Journal *of* Melittology
Bee Biology, Ecology, Evolution, & Systematics *The latest buzz in bee biology*
No. 20, pp. 1–9 28 October 2013

New Palearctic bee species of *Protosmia* subgenus *Nanosmia* (Hymenoptera: Megachilidae)

Terry L. Griswold[1]

Abstract. Bees of the genus *Protosmia* subgenus *Nanosmia* are not well known. Three new species are described and figured for both sexes: ***Protosmia* (*Nanosmia*) *hamulifera*** Griswold, new species, from the Arabian Peninsula, ***P.* (*N.*) *schwarzi*** Griswold, new species, from Morocco and Tunisia, and ***P.* (*N.*) *trifida*** Griswold, new species, from Turkey. An updated diagnosis and new distributional records are provided for the recently described *P.* (*N.*) *montana* Müller. The species is recorded for the first time from Turkey and Tajikistan.

INTRODUCTION

Protosmia Ducke is a Northern Hemisphere genus of Osmiini that includes four subgenera (Griswold & Michener, 1997): the monotypic *Dolichosmia* Griswold from Myanmar, *Chelostomopsis* Cockerell with a disjunct distribution of three species in the western Palearctic and one in the western United States, *Protosmia* s. str. from the western Palearctic, and *Nanosmia* Griswold with eight species (Table 1) found from the Mediterranean region to northern India (Michener, 2007). Of the four subgenera, *Nanosmia* is the least well known; numerous new species are likely. Müller (2012) recently described one of these, *Protosmia montana* Müller from the mountains of Greece. Here, three additional new species are described from the Palearctic region and additional taxonomic and distributional information is provided for *P. montana*. The species described herein support the premise of increased diversity for this poorly known subgenus.

MATERIAL AND METHODS

The morphological terminology used herein follows that proposed by Michener (2007). Mandibular teeth are numbered from ventral-most tooth to dorsal-most tooth. Thus, the ventral-most tooth is the first tooth and the dorsal-most tooth is the third. The following morphological abbreviations are used: flagellar segment (F), metasomal

[1] USDA-ARS Bee Biology and Systematics Laboratory, Utah State University, Logan, Utah 84322-5310, USA (terry.griswold@ars.usda.gov).

ISSN 2325-4467

Table 1. Summary of species currently included in *Protosmia* (*Nanosmia*), including species treated in this study, with information on the known sexes and distribution. Sex: ♂ = male; ♀ = female. Distributions are based in part on the catalog of Palearctic Osmiini (Ungricht *et al*., 2008).

Species	Sexes known	Distribution
P. asensioi Griswold & Parker, 1987	♂♀	Spain, Portugal
P. decipiens (Benoist, 1935)	♀	Morocco
P. devia Tkalců, 1978	♀	Pakistan, India (Kashmir)
P. hamulifera Griswold, **n. sp.**	♂♀	UAE, Saudi Arabia
P. limbata (Benoist, 1935)	♀	Lebanon, Syria, Turkey
P. minutula (Pérez, 1896)	♂♀	Spain, France, Switzerland, Italy
P. montana Müller, 2012	♂♀	Greece, Turkey, Tajikistan
P. pulex (Benoist, 1935)	♂	Israel
P. querquedula van der Zanden, 1994	♂♀	Tunisia
P. schwarzi Griswold, **n. sp.**	♂♀	Morocco, Tunisia
P. trifida Griswold, **n. sp.**	♂♀	Turkey

tergum (T), and metasomal sternum (S). Specimens were examined and measured using a Leica MZ12 dissection microscope and ocular micrometer. Photomicrographs were taken using a Keyence Digital Imaging System. The following cities are used to indicate specimen repositories, with the individuals who kindly arranged loans following in parentheses:

ANSFELDEN – Maximilian Schwarz personal collection, Austria.

DAVIS – University of California, Davis, California, USA (R.W. Thorp).

