly more widely separated and coarse on the more apical sterna, apical margins very narrowly yellowish-hyaline.

**MALE:** Length 12-13 mm.

**Head.** 1) compound eyes very slightly convergent below; lateral ocelli subequally distant from eyes and margin of vertex, 2) clypeal margin very slightly incurved on each side, 3) mandibles 3-dentate, outer margin curved as seen from above, lower edge amber in colour, lower process quite narrow and elongate, apex obliquely acute, densely pubescent on inner surface, basal in position, 4) gena much broader than compound eye (5:3.5), with a concave, shelf-like tubercle at lower margin that receives tip of the

lower mandibular process when closed, **5**) vertex very finely and closely punctate medially, punctures becoming somewhat more coarse and distinctly separated laterally, and with a small but distinct impunctate area just behind upper eye margin, very fine and dense on gena; frons finely and densely rugose, supraclypeal area and clypeus very finely and densely punctate, **6**) pubescence pale yellowish, copious and elongate around antennae and lower half of face, sparser and erect on vertex, short and sparse on gena, which have a pair of lines of short white hairs along lower margin, **7**) F1 slightly longer than broad (5:4), subequal in length to pedicel, shorter than remaining flagellomeres, which are longer than broad (4:2), apical flagellomere slightly dilated, rather strongly flattened.

**Mesosoma.** **1**) pubescence entirely pale, more whitish on pleura below, yellow on propodeum and on pleura above, dense, elongate and bright yellow on mesoscutum and scutellum, **2**) mesoscutum dull, punctures indistinct, very fine and densely crowded throughout, those on scutellum very minute, close but relatively distinct, pleura somewhat shining beneath the pubescence, punctures very fine, shallow and close throughout, propodeum shining laterally, with fine punctures, triangle dull and impunctate, **3**) front coxal spine robust, rather slender, subacute apically, anterior face of coxa entirely bare, without patch of setae; front tarsus yellow, basitarsus quite broadly dilated at base, slightly narrowed apically, quite deeply excavated anteriorly, tarsal fringe pale yellow, very dense and elongate; front tibia largely reddish-brown, becoming yellow at tip; posterior face of front femur black apically, but otherwise largely yellowish-brown, inner face with two thin dark lines in basal third, densely fringed posteriorly, outer hairs pale yellowish, inner hairs more orange; mid and hind femora much swollen, mid basitarsus with a thickened, quadrate process covering most of lower surface, hind basitarsus about half as long as broad, anterior margin evenly curved, **4**) tegula yellowish-brown, minutely and very closely punctate, **5**) wings subhyaline basally, becoming faintly clouded apically, veins brownish.

**Metasoma.** **1**) T2-T5 rather shallowly depressed across base, basal margin of groove distinct but hardly carinate, apical margins of terga rather abruptly depressed, at least laterally, and also medially on the more apical terga, margins yellowish-hyaline, fringed with pale hairs forming rather loose, indefinite fasciae; discal pubescence of all terga rather long, erect, entirely pale yellow; punctures of terga minute and quite close, becoming somewhat more distinct on the more apical terga, T6 finely and densely punctate, carina definite but rather low, irregularly serrate across median area,

emargination very shallow or absent, median teeth of apical margin prominent and acute, considerably nearer the small, barely visible, lateral teeth than to each other; T7 prominent, transverse, rather broadly triangular, apex obtusely angulate, **2**) S1-S4 exposed, finely and closely punctate, apical margins rather deeply depressed, yellowish-hyaline, more or less fringed with rather elongate, pale yellowish hairs.

**Genitalia.** Plate 2, Figure G36.

**Discussion.** This common species and *M. perhirta* can be regarded as an eastern (*M. latimanus*) and a western (*M. perhirta*) sibling species pair, although their ranges overlap in central Canada (ON-AB). *Megachile latimanus* is a ground-nesting species (Table 1).

**Distribution:** Widespread throughout most of Canada from NS as far west as AB (see Map 36).

### 37. *Megachile (Xanthosarus) melanophaea* Smith, 1853

*Megachile melanophaea* Smith, 1853. Cat. Hym. Brit. Mus. 1: 191 (♀, ♂).

*Megachile femorata* Provancher, 1882. Nat. Canad. 13: 228 (♂) (preoccupied).

*Megachile wootoni* Cockerell, 1898a. Ann. Mag. Nat. Hist. (7) 1: 125 (♂).

*Megachile calogaster* Cockerell, 1898b. Proc. Ac. Nat. Sc. Phil. 50: 55 (♂).

*Megachile canadensis* Friese, 1903. Ztschr. System. Hym. Dipt. 3: 248 (replacement name for *M. femorata* Provancher, 1882, not Smith, 1879).

*Megachile wootoni rohweri* Cockerell, 1906b. Amer. Mus. Nat. Hist. Bull. 22: 453 (♀).

*Megachile pseudolatimanus* Strand, 1917. Arch. Naturges. 83A (11): 65 (♂).

*Megachile tuala* Strand, 1917. Arch. Naturges. 83A (11): 66 (♀).

*Megachile (Delomegachile) melanophaea submelanophaea* Mitchell, 1935b. Trans. Amer. Entomol. Soc. 61: 197 (♀).

*Megachile (Delomegachile) melanophaea melanophaea* Mitchell, 1962. North Carolina Agric. Exper. Stat. Tech Bull. 152: 138 (misspelling of *M. melanophaea melanophaea*).

*Megachile (Delomegachile) melanophaea submelanophaea* Mitchell, 1962. North Carolina Agric. Exper. Stat. Tech Bull. 152: 140 (misspelling of *M. melanophaea submelanophaea*).

