

Original Article

DISPERSION OF BUMBLEBEE *BOMBUS SEMENOVIELLUS* SKORIKOV (HYMENOPTERA, APIDAE) IN POLAND

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Abstract

The aim of the study is to present all distribution sites of *Bombus semenoviellus* in Poland reported between 1988 and 2019. The increase of species dispersion was concluded, especially in the central part of the country, as well as the occurrence in the high Karkonosze and Tatry mountains. This is likely the effect of progressing climate change, as well as the increase in climate continentalism in Europe. Differences between summer and winter temperatures favour the spread of this Siberian bumblebee species throughout the continent. Many specimens were found on plants originating from its central and west Asia. Those plants also occur in eastern and central Europe which could have helped this bumblebee spread west throughout Europe. *B. semenoviellus* will increase its range towards Western Europe. Based on observations so far, it is not possible to determine its invasive features and increased competitiveness for food and nesting places in relation to other bumblebee species.

Keywords: Apidae, *Bombus semenoviellus*, dispersion, Poland

INTRODUCTION

Bombus semenoviellus is a medium-sized bumblebee with a short tongue. On its black hairy body there are three yellow stripes, two on the thorax and one on the first segment of the abdomen. The tip of the abdomen has white hairs. In addition, there are yellow hairs on the head and legs (Fig. 1). In males there is a larger admixture of yellow hairs on the body and also on the head. Hairs are uneven and puffy.

B. semenoviellus is widespread in the Palaearctic region (Williams, 1998) distributed in eastern and western Europe, from 48° (south) to 64° latitude, from western Germany to central Siberia. This species occurs mainly in Russia as a typical taiga bumblebee characteristic for birch forests (Skorikov, 1922). In Poland, it is known to be in dispersed locations but most often

has been recorded in the central and northern parts of the country (Pawlikowski, 2008). Even though this short-tongued bumblebee prefers mid-forest meadows and forests, subsequent observations show that the bumblebee during its expansion to the west has begun to occupy heaths, swamps, anthropogenic habitats and gardens (Sima & Smetana, 2012).

Not much is known about *B. semenoviellus* biology, nesting sites or family size. Its brood cuckoo bumblebee parasite is unrecognized. Seasonal activity lasts probably from May to August (Pawlikowski, 2008). In the European Red List of Bees it has been given the status of least concern (LC) and in Poland has the status of a semi-protected species (Pawlikowski & Pawlikowski, 2012; Nieto et al., 2014).

It is a polylectic species that most often visits flowers of *Trifolium pratense* L., *Hieracium*

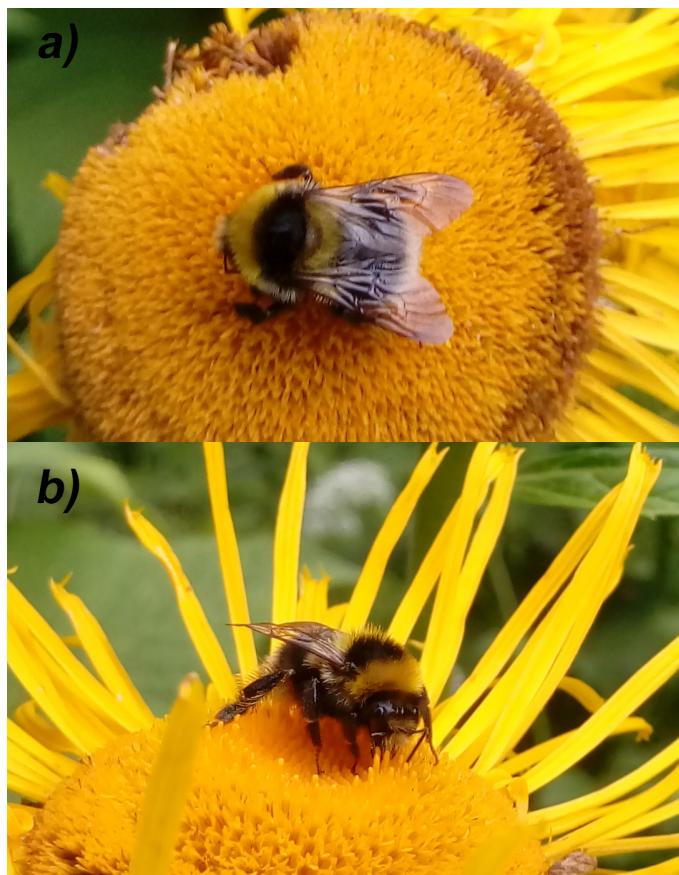


Fig. 1. Bumblebee *Bombus semenoviellus* Skorikov feeding on *Telekia speciosa* (Schreb.) Baumg. a) top view b) front view; Bukowiec 24 VI 2018; photo P. Michołap.