LAWRENCE – University of Kansas Biodiversity Research Institute, Division of Entomology, Lawrence, Kansas, USA (M.S. Engel, Z.H. Falin, & C.D. Michener).

LEIDEN – Leiden Nationaal Natuurhistorische Museum [Naturalis], Leiden, Netherlands, Entomology (G. van der Zanden).

LINZ – Oberösterreichisches Landesmusseum, Linz, Austria (F. Gusenleitner).

LOGAN – USDA Bee Biology and Systematics Laboratory, Logan, Utah, USA (H. Ikerd).

LONDON – The Natural History Museum, London, UK (D. Notton).

WASHINGTON – Smithsonian National Museum of Natural History, Department of Entomology, Washington, D.C., USA (D.G. Furth).

SYSTEMATICS

Genus *Protosmia* Ducke
Subgenus *Nanosmia* Griswold
Protosmia* (*Nanosmia*) *hamulifera Griswold, new species

ZooBank: urn:lsid:zoobank.org:act:9F70FA22-1E4E-498E-B2EB-CF5DF45F8FF0

(Figs. 1–3, 16, 17)

DIAGNOSIS: Males differ from other *Nanosmia* by the combination of: labrum and lower margin of mandible without dense pubescence; F3 short, at most as long as broad; S1 apically truncate but margin medially with shallow emargination; tegula

and tergal margins dark, not yellow; T2–T4 with complete apical fasciae; T6 with apical margin rounded. The forms of S5 and S6 (Figs. 2, 3) are distinctive. Females can be distinguished from all other *Nanosmia* by the combination of mouthparts scarcely exceeding fossa in repose and labial palpus with hooked setae (Fig. 17).

Description: ♂: Length, 3.5 mm; forewing length, 2.5 mm. *Color*: Black except flagellum, tegula, distal tarsi, S1, S3, and S4 brown distally. *Pubescence*: White; dense, obscuring integument on lower half of face, pronotal shoulder; long, abundant on apical margin of scutellum; distinct ventral fringe on midfemur. T1–T5 with apical fasciae, interrupted on T1. Wings hyaline. *Structure*: Head slightly broader than long. Mouthparts in repose not reaching forecoxa; galea shorter than head length. Labrum without basal ridge. Clypeus scarcely convex in profile, not modified laterally, apical margin crenulate. F1 broader than long; F2 broader than long; remaining segments one and one-third times as long as broad. Preoccipital ridge not carinate. Forefemur slender, sparsely punctate posteroventrally. Forebasitarsus slender. Midfemur slender, unmodified. T6 with reflexed apical rim, margin broadly convex medially. S1 as broad as long, very densely punctate, apical margin strongly, broadly convex with shallow emargination medially, scarcely covering apex of S2 medially, not reflexed, dorsal pubescent surface not visible when metasoma in normal position. S2 with disk depressed medially, densely pubescent, apical margin slightly convex, with shallow setae-fringed emargination on medial one-half. S3 with disk depressed, densely clothed with erect pubescence, margin shallowly concave, laterally with shallow notch, entire margin with long, medially-directed fringe. S4 with sparse, long setae covering most of disk, margin moderately convex, without lateral notch, with single, weak, medially-directed fringe. Genitalia and associated sterna as in figures 1–3.

♀: Length, 4 mm; forewing length, 2.5 mm. *Color*: Black except labrum, mandible distally, flagellum, tegula, distal tarsi, T1–T3 distally brown; distal margins of S2–S5, wings hyaline. *Pubescence*: White; dense, obscuring integument on lower half of face except for most of clypeus, pronotal shoulder, mesepisternum along omaulus; long, abundant on apical margin of scutellum; distinct ventral fringe on midfemur. T1–T5 with apical fasciae, interrupted on T1–T3, interruption very broad on T1 narrowing to one-third of margin on T3. *Structure*: Head slightly wider than long. Mouthparts in repose slightly exceeding fossa, not reaching forecoxa; galea shorter than head. Labial palpus with long hooked setae. Labrum with scattered erect setae and long apical tuft. Mandible with second tooth slightly farther from first tooth than from third, ratio = 1.1 (Fig. 16). Clypeus with low rounded convexity, apical margin with several denticles, scarcely concave. F3 width approximately four-fifths width of F10. Preoccipital ridge not carinate. Propodeal basal zone with fine, not coarse, longitudinal carinae. Forebasitarsus robust, much broader apically, ratio of length to apical width 1.6. Scopal setae pointed apically.