**Diagnosis.** The female of *M. melanophaea* can be



recognized by the combination of the metasoma, which lacks pale apical fasciae on the terga, giving a distinctive pattern of all pale hairs (T1 and T2) and black hairs (T3-T6) in dorsal view, the mandible tapering gradually but continuously from base to apex in lateral view, with the inner mandibular tooth with a small excision at its apex, and dark pubescence ventrally on the mesosoma. They are most similar to *M. circumcincta* and *M. gemula*. Females of *M. circumcincta* have the inner mandibular tooth rounded and lacking the excision at its apex, and pale pubescence on the ventral surface of the mesosoma. Females of *M. gemula* have the upper and lower margins of the mandible parallel in lateral view from the base to a length subequal to width prior to tapering, and the broadly truncate inner mandibular tooth. The male of *M. melanophaea* can be recognized by the combination of 4-dentate mandibles, the front basitarsus largely pale in colour, dilated and excavated along the anterior margin, the apical rim of front tibia with a strongly flattened and rounded tubercle projecting posteriorly, and T5 with a pale apical fascia. They are most similar to *M. circumcincta* and *M. gemula*. Males of *M. circumcincta* have the apical rim of front tibia with a short and strongly tapered spine. Males of *M. gemula* have the front basitarsus dilated and excavated along the anterior margin, but with the colour mostly black (i.e., not conspicuously pale coloured), and lack a pale apical fasciae on T5.

**FEMALE:** Length 12-14 mm.

**Head.** 1) compound eyes subparallel; lateral ocelli very slightly nearer margin of vertex than eye (5:6), 2) clypeal margin straight, but very finely crenulate with a small central crenulation, apical rim impunctate and shiny, 3) mandibles 4-dentate, inner tooth very slightly incised or emarginate, approaching a 5-dentate condition, with a complete cutting edge between the 3<sup>rd</sup> and 4<sup>th</sup> teeth, incomplete between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure M37), upper and lower margins of mandible in lateral view tapering gradually and evenly from base, 4) gena slightly broader than compound eye (8:7), 5) punctures of vertex quite deep and distinct, rather fine, close medially, becoming well separated laterally, fine and close on gena above, densely crowded and minute below; frons dull and densely rugose, supraclipeal area shining, punctures fine and slightly separated, clypeus shining and sparsely punctate medially, most specimens without a well defined impunctate line, 6) pubescence elongate and yellowish-white around antennae and lower part of face, clypeus with hairs entirely brownish medially with a few pale hairs on lateral margins, vertex with erect, elongate, pale hairs intermixed with shorter, brownish-black hairs, pubescence becoming largely brown on gena and on inner margin of compound eyes, 7) F1 longer than

broad (2:1), longer than pedicel, F2 and F3, subequal in length to remaining flagellomeres, which are slightly longer than broad (2:1.5).

**Mesosoma.** 1) pubescence copious, elongate, yellowish-white laterally and posteriorly, becoming brownish-black on lower 1/3 and on underside of mesosoma and on legs; mesoscutum with long, erect pubescence that is pale anteriorly, but in large part brownish across posterior half of disc, pubescence long, erect and mostly pale on scutellum, 2) mesoscutum shining, punctures quite deep and distinct, moderately coarse, sparser on centre of disc, becoming close laterally; scutellum with fine and rather sparse punctures on mid-line but becoming rather closely punctate on each side, punctures of axilla very fine and crowded; pleura dull, punctures fine and very close, becoming minute and crowded above; propodeum smooth but dull, with vague, shallow and minute punctures evident, triangle dull and impunctate, 3) mid and hind basitarsi about as broad as their tibiae, but somewhat shorter, spurs yellowish-brown, 4) tegula smooth, with only minute punctures anteriorly, 5) wings subhyaline, veins brownish-black.

**Metasoma.** 1) T2 and T3 shallowly depressed across base, scarcely grooved, basal margin evident but not sharply carinate, apical margins of T2-T4 very shallowly but broadly depressed, entirely lacking fasciae; discal pubescence on T1 and T2 long, erect, quite copious, and entirely pale, on T3-T6 quite long, erect and entirely black, with much subappressed pubescence on T6, T6 nearly straight in profile; median punctures of basal terga minute and quite sparse, becoming closer laterally, sparser and larger on T3-T6; T6 densely and finely punctate throughout, 2) S6 covered with scopal hairs, these becoming somewhat sparse toward apex, which is fringed with short hairs; scopa black to largely reddish, often tinged with brown hairs toward base; the more basal sterna very closely and rather finely punctate, punctures somewhat more widely separated apically on the apical sterna.

**MALE:** Length 9-12 mm.

**Head.** 1) compound eyes subparallel; distance from lateral ocelli to eyes subequal to distance to margin of vertex, 2) clypeal margin shallowly emarginate on laterally, otherwise straight and entire with minute crenulations on apical rim, 3) mandibles 4-dentate, outer margin obtusely angulate medially, lower process triangular, with a broad base, basal in position, 4) gena somewhat broader than compound eye (7:6), with a blunt ridge with an apical hairy tuft on lower posterior angle, with a deep, narrow excavation between this and base of mandible, 5) vertex

somewhat shining, punctures fine and close medially, becoming well separated laterally, very fine and close on gena above, becoming minute and densely crowded below, frons dull, rather finely rugosopunctate, becoming very finely and densely punctate on paraocular and supraclypeal areas, clypeus somewhat shining beneath pubescence, punctures very fine and very slightly separated over most of disc, **6**) pubescence yellowish-white, quite copious around antennae and over lower half of face, becoming somewhat sparser but long and erect on vertex, with a few dark hairs intermixed, very short and sparse on gena, but with a transverse line of elongate, whitish hairs toward lower margin, **7**) F1 longer than broad (2:1.5), and longer than pedicel, which is quadrate, subequal in length to F2, remaining flagellomeres longer than broad (2.5:2), apical flagellomere flattened and quite broadly dilated.

