Osmia disjuncta Tkalců, 1995 – a bee species new to the Western Palaearctic (Hymenoptera: Megachilidae)

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The mason bee *Osmia disjuncta* Tkalců, 1995 is reported from the Western Palaearctic for the first time. A single female was discovered during fieldwork in northern Sweden and three additional females were detected in material collected from Finland and Russia. A diagnosis, redescription and ecological notes are provided for the species. Slight morphological differences were observed in the mandibles and protibiae between the Fennoscandian and Mongolian specimens, but these dissimilarities were considered to fit in the limits of intraspecific variation. Validity of the species is supported by DNA barcoding.

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The bee fauna of northern Fennoscandia is still relatively poorly known. During the latter part of the last century, the alpine area of northern Europe revealed two species new to science: *Osmia svenssoni* Tkalců, 1983 and *Lasioglossum boreale* Svensson, Ebmer & Sakagami, 1977. During fieldwork in the vast and mainly unexplored Vindeln area in northern Sweden a single *Osmia* female was caught by a window trap in 2011. Initially the specimen caused some confusion as it was obvious that it did not belong to any known European species. Further investigations in museum collections revealed three more specimens, all collected in the boreal zone of northern Fennoscandia suggesting the existence of an undescribed species. However, when comparing the specimens with the available type material of Palaearctic *Melanosmia* species, the northern females corresponded well to the type specimens of *Osmia disjuncta* Tkalců, 1995, a species hitherto only known from Mongolia based on the type series.

The subgenus *Melanosmia* Schmiedeknecht, 1885 in northern Europe consists of eight previously recorded species which belong to three species groups: the *inermis* group, the *nigriventris* group and the *xanthomelana* group (Müller 2016, Rightmyer et al. 2010). The females within the *inermis* species group, which was originally defined by Tkalců (1983), can be readily identified by a completely shagreened propodeal area. From northern Europe six species of this group are known: *Osmia parietina* Curtis, 1828, *O. inermis* (Zetterstedt, 1838), *O. pilicornis* Smith, 1846, *O. uncinata* Gerstaecker, 1869, *O. laticeps* Thomson, 1872 and *O. svenssoni* Tkalců, 1983. Most of these can be identified using the keys of Amiet et al. (2004) and Scheuchl (2006). Since the European specimens of *O. disjuncta* exhibit some features not accounted for in the original description by Tkalců (1995), and the publication is hard to find and read (in German) for many Nordic entomologists, a complementary diagnosis is given for the species.

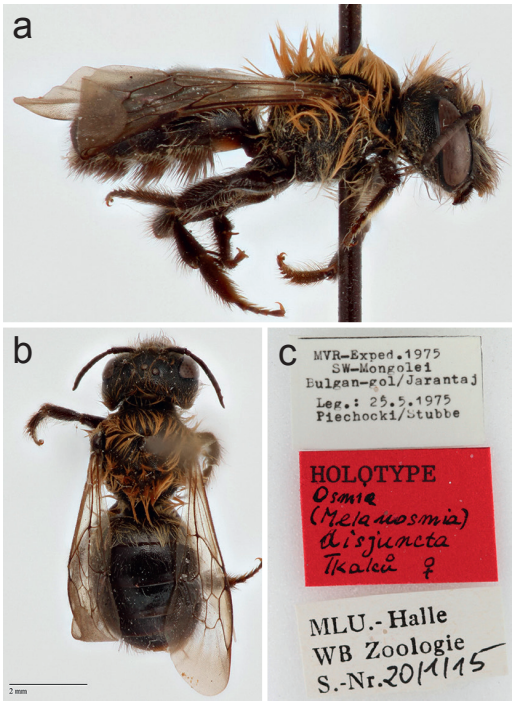

Figure 1. *Osmia disjuncta* Tkalců, 1995 female holotype: – a) lateral view, – b) Dorsal view and – c) labels. Scale bar is 2 mm. Photo: Hege Vårdal.

