Wild bees of the proposed nature reserve “Skarpa Wiślana” in Męcierz (Kazimierski Landscape Park).
Part 1 – long-tongued bees Megachilidae and Apidae

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Abstract. This paper presents data on bees of the families Megachilidae and Apidae (Apoidea) of the proposed nature reserve “Skarpa Wiślana” in Męcierz (Kazimierski Landscape Park). Distributional and phenological data are given. Thirty-one species of Megachilidae and forty-three species of Apidae were collected. For rare and very rare species (Anthidium oblongatum (ILLIGER , 1806); Heriades crenulatus NYLANDER , 1856; Hoplitis claviventris (THOMSON, 1872); Hoplitis papaveris (Latreille, 1799); Megachile genalis MORAWITZ , 1880; Osmia cerinthidis MORAWITZ , 1876; Stelis odontopyga NOSKIEWICZ, 1926; Stelis ornata (Klug,1807); Epeoloides coecutiens (Fabricius, 1775); Eucera interrupta Baer, 1850; Nomada bifasciata Olivier, 1811; Nomada stigma Fabricius, 1804; Nomada zonata Panzer, 1798) this paper summarizes information about their distribution in 21st century in Poland, as well as data on their bionomics and their present status of threat in Europe.

Key words: checklist, species occurrence, Hoplitis papaveris, Nomada stigma, Osmia cerinthidis.

I. INTRODUCTION

“Skarpa Wiślana” is a fragment of steep slope situated on the edge of the valley of the Vistula River near Kazimierz Dolny (Fig. 2). In order to protect the xerothermic grasslands and shrubs, habitats of rare animal species, and habitats that could be repopulated with endangered plant species, HARASIMIUK et al. (1987) proposed the creation of a floristic reserve in Męcierz. Knowledge of the entomofauna of the proposed nature reserve “Skarpa Wiślana” in Męcierz is fragmentary, however, what data there is allows it to be considered rich and interesting. More extensive data concern: Thysanoptera – KUCHARCZYK (1997); Hemiptera – CMOLUCHOWA (1964), GOLAN et al. (2001), ŁAGOWSKA & GOLAN (2002); Lepidoptera – BUSZKO (1997); and some groups of Coleoptera: Staphylinidae – STANIEC (2003), and Curculionidae – CMOLUCH (1971). Unfortunately, there is very little data about wild bees in the area of Męcierz. Some information about the bees of this area can be found in the papers of RUSZKOWSKI et al. (1994, 2004) and WISNIEWSKI et al. (2018), however these publications concern only three species of bees, among which particularly noteworthy is Eucera nigrescens PÉREZ, 1879, a rare species in Poland (BANASZAK 2000a).
Currently, there are no comprehensive studies of bees in this area. The aim of the present study was to compile a list of the fauna of long-tongued bees inhabiting the proposed nature reserve “Skarpa Wiślana”, including their zoogeography, and phenology.

II. STUDY AREA

The proposed nature reserve “Skarpa Wiślana” in Męcimerz (UTM - EB 68) is situated on the outskirts of the Bełżyce Plain Mesoregion, in the area of the Kazimierski Landscape Park, about 4 km south of Kazimierz Dolny (Fig. 1). The locality of Męcimerz is part of the Nature 2000 – The Lesser Poland Gorge of the Vistula (PLH 060045). The total area of “Skarpa Wiślana” is 9.27 ha. In recent years, protective measures in counteracting plant succession and the fragmentation of xerothermic communities has been carried out in the area of the planned nature reserve “Skarpa Wiślana” (PAWLOWSKI 2009). The flowery grassland plants can be assigned to xerothermic grasslands of the Festuco-Brometea class 6210 (Juncetum ensifoliae alliance and Origanobrachypodietum alliance) and Juniperus communis formations 5130 (JAROSZ-SOSIK 2013). They grow on strongly eroded rendzinas formed of marls on slopes of southern, south-western and western exposure, rarely on fragments of plateau. The xerothermic phytocoenoses have the character of a loose grassland with a mosaic-like shrub layer as a permanent element. The following species occur here: Juniperus communis L., Prunus spinosa L., Rosa canina L., and Viburnum opulus L. In the layer of herbaceous plants, the dominant species is Inula ensifolia L. or Brachypodium pinnatum (L.) P. BEAU (Fig. 3) and the following appear permanently, although less abundantly: Achillea sedilii J. PRESL & C. PRESL, Adonis vernalis L., Anemone sylvestris L., Anthericum ramosum L., Anthyllis vulneraria L., Aster amellus L., Campanula sibirica L., Euphorbia cyparissias L., Medicago falcata L., Origamun vulgare L., Salvia verticillata L., Salvia pratensis L., and Teucrium chamaedrys L. (KUCHARCZYK 2000).

III. MATERIAL AND METHODS

Field research was conducted over the course of six growing seasons, from 2010-2015. Two methods were used to collect bees: yellow pan traps (Möriecke traps) and hand-netting (by searching on flowers and at the bees’ favourite nesting sites). Hand-netting was used periodically every 10-14 days, throughout the duration of the field research period. Each collection time was about four hours. The Möriecke traps were used from April until the beginning of September in 2013-2015. Möriecke traps were placed on the ground’s surface. We used three, yellow plastic bowls, 20 cm in diameter, 2/3rds of the way filled with a mixture of water (95%), ethylene glycol (4.8%), and a detergent (0.2%) added to decrease surface tension. Captured insects were removed from the traps every 10 days. The collected bees are stored in the entomological collection of the Apiculture Division of Research Institute of Horticulture in Puławy. All specimens were collected by M. BORAŃSKI.

