A preliminary list of Andrena subgenera (Hymenoptera: Andrenidae) of Iran, with five new records

Safoora Allahverdi1, Ahmad Nadimi1, Ali Afshari1 and Khalid Aliyev2

1 Department of Plant Protection, Faculty of Plant Production, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran
2 Institute of Zoology, National Academy of Sciences of Azerbaijan, Passaj 1128, block 504, Baku, Azerbaijan

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ABSTRACT. The list of 41 subgenera of the genus Andrena Fabricius, 1775 from Iran is given. The list provided here is based on a detailed study of all available published data and current study. Four subgenera and five species are recorded for the first time from Iran, including Andrena (Cnemidandrena) fuscipes (Kirby, 1802), Andrena (Lepidandrena) curvungula (Thomson, 1870), Andrena (Lepidandrena) pandellei (Pérez, 1895), Andrena (Parandrena) sericata (Imhoff, 1868) and Andrena (Platygalandrena) tecta (Radoszkowski, 1876). Ecological notes on the newly recorded species are briefly discussed.

Key words: Andrena, Apoidea, Iran, Sand bees

Introduction
The Andrenidae is one of the largest families of bees, widely distributed (excluding Australia) and with greatest diversity in arid western North America, South America, and the Palearctic region (Danforth et al. 2013). It belongs together with the Halictidae, Colletidae, Melittidae and Stenotritidae to the short-tongued bees, which are characterized generally by labial palpi with four similar segments (Michener 2007). The Andrenidae is a challenging group from the prospective of the classification and phylogeny (Danforth et al. 2013; Michener 2007). Andrenidae consists of three subfamilies (Andreninae, Panurginae, and Oxaeinae) and eight tribes (Danforth et al. 2013). The subfamily Andreninae was divided into two tribes, the Andrenini and Euherbstiini, the latter is found only in Chile (Danforth et al. 2013; Michener 2007). Ascher and Pickering (2015) divided the tribe Andrenini into four genera, including Alocandrena Michener, 1986, Ancylandrena Cockerell, 1930, Megandrena Cockerell, 1927, and Andrena Fabricius, 1775. Among the genera, only genus Andrena has a Holarctic distribution and is abundant in the temperate regions of the Northern continents of both hemispheres (Michener 2007; Dubitzky et al. 2010). They are among the important pollinators of natural vegetation and crop plants (Osytshnjuk et al. 2005). For Andrena genus, there are 101 (17 Holarctic, 32 Nearctic, 1 Oriental and 51 Palearctic)
and 37 subgenera in the world and Iran, respectively (Dubitzky et al. 2010; Ascher and Pickering 2015). Among the all Iranian bees, little information is available on the fauna, taxonomy and the geographic distribution of Andrenidae, particularly genus *Andrena* and many records are restricted to the old literature.

Before 1974, there were some faunistic or taxonomic works by non-native researchers that have considered elements of the Iranian bee fauna including the genus *Andrena*. Notable examples of taxonomic works supplied material of genus *Andrena* from Iran before 1974 are those by Morice (1921, seven species), Strand (1921, one species), Alfken (1927, two species), Alfken (1935, 15 species), Alfken and Blüthgen (1937, three species), Popov (1940, 1949, 1958, 1967, 3, 4, 4 and 23 species, respectively). Esmaili and Rastegar (1974), as the first native researcher, found three species of the genus *Andrena* belonging to three different subgenera during a survey on Aculeata of Iran. Afterward, there was generally a 20 year gap on studying bees of Iran. Telebi et al. (1995) reported 33 bees visiting alfalfa flowers in Karadj County, including two species of different subgenera of *Andrena*. Tavakoli et al. (2010) collected three different subgenera on flowers of legume crops from Guilan province. In addition, there are some important published taxonomic studies on the genus *Andrena* in Iran (Ariana et al., 2009a; Ariana et al., 2009b). The most important faunistic work of bees, including the genus *Andrena* in recent years is presented by Khodaparast and Monfared (2012). They introduced 31 species of nineteen subgenera in studied areas in south of Iran (Fars province). Ascher and Pickering (2015) totally listed about 125 Iranian andrenid species belonging to 37 subgenera in "Discover Life’s bee species guide and world checklist". Herein we attempt to provide a list of the formerly and currently recorded subgenera of *Andrena* known to occur in Iran. This study was prompted by the absence of a comprehensive work on this important genus in Iran.