murorum C.B.Clarke, *Inula* spp., *Primula* spp., *Carduus* spp., *Tanacetum vulgare* L., *Cirsium* spp., *Taraxacum officinale* (L.) Weber ex F.H.Wigg., *Knautia arvensis* (L.) Coul., *Solidago* spp., *Hypochoeris radicata* Cabrera, *Centaurea* spp., *Acer platanoides* L., *Anchusa officinalis* L., *Vicia* spp., *Ranunculus* spp., *Cota tinctoria* (L.) J.Gay, *Epilobium angustifolium* L., *Helianthus annuus* L., *Rubus* spp., *Angelica sylvestris* L., *Geranium palustre* L., *Valeriana officinalis* L., *Thymus serpyllum* L., *Jasione montana* L., *Veronica longifolia* L. (Ruszkowski, 1998; Šima & Smetana, 2012). All plant species visited by this bumblebee have saucer-shaped or globular flowers with easily accessible nectaries.

The aim of the study is to present the current distribution of *B. semenoviellus* in Poland and an effort to identify conducive factors for the dispersion of the species.

MATERIAL AND METHODS

Our survey was based on specimens observed in

the 20th and 21st centuries in Poland. We compiled data from publications, internet databases and personal communications. Materials collected by Pawlikowski up to the year 2000 in "A Distribution Atlas of Bumblebees in Poland" (2008) were also developed and those by Rasmont et al. (2015) in Europe were also used. Observations were also made with the participation of numerous volunteers as a part of photographic monitoring of pollinating insects, organized on blogs belonging to the Biomonitoring Laboratory of Land Environment of the Nicolaus Copernicus University in Toruń and the Natura i Człowiek Association. The collected data were presented on a map including the UTM grid, while the chronology of the species observation was maintained.

In determining the species from the photographs, it was considered that the colour features of *Bombus semenoviellus* should not be confused with the common *B. hortorum*, or the less common *B. ruderatus* or *B. jonellus*. The first two species are long-tongued bumblebees

which visit flowers with long corolla, while the short-tongued *B. jonellus* does not have pale hairs on the face or on pollen baskets.

RESULTS

Records from the literature (Kosior & Płonka 2003; Banaszak, Ratyńska, & Banaszak, 2004; Banaszak et al., 2006; Banaszak & Motyka, 2007; Kosior et al., 2008; Kowalczyk & Kurzac, 2008; Pawlikowski, 2008; Banaszak & Jaroszewicz, 2009; Banaszak & Ratyńska, 2014; Banaszak, 2016; Banaszak & Ratyńska, 2016) Q=queen, W=worker, M=male, ex.=extend material:

Magdaleno [FE39] 20 VIII 1988 - 1 W, leg. A. Krzysztofiak
 Smolniki [FF21] 04 VIII 1991 - 1 W, leg. A. Krzysztofiak
 Bryzgiel [FE38] 09 VIII 1991 - 1 W, leg. A. Krzysztofiak
 Łódź-Łagiewniki [CC94] 04 VIII 1993 - 1 M, leg. J.K. Kowalczyk
 Dziekanów Leśny [DD80; DD90] 30 IV 1994 - 2 W feeding on *Taraxacum officinale* F. H. Wigg. and 1 M feeding on *Solidago virgaurea* L., leg. T. Plewka
 Kępa Kiełpińska [DD90] 07 VI 1994 - 4 W feeding on *Knautia arvensis* (L.) Coult., leg. T. Plewka
 Wiersze [DC79] 07 VIII 1994 - 4 W feeding on *Tanacetum vulgare* L., leg. T. Plewka
 Kamionka [FE39] 16 VIII 1994 - 2 W, leg. A. Krzysztofiak
 Miączynek [DD60] 26 VII 1995 - 3 W feeding on *Veronica spicata* L., leg. T. Plewka
 Kózki [EC69] 30 VII 1995 - 2 W feeding on *Lythrum salicaria* L., leg. T. Plewka
 Podsusze [EC69] 30 VII 1995 - 7 W feeding on *Polygonum bistorta* L., 1 W feeding on *Knautia arvensis* (L.) J. M. Coul. and 5 W feeding on *Centaurea jacea* L., leg. T. Plewka
 Kikoły [DD81] 03 VIII 1995 - 1 W feeding on *Allium angulosum* L., leg. T. Plewka
 Łąki Mariewskie [DC89] 08 VIII 1995 - 13 W, leg. T. Plewka
 Wólka Zaborowska [DC79] 08 VIII 1995 - 1 W and 1 M feeding on *Polygonum bistorta* L., leg. T. Plewka