Classification into families and genera and their systematic arrangement has been presented according to SCHEUCL & WULNER (2016). The following publications were used to identify the species of bees: BANASZAK & ROMASENKO (1998); CELARY (1995a); KASPAREK (2015); PAWLKOWSKI (1996); SCHEUCL (2000), (2006); SMIT (2018); WARNKE (1992). The species of the Bombus lucorum-complex (BOSSERT 2015) are not distinguishable by morphological features and additionally, B. lucorum and B. terrestris are easily confused (WOLF et al. 2010), therefore data on the occurrence of bumblebees of the subgenus Bombus LATREILLE, 1802 = Terrestrisbomuts VOGT, 1911 are summarized. Honey bees (Apis mellifera LINNAEUS, 1758) were observed at all times during the study but this species was not included because of its anthropogenic origin. The zoogeographical partitioning of the regions of Poland follows the one used in the Catalogue of Polish Fauna (BRAKOWSKI et al. 1978). IUCN categories of threat are given after NIETO et al. (2014). Status of threat in particular European countries is given after available regional red lists or red books of threatened species.

CR - Critically Endangered – species, whose numbers have decreased to a critical level, which persists at single localities, or whose rate of decline is within the range of values established by the IUCN. The survival of species belonging to this category is rather unlikely without active protection focused, among others, on elimination of causes of extinction.

EN - Endangered – species facing a very high risk of extinction because of small populations, a fragmented, insular range, and/or a quick rate of population decline.

VU - Vulnerable – species facing a high risk of extinction due to continuing population decline and habitat loss or over-exploitation; however, the observed or prognosticated rate of their decline is slower than in the case of taxa assigned to the higher categories of threat.
NT – Near Threatened – species that maybe considered threatened with extinction in the near future, although they don’t currently qualify for the threatened status.

LC – Least Concern – species that have been evaluated and do not qualify for any other category.

DD – Data Deficient – species where there is inadequate information to make a direct, or indirect, assessment of their risk of extinction based on their distribution and/or population status.

Abbreviations:
- NP – National Park (e.g. Wolin NP = Wolin National Park)
- LP – Landscape Park (e.g. Cisów-Orłowiny LP = Cisów-Orłowiny Landscape Park)
- F – female, M – male, W – worker

IV. RESULTS AND DISCUSSION

List of Species

Family: Megachilidae

Genus: *Anthidiellum* Cockerell, 1904

*Anthidiellum strigatum* (Panzer, 1805)
12 Jun 2011 – 1F; 27 Aug 2011 – 1M.

Genus: *Anthidium* Fabricius, 1804

*Anthidium manicatum* (Linnaeus, 1758)
02 Jul 2013 – 1F; 22 Jul 2015 – 2M.
**Anthidium oblongatum** (ILLIGER, 1806)
17 Jun 2012 – 1F; 02 Jul 2013 – 1M; 01 Jul 2014 – 1M.

**Anthidium punctatum** LATREILLE, 1809
_Erigeron annuus_ (L.) PERS., 12 Jun 2011 – 2FF, 1M; 03 Jun 2012 – 3M; 17 Jun 2012 – 3FF, 1M; 02 Jul 2012 – 1M; _Salvia pratensis_, 29 May 2013 – 1F, 1M.

**Genus: Chelostoma** LATREILLE, 1809
_Chelostoma florisomne_ (LINNAEUS, 1758)
08 May 2010 – 3FF, 1M; 22 May 2011 – 1F, 1M; _Ranunculus_, 22 May 2011 – 3FF, 3MM; _Hieracium_, 22 May 2011 – 1M; 03 Jun 2012 – 1F; _Ranunculus_, 17 Jun 2012 – 1F.

_Chelostoma rapunculi_ (LEPELETIER, 1841)
03 Jul 2010 – 1M; _Campanula_ L., 17 Jun 2012 – 3MM.

**Genus: Coelioxys** LATREILLE, 1809
_Coelioxys mandibularis_ NYLANDER, 1848
27 Aug 2011 – 1F.

_Coelioxys quadridentata_ (LINNAEUS, 1758)
_Ranunculus_, 22 May 2011 – 1M.

**Genus: Heriades** SPINOLA, 1808
_Heriades crenulatus_ NYLANDER, 1856
17 Jun 2012 – 1F.

_Heriades truncorum_ (LINNAEUS, 1758)
27 Aug 2011 – 1F; 12 Aug 2012 – 1F.

**Genus: Hoplitis** KLUG, 1807
_Hoplitis adunca_ (PANZER, 1798)
_Echium vulgare_ L., 12 Jun 2011 – 1F; _Cichorium intybus_ L., 12 Jul 2011 – 1F; 30 Jun 2012 – 2FF, 1M; 20 May 2014 – 1M.

_Hoplitis claviventris_ (THOMSON, 1872)
08 May 2010 – 1M; 12 Jun 2011 – 1F; 17 Jun 2012 – 1F; 02 Jul 2015 – 1F.

_Hoplitis leucomelana_ (KIRBY, 1802)
12 Jun 2011 – 2M; 15 Jul 2013 – 1F.

_Hoplitis papaveris_ (LATREILLE, 1799)
03 Jun 2012 – 1M.

**Genus: Megachile** LATREILLE, 1802
_Megachile circumcincta_ (KIRBY, 1802)
07 Jul 2015 – 1F.

_Megachile genalis_ MORAWITZ, 1880
Jun 2013 – 1F.

_Megachile ligniseca_ (KIRBY, 1802)
21 Aug 2010 – 1F.

