

Ophrys apifera Huds. (Orchidaceae), a new orchid species to the flora of Poland

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Abstract: The paper provides data on the first locality of *Ophrys apifera* Huds. s. str. in Poland. Information about its geographical distribution and ecological features is given. A newly discovered population, found in a worked-out dolomite quarry near Imielin (Silesian Upland), is described and illustrated, as also, *O. apifera* is compared with *O. insectifera* L.

Key words: Orchidaceae, *Ophrys apifera*, orchid species, distribution, Poland

1. Introduction

The genus *Ophrys* L. is a monophyletic group (Soliva *et al.* 2001), placed in the family Orchidaceae Juss., subfamily Orchidoideae Lindl., tribe Orchideae Verm., subtribe Orchidinae Verm. (Dressler 1993). The taxonomy of *Ophrys* was discussed by Devey *et al.* 2008 and Soliva *et al.* 2001. This genus comprises from 20 to 200 species dependent on a systematic approach (Nelson 1962; Delforge 2005).

Hitherto, in Poland only the occurrence of one species of this genus was recorded – *O. insectifera* L. (Mirek *et al.* 2002) – in the small number of localities in southern part of the country, situated beyond the compact range of the species (Kaźmierczakowa & Zarzycki 2001; Zajac & Zajac 2001). In the summer of 2010, during field investigations in a worked-out dolomite quarry near Imielin, the first locality of *Ophrys apifera* Huds. in Poland was found.

The aim of this study is to document the findings and preliminary description of a previously unknown population and locality. General knowledge about the taxonomy, morphology, biology, distribution and ecology of the species was also presented.

2. Classification and morphology

Ophrys apifera Huds belongs to the complex: *Ophrys fuciflora*, and section: *Euophrys* Delforge

(2005). The name of genus (from Greek “ophrys”, ang. Lash) is most probably connected with ciliated labellum occurring in majority of species of this genus (Piękoś-Mirkowa & Mirek 2003). The species name is derived from the Latin words: “apis” (=bee) and “fero” (=to carry). According to Soó (1980), the plant grows to 20-50(70 cm) with two ovate tubers. The stem has 1-2 basal leaves, 2-4 rosette leaves and 4-7 leaves growing above. Lanceolate leaves of 6-13 cm and 1.5-2.8 cm wide. Coloured flowers, in number of 3-10(-17) in long inflorescence. The number and vigorousness of individuals as well as number of flowers in inflorescence are different in various habitats and very changeable year to year, dependent on weather conditions. Sepals of 11-17 mm and 5-9 mm wide, pink or red, ovate-lanceolate. Lateral petals of 2.5-7.0 mm, pink or greenish, hairy, truncate. Wide labellum of 9-14 mm, without spur, profoundly tree-lobed with brown medium marking, at the front part strongly protuberant with bent tip, haired margin and large downward lanceolate or trapezoid 3 mm appendix with medium tip. “Mirror” encompassing basal field (frequently protruding forward or sideward) brown with white margin. Tubers at the bottom of strongly downward, densely haired lateral lobes. The base of labellum with two yellow basal nodes with dark tips, at the margin marked with two red staminoidal points. The gynostemium with bent connectivum 2-3 mm. Number of chromosomes $2n=36$ (Bianco *et al.* 1987).



Fig. 1. *Ophrys apifera* Huds. – locality in the worked-out dolomite quarry near Imielin (29.06.2010, photograph by M. Kręciała)



Fig. 2. *Ophrys insectifera* L. – locality in Kalina Lisiniec (23.05.2008, photograph by M. Kręciała)

Ophrys apifera in contradistinction to *O. insectifera* is characterized by: lip with a tooth-like appendage at the apex, speculum H-shaped or shield- or W-shaped, violet-purple with a pale green margin, sometimes indistinct, anther-connective pointed (Figs. 1-2).

3. Biology

Ophrys apifera is perennial and geophyte. Early stages of ontogenesis in this species were studied in the middle of the 19th century (Fabre 1857). Seed germination occurs in March. In the same period, weakly differentiated protocorms with rhizoids appear in soil. First aerial green leaf is formed 2 years after seed germination and the plant starts flowering in the age of 9-11 years (May and June) (Ziegenspeck 1936; Summerhayes 1951). A fruit contains about 10,000 seeds. In favourable seasons, vegetative reproduction may occur, if 2 daughter tuberoids are formed (Lang 1980). In natural conditions *O. apifera* forms mycorrhiza intensively (Rasmussen 1995).