**Mesosoma.** **1**) pubescence rather copious, elongate, yellowish-white laterally and posteriorly, mesoscutum with elongate, erect pubescence that is somewhat sparser and pale anteriorly, becoming mostly brownish over posterior half, scutellum with mostly pale hairs, **2**) mesoscutum somewhat dull, punctures quite deep and distinct, rather fine, slightly separated in centre of disc, but very close elsewhere, finer and uniformly close on scutellum and axilla, pleura dull, punctures very fine, shallow and quite densely crowded, propodeum somewhat smoother but dull, posterior face with well spaced, shallow, minute and rather obscure punctures, triangle dull and impunctate, **3**) front coxal spine subtriangular, acute at tip, rather short but well developed, with elongate, pale pubescence posteriorly, a dense, transverse patch of short, brownish bristles at base of spine, coxa otherwise largely bare; mid tibial spurs short but well developed; front tarsus entirely yellowish, basitarsus broadly dilated and very deeply excavated, apex fully as broad as its tibia, following tarsomeres short, posterior margins with a dense fringe of yellowish-white hairs, intermixed with brown at tips; front tibia yellowish at apex and brownish on anterior and posterior faces, outer face black, distal rim with a strongly flattened and rounded tubercle projecting posteriorly; front femur largely yellowish-brown, with a dark band from base to apex on posterior face, rather prominently whitish-fringed posteriorly, mid and hind basitarsi much narrower and shorter than their tibiae, **4**) tegula somewhat shining, rather closely and minutely punctate, **5**) wings subhyaline, veins brownish-black.

**Metasoma.** **1**) T2 and T3 shallowly depressed toward base, their basal margins distinct but not conspicuously carinate, T4-T6 faintly depressed at base, apical margins shallowly but rather broadly depressed, not at all fasciate, discal pubescence of T1, T2 and base of T3 entirely pale,

erect, quite copious, pubescence on apical portion of T3, and T4-T5 largely blackish, erect and quite copious, T6 sparsely pubescent with long, pale hairs; punctures of terga medially minute, well separated, with surface shining, punctures becoming quite close at sides; T6 densely and finely punctate above, margin of carina irregularly crenulate, with a deep, rounded, median emargination, median teeth of apical margin elongated, slightly narrowed and abruptly truncate at tip, slightly nearer the low, subangulate lateral teeth than each other, T7 pointed apically, **2**) S1-S4 exposed, shining, punctures very fine but rather close on the more basal sterna, becoming minute and vague apically, apical margin of each sternum narrowly but deeply and abruptly depressed, yellowish-hyaline, rather prominently fringed toward sides, discs sparsely pale pubescent.

**Genitalia.** Plate 2, Figure G37.

**Discussion.** Much confusion has arisen with use of the name *Megachile femorata*; Smith (1853) proposed it for a male specimen from North America, which was synonymous with *M. latimanus* Say, 1823. Provancher (1882) misdetermined males of *M. melanophaea* Smith, 1853 as *M. femorata* Smith, 1853. Subsequently, Smith (1879) used the name *Megachile femorata* for a new species from India (Bombay) (and Dalla Torre (1896) incorrectly placed the North America species *M. femorata* Provancher, 1882, 1883 (i.e., *M. melanophaea*) in synonymy). Because *M. femorata* Smith, 1853 is synonymous with *M. latimanus*, *Megachile femoratella* Cockerell, 1918, is the valid replacement name for *M. femorata* Smith, 1879 (not 1853) from India (M. Schwarz; pers. comm. to J. Ascher). *Megachile melanophaea* is a very common ground nesting species (Table 1).

**Distribution.** Widespread and abundant throughout Canada, from NF-BC, and into NT to Alaska (see Map 37).

### 38. *Megachile (Xanthosarus) perihirta* Cockerell, 1898

*Megachile perihirta* Cockerell, 1898. Ann. Mag. Nat. Hist. (7) 1: 126 (♂).

*Megachile latimanus grindeliarum* Cockerell, 1904. Entomol. News 15: 33 (♀).

**Diagnosis.** The female of *M. perihirta* can be recognized by the combination of 5-dentate mandibles, with the 4<sup>th</sup> tooth approximately parallel-sided throughout its length, with an oblique emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth which is much deeper than emargination between 2<sup>nd</sup> and 3<sup>rd</sup> teeth, the metasomal terga with fasciae less dense

and usually interrupted medially on the more basal terga, the black pubescence of mesoscutum usually occupying the posterior half and extending to scutellum, T2 with discal pubescence usually black in apical half, T6 with intermixture of black and pale pubescence, and a distinct median impunctate area on the clypeus. They are most similar to *M. dentitarsus* and *M. latimanus*. Females of *M. dentitarsus* have relatively dense and conspicuous white metasomal fasciae, and the absence of dark pubescence on the mesosoma. Females of *M. latimanus* have the black pubescence of mesoscutum scarcely occupying half of surface and usually not extending to the scutellum, T2 with discal pubescence entirely pale or almost so, T6 with mostly pale pubescence, and by the absence of a distinct median impunctate area on the clypeus. The male of *M. perihirta* can be recognized by the mid-tibial spur being absent, the ventral protuberance of the mid basitarsus being keel-shaped, and the low carinae on the mesosternum. They are most similar to *M. dentitarsus* and *M. latimanus*. The male of *M. dentitarsus* has small sharp spines on the mesosternum. Males of both *M. dentitarsus* and *M. latimanus* have the mid basitarsus bearing a large, quadrate ventral protuberance.

**FEMALE:** Length 13-14 mm.

**Head.** 1) compound eyes parallel; lateral ocelli slightly nearer margin of vertex than eyes (3.5:4), 2) clypeal margin straight, minutely and rather sparsely denticulate, 3) mandibles 5-dentate, with the 4<sup>th</sup> tooth approximately parallel-sided throughout its mid-length; deep oblique emargination between the 3<sup>rd</sup> and 4<sup>th</sup> teeth much deeper than emargination between the 2<sup>nd</sup> and 3<sup>rd</sup> teeth, width of emargination between 3<sup>rd</sup> and 4<sup>th</sup> teeth subequal or at most two times width of the 4<sup>th</sup> tooth at midlength, with complete cutting edges between 3<sup>rd</sup> and 4<sup>th</sup> and 4<sup>th</sup> and 5<sup>th</sup> teeth, incomplete between 2<sup>nd</sup> and 3<sup>rd</sup> teeth (Plate 1, Figure M38), 4) gena slightly broader than compound eye (5:4), 5) punctures of vertex deep and distinct, rather fine, close medially, becoming slightly separated laterally, minute, close and obscure on gena; frons densely rugosopunctate, somewhat smoother or very minutely rugose laterally beneath the pubescence, supraclypeal area shining, especially medially, with scattered, rather deep and distinct punctures laterally, clypeus with a rather distinct, median impunctate band, punctures otherwise rather deep, distinct and fine, and closely crowded throughout, 6) pubescence around and on face below pale yellowish, quite copious but not very long, somewhat longer and sparser, and entirely yellowish on gena below, becoming shorter above, vertex with considerable, somewhat shorter but erect and conspicuous black pubescence that extends down inner eye margin about  $\frac{1}{4}$  of its length, 7) F1 slightly longer than broad (2: 1.5), longer than