Holotype: ♀: UNITED ARAB EMIR. Dubai (Zabeel), Reared blocks, E.A. Sugden, 53911A [Logan].

Paratypes: UNITED ARAB EMIRATES: 10♂♂, 11♀♀, same data as holotype except rearing number [Logan]; 1♀, Dubai, Main Palace, 9 Mar 1984, E.A. Sugden [Davis]; 1♀, Al Awir, 12-16 May 1984, malaise trap, E.A. Sugden [Logan]; 1♂, 2♀♀, J. Ali Hotel, 14 Apr 1989, I.L. Hamer [Lawrence]. SAUDI ARABIA: 4♂♂, 2♀♀, Najran, 15 Mar 1990, G.G.M. Schulten [Leiden]; 1♂, 1♀, same data [Logan].

Distribution: Arabian Peninsula (United Arab Emirates, Saudi Arabia).

Etymology: From the Latin, *hamulus*, small hook, and *–fer*, to bear, relating to the distinctive hooked setae on the female labial palpi.


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Comments: For most *Nanosmia* the male is the most distinctive sex and, therefore, the preferred sex in choosing the holotype, as is done here for both other species. In this case, however, the female is the most distinctive and has therefore been chosen for the holotype.

This is the second species of *Nanosmia* to have been reared from trap nests; the previously described *P*. (*N*.) *asensioi* Griswold & Parker also nests in existing cavities (Griswold & Parker, 1987).

Protosmia* (*Nanosmia*) *schwarzi Griswold, new species

ZooBank: urn:lsid:zoobank.org:act:27415516-D104-4880-B38E-93968FB56EFD

(Figs. 7–9, 14, 18)

Diagnosis: Males differ from all other *Nanosmia* by the combination of: labrum and lower margin of mandible without dense pubescence; F3 short, at most as long as broad; hind tibia without dense dorsal pubescence; T2 with medially interrupted apical fascia; T6 with apical margin rounded; S1 densely punctate laterally, without dense longitudinal pubescent band medially, apical margin truncate but medially with shallow emargination; tegula and tergal margins dark, not yellow. The forms of S5 and S6 (Figs. 8, 9) are distinctive. Females of *P*. *schwarzi* share with *P*. *querquedula* van der Zanden and *P*. *asensioi* a combination that is unique within *Nanosmia*: propodeal basal zone with fine, not coarse, longitudinal carinae; labial palpus without hooked setae; labrum with apical tuft in addition to sparse pubescence; and flagellum dark brown. They differ from *P*. *querquedula* and *P*. *asensioi* by scopal setae blunt apically; and by the combination of middle tooth of mandible not closer to lower tooth than to upper (Fig. 14), hind tibia with sparse pubescence on dorsal margin, and T3 with broad gap in apical pubescent band, gap little narrower than on T1.