O. apifera may flower only once in their lifetime (which explains their erratic appearance in large numbers some years and disappearance in others). Biology of pollination of this species is subject of many long-term studies. Since flowers of *O. apifera* are similar to females of *Aculeata* of the *Andrena* genus (Szafer 1969), it was believed that zoogamy occurs likewise in other species of the *Ophrys* genus. Kullenberg (1961) observed, how various male insects of the genus *Eucera* and *Tetralonia* were attracted to the flower and attempted copulation. Darwin (1877) was the first to report that *O. apifera* is self-pollinating. Claessens & Kleynen (2002) showed that insects do not play any role in the process of pollination – the species is an almost obligate autogam. According to Kullenberg & Bergström (2008), pollination in *O. apifera* can be realized in two ways – with participation of males of *Eucera* or autogamically.

Occasional hybrids with other *Ophrys* species, among others, hybrid with *O. insectifera* – *O. ×pietzschii* Kämpel ex F. J. Rumsey & H. J. Crouch – known,

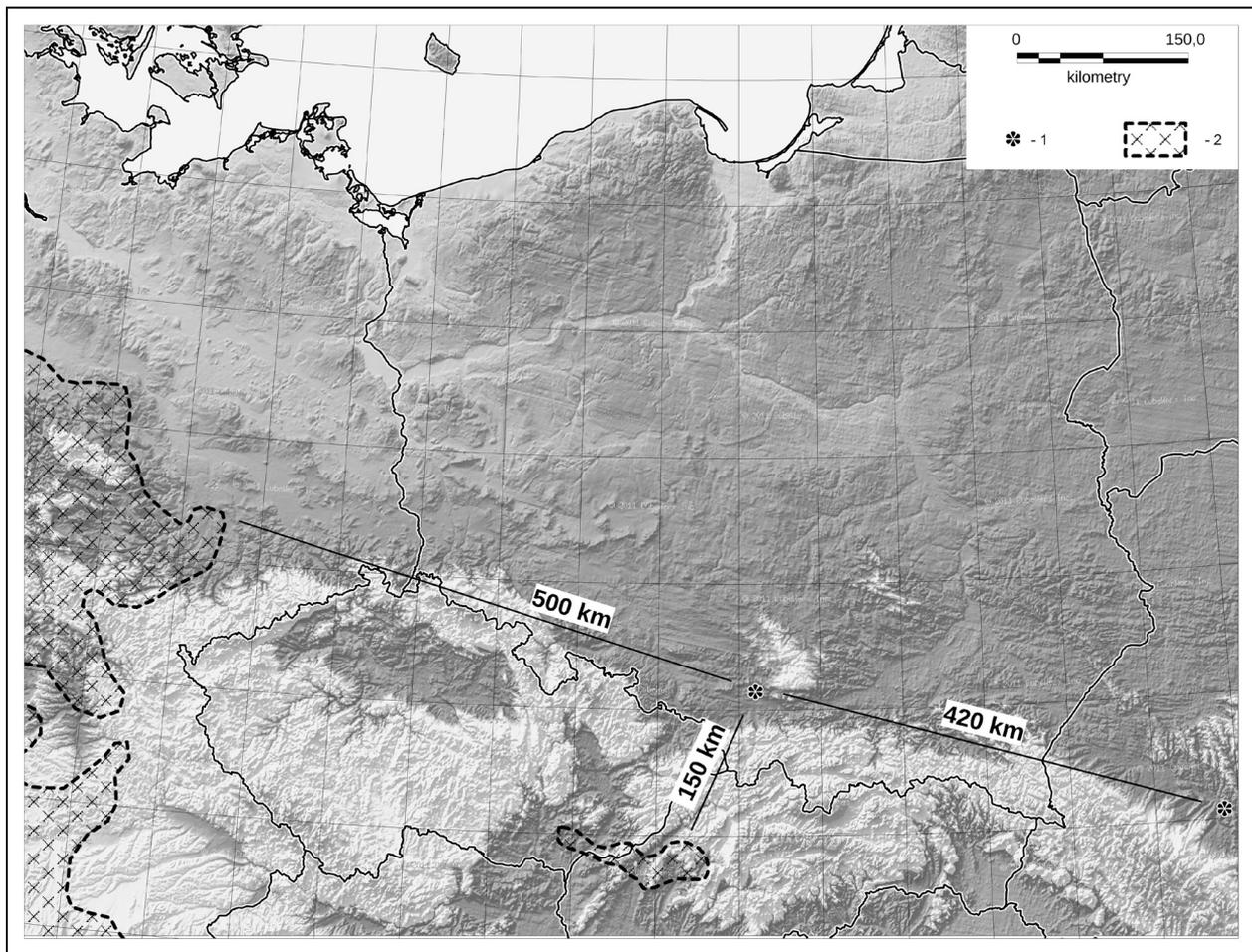


Fig. 3. Distribution of *Ophrys apifera* Huds. in Central Europe

Explanations: 1 – localities of *Ophrys apifera* Huds. in Poland and Ukraine (Danylyk & Borsukevych 2011), 2 – range of *Ophrys apifera* Huds. in Germany (Kretzschmar 2014), Czech and Slovakia (Čeřovský *et al.* 1999)