Osmia disjuncta Tkalců, 1995 hona holotyp: – a) från sidan, – b) ovanifrån. – c) etiketter. Skalstrecket är 2 mm. Foto: Hege Vårdal.

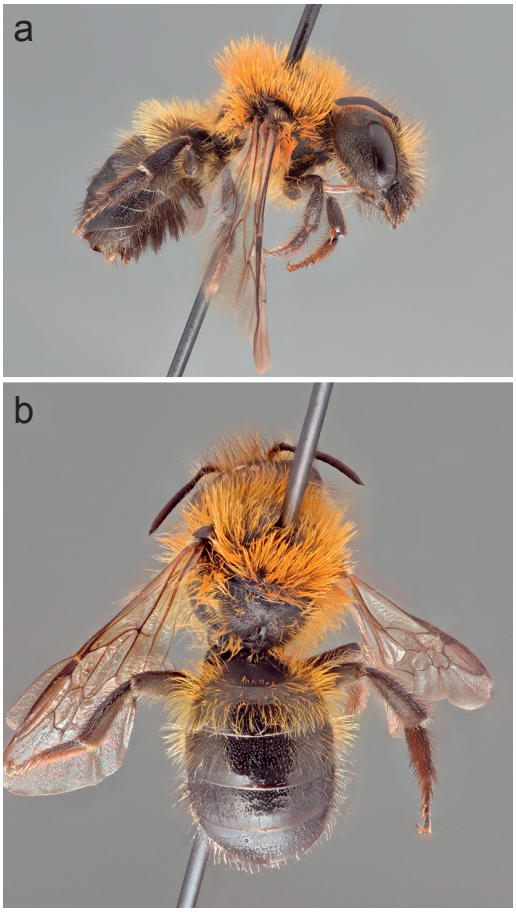

Figure 2. *Osmia disjuncta* Tkalců, 1995 female collected from Vb, Vindeln, Sweden, in 2011. – a) Lateral view and – b) Dorsal view. Photo: Magnus Persson.

Osmia disjuncta Tkalců, 1995 hona insamlad i Västerbotten, Vindeln, Sverige, 2011. – a) från sidan och – b) ovanifrån. Foto: Magnus Persson.

Materials and methods

In addition to the Fennoscandian specimens, we studied a part of the type series of *O. disjuncta* consisting of the holotype female (Fig. 1) and three paratype females. The morphological terminology used follows the glossary of the Hymenoptera Anatomy Ontology Portal (Hymenoptera Anatomy Consortium 2016). Numbering of mandibular teeth starts from the most apical tooth (first tooth) and ends to the most basal tooth (fourth tooth).

Material examined

♀ Sweden, Vb, Vindeln, Käringberget ["Old lady's mountain"], window trap, 4.vi–1.viii.2011, leg. M. Larshagen [Sveaskog]. ♀ Finland, InL, Ivalo, 8.–11. vi.1937, leg. A. Nordman; ♀ Finland, Kn, Paltamo [Leppikoski], 6.vi.1949, leg. E. Hellman. ♀ Russia, Murmansk Oblast, Lps, 2 km east of Nikel, 4.vii.2007, leg. M. Kozlov. All specimens are deposited in the collection of the Finnish Museum of Natural History, Helsinki, Finland.

Identification and ecology

Diagnosis of female

The female of *O. disjuncta* (Figs 1-3, 4a, c) can be distinguished from other European members

Table. 1. Morphology of *Osmia disjuncta* in relation to *O. parietina* and *O. laticeps*. Abbreviations: T = tergite.
Morfologi hos *Osmia disjuncta* jämfört med de närstående *O. parietina* och *O. laticeps*. Förkortningar: T= tergit.