Description: ♂: Length, 4–4.5 mm; forewing length, 2.5–3 mm. *Color*: Black except flagellum, tegula, distal tarsi, S1 and S4 distally brown; posterior margin of S1, wings hyaline. *Pubescence*: White; dense, obscuring integument on lower half of face, pronotal shoulder; long, abundant on apical margin of scutellum; indistinct ventral fringe on midfemur. T1–T2 with apical interrupted fasciae. *Structure*: Head slightly broader than long. Mouthparts in repose reaching forecoxa; galea slightly shorter than head. Labrum without basal ridge. Clypeus scarcely convex in profile, not modified laterally, apical margin crenulate. F1 broader than long; F2 broader than long; remaining flagellar segments one and one-third times as long as broad. Preoccipital ridge not carinate. Forefemur slender, sparsely punctate posteroventrally. Forebasitarsus slender. Midfemur slender, unmodified. T6 with reflexed apical rim, margin broadly convex medially. S1 as broad as long, densely punctate, apical margin strongly, broadly convex, scarcely covering apex of S2 medially, not reflexed, dorsal pubescent surface not visible when metasoma in normal position. S2 with disk depressed medially, densely pubescent, apical margin slightly convex, with shallow setae-fringed emargination on medial two-fifths. S3 with disk depressed, densely clothed with erect pubescence, margin shallowly concave, laterally with shallow notch, entire margin with long, me-

← facing page

Figures 1–12. Male genitalia and associated sterna (1, 4, 7, 10, genitalia; 2, 5, 8, 11, S6; 3, 6, 9, 12, S5). **1–3.** *Protosmia hamulifera*, new species. **4–6.** *P*. *trifida*, new species. **7–9.** *P*. *schwarzi*, new species. **10–12.** *P*. *montana* Müller. Scale bars represent the following sizes: genitalia, 0.1 mm; S6, 0.25 mm; S5, 0.25 mm.

Figures 13–16. Female mandibles. **13.** *Protosmia montana* Müller. **14.** *P. schwarzi*, new species. **15.** *P. trifida*, new species. **16.** *P. hamulifera*, new species. Scale bars represent 0.1 mm.

dially-directed fringe. S4 with sparse, long setae covering most of disk, margin moderately convex, without lateral notch, with distinctly separated pair of medially-directed fringes. Genitalia and associated sterna as in figures 7–9.

♀: Length, 5.5 mm; forewing length, 3.5 mm. *Color*: Black except mandible apically, flagellum, tegula, distal tarsi, S1 and S4 distally brown; wings hyaline. *Pubescence*: White; dense, obscuring integument across face at level of antennal sockets, pronotal shoulder; long, abundant on apical margin of scutellum; indistinct ventral fringe on midfemur, sparse on dorsal margin of hindtibia. T1–T4 with apical, broadly interrupted fasciae, weak on T4, width of interruption on T3 only slightly greater than on T1. *Structure*: Head slightly longer than broad. Mouthparts in repose reaching forecoxa; galea slightly shorter than head. Labial palpus without long hooked setae. Labrum with scattered erect setae and long apical tuft. Mandible with second tooth farther from first tooth than from third, ratio = 1.3 (Fig. 14). Clypeus with low rounded convexity, apical margin simple, scarcely concave. F3 width approximately two-thirds width of F10. Preoccipital ridge not carinate. Propodeal basal zone with fine, not coarse, longitudinal carinae. Forebasitarsus slender, slightly broader apically, ratio of length to apical width 3.3. Scopal setae blunt apically.

HOLOTYPE: ♂: Marokko, 12.4.1996, Tizi-n-Tinififft, 25 km NW Agdz, 6°37′[W] 30°44′ [N], 1660m, leg. M. Schwarz [Ansfelden].