**Materials and Methods**

Information sources are based both from literatures and collecting bees from different localities in Gorgan County, Golestan Province (Iran), in 2014 using sweeping nets. Information for each specimen caught, such as location and altitude of the collection site, were recorded with a GPS device (Garmin GPS map 62s). Bees were killed in jars containing ethyl acetate. Bees were later pinned, prepared according to the standard methods and stored until their identification to species level. For studying male genitalia, we brought it out with a fine forceps, while sticking to end of abdomen. Specimens were examined under a binocular microscope by using valid related sources (Gusenleitner and Schwarz, 2002; Osytshnjuk, et al. 2005; Michener 2007). The morphological terminology used in the descriptions follows Osytshnjuk et al. 2005. The photographs were taken using an Olympus SZ stereo-microscope equipped with a Sony digital camera. All specimens are deposited in collection woody boxes in entomology laboratory of Gorgan University of Agricultural Sciences and Natural Resources. The vegetation cover of this area consists mainly of broad-leaved trees, bushes and shrubbery often with Loess soil. All visited flower plants by bees were collected and then identified by help of botanist experts of Golestan Agricultural and Natural Resources Research and Education Center.

**Results**

Herein we reported four newly subgenera *Cnemidandrena*, *Lepidandrena*, *Parandrena* and *Platygalandrena* with five new recorded species for Iranian bee fauna. Subgenera are arranged herein alphabetically within genus *Andrena* (Table 1).
Table 1. List of *Andrena* subgenera (Hymenoptera: Andrenidae) from Iran.

<table>
<thead>
<tr>
<th>Subgenera</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aciandrena</td>
<td>Popov (1967); Alfken (1927); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Aenandrena</td>
<td>Alfken (1927); Ariana et al. (2009a); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Brachyandrena</td>
<td>Popov (1967); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Campylogaster</td>
<td>Khodaparast and Monfared (2012); Alfken (1935); Popov (1967); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Carandrena</td>
<td>Khodaparast and Monfared (2012); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Chlorandrena</td>
<td>Khodaparast and Monfared (2012); Popov (1967); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Cnemidandrena</td>
<td>Current study.</td>
</tr>
<tr>
<td>Cordandrena</td>
<td>Khodaparast and Monfared (2012); Morice (1921); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Euandrena</td>
<td>Khodaparast and Monfared (2012); Morice (1921); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Holandrena</td>
<td>Khodaparast and Monfared (2012); Esmaili and Rastegar (1974); Alfken (1935); Popov (1967); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Lepidandrena</td>
<td><em>Current study.</em></td>
</tr>
<tr>
<td>Melanapis</td>
<td>Khodaparast and Monfared (2012); Tavakoli <em>et al.</em> (2010); Popov (1967); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Melandrena</td>
<td>Alfken (1935); Morice (1921); Popov (1967); Strand (1921); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Melitoides</td>
<td>Khodaparast and Monfared (2012); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Micrandrena</td>
<td>Khodaparast and Monfared (2012); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Nobandrena</td>
<td>Khodaparast and Monfared (2012); Popov (1967); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Notandrena</td>
<td>Morice (1921); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Orandrena</td>
<td>Khodaparast and Monfared (2012); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Osychnyukandrena</td>
<td>Ariana et al. (2009b); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Paranandrena</td>
<td><em>Current study.</em></td>
</tr>
<tr>
<td>Parandrenella</td>
<td>Khodaparast and Monfared (2012); Popov (1957,1967);</td>
</tr>
<tr>
<td>Plastandrena</td>
<td>Khodaparast and Monfared (2012); Alfken (1935); Morice (1921). Popov (1967, 1949); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Platygalandrena</td>
<td><em>Current study.</em></td>
</tr>
<tr>
<td>Poeclandrena</td>
<td>Popov (1967); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Ptilandrena</td>
<td>Khodaparast and Monfared (2012); Morice (1921); Ascher and Pickering (2015).</td>
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<tr>
<td>Scitandrena</td>
<td>Popov (1967); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Simandrena</td>
<td>Khodaparast and Monfared (2012); Alfken (1935); Morice (1921); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Suandrena</td>
<td>Khodaparast and Monfared (2012); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Thysandrena</td>
<td>Morice (1921); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Trachandrena</td>
<td>Alfken (1935); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Trunchandrena</td>
<td>Khodaparast and Monfared (2012); Popov (1967); Ascher and Pickering (2015).</td>
</tr>
<tr>
<td>Zonandrena</td>
<td>Khodaparast and Monfared (2012); Tavakoli <em>et al.</em> (2010); Esmaili and Rastegar (1974); Alfken (1935). Morice (1921); Talebi <em>et al.</em> (1995); Ascher and Pickering (2015).</td>
</tr>
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</table>