	Osmia parietina	*Osmia disjuncta*	*Osmia laticeps*
Size	8 mm.	8-9 mm.	8-9 mm.
Body shape	Slender.	Slender.	Robust, broad.
Distance between lateral ocelli and preoccipital margin	2 times the ocellar diameter.	2.5 times the ocellar diameter.	3 times the ocellar diameter.
Frons in front of ocelli	Punctation mostly dense and uniform.	Punctation mostly dense and uniform.	Punctation very dense, uniform.
Setae on clypeus	Short, scarce. Bristle-like dark setae rising above the pilosity.	Long, pale, intermixed with darker setae. Lacking long, bristle-like darker setae.	Rather long, predominantly pale. Lacking long, bristle-like darker setae.
Mandibular dentition	Mandible with third tooth clearly separated from fourth. Third tooth and fourth tooth more equal in size.	Mandible in European specimens with third tooth clearly separated from fourth. Third tooth broad, rounded, about two times as large as fourth tooth.	Mandible with third tooth not clearly separated from fourth. Third tooth broad, angular, about three times as large as fourth tooth.
Protibial spur	Apex short, truncate, its dorsal margin not distinctly concave.	Apex relatively long, its dorsal margin distinctly concave in European specimens.	Apex long, its dorsal margin. distinctly concave.
Probasitarsus	Relatively short and thick. Less than 3.0 times longer than wide.	Relatively short and thick. Less than 3.0 times longer than wide.	Relatively long and slender, about 3.5-4.0 times longer than wide.
Ventral setae on meso- and metafemur	Short. Setae of metafemur at most 1/3 of the diameter of the metafemur. The setae of the mesofemur at most ½ of the femoral width.	Long. Meso- and metafemur with long conspicuous setae. On metafemur as long as diameter of femur. On mesofemur about 1.3 times femurs greatest width	Short. At most 1/2-1/3 of the diameter of the metafemur. The setae of the mesofemur at most ½ of the femoral width.
Ventral setae on meso- and metacoxa	Short.	Long.	Rather short.
Mesepisternal setae	Predominantly pale, brownish-white.	Predominately yellowish-brown, slightly paler than thoracic setae.	Predominately yellowish-brown, slightly paler than thoracic setae.
Declining basal portion of T1	Shining, at most superficially shagreened around the edges.	Distinctly shagreened, dull, only with a silky lustre.	Shining, at most superficially shagreened around the edges.
Surface of T1-T3	Shiny, almost polished. Apical. margin shining, impunctate, vaguely shagreened.	Shiny, almost polished. Apical margin shining, impunctate, vaguely shagreened.	Shiny, rather strongly shagreened. Apical margin punctate, rather strongly shagreened.
Setae on T2	Predominantly dark, short.	Predominantly light brown, longer.	Predominantly light, short.

of the *inermis* species subgroup by the combination of the following morphological features: 1) slender habitus (body more robust in e.g. *O. inermis*, *O. laticeps* and *O. uncinata*), 2) basal portion of T1 shagreened and dull (shiny in e.g. *O. laticeps*, *O. parietina* and *O. uncinata*), 3) pale setae ventrally on mesofemur longer than width of femur (shorter in e.g. *O. laticeps*, *O. parietina* and *O. uncinata*), and 4) clypeus with long pale setae (shorter in *O. parietina* and darker in *O. uncinata*). As stated in the original description (Tkalců 1995), the species is morphologically somewhat intermediate between *O. parietina* and *O. laticeps* (Table 1). While resembling *O. parietina* by its slender habitus, the long pale clypeal pilosity is similar to *O. laticeps*.

Description of female (based on all studied specimens)
Structure: Body length 9 mm, forewing length 5.5 mm. Labial palpus four-segmented. Mandible with outer and inner condylar ridges of equal thickness, parallel to slightly diverging towards base of mandible. Mandible, when unworn, with