_Megachile maritima_ (KIRBY, 1802)
_Anthericum ramosum_, 17 Jun 2012 – 1F.

**Genus: Osmia** PANZER, 1806
_Osmia aurulenta_ (PANZER, 1799)

_Osmia bicolor_ (SCHRANK, 1781)

_Osmia bicornis_ (LINNAEUS, 1758)
21 Apr 2012 – 1M; 06 May 2013 – 1MM; 11 May 2015 – 2MM.

_Osmia caerulescens_ (LINNAEUS, 1758)
08 May 2010 – 1F.

_Osmia cerinthidis_ MORAWITZ, 1876
_Cerinthe minor_ L., 17 Jun 2012 – 1F.

_Osmia leaiana_ (KIRBY, 1802)
_Hieracium_, 22 May 2011 – 1F.

_Osmia niveata_ (FABRICIUS, 1804)
06 May 2013 – 1M.
Osmia spinulosa (Kirby, 1802)

Genus: Stelis Panzer, 1806
Stelis odontopyga Noskiewicz, 1926

Inula ensifolia, 13 Aug 2011 – 1F, 1M; 30 Jun 2012 – 1F; 02 Aug 2013 – 1F; 22 Jul 2014 – 1F, 1M.

Stelis ornatula (Klug, 1807)
Jul 2013 – 1M.

Genus: Trachusa Panzer, 1804
Trachusa byssina (Panzer, 1798)
17 Jun 2012 – 1F; 02 Jul 2015 – 2FF.

Family: Apidae
Genus: Anthophora Latreille, 1803
Anthophora aestivalis (Panzer, 1801)
06 Jun 2010 – 2M M; Salvia pratensis, 22 May 2011 – 1M.

Anthophora plumipes (Pallas, 1772)
17 Apr 2010 – 1M; 30 Apr 2011 – 2FF; 21 Apr 2012 – 1F, 1M.

Genus: Bombus Latreille, 1802
Bombus Latreille, 1802 = Terrestris Bombus Vogt, 1911 (subgenus)

Bombus bohemicus Seidl, 1838

Inula ensifolia, 12 Jul 2011 – 1M; 24 Jul 2011 – 1M; 11 May 2015 – 1F.

Bombus campestris (Panzer, 1801)
24 Jul 2011 – 1M.

Bombus hortorum (Linnaeus, 1761)
12 Jun 2011 – 2FF, 2M M, 4W W; 31 Jul 2014 – 1W.

Bombus hypnorum (Linnaeus, 1758)
20 Jun 2010 – 1F, 2M M, 12 Jun 2011 – 3W W;

Bombus lapidarius (Linnaeus, 1758)

Bombus muscorum (Linnaeus, 1758)
03 Jul 2010 – 1W.

Bombus pascuorum (Scopoli, 1763)

Bombus pratorum (Linnaeus, 1761)

Origanum vulgare, 12 Jul 2011 – 1M; 17 Apr 2012 – 1W.

Bombus ruderarius (Müller, 1776)

Bombus rupestris (Fabricius, 1793)

Origanum vulgare, 24 Jul 2011 – 2M M

Bombus sylvarum (Linnaeus, 1761)
Bombus sylvestris (LEPELETIER, 1832)
30 Apr 2011 – 1F.

Genus: Ceratina LATREILLE, 1802

Ceratina cyanaea (KIRBY, 1802)

Genus: Epeoloides GIRAUD, 1863

Epeoloides coecutiens (FABRICIUS, 1775)
18 Aug 2011 – 1F; 10 Jul 2018 – 1F.

Genus: Epeolus LATREILLE, 1802

Epeolus variegatus (LINNAEUS, 1758)
12 Jul 2014 – 1F.

Genus: Eucera SCOPOLI, 1770

Eucera interrupta BAER, 1850
20 May 2012 – 1M.

Eucera longicornis (LINNAEUS, 1758)
Salvia pratensis, 22 May 2011 – 4M M; Salvia pratensis, 12 Jun 2011 – 1M; 20 May 2012 – 1M; Hieracium, 29 May 2013 – 1M.

Genus: Melecta LATREILLE, 1802

Melecta luctuosa (SCOPOLI, 1770)
30 Apr 2011 – 1M; 20 May 2012 – 1F.

Genus: Nomada SCOPOLI, 1770

Nomada armata HERRICH-SCHÄFFER, 1839
30 Jun 2012 – 1F.

Nomada bifasciata OLIVIER, 1811

Nomada fabriciana (LINNAEUS, 1767)
17 May 2010 – 1M.

Nomada ferruginata (LINNAEUS, 1767)
08 May 2010 – 1F; 12 Jun 2011 – 1F; 21 Apr 2012 – 5FF, 3M M; 01 May 2012 – 1F; 06 May 2013 – 1F; 20 May 2014 – 1F; 11 May 2015 – 1F; 02 Jul 2015 – 1F.

Nomada flavata PANZER, 1798
17 Apr 2010 – 1M; 17 May 2010 – 1F; 06 Jun 2010 – 1F; Euphorbia cyparissias, 30 Apr 2011 – 1F; 21 Apr 2012 – 3M M; 11 May 2015 – 1M.

Nomada flavoguttata (KIRBY, 1802)

Nomada flavopicta (KIRBY, 1802)
Hieracium L., 12 Jul 2011 – 1F.

Nomada fucata PANZER, 1798
01 May 2012 – 2FF; 30 Jun 2012 – 1F.

Nomada fulvicornis FABRICIUS, 1793
30 Apr 2011 – 2FF; 21 Apr 2012 – 2M M.