The asterisk beside subgenera indicates new records.
Subgenus *Cnemidandrena* Hedicke 1933

**Diagnosis:** Basal area of labrum large, trapezoidal, usually thickened; first flagellar segment in males usually shorter than combined length 2nd and 3rd segments; ocellocipital distance 2 times as wide as ocellar diameter (Fig. 1).

*Andrena (Cnemidandrena) fuscipes* (Kirby, 1802)

**Synonyms:** *Melitta fuscipes* Kirby, 1802; *Melitta pubescens_homonym* Kirby, 1852; *Andrena cincta_homonym* Nylander, 1852; *Andrena germanica* Verhoeff, 1890 (Ascher and Pickering 2015).

**Material examined:** Gorgan County, Chahar bagh village (36° 36’ N, 54° 34’ E, 2147 m, a.s.l.), 24.v.2014, 1♀, Floral resources: *Lepidium draba* L. (Brassicaceae), leg. S. Allahverdi.

**General distribution:** Azerbaijan, Croatia, Denmark, France, Georgia, Greece, Italy, Kazakhstan, Latvia, Netherlands, Romania, Spain, Slovakia, Sweden, Turkey, Ukraine (Ascher and Pickering 2015).

**Diagnosis:** Body length 12–13 mm in females (Fig. 7); Facial foveae occupying 2/3 ocellocular distance, extending to level of clypeus base, narrowed (Fig. 8); the last segment of metatarsus with an arched appearance (Fig. 9).

*Andrena (Lepidandrena) pandellei* Pérez, 1895

**Synonyms:** *Andrena anceyi* Pérez, 1895; *Andrena pandellei europaea* Warncke, 1967 (Ascher and Pickering 2015).

**Material examined:** Gorgan County, Between Shastkalate and Alofen village (36° 41’ N, 54° 20’ E), 17.v.2014, 4♀♀, Floral resources: *Lepidium draba* L. (Brassicaceae), leg. S. Allahverdi.

**General distribution:** Algeria, Austria, Bosnia and Herzegovina, Bulgaria, Corsica, Croatia, France, Germany, Greece, Hungary, Italy, Luxembourg, Morocco, Moravia, Netherlands, Poland, Portugal, Romania, Sicily, Slovakia, Turkey, Ukraine (Ascher and Pickering 2015).

**Diagnosis:** Body length 10–12 mm in females (Fig. 10); Basal area of labrum longer and narrower than *A. curvungula*; Pubescence of facial foveae brownish-grey; mesoscuturn, scutellum and metanotum with brownish-yellow squamous hairs; facial foveae narrower, occupying 1/3 ocellocular distance (Fig. 11); the last segment of metatarsus with a rectilinear appearance (Fig. 12).