Warszawa-Wilanów [EC08] 09 VIII 1995 - 3 M feeding on *Solidago gigantea* Aiton, leg. T. Plewka
 Darłowo-Darłówko [WA93] 12 VIII 1995 - 2 W feeding on *Hieracium umbellatum* L., leg. T. Pawlikowski
 Sutno [FC49] 18 VIII 1995 - 2 W feeding on *Trifolium repens* L., leg. T. Plewka
 Siemiatycze [FD21] 19 VIII 1995 - 8 M feeding on *Polygonum bistorta* L., leg. T. Plewka
 Lednica [XU62] 1996 - 3 ex., author's coll.
 Świerczynki [CD38] 20 VI 1997 - 1 W, leg. T. Barczak
 Gdańsk-Sobieszowo [CF52] 1997 - 1 W, leg. T. Plewka
 Dziekanów Leśny [DD80] 1997 - 1 W, leg. T. Plewka
 Grajewo [FE04] 1997 - 1 W, leg. T. Plewka
 Turtul [FF11] 09 VII 1997 - 1 W feeding on *Knautia arvensis* (L.) Coult., 10 W feeding on *Centaurea stoebe* L., leg. T. Pawlikowski
 Świerczynki [CD38] 28 VI 1998 - 2 W, leg. T. Barczak
 Chrystkowo [CE21] 27 VII 1998 - 1 W, leg. T. Barczak
 Skoców [CA41] 23 V 1999 - 1 W, leg. V. Soon
 Bydgoszcz-Fordon [CD19] 26 VII 1999 - 1 W, leg. Krieger
 Osinki [FE29] 04 VIII 1999 - 1 W, leg. A. Krzysztofiak
 Szurpiły [FF20] 10 VIII 1999 - 1 W feeding on *Trifolium pratense* L., leg. A. Krzysztofiak
 Czerwonka [FF30] 10 VIII 1999 - 1 W, leg. A. Krzysztofiak
 Wojponie [FF31] 10 VIII 1999 - 1 M, leg. A. Krzysztofiak
 Budzisko [FF31] 13 VIII 1999 - 1 W, leg. A. Krzysztofiak
 Puńsk [FF41] 14 VIII 1999 - 2 M feeding on *Lotus corniculatus* L., A. Krzysztofiak
 Szypliszki [FF31] 14 VIII 1999 - 3 W, A. Krzysztofiak
 Dzikowiec [XS10] 15 VIII 1999 - 1 W, leg. M. Tulski
 Szurpiły [FF20] 27 IV 2000 - 1 W feeding on *Taraxacum officinale* F. H. Wigg., leg. A. Krzysztofiak
 Krzywe [FE39] 05 VI 2000 - 2 W, leg. A. Krzysztofiak

Dzikowiec [XS10] 2000 - 52 W, leg. M. Tulski
Rogaczewo [XT27] 2000 - 2 W, leg. J. Banaszak
Kozielec Reserve [CE10] 2000-2002 - 5 ex.,
author's coll.
Nowe [CE54] 2002 - 1 ex., author's coll.
Waniewo [FD28] 2002 - 9 ex., author's coll.
Kurowo [FD18] 2002 - 1 ex., author's coll.
Tarnica [FV23] 2002 - 16 ex., author's coll.
Folusz Reserve Szubin [XU87] 2002 - 1 ex.,
author's coll.
Jamy Reserve [CE63] 2003 - 1 ex., author's coll.
Kraków [DA34] 2003 - 1 ex., author's coll.
Plichtów [DC04] 2004 - 1 ex., author's coll.
Krusze, Bielawy [DE70] 2004 - 1 ex., author's
coll.
Kruszyn Reserve [XU99] 2004 - 1 ex., author's
coll.
Białowieski National Park [FD94] 2005 - 3 ex.,
author's coll.
Lubostróń [XU96] 2006 - 1 ex., author's coll.
Turew [XT26] 2008 - 1 ex., author's coll.
Ustka Uroczysko [XA24] 2009 - 4 ex., author's
coll.
Posłonkowe Hill [XU61] 2013 - 1 ex., author's
coll.;