pedicel and F2, which is quadrate, subequal in length to remaining flagellomeres, which are slightly longer than broad (2.3:2), apical flagellomere more elongate (3.5:2).

**Mesosoma.** 1) pubescence mostly pale, quite dense and copious laterally and posteriorly, mesoscutum with considerable, somewhat shorter but erect and conspicuous black pubescence, scutellum with long black hairs intermixed with pale hairs, 2) mesoscutum and scutellum very finely, closely and quite deeply punctate throughout; pleura very finely and densely punctate, propodeum somewhat more shining and smooth with minute, rather close, vague punctures that are slightly separated medially, triangle dull and impunctate, 3) mid and hind basitarsi nearly as broad as their tibiae, hind basitarsus nearly equal to its tibia in length, spurs pale yellow, 4) tegula rather dull, minutely and very closely punctate, 5) wings subhyaline, faintly clouded apically, veins brownish.

**Metasoma.** 1) T2-T4 shallowly depressed across base, basal margin of depressions distinct but hardly carinate, apical margins of terga rather narrowly depressed, yellowish fasciate at least laterally; discal pubescence of T1 and T2 long, erect and quite copious, entirely pale yellowish on T1, black apically on T2, black over most of T3-T5; punctures of terga minute but rather close, becoming very close at sides; T6 very slightly concave in profile, pubescence entirely dark, with a few suberect black hairs, punctures fine and densely crowded throughout, 2) S6 covered with yellowish scopal hairs, but these becoming somewhat sparse apically, with a dense fringe of short hairs apically; scopa otherwise orange in color; the more basal sterna very finely and densely punctate, punctures becoming slightly more widely separated and coarse on the more apical sterna, apical margins very narrowly yellowish-hyaline.

**MALE:** Length 12-13 mm.

**Head.** 1) compound eyes subparallel to slightly convergent below; lateral ocelli subequally distant from eyes and margin of vertex, 2) clypeal margin very slightly incurved on each side, medially with a few tubercles or crenulations, 3) mandibles 3-dentate, outer margin curved as seen from above, lower edge amber in colour, lower process quite narrow and elongate, apex obliquely acute, densely pubescent on inner surface, basal in position, 4) gena wider than compound eye (3:2), with a concave, shelf-like tubercle at lower margin that receives tip of the lower mandibular process when closed, 5) vertex very finely and closely punctate medially, punctures becoming somewhat more coarse and distinctly separated laterally, very fine and dense on gena; frons finely and densely



rugosopunctate, supraclypeal area finely and densely punctate, with a prominent medial tubercle just below level of antennae, clypeus very finely and densely punctate with a rather wide impunctate area along apical rim, **6**) pubescence pale yellowish, copious and elongate around antennae and lower half of face, sparser and erect on vertex, short and sparse on gena, which have a pair of lines of short white hairs along lower margin, **7**) F1 slightly longer than pedicel, and 2/3 as long as F2; remaining flagellomeres slightly longer than F2, apical flagellomere elongate and slightly dilated, rather strongly flattened.

**Mesosoma.** **1**) pubescence entirely pale, more whitish on pleura below, yellow on propodeum and on pleura above, on mesoscutum and scutellum dense, elongate and bright yellow, **2**) mesoscutum dull, punctures very fine and densely crowded throughout, those on scutellum very minute, close but relatively distinct, pleura somewhat shining beneath pubescence, punctures very fine, shallow and close throughout, propodeum shining laterally, rather dull, with minute, indistinct, fine punctures separated by >1 pd, triangle dull and impunctate, **3**) front coxal spine robust, rather slender, subacute apically, anterior face of coxa entirely bare, without patch of setae; front tarsus yellow, basitarsus quite broadly dilated at base, very slightly narrowed apically, quite deeply excavated anteriorly, tarsal fringe pale yellow, very dense and elongate; front tibia largely reddish-brown, becoming yellow at tip, occasionally with black spot medially; posterior face of front femur black apically, but otherwise largely brownish, densely fringed posteriorly, outer hairs pale yellowish, inner hairs more orange; mesosternum with a low carina just anterior to mid coxa; mid and hind femora swollen, mid basitarsus with a keel shaped process covering most of lower surface; hind basitarsus medially expanded, about half as broad as long, anterior