Nomada goodeniana (KIRBY, 1802)
08 May 2010 – 2FF; 06 Jun 2010 – 2FF; 30 Apr 2011 – 1F.

Nomada integra BRULLÉ, 1832
20 May 2012 – 1F; 06 Jun 2010 – 1F.

Nomada lathburiana (KIRBY, 1802)
30 Apr 2011 – 2M M; 07 May 2013 – 1M; 19 Apr 2014 – 1M.

Nomada marshamella (KIRBY, 1802)
08 May 2010 – 1F.

Nomada moeschleri ALFKEN, 1913
21 Apr 2012 – 1M; 01 May 2012 – 1F; 11 May 2014 – 1M; 28 May 2015 – 1M.

Nomada panzer LEPELETIER, 1841
21 Apr 2012 – 1M; 06 May 2013 – 1F, 1M; 07 May 2013 – 1F; 11 May 2015 – 1F, 1M.

Nomada ruficornis (LINNAEUS, 1758)
30 Apr 2011 – 1M; Tussilago farfara L., 21 Apr 2012 – 1M.

Nomada rufipes FABRICIUS, 1793
21 Aug 2010 – 1M.

Nomada signata JURINE, 1807
30 Apr 2011 – 1M; 11 Apr 2015 – 1M.

Nomada stigma FABRICIUS, 1804
12 Jun 2011 – 1F.

Nomada zonata PANZER, 1798
30 Apr 2011 – 1M.
Genus: *Tetralonia* Spinola, 1838

*Tetralonia malvae* (Rossi, 1790)


*Tetralonia salicariae* (Lepeletier, 1841)

22 Jul 2015 – 1M.

V. REVIEW OF PARTICULARLY NOTEWORTHY SPECIES

**Megachilidae**

*Heriades crenulatus*

This Subponto-Mediterranean species inhabits North Africa (from Morocco to Libya) and in Eurasia, from Portugal across Southern Europe, Asia Minor and the Caucasus to Kazakhstan; north to Brandenburg, northern Poland, Belarus, central Ukraine and Rostov; south to Sicily, Malta and Crete, and in Asia to northwestern Iran (Cheuchl & Illner 1998). The females nest in pre-existing cavities in wooden material, in the galleries of wood-boring insects and in hollow stems (Cheuchl & Willner 2016). Nests are parasitized by cuckoo bee *Stelis breviuscula* Nylander, 1848, (Kasparek 2015).

Information on the Polish localities (with UTM coordinates) until 2010 are given in Celary & Wisiński (2011), however two records of this species before 2010 were omitted by the authors:


The present status of threat in Europe is unknown. *H. crenulatus* is listed on the European Red List of Bees as least concern (Nieto et al. 2014), but due to the species’ wide distribution and solitary habit, it is presumed to have a large population (Lhomme 2014a). The species is listed as least concern on the National Red Lists of the Netherlands (Peeters & Reemer 2003) and Germany (Westrich et al. 2011). In Poland, until the 21st century, this species was known from only six records in the Pomeranian Lakeland, Wielkopolska-Kujawy Lowland, Mazovian Lowland, Małopolska Upland, and Lublin Upland (Celary & Wiśniowski 2011). In recent years, a dynamic spreading of this Subponto-Mediterranean species has been observed all over the country, which may be related to climatic change. Dynamic changes in species dispersion in relation to climatic changes have been documented in bumblebees (Kerr et al. 2015, Rasmont et al. 2015) and solitary bees (Hofmann et al. 2018).

*Holitis claviventris*

This Palaearctic species occurs from Portugal through Europe, Asia Minor and Siberia to Irkutsk; north to Wales and northern England, in Norway to 62°N, in Sweden to the Arctic Circle, in Finland to 65.5°N, in Russia to Karelia and Kirov; south to Sicily, and in northern Greece and southeastern Turkey (Cheuchl & Willner 2016). A disturb of *H. claviventris* fly from the second half of May until mid-August (Celary & Wiśniowski 2007). The females visit blooming plants of the families Asteraceae, Boraginaceae, Cistaceae, Crassulaceae, Fabaceae, Lamiaceae, Hypericaceae, and Rosaceae, but with preference for Lotus corniculatus (Cheuchl & Willner 2016). Nesting usually occurs in hollow twigs (e.g. *Rosa* spp. and *Rubus* spp.) and stems (e.g. *Senecio* spp.), less often in the ground or in holes in dead wood or root plates (Falk & Lewington 2015). Nests are parasitized by cuckoo bees *Stelis minuta* Lepeletier & Serville, 1825 and *Stelis ornata* (Kasparek 2015). Information on the Polish localities until 2006 are given in Celary & Wiśniowski (2007), after this time *H. claviventris* was recorded in various regions: Baltic Coast: CF56 Kuźnica CF56 – Banaszak (2016), Pomeranian Lakeland: XV67, XV76 Bory Tuchol-
This species is listed on the European Red List of Bees as least concern (Nieto et al. 2014), due to the species' wide distribution and solitary behaviour, it is presumed to have a large population (Lhomme 2014b). The species is listed as least concern in the National Red Lists of the Netherlands (Peeters & Reemer 2003) and Germany (Westrich et al. 2011) and it is very rare in Portugal (Baldock et al. 2018). In Poland, until the 21st century, this species was known from 11 records in the Baltic Coast, Pomeranian Lakeland, Masurian Lakeland, Wielkopolska-Kujawy Lowland, Lublin Upland, Roztocze, and Western Beskidy Mts (Celary & Wisniewski 2007). In recent years, a dynamic spreading of this Palaeartic species has been observed all over the country, which may be related to climate change.