New records:

Miłachowo Reserve [XV43] 2001 - 1 ex., author's
coll., leg. J.K. Kowalczyk
Łódź [CC93] 2002 - 1 ex., author's coll., leg. J.K.
Kowalczyk
Kazimierówka [FF21] 2002 - 1 ex., author's coll.,
leg. E. Szałaszewicz
Rudniki [XV46] 2010 and 2011 - 1 ex., author's
coll., phot. J. Dąbrowski
Kościeliska Valley, Polana Pisana, Tatra
Mountains [DV15] 09 VIII 2018 - 1 W feeding on
Centaurea jacea L., leg. P. Michołap and A. Sikora
Bukowiec [WS53] 24 VI 2018 - 1 W feeding on
Telekia speciosa (Schreb.) Baumg., leg. P.
Michołap and A. Sikora
Kocioł Wielkiego Stawu, Giant Mountains [WS42]
17 VII 2019 - 1 W feeding on *Senecio ovatus*
Willd., leg. P. Michołap and A. Sikora
Dom Śląski, Giant Mountains [WS52] 17 VII 2019
- 1 W feeding on *Senecio ovatus* Willd., leg. P.
Michołap and A. Sikora
Śnieżka peak, Giant Mountains [WS52] 18 VII

2019 - 1 W feeding on *Solidago virgaurea* subsp.
alpestris (Waldst. & Kit. ex Willd.) Rchb., leg. P.
Michołap and A. Sikora;

DISCUSSION

Bumblebees most often occur in temperate
and cold climate regions and in mountainous
areas (Williams, 1998), which are the most
exposed to climate change. Climate warming is
predicted to reduce the ranges of occurrence
of most bumblebee species and to change the
structure of their functioning (Rasmont et al.,
2015) including access to host plants (Memmott
et al., 2007). On the other hand, the expansion
of some bumblebee species into new areas
has been observed (MacDonald, 2001). Data
on distribution and occurrence in new habitats
can lead to important conclusions about the
ecological plasticity of bumblebees and the possi-
bilities of adaptation in the context of ongoing
changes.

Despite all scenarios showing that the area
of this species' occurrence is decreasing due
to global warming (Rasmont et al., 2015),
B. semenoviellus has been confirmed to be
increasing its range in Finland in the 1960s
(Elfving, 1965), in Lithuania (Monsevičius, 1993)
and in Poland in the 1980s (Pawlakowski, 2008).
Currently, it is probably dispersed throughout
the whole country but is rarely found (Banaszak,
2006; Banaszak et al., 2006; Kosior et al.,
2008; Pawlikowski, 2008; Banaszak, 2009;
Pawlakowski & Pawlikowski, 2012). Its presence
has also been confirmed in Germany (Smissen
& Rasmont, 2000), Czech Republic (Přidal &
Tkalců, 2003), Austria (Streinzer, 2010) and
Slovakia (Šima & Smetana, 2012). In Ukraine
it has been confirmed only in the 21st century
but probably appeared there much earlier
(Konovalova, 2002, 2007). In 2013 it was also
recorded in Norway (Ødegaard et al., 2015), and
in 2017 in Sweden (Cederberg & Holmström,
2018). Recently, the species has spread further
westward towards France and the Benelux
countries, as well as in the northern part of the
Scandinavian peninsula up to the Arctic Circle
(GBIF Secretariat, 2017). Now Hesse, Germany