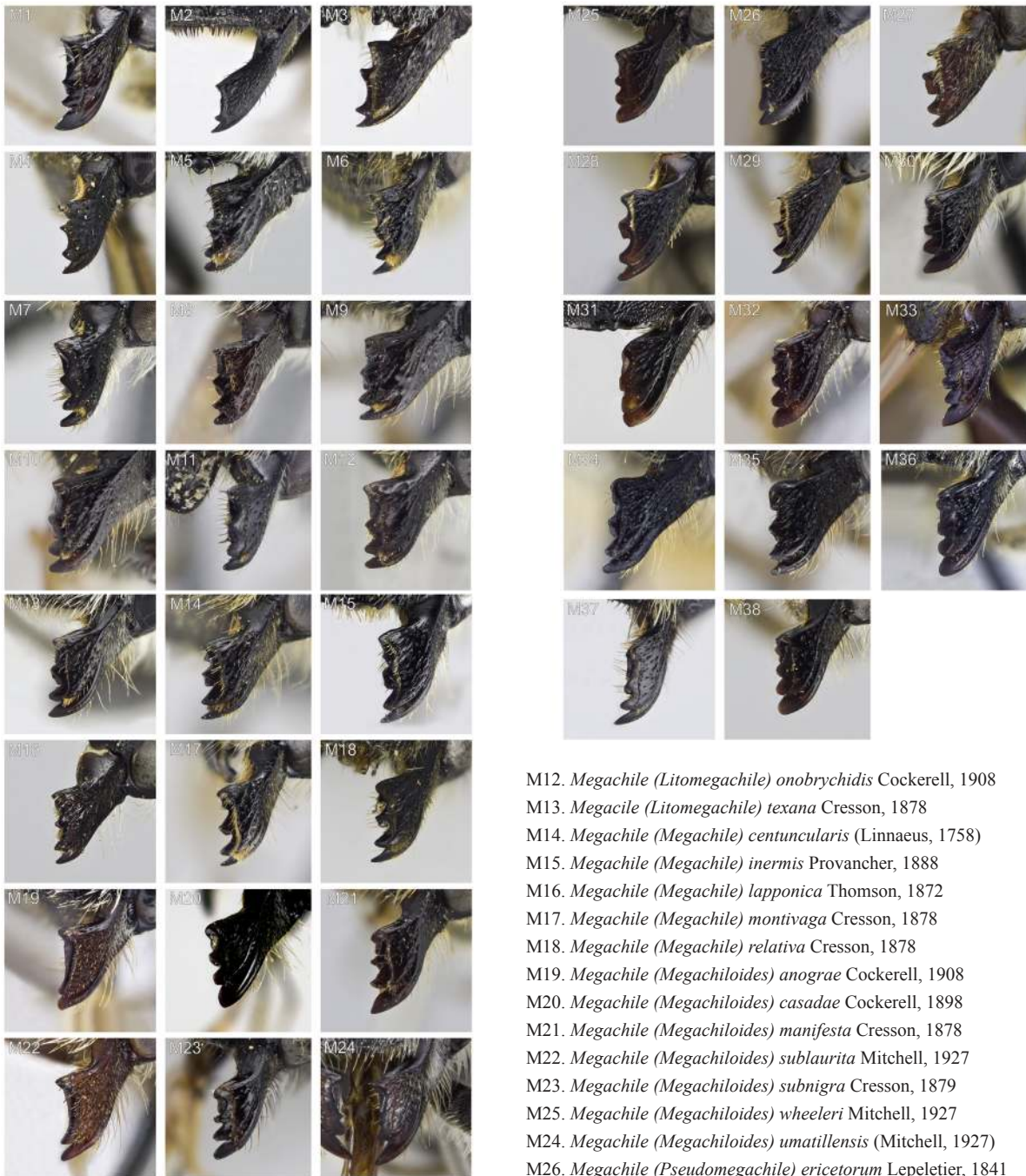
margin evenly curved, **4**) tegula brownish, minutely and very closely punctate, **5**) wings subhyaline basally, becoming faintly clouded apically, veins brownish.

**Metasoma.** **1**) T2-T5 rather shallowly depressed across base, basal margin of groove distinct but hardly carinate, apical margins of basal terga rather abruptly depressed laterally, fully depressed on the more apical terga, margins yellowish-hyaline, fringed with pale hairs that form rather loose, indefinite fasciae; discal pubescence of all terga rather long, erect, entirely pale yellow; punctures of terga minute and quite close, becoming somewhat more distinct on the more apical terga, T6 finely and densely punctate, carina definite but rather low, irregularly serrate across median area, emargination very shallow or absent, median teeth of apical margin prominent and acute, considerably nearer the small, barely visible, lateral teeth than each other; T7 prominent, transverse, rather broadly triangular, apex obtusely angulate, **2**) S1-S4 exposed, finely and closely punctate, apical margins rather deeply depressed, yellowish hyaline, more or less fringed with rather elongate, pale yellowish hairs, discs of sterna sparsely pubescent, not at all hiding the surface.

**Genitalia:** Plate 2, Figure G38.

**Discussion.** This species and *M. latimanus* can be regarded as an eastern (*M. latimanus*) and a western (*M. perihirta*) sibling species pair, although their ranges overlap in central Canada (ON-AB). Although distinct morphological differences distinguish the males, only subtle characters separate the females. *Megachile perihirta*, like *M. latimanus*, is a ground-nesting species (Table 1).

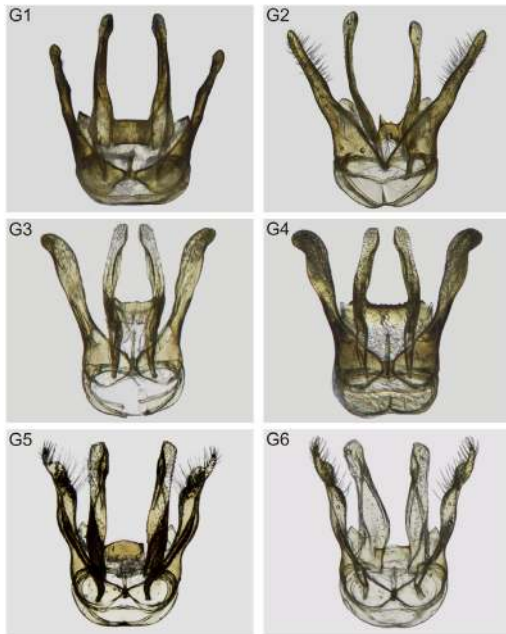
**Distribution.** Found primarily in western Canada from SK-BC and into the western subarctic, though occasionally found as far east as ON (see Map 38).