**Subgenus Parandrena Robertson, 1897**

**Diagnosis:** Genal area narrow; ocelloccipital distance more than one ocellar diameter (in *A. sericata* over 2 times as wide as ocellar diameter) (Fig. 13); the female labrum is transversely sulcate, and the male sixth sternum is reflexed with apicolateral teeth.

*Andrena (Parandrena) sericata* Imhoff, 1868

**Synonym:** *Andrena favosa* Morawitz, 1872 (Ascher and Pickering 2015).
Material examined: Gorgan County, Near to Chahar bagh village (36° 36.75′ N, 54° 29.96′ E, 2127 m, a.s.l), 09.vi.2014, 1♂, Floral resources: Centaurea sp. (Asteraceae); Chahar bagh-Jahannam road (36° 34.09′ N, 54° 25.59′ E, 2130 m, a.s.l), 24.v.2014 1♀1♂, Floral resources: Ixiolirion tataricum (Pall.) (Ixioliriaceae) and Tragopogon sp. (Asteraceae), leg. S. Allahverdi.

General distribution: Armenia, Austria, Croatia, Czech Republic, France, Georgia, Germany, Greece, Hungary, Italy, Poland, Russia, Romania, Serbia, Slovakia, Spain, Switzerland, Turkey, Ukraine (Ascher and Pickering 2015).

Diagnosis: Body length 12–13 mm in females and 11–12 mm in males (Fig. 14 and 15); clypeus yellow with five black spots in females and with two black spots in males (Fig. 16 and 17); genitalia has distinct dorsal gonocoxite which vesicular swollen aedeagus valve is visible on the base (Fig. 18).

Subgenus Platygalandrena Dubitzky, 2006

Diagnosis: Facial fovea flat, weakly depressed (Fig. 19), more than one ocellar diameter; galea strongly punctate and flattened dorsoventrally (Fig. 20).

Andrena (Platygalandrena) tecta Radoszkowski, 1876

Synonym: Andrena (Llandrena) tecta Radoszkowski, 1876 (Ascher and Pickering 2015).

Material examined: Gorgan County, Near to Chahar bagh village (36° 36.75′ N, 54° 29.96′ E, 2127 m, a.s.l), 24.v.2014, 1♀, Floral resources: Acanthophyllum sp. (Caryophyllaceae), leg. S. Allahverdi.


Diagnosis: Body length 11 mm in females (Fig. 21); ocellocipital distance one and half times as wide as ocellar diameter (Fig. 22); with long and curve light trochanteral flocculus in hind leg (Fig. 23).

Figures 13-18. Morphological characteristics of *Andrena (Parandrena) sericata* (Imhoff, 1868):
Discussion

According to the results of this research, the number of recorded *Andrena* subgenera of Iran increased to 41 (Table 1).

The subgenus *Cnemidandrena* with 48 recorded species in the world (Ascher and Pickering 2015), is relatively poorly represented in Eurasia (LaBerge, 1986). A staple food for the oligolectic solitary bee, *Andrena fuscipes*, is *Calluna* genus (Ericaceae) (Ruszkowski et al. 1999; Dupont and Olesen 2009; Exeler et al. 2010; Hodges and Cane 1949; Moroń et al. 2008; Gusenleitner 1985) and also is one of the most important pollinators of *Calluna vulgaris* side by side with the honey bee (Hodges and Cane 1949). We collected *A. fuscipes* from the yellow flowers of *Paliurus spina-christi* (Rhamnaceae).

At present, heathland habitats are listed as critically endangered in Germany and other parts of Europe and are protected by the EU Habitats Directive and *A. fuscipes* in Central Europe is specialized on heather pollen (Exeler et al. 2010). Although *A. fuscipes* widely distributed species in Central Europe (Exeler et al. 2010) but has become rare and is listed as vulnerable in following countries where red lists for Hymenoptera exist, such as Switzerland (Regionally extinct), Germany (Near Threatened), Slovenia (Endangered), Netherlands (Critically Endangered) (Peeters and Reemers 2003) and threatened and rare in other European countries like Ireland.