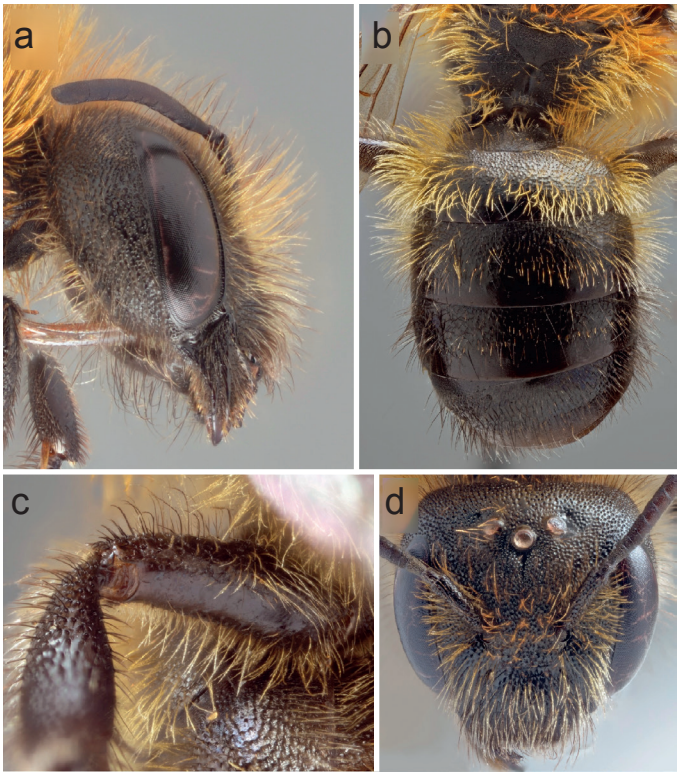

Figure 3. *Osmia disjuncta* (same specimen as in Fig. 2): – a) Head lateral view, – b) Metasoma dorsal view, – c) Pilosity of metafemur, – d) Head frontal view. Photo: Magnus Persson.

Osmia disjuncta (samma exemplar som i Fig. 2) – a) Huvud sett från sidan, – b) Mellankropp sedd ovanifrån – c) behåring baklår, – d) huvud framifrån. Foto: Magnus Persson.

third tooth clearly separated from fourth (Fig. 4c). Third tooth broadly rounded, slightly longer than fourth tooth. Third and fourth tooth clearly separated by distinctly sinuate incision. Basal ridge between second and fourth tooth elongated, not semicircular. First tooth longer than second tooth. Vertex behind lateral ocelli 2.5 ocellar diameters in length (Fig. 3d). POL:OOL = 1.2. Face relatively narrow, similar to *O. parietina*. Genal width 1.5x that of compound eye in lateral view (Fig. 3a). Protarsal segments excluding basitarsus and apical segment with anterior lobes distinctly longer than posterior (Fig. 2a). Metasomal segments mostly slender, elongate. Width of second tergite about 2.5 times its length (Fig. 3b).

Figure 4. a-b) Basal portion of tergite 1, – a) *Osmia disjuncta*, – b) *Osmia parietina* – c) Mandibular dentition *Osmia disjuncta*. Photo: Magnus Persson.

a-b) Första tergitens (bakkropppens ovansida) basala del på – a) *Osmia disjucta*, – b) *Osmia parietina*, – c) mandibelspets *Osmia disjuncta*. Foto: Magnus Persson