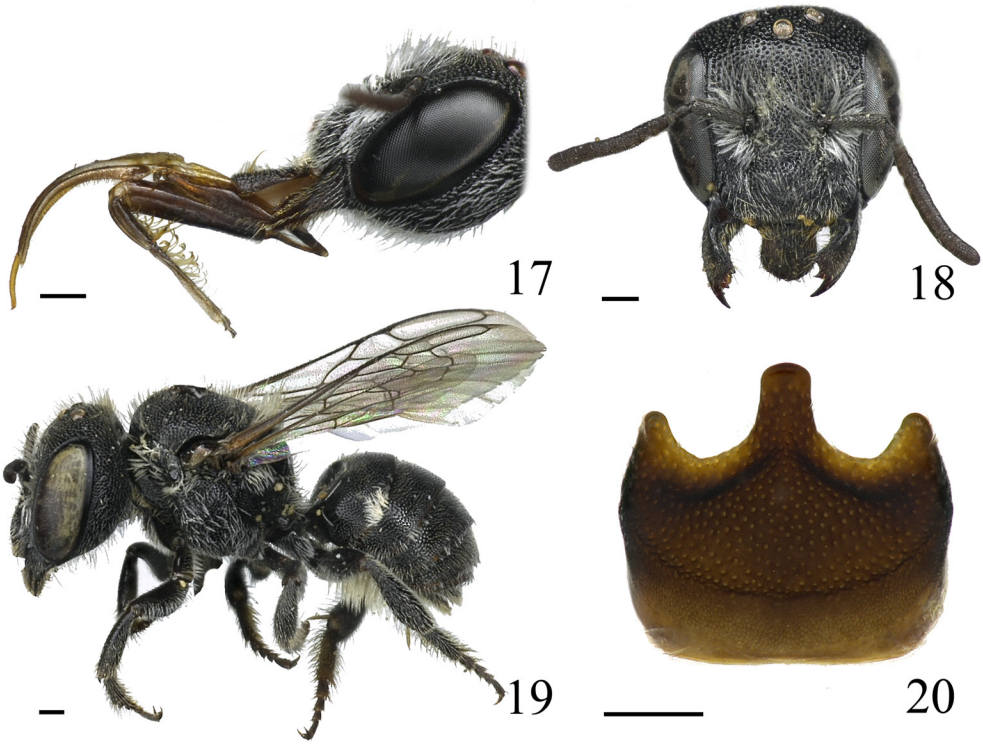
PARATYPES: MOROCCO: 1♂, same data as holotype [Logan]. TUNISIA: 1♂ 3♀♀, 10 km SE Matmata, 15 Apr 1994, M. Schwarz [Ansfelden]; 1♀, same data [Logan]; 1♂, 30 km S Medenine, 12 Apr 1994, M. Schwarz [Ansfelden]; 1♀, 30 km S Medenine, 12 Apr 1994, J. Gusenleitner [Linz]; 1♀, Matmata, SW Gabes, 7 Apr 1994, U. Willand [Linz].

DISTRIBUTION: North coast of Africa from Morocco to Tunisia.

ETYMOLOGY: It is an honor to name this species after my colleague and friend, Maximilian Schwarz, who has done so much to further our understanding of the world's bees.

COMMENTS: One other described *Nanosmia* is present in North Africa, *P. decipiens* Benoist, known only from the female. In females of *P. decipiens* the tergal margins are hyaline and partly yellowish in contrast to the dark, opaque tergal margins of *P. schwarzi*. Presumably, this distinction would apply to males.

Protosmia* (*Nanosmia*) *trifida Griswold, new species
ZooBank: urn:lsid:zoobank.org:act:82361395-B279-4089-9406-E4FB368B79E9
(Figs. 4–6, 15, 20)



Figures 17–20. Species of *Protosmia*, subgenus *Nanosmia*. **17.** Female mouthparts, *Protosmia hamulifera*, new species. **18.** Female head, *P. schwarzi*, new species. **19.** Female lateral habitus, *P. montana* Müller. **20.** Male T6, *P. trifida*, new species. Scale bars represent 0.25 mm.

Diagnosis: Males are easily distinguished from all other *Nanosmia* by the tridentate T6 (Fig. 20). In addition, the forms of S5 and S6 (Figs. 5, 6) are distinctive. Females differ from all other *Nanosmia* by the labrum without apical tuft of setae, with long, rather dense, erect setae bent apically toward the apex of the labrum.