e.g., from natural localities in England, France and Germany (Willis 1980; Rumsey *et al.* 2012), may be due to insect visitors removing excess pollen from already-fertilized flowers (Turner Ettliger 1998). The species reproduces by seeds and vegetatively (Lang 1980).

4. General distribution and habitat conditions

It is one of the most successful *Ophrys* species as proves its large distribution area (Soliva *et al.* 2001). This species is an Euromediterranean geoelement. It is comparatively widely distributed in Europe – in western part of Europe with oceanic climate, it ranges to the north (south of the Scandinavian Peninsula and England) (Buttler 2000; Vakhrameeva *et al.* 2008; Gardiner & Vaughan 2009; Turner Ettliger 1998). Its areal reaches east to the Caucasus Mts. and south to North Africa. Hitherto, localities situated nearest the borders of Poland were found in the Czech Republic, Slovakia (ca 150 km away) and Germany (ca 500 km) (Fig. 3). This species also occurs in Ukraine – in the Crimean

peninsula and Ivano-Frankivsk Region (Danylyk & Borsukevych described this locality in 2011).

It inhabits areas from light to shady, from dry to moist meadows or open forests, up to 1800 m alt. (Vakhrameeva *et al.* 2008). High concentration of flavonoids in the sepals and labellum, possibly indicates the necessity for stronger UV-B protection. The above feature could be attributed to the adaptation of *O. apifera* to higher altitudes (up to 1800 m a. s. l.) compared with the other *Ophrys* species (Karioti *et al.* 2008).

This orchid is more commonly recorded on soils with a high pH (7) (Gardiner & Vaughan 2009). It is a pioneer species and among the first to appear on disturbed sites (Wells & Cox 1991). In recent years, information about the appearance of *O. apifera* in secondary and urban locations in Western Europe (such as: brown coal opencast mines areas, former mine waste dumps, inactive landfills of debris, worked-out quarries, and also urban green spaces – lawns, cemeteries, parks and gardens) became more common (Hammel 2008; Heinrich & Dietrich 2008).

The species grows usually in small groups of 1-3 (max 5) individuals, contrary to *O. insectifera*, which populations can be estimated at several dozens of individuals (Kaźmierczakowa & Zarzycki 2001; Vakhrameeva *et al.* 2008).

5. Material and methods

As a part of our field studies of aphidofauna of semi-natural dry grasslands in Poland, conducted in May-August 2010, we visited several locations in the area of Imielin and Jaworzno and discovered population of *O. apifera* in one of them. Next, we conducted some other field investigations in the surrounding area, but we found no other populations of *O. apifera*. Plants were photographed and their positions noted and mapped.

The herbal material, i.e., a flower, was delivered to the Herbarium of Department of Plant Systematics of Silesian University. The detailed geographical coordinates of the locality were delivered to the Editorial Board of “Biodiversity: Research and Conservation” and are stored in the database of *Upper Silesian Nature Heritage Center*.

6. Results

In the summer of 2010, the first locality of *Ophrys apifera* Huds. in Poland has been found (ATPOL: DF54) during the field investigations in the worked-out dolomite quarry near Imielin. According to the physical-geographical division by Kondracki (2009), this area is

included in the macroregion *Silesian Upland* (341.1) and mesoregion *Jaworznicke Hills* (341.14).

A single flowering individual of *O. apifera* (Fig. 1) was found in the direct vicinity of the path along the edge of the quarry. The inflorescence contained 4 flowers: 1 well-developed, two faded flowers and 1 flower bud. Unfortunately, despite further investigations, no other individuals were noted. The locality has been constantly monitored, however, no *O. apifera* individuals were found during the research conducted in 2011, 2012 and 2013.