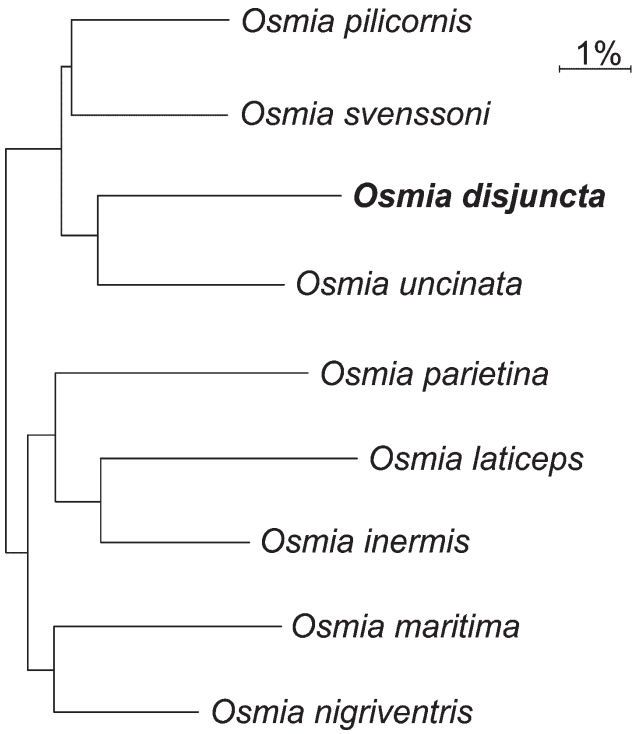

Figure 5. Relationships among Fennoscandian species of the subgenus *Melanosmia* according to their DNA-barcodes. The neighbor-joining phylogenetic tree was constructed on the basis of Kimura 2-parameter distances. All samples are from Finland, except *O. disjuncta* from Sweden and *O. maritima* from Russia (Murmansk Oblast). The scale line indicates 1% sequence divergence.

Släktskap hos fennoskandiska representanter för undersläktet *Melanosmia* utifrån DNA- streckkoder. Det fylogentiska trädet konstruerades genom att bedöma avståndet mellan Kimura-2 parametrar. Alla prover härör från Finland med undantag av *O. disjuncta* från Sverige och *O. maritima* från Ryssland. Skalstrecket indikerar 1% skillnad i gensekvenser.

Pilosity: Clypeus below apical margin with lateral tuft of golden, medially directed setae (Fig. 4c). Clypeal surface with long light, golden brown setae intermixed with a few black setae, but lacking any longer bristle-like setae (Fig. 3d). Pilosity not denser towards apical margin. Frons with long light brown setae (Figs 3a, d). Scape with long light brown pilosity about three times diameter of scape (Fig. 3d). Genal area with long light brown and black setae that observed in frontal view form a quite dense collar (Figs 3a, d). Galea and basal two labial palpal segments with setae on lateral margins short, straight. Metafemur and metacoxa ventrally, apart from shorter, denser setae also with long, yellowish setae about as long as width of femur (Fig. 3c). Metafemur dorsally with conspicious long, bent setae (Fig. 3c). Mesofemur and profemur and adjacent coxae ventrally with long yellowish setae about 1.2–1.3 femoral width. All tibiae and tarsal segments covered with short rather dense, bristle-like pilosity (Fig. 2a). Mesosoma dorsally with long golden-red pilosity, and laterally and ventrally with yellowish pilosity (Figs 2a, b). Metasoma on tergite 1 with long golden pilosity, on tergite 2 setae clearly shorter and sparser, basally, especially on the sides, distinctly golden brown, gradually turning black towards apical margin (Figs 2a, b, 3b). Tergites 3–6 with black pilosity, on tergite 6 relatively dense. Scopa black, bristles thinner and slightly longer than in *O. parietina* (Fig. 2a).

Punctation: Head and mesosoma with punctures nearly contiguous, more or less rounded. Clypeus with distinct round punctures with narrow shining interstices (Fig. 4c). Punctation becoming denser and less well defined towards the apical margin. Lower frons on sides of clypeus shagreened with distinct punctures of equal size compared to the more irregular punctation of upper clypeus (Fig. 3d). Frons below ocelli with dense punctures without distinct interstices (Fig. 3d). Mesopleuron ventrally more or less shagreened, mainly with indistinct punctures, thereby dull. Metapleuron with scarce punctures, medioventrally with interstices 1–2 times

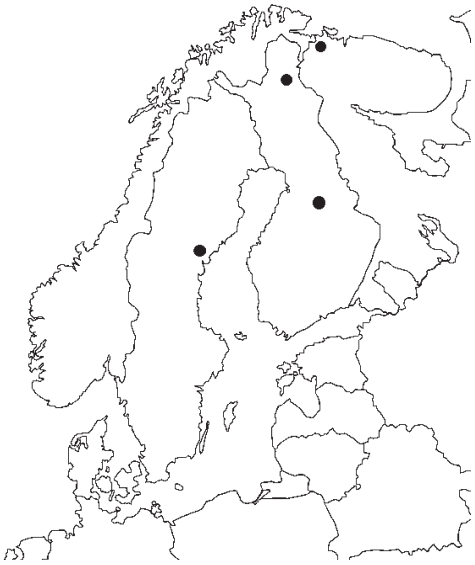

Figure 6. Map of Fennoscandia. Dots mark the known European localities for *Osmia disjuncta*.