Description: ♂: Length, 4.5 mm; forewing length, 3.5 mm. *Color*: Black except mandible apically, flagellum, tegula, distal tarsi, apical margin of T6, S1–S2 reddish brown. Wings hyaline. *Pubescence*: White; dense, obscuring integument on face, pronotum dorsally, scutum anteriorly, dorsal margin of hindtibia, ventral fringe on midfemur absent; long, abundant on apical margin of scutellum. T1–T5 with apical fasciae. *Structure*: Head as broad as long. Mouthparts in repose reaching forecoxa, galea as long as head. Labrum with transverse basal ridge. Mandible with acetabular carina prominent basally, forming prominent rounded angle. Clypeus strongly convex in profile, apical margin with narrowly rounded, ventrally directed, lateral projection and submedian denticle. Preoccipital ridge not carinate. F1 as long as broad; F2 broader than long; remaining segments one and one-third times as long as broad. Fore femur stout, sparsely punctate posteroventrally. Forebasitarsus parallel-sided. Midfemur stout, unmodified. Apical margin of T6 tridentate. S1 broader than long, apical margin truncately produced, not reflexed, covering apex of S2 medially, dorsal pubescent surface not visible when metasoma in normal position. S2 with disk flat, densely pubescent medially, apical margin convex with deep, fringed emargination on medial one-half. S3 with disk depressed, densely clothed with erect pubescence, margin very

shallowly concave with distinctive hyaline flap, laterally without notch, with weak, straight fringe. S4 with moderately dense short setae on disk, margin strongly convex, without lateral notch, without paired tufts, with medial spike. Genitalia and associated sterna as in figures 4–6.

♀: Length, 4.5 mm; forewing length, 3 mm. *Color*: Black except mandible apically, flagellum, distal tarsi, dark reddish brown; tegula, apical margins of T1–T5 amber. Wings hyaline. *Pubescence*: White; dense, obscuring integument on paraocular area, pronotum dorsally, scutum anteriorly, mesepisternum along omaulus, metanotum medially; long, abundant on apical margin of scutellum. T1–T5 with apical fasciae. *Structure*: Head slightly longer than broad. Mouthparts in repose reaching forecoxa; galea slightly shorter than head. Labial palpus without long hooked setae. Labrum with long, rather dense, erect setae bent apically toward apex of segment, without apical tuft of setae. Mandible with second tooth twice as far from first tooth as from third, ratio = 1.5 (Fig. 15). Clypeus with moderately rounded convexity, apical margin with several denticles, scarcely concave. F3 width approximately four-fifths width of F10. Preoccipital ridge not carinate. Propodeal basal zone with fine, not coarse, longitudinal carinae. Forebasitarsus slender, slightly broader apically, ratio of length to apical width 2.1. Scopal setae pointed apically.

HOLOTYPE: ♂: Türkei, Hakkari: Suvari-Halil Pass, 27.6.1985, 2500 m, leg. Max. Schwarz [Ansfelden].

PARATYPES: TURKEY: 1♂, same data as holotype [Logan]; 1♂, 1♀, Hakkari, Suvari-Halil Pass Beytüssebap, 2300 m, 3 Aug 1982, M. Schwarz [Ansfelden]; 1♂, Hakkari, Suvari - Halil Pass Beytüssebap, 2300 m, 2 Aug 1982, M. Schwarz [Ansfelden]; 1♀, 15 km E Yuksekova, 2100–2200 m, 20 Jul 1986, A.W. Ebmer [Leiden]; 1♀, same data [Logan].

DISTRIBUTION: Turkey.

ETYMOLOGY: From the Latin *trifidus*, three-parted, referring to the unique form of the sixth tergum.