_Hoplistis papaveris_

This rare bee species occurs from Portugal through Southern and Central Europe, Ukraine and southern Russia, as well as in Asia Minor, Caucasus and Central Asia to Buryatia; north to northern Germany, northern Poland, Kirov, and Perm; south to Sicily, Peloponnese, Israel, and Jordan (Scheucl & Willner 2016). A dults appear in the first half of June and can be observed until mid-August (Celary & Wisniewski 2007). The females visit blooming plants of the families Asteraceae, Campanulaceae, Caryophyllaceae, Cistaceae, Convolvulaceae, Papaveraceae (Scheucl & Willner 2016). They nest in pre-existing cavities in the soil, seldomly excavating their own tunnels. The nest consists of one cell, sometimes two cells, with all walls constructed of bits of petals (Banaszk & Romasenko 1998). The females usually cut fragments of petals of Papaver rhoas L., Cyanus segetum Hill, Malva moschata L., Helianthemum spp. and Genista tinctoria L. (Westrich 1990). Nests are parasitized by cuckoo bees: Coelioxys brevis Eversmann, 1852; Coelioxys elongata Lepeltier, 1841; Coelioxys inermis (Kirby, 1802); Coelioxys mandibularis and Stelis phaseoptera (Kirby, 1802) (Scheucl & Willner 2016).


The present status of threat in Europe is unknown. A according to the IUNC Red List (Europe), their category is least concern (Nieto et al. 2014), but _H. papaveris_ is probably extinct in the Czech Republic (Straka & Bogusch 2017), Switzerland (Amiet 1994), and in the Netherlands (Peeters & Reemer 2003). In Germany it is critically endangered (Westrich et al. 2011). In the “Red List of Threatened Animals in Poland”, it is listed as vulnerable (Głowański 2002). This is the first record of this species in the Lublin Upland.

_Megachile genalis_

This Palaeartic species occurs from Spain through Europe, Asia Minor, the Caucasus, Sibe-
ria and Central Asia to the Pacific coast in the Far East; north to the Baltics, in Russia to Kirov and Perm; south to Lazio, Croatia, southern Romania, southern Turkey and Northern Caucasus (Scheuchl & Willner 2016). This is an oligolectic species on Asteraceae (Scheuchl 2006). Females usually build nests in the stems of Allium cepa L., Angelica sylvestris L., Carduus acanthoides L., Carduus crispus L., Ciceraea spp., Cirsium palustre (L.) Coss. ex Scop., Conium maculatum L., Dahlia pinnata Cav., Echinops sphaerocephalus L. and Heracleum spp. (Ruhinke 2000). They fly from June till the beginning of September (Banaszak & Romasenko 1998). Information on the Polish localities (with UTM coordinates) until 2010 are given in Celary & Wisniowski (2011), after this time M. genalis was recorded in Wielkopolska-Kujawy Lowland: XU 98 Male Rudy „Ostrów” near Szubin – BANAZAK (2010c); CD 14 Inowrocław, CD 05 Janikowo – Twerd & Banaszak (2017).

The present status of threat in Europe is unknown. On the IUCN Red List (Europe) they are listed in the category DD (data deficient) (Nieto et al. 2014). The species is listed in the National Red Lists as regionally extinct in the Czech Republic (Straka & Bogusch 2017), endangered in Germany (Westrich et al. 2011), and vulnerable in Slovenia (Anonymous 2002). In Switzerland it was listed as extinct (AMiet 1994) but later discovered again (AMiet et al. 2014). This is the first record of this species in the Lublin Upland.

Osmia cerinthidis

This rare Subpontic-Mediterranean species occurs in Central, Eastern and Southern Europe, Asia Minor, Iran and Sicily (BANAZAK & ROMASENKO 1998, Scheuchl & Willner 2016). A dull of O. cerinthidis appear in the second half of April and fly until the beginning of July (BANAZAK et al. 2001). This is an oligolectic species on Boraginaeae with a strong preference for Cerinthe (Scheuchl & Willner 2016), females have also been recorded on the flowers of Anchusa officinalis L., Sinapis arvensis L. and some species from Fabaceae (Ruszkowski & Bilinski 1986). They nest in pre-existing cavities in different substrata, preferring those of plant origin. The cell partitions and nest plug are made of mud. The nest consists of 2-9 cells (BANAZAK & ROMASENKO 1998). In Poland, O. cerinthidis is known from a few stands, scattered in the south and south-eastern part of the country (Dylewska & Celary 2000, Banaszak et al. 2003). In the 21st century O. cerinthidis was recorded in regions: Malopolska Upland: DB 82 Ciśów-Orlowiny LP: Szczecno; Chęciny-Kielce LP: DB 62 near Chęciny, DB 63 near Jaworzyńka and near Szewce forest district 97; DA 69 Nadzidzie LP: Pińczów M is near Pińczów, Pińczów M is west Pińczów and Włochy – Bąk-Badowska (2012a); Nadzidzie LP: DA 78 near Chotel Czerweny „Przéslín” nature reserve – Bąk-Badowska (2012c); DB 82 Ciśów-Orlowiny LP: Słopiec Szlachecki – Bąk-Badowska (2014), Świętokrzyskie Mts: EB 03 Świętokrzyski PN: near Nowa Słupia – Bąk-Badowska (2012a), Pienni Mts: DV 57, 67 Pienni NP: Dunajec and Poprad valleys – Dylewska & Kozik (2007). This species is listed on the European Red List of Bees as least concern (Nieto et al. 2014), but it is critically endangered in the Czech Republic (Straka & Bogusch 2017) and Germany (Westrich et al. 2011). In Poland (Głowaciński 2002) and Slovenia (Anonymous 2002), it is listed as vulnerable.