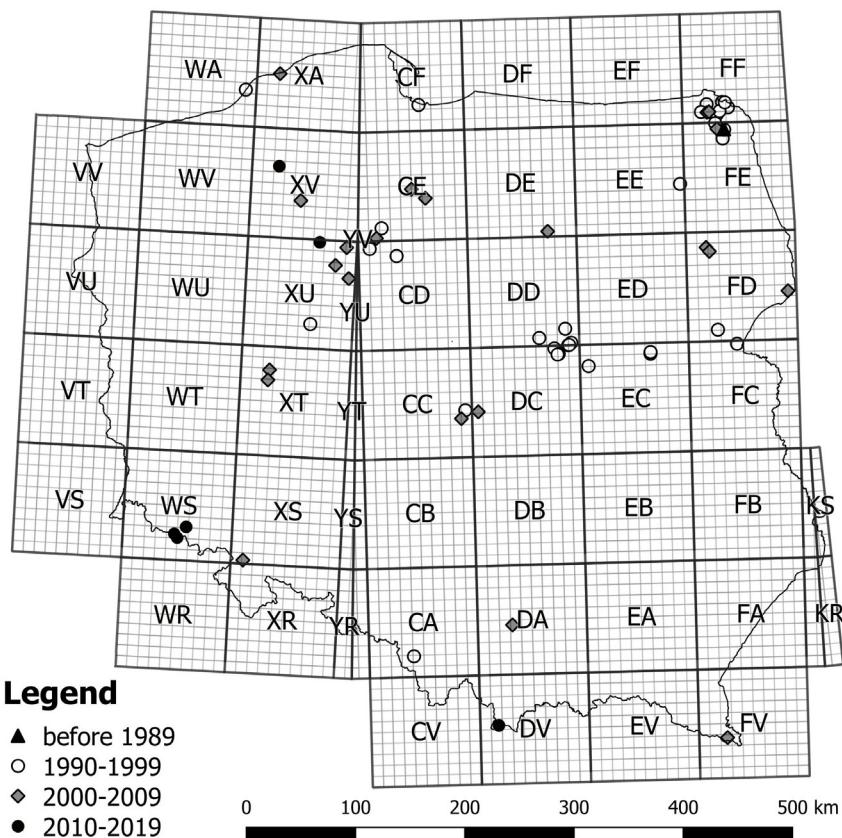
Fig. 2. Current dispersion of bumblebee *Bombus semenoviellus* Skorikov in Poland.

Table 1.
Food plants of bumblebee *Bombus semenoviellus* Skorikov in Poland

Species	n	%	Place of origin
<i>Polygonum bistorta</i>	16	24.62	Eurasia
<i>Centaurea stoebe</i>	10	15.38	Central Europe
<i>Centaurea jacea</i>	6	9.23	Eurasia
<i>Knautia arvensis</i>	6	9.23	Eurasia
<i>Tanacetum vulgare</i>	4	6.15	Eurasia
<i>Solidago gigantea</i>	3	4.61	North America
<i>Taraxacum officinale</i>	3	4.61	Eurasia
<i>Veronica spicata</i>	3	4.61	Eurasia
<i>Hieracium umbellatum</i>	2	3.08	Eurasia
<i>Lotus corniculatus</i>	2	3.08	Eurasia
<i>Lythrum salicaria</i>	2	3.08	Eurasia
<i>Senecio ovatus</i>	2	3.08	Central Europe
<i>Trifolium repens</i>	2	3.08	Eurasia
<i>Allium angulosum</i>	1	1.54	Eurasia
<i>Solidago virgaurea</i>	1	1.54	Eurasia
<i>Telekia speciosa</i>	1	1.54	West Asia
<i>Trifolium pratense</i>	1	1.54	Eurasia
Σ	65	100	

is the most western locality of its entire range (Frommer, 2018).

Current reports from Poland indicate new locations and their dispersal, especially in the central part of the country (Fig. 2). A 2018 report from the Polish part of the Tatra Mountains, at an altitude of 1050 m a.s.l., and 2019 from Mt. Śnieżka of the Giant Mountains at a maximum altitude of 1603 m a.s.l. indicate the existence of suitable habitats in high mountains, which can be argued because of climate change. This species could have appeared earlier in the Polish Tatras and then spread to the Slovakian side, where it was recorded in 2011 (Šima & Smetana, 2012). Such an expansion in the high mountains demonstrates the ecological plasticity of the species.

The increase of continentalism in Europe is also likely to affect the current status of the species expansiveness. Three species of bumblebees from the Siberian parts of Eurasia: *B. hypnorum*, *B. schrencki* and *B. semenoviellus* are now increasing their prevalence in the west (Rasmont et al., 2015). High differences between temperatures in summer and winter favour those Siberian species. Also of interest, many specimens of *B. semenoviellus* have been found on plants originating from its native central and west Asia. Those plants also occurring in eastern and central Europe could have helped this bumblebee spread west throughout Europe (Tab. 1).

It is possible that this species will further increase its distribution range towards Western Europe. Based on the observations made so far, it is not possible to determine its invasive features and increased competitiveness for food and nesting places in relation to other bumblebee species. However, *B. semenoviellus* expansion should still be monitored, and the knowledge about its life needs should be gradually supplemented.

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