**Plate 1 - Female Mandible**

- M1. *Megachile (Argyropile) parallela* Smith, 1853  
 M2. *Megachile (Callomegachile) sculpturalis* Smith, 1853  
 M3. *Megachile (Chelostomoides) angularum* Cockerell, 1902  
 M4. *Megachile (Chelostomoides) campanulae* (Robertson, 1903)  
 M5. *Megachile (Euricharaea) apicalis* Spinola, 1808  
 M6. *Megachile (Euricharaea) rotundata* (Fabricius, 1793)  
 M7. *Megachile (Litomegachile) brevis* Say, 1837  
 M8. *Megachile (Litomegachile) coquilletti* Cockerell, 1915  
 M9. *Megachile (Litomegachile) gentilis* Cresson, 1872  
 M10. *Megacile (Litomegachile) lippiae* Cockerell, 1900  
 M11. *Megachile (Litomegachile) mendica* Cresson, 1878

- M12. *Megachile (Litomegachile) onobrychidis* Cockerell, 1908  
 M13. *Megacile (Litomegachile) texana* Cresson, 1878  
 M14. *Megachile (Megachile) centuncularis* (Linnaeus, 1758)  
 M15. *Megachile (Megachile) inermis* Provancher, 1888  
 M16. *Megachile (Megachile) lapponica* Thomson, 1872  
 M17. *Megachile (Megachile) montivaga* Cresson, 1878  
 M18. *Megachile (Megachile) relativa* Cresson, 1878  
 M19. *Megachile (Megachiloides) anograe* Cockerell, 1908  
 M20. *Megachile (Megachiloides) casadae* Cockerell, 1898  
 M21. *Megachile (Megachiloides) manifesta* Cresson, 1878  
 M22. *Megachile (Megachiloides) sublaurita* Mitchell, 1927  
 M23. *Megachile (Megachiloides) subnigra* Cresson, 1879  
 M25. *Megachile (Megachiloides) wheeleri* Mitchell, 1927  
 M24. *Megachile (Megachiloides) umatillensis* (Mitchell, 1927)  
 M26. *Megachile (Pseudomegachile) ericetorum* Lepeletier, 1841  
 M27. *Megachile (Sayapis) fidelis* Cresson, 1878  
 M28. *Megachile (Sayapis) mellitarsus* Cresson, 1878  
 M29. *Megachile (Sayapis) pugnata* Say, 1837  
 M30. *Megachile (Xanthosarus) addenda* Cresson, 1878  
 M31. *Megachile (Xanthosarus) circumcincta* (Kirby, 1802)  
 M32. *Megachile (Xanthosarus) dentitarsus* Sladen, 1919  
 M33. *Megachile (Xanthosarus) fortis* Cresson, 1872  
 M34. *Megachile (Xanthosarus) frigida* Smith, 1853  
 M35. *Megachile (Xanthosarus) gemula* Cresson, 1878  
 M36. *Megachile (Xanthosarus) latimanus* Say, 1823  
 M37. *Megachile (Xanthosarus) melanophaea* Smith, 1853  
 M38. *Megachile (Xanthosarus) perihirta* Cockerell, 1898

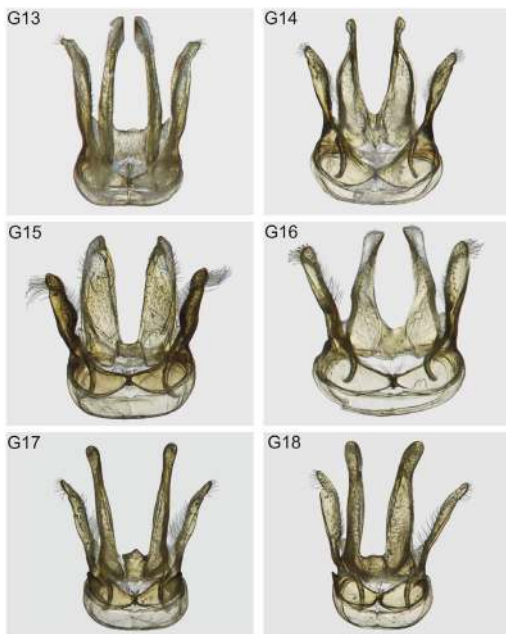


**Plate 2. Male genitalia.**

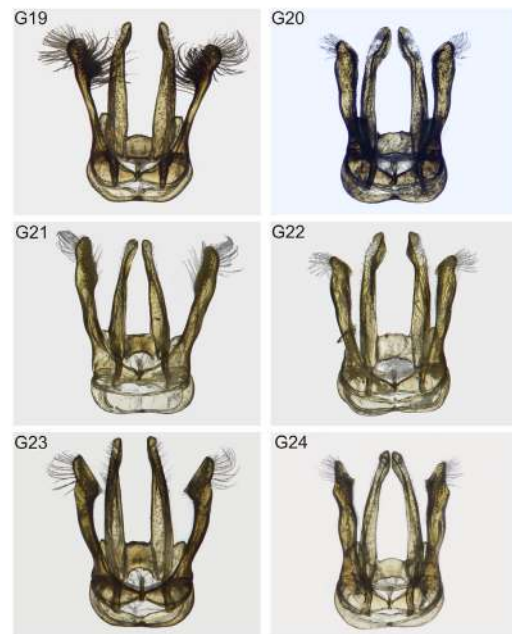
- G1. *Megachile (Argyropile) parallela* Smith, 1853  
 G2. *Megachile (Callomegachile) sculpturalis* Smith, 1853  
 G3. *Megachile (Chelostomoides) angularum* Cockerell, 1902  
 G4. *Megachile (Chelostomoides) campanulae* (Robertson, 1903)  
 G5. *Megachile (Eutricharaea) apicalis* Spinola, 1808  
 G6. *Megachile (Eutricharaea) rotundata* (Fabricius, 1793)



- G7. *Megachile (Litomegachile) brevis* Say, 1837  
 G8. *Megachile (Litomegachile) coquilletti* Cockerell, 1915  
 G9. *Megachile (Litomegachile) gentilis* Cresson, 1872  
 G10. *Megachile (Litomegachile) lippiae* Cockerell, 1900  
 G11. *Megachile (Litomegachile) mendica* Cresson, 1878  
 G12. *Megachile (Litomegachile) onobrychidis* Cockerell, 1908