Protosmia (*Nanosmia*) *montana* Müller
(Figs. 10–13, 19)

DIAGNOSIS: Males can be distinguished from all other *Nanosmia* by the combination of dense, plumose pubescence covering the labrum, hypostomal area, and ventral margin of the mandible and S2 not emarginate, without apical fringe, not covered by S1 in repose. The elbowed gonostylus (Fig. 10) is unique among known *Nanosmia*, as are the forms of S5 and S6 (Figs. 11, 12). Females can be distinguished by the combination of labial palpus without hooked setae, labrum with apical setal tuft, clypeus with narrow medial impunctate line, and frons quite flat, not distinctly convex below the median ocellus in lateral view.

NEW RECORDS: TURKEY: 4♂♂, Hakkari, Tanin-Tanin Pass, 2500 m, 25 Jun 1985, M. Schwarz [Ansfelden]; 1♂, same data [Logan]; 1♂, Hakkari, Tanin-Tanin Pass 2300–2600 m, 3 Jun 1980, M. Schwarz [Ansfelden]; 1♂, 1♀, Hakkari: Oramar 1700 m, 29 Jun 1985, K. Warncke [Linz]; 3♀, Bitlis, Nemrut Dog, 2300 m, 15 Aug 1991, K. Warncke [Linz]; 1♀, same data [Logan]; 1♀, Aksehir, Konya, 2100 m, 2 Aug 1991, K. Warncke [Linz]; 5♀♀, W Seydisehir-Konya, 1800 m, 4 Aug 1991, K. Warncke [Linz]; 1♀, Ankara, Kavaklidere, 12 Aug 1960, K.M. Guichard, Harvey [London]; 3♂♂, Gürün, Şuğul-Tal, 1400 m, 31 Jul 1986, A.W. Ebmer [Leiden]; 1♂, same data [Logan]; 1♂, S Göksun, Pürin-Pass, S seite, 1550–1650 m, 10 Jul 1990, A.W. Ebmer [Leiden]; 1♂, NE Kahta, Nemrut Dağ, 2100 m, 11 Jul 1990, A.W. Ebmer [Leiden]; 1♀, Bey Daglari, 26 km S Elmali Zedern-

wald, 1600–1700 m, 4 Jul 1990, A.W. Ebmer [Leiden]. GREECE: 1♂, Phokis, Giona, Lyritsa, 1300–1600 m, 3 Aug 1981, A.W. Ebmer [Leiden]; 1♀, Pindas, Lakmos (Peristeri), oberh. v. Anthochori, 1700–2000 m, 1 Aug 1983, A.W. Ebmer [Leiden]; 1♀, Timfristos, 17 Jul 1976, K.M. Guichard [London]. TAJIKISTAN: Takob, 8 Aug 1976, W.J. Pulawski [Washington].

Distribution: Greece, Turkey, and Tajikistan.

Comments: The diagnosis of *P. montana* has been expanded to distinguish it from the additional species here described. This species was previously known only from a few mountain ranges in the Pelopones of Greece (Müller, 2012). The distribution of *P. montana* is here documented eastward into Turkey and Tajikistan.

ACKNOWLEDGEMENTS

I am most grateful to the individuals and institutions listed above for providing access to the material described herein and particularly to Maximilian Schwarz; without his patient assistance this project would not have been successful. Thanks to Harold Ikerd for providing the images, and to him and Kimberly Huntzinger for entering specimen data for these species into the U.S. National Pollinating Insects Database. Reviews by Andreas Müller, James Pitts, and two anonymous reviewers are greatly appreciated.

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ZooBank: urn:lsid:zoobank.org:pub:A1D8B071-1A24-4075-83C4-0C82416736B7

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The *Journal of Melittology* was established at the University of Kansas through the efforts of Michael S. Engel, Victor H. Gonzalez, Ismael A. Hinojosa-Díaz, and Charles D. Michener in 2013 and each article is published as its own number, with issues appearing online as soon as they are ready. Papers are composed using Microsoft Word® and Adobe InDesign® in Lawrence, Kansas, USA.

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http://journals.ku.edu/melittology
ISSN 2325-4467