De kända europeiska fyndlokalerna för *Osmia disjuncta.*

diameter of punctures. Basal portion of metasomal tergite 1 densely shagreened, dull with a silky lustre, like in *O. inermis* (Fig. 4a). Adjoining area on tergite 1 mediodorsally shagreened with small punctures which become larger and more scattered towards the hind margin of the tergite. Surface of tergites 2-4 shiny, almost polished (Fig. 3b). Apical margin on tergites 1-3 impunctate, vaguely shagreened, strongly shining (Fig. 3b). Propodeal triangle with dorsal sixth finely areolate to lineate, ventral 4/5 regularly granulose, dull. Sternites 1-3 with regular, well defined and relatively large punctures, hereby slightly differing from the more irregular, indistinct punctation of *O. parietina*.

DNA barcode

The full DNA barcode sequence of the Swedish *O. disjuncta* specimen is available at GenBank (www.ncbi.nlm.nih.gov/genbank, accession number MF040883) and BOLD systems database (www.boldsystems.org, dataset code DS-OSMDIS). In animals, a DNA barcode is a DNA segment of 658 base pairs of the mitochondrial gene cytochrome oxidase I (COI), and is commonly used for species identification and delimitation. With a divergence of 6%, *O. uncinata* was found to have the most similar DNA barcode of Nordic *Osmia* species (Fig. 5). Of all DNA barcoded species, the Nearctic *O. tersula* Cockerell, 1912, has the most similar barcode with a divergence of 5.5%. These large divergences indicate a long evolutionary differentiation of *O. disjuncta* from other congeneric species.

Distribution

The Swedish female of *O. disjuncta* was caught by a window trap placed on a high Scots pine stump in Vindeln, northeast Sweden (Fig. 7). The species is also known from central and northern Finland as well as northwestern Russia (Murmansk Oblast) (Fig. 6). All known localities are in Fennoscandia and within the western part of the vast boreal forest zone known as the taiga. An attempt to collect complementary material at the Swedish site by a Malaise trap, yellow pan traps and sweep netting, was unsuccessful indicating that the species occurs in low densities.

Phenology

The dates on the labels indicate that the females fly from early June to at least the beginning of July in Europe. *Osmia disjuncta*, as other woodland *Osmia* species in the area, are probably slightly protandric and males can be expected to emerge as early as late May.

Biology

No detailed information on the biology of *O. disjuncta* is known. However, the poor plant community on the Swedish locality (Fig. 6), in combination with the phenology, strongly suggests that the species forages on flowering *Vaccinium*. Unfortunately, none of the European specimens show any trace of pollen grains. The Russian locality consists of an industrial barren in an open subarctic landscape. This record, together with the observations from the type-locality in Mongolia, suggests that the species probably has a preference for open or semi-open habitats.

Figure 7. Locality for *Osmia disjuncta* in Käringbergets ecopark in Vindeln, northern Sweden. One female was caught in one of the depicted window traps. The habitat consists of a quite open, reindeer grazed, Scots pine forest on sandy ground. The vegetation is totally dominated by ground lichens *Cladonia* spp., *Vaccinium vitis-idaea* and *V. myrtillus*. Photo: Sven Hellqvist.

Fyndlokal för *Osmia disjuncta* i Käringbergets ekopark i Vindeln, Norra Sverige. En hona fångades i en av de avbildade fönsterfällorna. Habitatet består av en relativt öppen renbetad sandtallskog. Fältskiktet domineras av renlavar *Cladonia* spp, lingon *Vaccinium vitis-idaea* och blåbär *Vaccinium myrtillus*. Foto: Sven Hellqvist

Remarks

The European specimens of *O. disjuncta* are all females. We have noted that there are some small but consistent discrepancies between the European and the Mongolian females, primarily concerning the shape of the mandibular dentition and the shape of the protibial spur. The incision between the third and fourth mandibular tooth is deeper and the semitransparent spur of the protibia is more concave dorsally in the European specimens. We consider this to be intraspecific variation and what could be expected from specimens collected from such widely separated populations. An attempt to produce a DNA barcode sequence of one of the paratype females to compare it to the Swedish specimen unfortunately failed. We have not been able to identify any males of the species in Nordic collections.