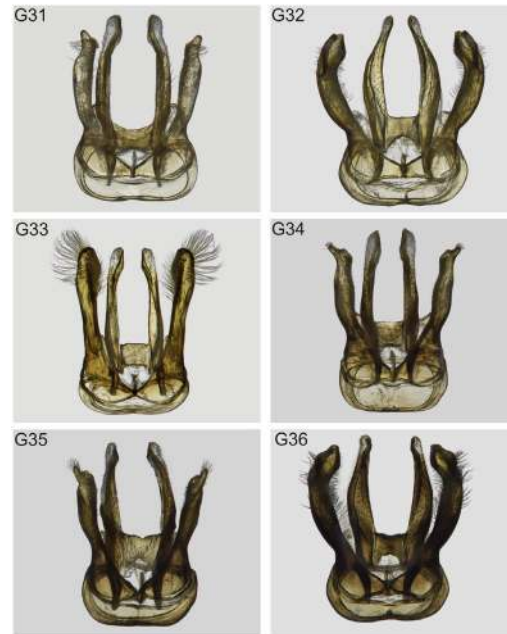
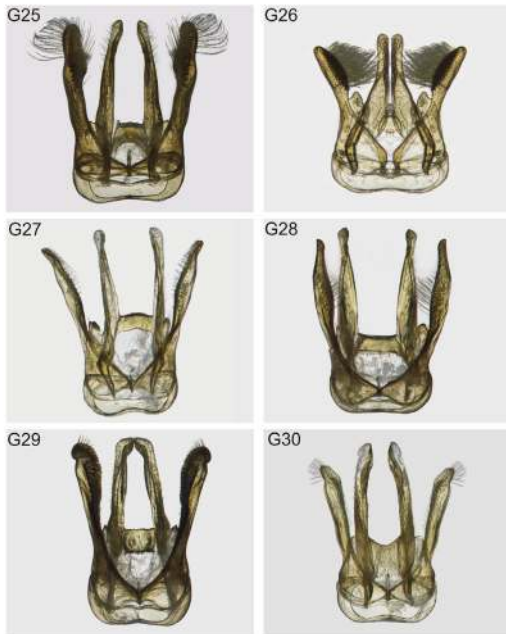


- G13. *Megachile (Litomegachile) texana* Cresson, 1878  
 G14. *Megachile (Megachile) centuncularis* (Linnaeus, 1758)  
 G15. *Megachile (Megachile) inermis* Provancher, 1888  
 G16. *Megachile (Megachile) lapponica* Thomson, 1872  
 G17. *Megachile (Megachile) montivaga* Cresson, 1878  
 G18. *Megachile (Megachile) relativa* Cresson, 1878



- G19. *Megachile (Megachiloides) anograe* Cockerell, 1908  
 G20. *Megachile (Megachiloides) casadae* Cockerell, 1898  
 G21. *Megachile (Megachiloides) manifesta* Cresson, 1878  
 G22. *Megachile (Megachiloides) sublaurita* Mitchell, 1927  
 G23. *Megachile (Megachiloides) subnigra* Cresson, 1879  
 G24. *Megachile (Megachiloides) umatillensis* (Mitchell, 1927)

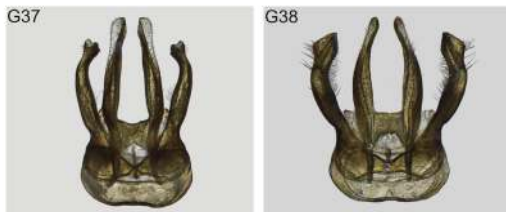




**Plate 2 - Male Genitalia continued**

- G25. *Megachile (Megachiloides) wheeleri* Mitchell, 1927
- G26. *Megachile (Pseudomegachile) ericetorum* Lepeletier, 1841
- G27. *Megachile (Sayapis) fidelis* Cresson, 1878
- G28. *Megachile (Sayapis) mellitarsus* Cresson, 1878
- G29. *Megachile (Sayapis) pugnata* Say, 1837
- G30. *Megachile (Xanthosarus) addenda* Cresson, 1878

- G31. *Megachile (Xanthosarus) circumcincta* (Kirby, 1802)
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- G35. *Megachile (Xanthosarus) gemula* Cresson, 1878
- G36. *Megachile (Xanthosarus) latimanus* Say, 1823



- G37. *Megachile (Xanthosarus) melanophaea* Smith, 1853
- G38. *Megachile (Xanthosarus) perihirta* Cockerell, 1898



**Plate 3. Female (top) and male (bottom) lateral images.**  
1. *Megachile (Argyropile) parallela* Smith, 1853

2. *Megachile (Callomegachile) sculpturalis* Smith, 1853



3. *Megachile (Chelostomoides) angelarum* Cockerell, 1902

4. *Megachile (Chelostomoides) campanulae* (Robertson, 1903)



Plate 3. Female (top) and male (bottom) lateral images continued.  
5. *Megachile (Eutricharaea) apicalis* Spinola, 1808

6. *Megachile (Eutricharaea) rotundata* (Fabricius, 1793)



7. *Megachile (Litomegachile) brevis* Say, 1837

8. *Megachile (Litomegachile) coquilletti* Cockerell, 1915





Plate 3. Female (top) and male (bottom) lateral images continued.  
9. *Megachile (Litomegachile) gentilis* Cresson, 1872

10. *Megachile (Litomegachile) lippiae* Cockerell, 1900



11. *Megachile (Litomegachile) mendica* Cresson, 1878

12. *Megachile (Litomegachile) onobrychidis* Cockerell, 1908



Plate 3. Female (top) and male (bottom) lateral images continued.  
13. *Megachile (Litomegachile) texana* Cresson, 1878

14. *Megachile (Megachile) centuncularis* (Linnaeus, 1758)