The locality of *O. apifera* is located on the south-facing slope built by the dolomites of Medium Triassic period at 290 m a. s. l. It is covered by calcareous grassland in the phase of succession of overgrowing an exploitation hollow on rendzina (Fig. 4). The community is mainly built by: *Brachypodium pinnatum*, *Anthyllis vulneraria* and *Ononis spinosa*. These taxa are accompanied by not numerous individuals of: *Leontodon hispidus*, *Lotus corniculatus*, *Picris hieracioides*, *Sanguisorba minor* and *Silene otitis*, and single individuals of: *Artemisia campestris*, *Briza media*, *Calamagrostis epigejos*, *Campanula glomerata*, *Carlina acaulis*, *C. vulgaris*, *Centaurea scabiosa*, *C. stoebe*, *Coronilla varia*, *Echium vulgare*, *Galium mollugo*, *Gypsophila fastigiata*, *Hieracium piloselloides*, *Hypericum perforatum*, *Linum catharticum*, *Medicago* × *varia*, *Peucedanum oreoselinum*, *Scabiosa ochroleuca*, *Thesium linophyllum* and *Thymus pulegioides*. Intensive encroachment of *Betula pendula* and *Pinus sylvestris*, as well as seedlings of *Aesculum hippocastanum*, *Fraxinus excelsior* and *Quercus rubra* were observed.



Fig. 4. Locality of *Ophrys apifera* Huds – the worked-out quarry near Imielin (29.06.2010, photograph by M. Kręciała)

7. Discussion

The first locality of *O. apifera* in Poland is located beyond the compact range of this species. It is probably the most northeastern locality in Central Europe. Also, in 2010, *O. apifera* has been observed in Ukraine, for the first time outside the only sites so far known, grouped in the Crimean peninsula (Danylyk & Borsukevych 2011). Such information, as well as the appearance of this species in the secondary and urban locations in Western Europe (Heinrich & Dietrich 2008), may also indicate the increase of its range.

A characteristic feature of the *Ophrys* species, essential for their spread, is a production of the large number of small-sized seeds (Devey *et al.* 2008). The increase in range of *Ophrys apifera* and other species of this genus can be determined by climate changes (Houghton *et al.* 2001) in last decades, which might be reflected by, among others, strong winds. Based on the data from the meteorological station in Sosnowiec, it could be suspected that this species arrived to Poland from the south through the Moravian Gate. Only genetic studies comparing individuals occurring in Poland with the Czech population of this species may confirm this hypothesis.

O. apifera is an autogamous species and therefore it can become naturalized in Poland. However, it can grow only in specific habitats, similar to those occurring within its compact range or analogous for newly opened postglacial areas (Devey *et al.* 2008). Also, it can occur in some anthropogenic locations, like in Western Europe. On the other hand, autogamy may cause threat to this species through limitation of genetic diversity of its populations or displacement by congeneric hybrids. The genus *Ophrys* is a relatively young group, in which genetic and behavioral barriers did not fully developed. It should be also noted that many species of *Ophrys* prefer 'man-made' (anthropogenic) and 'man-maintained' (anthropostatic) biotopes (Devey *et al.* 2008). In Poland, *O. apifera* is reported from a worked-out quarry – man-made environment, which may be treated as a freshly uncovered post-glacial site, while *O. insectifera* occurs in xerothermic grasslands – anthropostatic environment, which was formed or is maintained owing to man for relatively long time.

Based on the analysis of distribution of species from the genus *Ophrys* in the territory of Poland, it can be concluded that individual populations of *O. insectifera* are well-isolated and the chance of hybridization with *O. apifera* (Willis 1980; Vakhrameeva *et al.* 2008; Rumsey *et al.* 2012) is currently insignificant. Under these circumstances, it is necessary to monitor both a new locality of *O. apifera* and known localities of *O. insectifera*, as well to search for further localities of these species.

The *Ophrys apifera* has been included in the CITES Convention (Appendix II) as an endangered species which is – or may become – the object of trade. In the area of Carpathians Mts, the species is considered as threatened (Category EN – endangered). It is also under legal protection in the Czech Republic, Slovakia and Hungary (Witkowski *et al.* 2003). Moreover, it is mentioned in the Red Books of Czech Republic and Slovakia (category CR – critically endangered) (Čeřovský *et al.* 1999) and the Red Book of Ukraine – category endangered (Didukh 2009).

The described site of *O. apifera* is situated in the unprotected area. Therefore, we suggest that the species category of threat should be CR – critically endangered. Thus, it seems sensible to include it in the *List of the protected plants in Poland*. Moreover, due to the occurrence of well-developed dry calcareous grasslands with rare and protected plants in the studied locality, it is suggested to recognize the whole area as a protection-landscape area. Also, it seems necessary to use conservation management practices consisting in removal of pines and birches (such treatment was conducted in the summer of 2012 and 2013). As study by Gardiner & Vaughan (2009) shows, *O. apifera* responds well to the disturbance of the soil. Their observations suggests that the combination of scrub clearance followed up by a small-scale soil disturbance enhanced the establishment of this orchid in the calcareous grassland.

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