The subgenus *Lepidandrena* with 16 species in the world, restricted to the Palaeartic region (Xu and Cui 2007). According to Data from the Swedish Species Information Centre (ArtDatabanken), *Andrena curvungula* is oligolectic, specialized on *Campanula* spp. (Campanulaceae) (Naylor 2006; Lara Ruiz 2012; Zettel et al. 2003; Schlindwein et al. 2005; Monsevičius 2004; Westrich 1996) and also sometimes as pollinator of Malvaceae, Apiaceae, Ranunculaceae (Westrich and Schmidt 1987). Also *A. curvungula* is a rare species in Central Europe and on the red list of highly threatened in Germany (Feitz et al. 2003; Westrich 1996). *Andrena pandellei* is extremely rare in Germany and Central Europe (Westrich 2000; Flechtner et al. 2000) and oligolectic on bellflower (*Campanula*) and *Geranium* spp. (Geraniaceae) (Naylor 2006; Zettel et al. 2002; Gusenleitner 1985; Schlindwein et al. 2005; Monsevičius 2004; Westrich 1996; Münze et al. 2006). Recently, *A. pandellei* has been used for meadow management and used in the commercial grassland in Germany (Westrich et al. 2008). Neumayer (2010) showed that *A. fuscipes*, *A. curvungula* and *A. pandellei* are solitary nesting bee species.

The subgenus *Parandrena* with 15 species in the world (Ascher and Pickering 2015) is developed from the subgenus *Opandrena* (Robertson 1902). *Andrena sericata* rarely found in Central Europe and in Germany and limited to the Alpine region (Westrich et al. 1998; Westrich and Dathe 1997) and according to Neumayer (2010) is oligolectic on *Salix* spp. (Salicaceae).

The subgenus *Platygalandrena* with 11 species in the world is most likely plesiomorphic. Based on the research results of the Dubitzky et al. (2010) members of *Platygalandrena* were separated from the subgenus *Ulandrena*, where they were placed originally by Warncke (1968) and *Ulandrena* is the sister taxon to *Platygalandrena. Andrena tecta* belongs to the subgenus *Platygalandrena* that the adult bees of this subgenus are active from the end of March to July. (Dubitzky et al. 2010; Ascher and Pickering 2015).

According to Figure 24, about 77% of Andrenid bees of Iran belong to Andrenini tribe (*Andrena* genus), followed by Panurgini (12%) and Melitturgini (11%). In the genus *Andrena*, the maximum species percentage belongs to the subgenus *Melandrena* with 12.5%.

Given that Iranian bee fauna is rich so continuing faunal samplings is necessary in
Iran, especially in un-sampled regions to discover more new endemic threatened and rare species and subgenera.

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Figure 24. Composition of Andrenidae of Iran. Same color indicates the same percentage of subgenera of genus *Andrena*. 
References


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فهرست مقدماتی زیر جنس های Andrena در ایران به همراه 

صفراءالوردي، احمد ندیمی، علی افشاری و خالد علیف

1. گروه گیاه‌پزشکی، دانشکده تولید گیاهی، دانشگاه علوم کشاورزی و منابع طبیعی گرگان، گرگان، ایران
2. دانشکده علوم کشاورزی و منابع طبیعی گرگان، گرگان، ایران

این مقاله در ارائه اطلاعات موجود در منابع Andrena منشأ شده و به‌همراه دیگر اطلاعات شناسایی چهار زیر جنس Andrena و پنج گونه شامل Andrena (Lepidandrena) fuscipes (Kirby, 1802) Andrena (Lepidandrena) pandellei (Pérez, 1868) Andrena curvungula (Thomson, 1870) Andrena (Parandrena) sericata (Imhoff, 1868) و Andrena (Platygalandrena) tecta (Radoszkowski, 1876) در ایران پیش‌بینی می‌شود.

واژگان کلیدی: Apoidea Andrena