15. *Megachile (Megachile) inermis* Provancher, 1888

16. *Megachile (Megachile) lapponica* Thomson, 1872



**Plate 3. Female (top) and male (bottom) lateral images continued.**  
17. *Megachile (Megachile) montivaga* Cresson, 1878

18. *Megachile (Megachile) relativa* Cresson, 1878



19. *Megachile (Megachiloides) anograe* Cockerell, 1908

20. *Megachile (Megachiloides) casadae* Cockerell, 1898





**Plate 3. Female (top) and male (bottom) lateral images continued.**  
21. *Megachile (Megachiloides) manifesta* Cresson, 1878

22. *Megachile (Megachiloides) sublaurita* Mitchell, 1927



23. *Megachile (Megachiloides) subnigra* Cresson, 1879

24. *Megachile (Megachiloides) umatillensis* (Mitchell, 1927)



**Plate 3. Female (top) and male (bottom) lateral images continued.**  
25. *Megachile (Megachiloides) wheeleri* Mitchell, 1927

26. *Megachile (Pseudomegachile) ericetorum* Lepeletier, 1841



27. *Megachile (Sayapis) fidelis* Cresson, 1878

28. *Megachile (Sayapis) mellitarsus* Cresson, 1878



**Plate 3. Female (top) and male (bottom) lateral images continued.**  
29. *Megachile (Sayapis) pugnata* Say, 1837

30. *Megachile (Xanthosarus) addenda* Cresson, 1878



31. *Megachile (Xanthosarus) circumcincta* (Kirby, 1802)

32. *Megachile (Xanthosarus) dentitarsus* Sladen, 1919





**Plate 3. Female (top) and male (bottom) lateral images continued.**  
33. *Megachile (Xanthosarus) fortis* Cresson, 1872

34. *Megachile (Xanthosarus) frigida* Smith, 1853



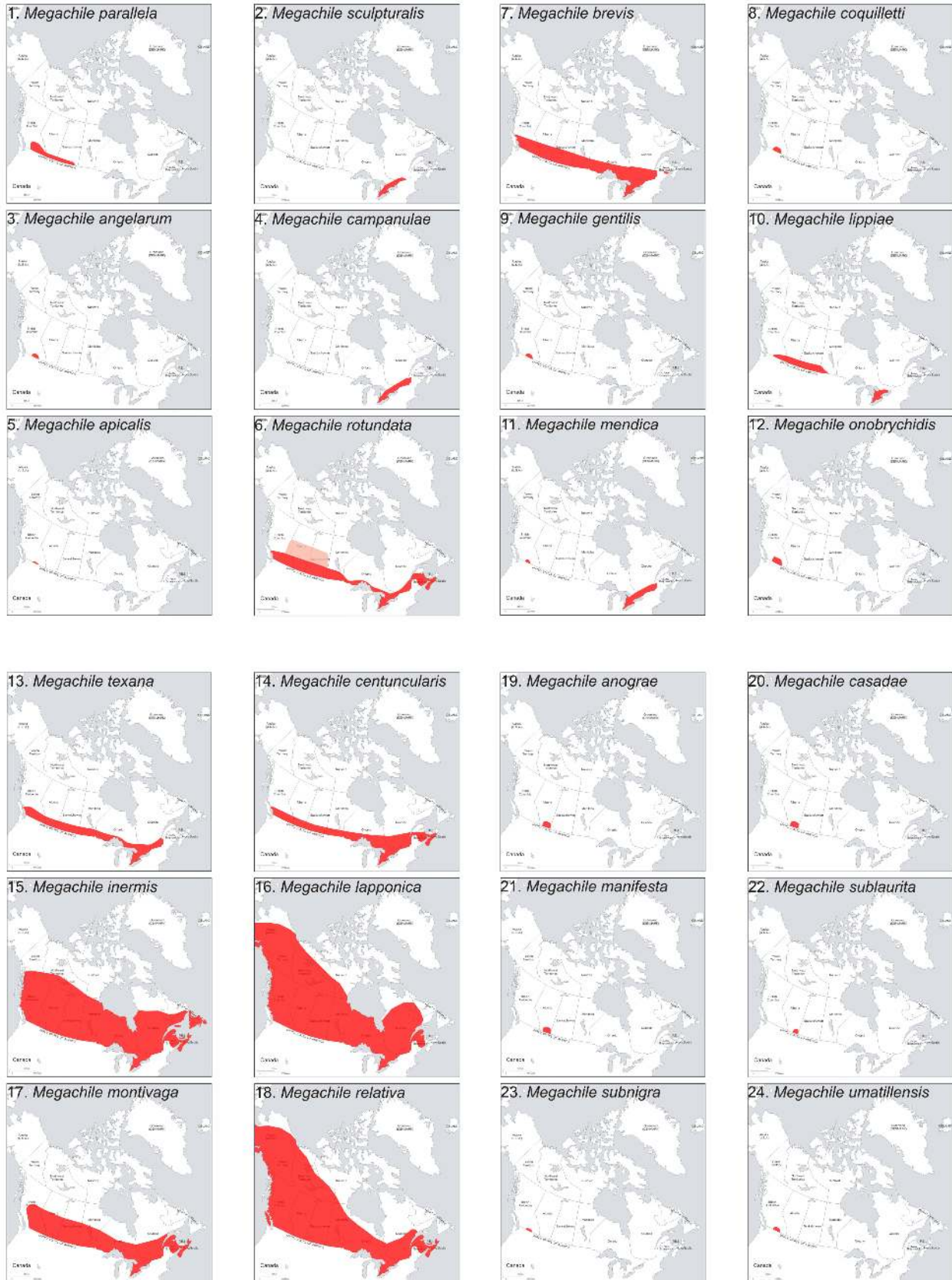
35. *Megachile (Xanthosarus) gemula* Cresson, 1878

36. *Megachile (Xanthosarus) latimanus* Say, 1823



**Plate 3. Female (top) and male (bottom) lateral images continued.**  
37. *Megachile (Xanthosarus) melanophaea* Smith, 1853

38. *Megachile (Xanthosarus) perihirta* Cockerell, 1898







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