Anthidium oblongatum

The present status of threat in Europe is unknown. On the IUCN Red List (Europe) this bee is classified as least concern (Nieto et al. 2014). This species is rare in Slovenia (Anonymous 2002), Hungary (Józan 2011), and Switzerland (Scheuchl & Willner 2016). *S. odontopyga* is listed on the National Red Lists of the Czech Republic (near threatened; Straka & Bogusch 2017), Germany (vulnerable; Ewstrich et al. 2011), and Poland (data deficient; Glowiński 2002).

### Stelis ornatula


### Stelis odontopyga

The present status of threat in Europe is unknown. On the IUCN Red List (Europe), it is listed as least concern (NIETO et al. 2014). The species is rare, yet widely distributed throughout its range. The overall population is presumed to be relatively large for a parasitic bee (ORTIZ-SÁNCHEZ & ORNOSA 2014). *S. ornatula* is listed as least concern in Finland (RASSI et al. 2010) and Germany (WESTRICH et al. 2011). In the Netherlands it is vulnerable (PEETERS & REEMER 2003) and rare in Slovenia (ANONYMUS 2002) and Great Britain (FALK & LEWINGTON 2015). In the “Red List of Threatened Animals in Poland”, it is listed as DD (data deficient) (GŁOWACIŃSKI 2002).

**Apidae**

_Epeoloides coecutiens_


The species was previously considered to be the rarest European cuckoo bee but in some parts of Europe it is clearly quite common (BOGUSCH & STRAKA 2014). _E. coecutiens_ is listed on the European Red List of B bees as least concern (NIETO et al. 2014), the same status of threat is given in the Netherlands (PEETERS & REEMER 2003) and Germany (WESTRICH et al. 2011). The species is also listed on the National Red Lists as vulnerable in Slovenia (ANONYMUS 2002) and near threatened in the Czech Republic (STRAKA & BOGUSCH 2017). In the “Red List of Threatened Animals in Poland”, it is listed as DD (data deficient) (GŁOWACIŃSKI 2002).

_Eucera interrupta_

This rare Subpontic-Mediterranean species occurs from the Iberian Peninsula in the west, Southern and Central Europe, to Asia Minor, the northern border of its range is the Baltic Sea and Perm, southern: Sicily and Thessaly (SCHEUCHL & WILLNER 2016). These univoltine bees fly from May until the end of July (SCHEUCHL 2000). As an oligoleptic species, they collect pollen from the flowers of the Fabaceae family (SCHUECL & WILLNER 2016), e.g. *Coronilla varia* L., *Lotus corniculatus*, *Trifolium pretense*, *Medicago sativa* (RUSZKOWSKI et al. 1994). Their nests have numerous branches, with an average depth of 28 cm;
the nest cells are arranged vertically (Ruszkowski et al. 1998). Nests are parasitized by a cuckoo bee, Nomada sexfasciata Panzer, 1799, and probably by Nomada nobilis Herrich-Schäffer, 1839 (Smít 2018). In the 21st century, Plewka (2003) confirms the occurrence of this species in the Mazovian Lowland: DD80 Kampinos NP: near Dziekanów Polski, and only one new locality of this species was published, but it comes from 1927: Wielkopolska-Kujawy Lowland: WU14 Gorzów Wielkopolski – Banaszak (2006b). The species was considered very common in central Europe at the end of the 19th century, but now the population trend is considered to be decreasing (Quaranta 1993) – Lublin Upland: FB84 „Gliniska” nature reserve, GB03 Gródek, GA09 Radków. A lack of new records in the last 25 years may suggest a decline in the population of this species in Poland as well.

This species is listed on the European Red List of Bees as least concern (Niêto et al. 2014), but it is rare in Slovenia (Anonymous 2002) and in Portugal (Baldock et al. 2018). E. interrupta is listed on the National Red Lists of: the Czech Republic (critically endangered; Straka & Bogusch 2017), Germany (vulnerable; Westrich et al. 2011), Switzerland (least concern; A. Miet 1994), and Poland (data deficient; Głowaciński 2002).

Nomada bifasciata


This species is observed in different parts of Poland, however, rarely (Celarý 1995a, Celarý & Wisiński 2007). The new locality of N. bifasciata in a proposed nature reserve „Skarpa Wistana” in Męcmierz is characterized by a high number of specimens of this species. The populations of N. bifasciata seem to be stable (Smít 2013), and are in the category least concern according to the IUNC Red List (Europe) (Niêto et al. 2014). This species is listed as least concern in Germany (Westrich et al. 2011), vulnerable in the Netherlands (Peeters & Reemer 2003), and deficient data in Poland (Głowaciński 2002).

Nomada stigma

This rare Palaearctic species occurs in North Africa (Algeria and Tunisia) and Eurasia, from Portugal through Europe, Asia Minor, the Caucasus and Central Asia to Yakutia (Scheuchl & Willner 2016). This species is partially bivoltine and flies from April to August (Smít 2018). Nomada stigma visits blooming plants of the families Brassicaceae, Rosaceae, Apiaceae, Fabaceae, Dipsacaceae and Asteraceae (Celarý & Wisiński 2011). This is a cleptoparasite of Andrena labialis (Kirby, 1802) and probably A. decipiens Schenck, 1861, A. schencki Morawitz, 1866, A. fimbrinata Brulle, 1832, A. flavilabris Schenck, 1874 (Smít 2018) as well. Hosts apparently also include A. humilis Imhoff, 1832 and A. taraxaci Giraud, 1861 (Celarý 1995a).