Acknowledgements

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of great service in the process of sorting out the species identity and providing high resolution photos of the types of *O. disjuncta*. We thank Sven Hellqvist (Umeå) and Mats Larshagen (at Sveaskog) for providing us with information on the Swedish locality. We are also grateful to Magnus Persson (Södra Sandby) for the photos and to Andreas Müller (Zürich) for informative discussions on the status of the species. Anders Nilsson (Uppsala), Andreas Müller and an anonymous referee provided valuable feedback on the manuscript. DNA barcode data used in this publication was generated in collaboration with the Finnish Barcode of Life project (FinBOL) funded by the Kone Foundation and University of Oulu.

References

Amiet, F., Herrmann, M., Müller, A. & Neumeyer, R. 2004. Apidae 4: *Anthidium*, *Chelostoma*, *Coelioxys*, *Dioxys*, *Heriades*, *Lithurgus*, *Megachile*, *Osmia*, *Stelis*. – Fauna Helvetica. Vol. 9. Centre Suisse de Cartographie de la Faune (CSCF)/Schweizerische Entomologische Gesellschaft (SEG), Neuchâtel.

Hymenoptera Anatomy Consortium 2016. The Hymenoptera Glossary. – http://glossary.hymao.org

Müller, A. 2016. Palaearctic Osmiine Bees, ETH Zürich. – http://blogs.ethz.ch/osmiini

Rightmyer, M.G., Griswold, T. & Arduser, M.S. 2010. A review of the non-metallic *Osmia* (*Melanosmia*) found in North America, with additional notes on palearctic *Melanosmia* (Hymenoptera, Megachilidae). – ZooKeys 60: 37-77.

Scheuchl, E. 2006. Illustrierte Bestimmungstabellen der Wildbienen Deutschlands und Österreichs. II: Megachilidae – Melittidae. 2nd ed. Apollo Books, Stenstrup.

Tkalců, B. 1983. Die europäischen *Osmia*-Arten der Untergattung *Melanosmia* (Hymenoptera, Apoidea, Megachilidae). – Věstnik Československe Společnosti Zoologické 47: 140-159.

Tkalců, B. 1995. Die Bienen der Tribus Osmiini der Mongolei (Insecta: Hymenoptera: Apoidea: Megachilidae). – Entomologische Abhandlungen (Dresden) 57: 109-147.

Sammanfattning

Murarbiet *Osmia disjuncta* Tkalců, 1995, är en art som tidigare endast var känd genom typserien från Mongoliet. Nu rapporterar vi den från Västra Palaearktis för första gången. En hona upptäcktes av försteförfattaren i ett fällprov från Vindeln i Västerbotten. varpå ytterligare tre honor kunde identifieras i material från Finland och Ryssland.

De nordiska honorna skiljer sig en aning från de exemplar som arten beskrevs efter. Skillnaderna är dock inte större än att vi tror det är inomartsvariation som kan förväntas med så stora geografiska avstånd. Hanliga exemplar från Norden skulle dock kunna bringa mer klarhet, men någon sådan har ej kunnat hittas, vare sig i muséer eller genom sökande på fyndlokalen i Vindeln eller liknande platser. Tyvärr misslyckades också försöken att sekvensera DNA från bin fångade i Mongoliet.

Eftersom de nordiska exemplaren ser lite annorlunda ut och beskrivningen av arten är svår att finna och skriven på tyska, så ges här en detaljerad beskrivning av hur arten ser ut. Att arten är skiljd från andra närstående arter stöds av genomförd DNA-sekvensering.