This species is listed on the European Red List of Bees as least concern (Niêto et al. 2014), but populations are small and in a number of countries the species is in decline (Smít 2014). This species is included on the National Red Lists of the following European countries: Slovenia (regionally extinct; Anonymous 2002), Finland (critically endangered; Rassi et al. 2010), Switzerland (endangered; A. Miet 1994), Sweden (vulnerable; Gärdenfors et al. 2015), the Czech Republic (vulnerable; Straka & Bogusch 2017), the
Netherlands (near threatened; PEETERS & REEMER 2003), Germany (least concern; WESTRICH et al. 2011) and rare in Portugal (BALDOCK et al. 2018). In the “Red List of Threatened Animals in Poland” this species was not evaluated. This is the first record of this species from the Lublin Upland.

Nomada zonata

This rare cuckoo bee lives in North Africa (Morocco) and in Eurasia, from Portugal through Southern and Central Europe, Asia Minor, the Caucasus to Central Asia; north to the Baltics, in Southern and Central Europe, Asia Minor, the Mediterranean, South-West Palaearctic (Eurocaucasian (Stelis odontopyga), 5 – South-West Palaearctic (Anthidium oblongatum), 6 – South Palaearctic (Hoplitis papaveris), 7 – Subponto-Mediterranean (Heriades cremulatus, Osmia cerinthidis). The frequency distribution of particular elements is presented in Table 1.

Table 1

<table>
<thead>
<tr>
<th>Zoogeographical element</th>
<th>Number of species</th>
<th>Share in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holarctic</td>
<td>2</td>
<td>6.45</td>
</tr>
<tr>
<td>Palaearctic</td>
<td>18</td>
<td>58.06</td>
</tr>
<tr>
<td>West Palaearctic</td>
<td>6</td>
<td>19.35</td>
</tr>
<tr>
<td>Eurocaucasian</td>
<td>1</td>
<td>3.23</td>
</tr>
<tr>
<td>South-West Palaearctic</td>
<td>1</td>
<td>3.23</td>
</tr>
<tr>
<td>South Palaearctic</td>
<td>1</td>
<td>3.23</td>
</tr>
<tr>
<td>Subponto-Mediterranean</td>
<td>2</td>
<td>6.45</td>
</tr>
</tbody>
</table>

The results in Table 1 indicate that in the fauna of Megachilidae of the proposed nature reserve “Skarpa Wiślana”, the most numerous elements are Palaearctic and West Palaearctic (respectively – 18 species – 58% and 6 species – 19%), while the remaining ones are much less numerous (1-2 species – 3-6%).

Apidae

The fauna of Apidae of the proposed nature reserve “Skarpa Wiślana” includes nine zoogeographical elements. The following elements have been evidenced: 1 – Holarctic (Bombus lacteolus, 1802 = Terrestris bombus Vogt, 1911), 2 – Palaearctic (Anthophora eustilis, Bombus bohemicus, B. campestris, B. hortorum, B. hypnorum, B. muscorum, B. pascuorum, B. pratorum, B. ruderalis, B. rupestris, B. sylvestris, Ceratina cyanae, Epeoloides coecutiens, Epeolus variegatus, Eucera longicornis, Melecta luctuosa, Nomada flavoguttata, N. fulvicornis, N. lathubiana, N. panzer, N. ruficornis, N. rufipes, N. stigma), 3 – West Palaearctic (Anthophora plumipes, Bombus lapidarius, B. sylvarum, Nomada fucata, N. fabriciana, N. flavopicta, N. goodeniana, N. integra),
The results in Table 2 show that the most numerous are the summer species (20 species – 64.5%), while the late spring species constitute no more than 29% of the Megachilidae inhabiting the Meckmierz, and the early spring species are rarest (2 species – nearly 6.5%).

The results in Table 3 show that the most numerous are the summer species (20 species – 64.5%, while the late spring species constitute no more than 29% of the Megachilidae inhabiting the Meckmierz, and the early spring species are rarest (2 species – nearly 6.5%).

### VI. PHENOLOGICAL ANALYSIS

#### Megachilidae

Based on Dyblewska studies (Dyblewska 1987, 2000) the fauna of M egachilidae inhabiting the proposed nature reserve “Skarpa Wiślana” belong to three phenological groups. The first group, early spring species (Osmia bicolor, O. bicornis), appear when the average daily temperature reaches at least 8°C and the temperature in sun is at least 21°C. The second group, late spring species (Chelostoma florissime, C. rapunculi, Hoplitis adunca, Megachile versicolor, Osmia aurulenta, O. leaiana, O. caeruleascens, O. cerinithis, Stelis ornata), appear when the average daily temperature is at least 10°C. The third group, summer species (Anthidiellum strigatum, Anthidium manicatum, A. oblongatum, A. punctatum, Coelioxys mandibularis, C. quadridentata, Heriades crenulatus, H. truncorum, Hoplitis claviventris, H. leucome- lana, H. papaveris, Megachile centuncularis, M. circumcincta, M. genitalis, M. ligniseca, M. maritima, Osmia niveata, O. spinulosa, Stelis odontopyga, Trachusa byssina), appear at an average daily temperature exceeding 15°C. The frequency distribution of the phenological groups is presented in Table 3.

<table>
<thead>
<tr>
<th>Phenological group</th>
<th>Number of species</th>
<th>Share in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early spring species</td>
<td>2</td>
<td>6.45</td>
</tr>
<tr>
<td>Late spring species</td>
<td>9</td>
<td>29.03</td>
</tr>
<tr>
<td>Summer species</td>
<td>20</td>
<td>64.52</td>
</tr>
</tbody>
</table>

In the fauna of Apidae of the proposed nature reserve “Skarpa Wiślana” three phenological groups are present as well. The groups include the following species: early spring species – Anthophora plumipes, Melicta lactuosa, Nomada bifasciata, N. fabriciana, N. ferruginata, N. flava, N. flavoguttata, N. fucata, N. fulvicorins, N. goodeniana, N. lathburiana, N. marshamella, N. panzeri, N. ruficornis, N. signata, N. zonata; late spring species – Anthophora estivalis, Ceratina cyanea, Eucera longicornis, E. interrupta, Nomada integra, N. moeschleri, N. stigma; summer species – Epeoloides coecutiens, Epeolus variegatus, Nomada armata, N. flavopicta, N. rufipes, Tetralonia salicariae, T. malvae. Wild bees of the genus Bombus are social insects (or their parasites) with several generations during the whole season from March to September or October, so they were excluded from our phenological analysis. The frequency distribution of the phenological groups is shown in Table 4.

The results in Table 4 indicate that the most numerous group includes the early spring species (16 species – 53.34%), while the remaining ones are less numerous (both 7 species – 23.33%).

In the study area, we recorded 74 species of wild, long-tongued bees (31 of Megachilidae and 43 of Apidae). This constitutes 35% of the fauna of long-tongued bees in Poland. A mong of the long-tongued species of the proposed reserve “Skarpa
Wiślana”, twelve species are included in the “Polish Red List of Threatened and Endangered Animals” (GLOWACIŃSKI 2002), three of them are vulnerable: Anthidium oblongatum, Hoplitis papaveris, Osmia cerinthidis. All of the recorded species are listed on the IUCN Red List of Bees (NIETO et al. 2014). Despite 6 years of research, we did not find Eucera nigrescens – a species that occurred in this area in the 80’s of the last century (given as Eucera tuberculata Fabricius, 1793) (RUSZKOWSKI et al. 1994) – a rare species in Poland (BANASZAK 2000a).

The species diversity of long-tongued wild bees in the proposed reserve “Skarpa Wiślana” can be compared with research conducted in similar habitats. In the research conducted in the reserves of xerothermic vegetation of the Nadnidzianiski Landscape Park (BAK-BADOWSKA 2012a, 2012c), 62 species of long-tongued bees were recorded, also BANASZAK (2003) from the “Góry Pieprzowe” reserve, lists fewer species – 64. BANASZAK et al. (2006) recorded 99 species of long-tongued bees (43 Megachilidae and 56 Apidae) in the xerothermic swards of the lower Vistula valley, however, the research area was much larger and included 17 locations. Individually analyzed, the number of long-tongued bee species found in particular sites ranged from 2 to 55. This includes the intensively studied xerothermic plant community reserve „Zbocza Płutowskie” (BANASZAK 1975, 1980, BANASZAK & CIERZNIK 1994, BANASZAK et al. 2006; PAVLIKOWSKI & KOWALEWSKA 1998), which is an important refuge for the migration of bees, where 41 species of long-tongued bees were found. Comparable in terms of area, the xerothermic plant reserve „Góra Gipsowa” (8.65 ha) near Kietrz recorded only 45 species belonging to the families Megachilidae and Apidae (BANASZAK et al. 2017). Taking into account the above data, as well as how small the area of research was (ap. 10 ha), the number of recorded species in the proposed nature reserve “Skarpa Wiślana” should be considered to be very high indeed.

Considering the phenology of bees, among the Megachilidae, summer species predominated in the studied habitat (64.52%), whereas among the Apidae, the most numerous group was the early spring species (53.34%). The high share of summer species among Megachilidae in xerothermic habitats showed i.a. BANASZAK (2003) in the reserve „Góry Pieprzowe” – 70.1%; BANASZAK et al. (2006) in the xerothermic swards of the lower Vistula valley – 72.1% and BANASZAK et al. (2017) in the reserve „Góra Gipsowa” – 76.2%. A large portion of the early spring species of Apidae in “Skarpa Wiślana” (53.34%) is made up of the large number of species from the genus Nomada. A similar relation was recorded in other xerothermic habitats (BANASZAK et al. 2006, 2017).

Considering the total number of species, a large number of which are rare and /or endangered species of bees, as well as data on the occurrence of endangered butterfly species in the study area i.a. Chazara briseis (LINNAEUS, 1764) Chelis maculosa (GERNING, 1780), Colias myrmidon (ESPER, 1780), Scollitantides orion (PALLAS, 1771) (BUSZKO 1997, PALKA 1990), the location „Skarpa Wiślana” should be protected as a nature reserve and kept secure against excessive human incursion. At the site in Męczmierz, protective measures should be continued consisting of counteracting plant succession and the fragmentation of xerothermic communities.

Table 4
Numerical and percentage frequency of phenological groups in the fauna of Apidae of the proposed nature reserve “Skarpa Wiślana”

<table>
<thead>
<tr>
<th>Phenological group</th>
<th>Number of species</th>
<th>Share in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early spring species</td>
<td>16</td>
<td>53.34</td>
</tr>
<tr>
<td>Late spring species</td>
<td>7</td>
<td>23.33</td>
</tr>
<tr>
<td>Summer species</td>
<td>7</td>
<td>23.33</td>
</tr>
</tbody>
</table>

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Long-tongued bees in proposed nature reserve


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