Евразиатский энтомол. журнал 13(3): 290–294

Contribution to the fauna of bumble bees (Hymenoptera, Apidae: *Bombus* Latreille, 1802) of the Republic of Tyva, Eastern Siberia

К фауне шмелей (Hymenoptera, Apidae: *Bombus* Latreille, 1802) Республики Тыва, Восточная Сибирь

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***Key words*:** Apoidea, Apiformes, Palaearctic region, biodiversity, new records.
***Ключевые слова*:** Apoidea, Apiformes, Палеарктика, биоразнообразие, новые находки.

Abstract. An annotated list of 27 species of bumble bees collected in Republic of Tyva (Tuva) in 2013 is given. The list of the bumble bee species of Tuva is increased up to 33 species. Ten species, *Bombus amurensis* Radoszkowski, *B. barbutellus* (Kirby), *B. bohemicus* Seidl, *B. campestris* Dahlbom, *B. cryptarum* (Fabricius), *B. distinguendus* Morawitz, *B. margreiteri* Skorikov, *B. pseudobaicalensis* Vogt, *B. sporadicus* Nylander, and *B. veteranus* (Fabricius) are newly recorded from Tuva. Diversity of bumble bees in Tuva and Siberia are discussed.

Резюме. Приведён аннотированный список 27 видов шмелей, собранных в Республике Тыва (Тува) в 2013 г. Общий список шмелей Тувы увеличен до 33 видов. Десять видов: *Bombus amurensis* Radoszkowski, *B. barbutellus* (Kirby), *B. bohemicus* Seidl, *B. campestris* Dahlbom, *B. cryptarum* (Fabricius), *B. distinguendus* Morawitz, *B. margreiteri* Skorikov, *B. pseudobaicalensis* Vogt, *B. sporadicus* Nylander и *B. veteranus* (Fabricius) впервые указываются для фауны Тувы. Обсуждаются особенности разнообразия шмелей в Туве и Сибири.

Introduction

Bumble bees number about 250 species worldwide, and are placed in a single genus *Bombus* Latreille, 1802 with 15 subgenera [Williams et al., 2008]. They are important pollinator of many vascular plants, especially in temperate and northern areas.

The bumble bees of the Eastern Siberia currently in the focus of the research. There are lists of the species of Yakutia [Davydova, Pesenko, 2002], Transbaikalia [Proshchalykin, Kupianskaya, 2009], Khakassia [Kupianskaya et al., 2013] and Krasnoyarsk Territory [Byvaltsev et al., in litt.]. There is one paper on bumble bees of central and eastern areas of Tuva [Panfilov et al., 1961] where 24 species (currently 23) are listed. The subsequent records of bumble bee species of Tuva [Tkalcù, 1967; Panfilov, 1982, 1984; Byvaltsev, 2011; Levchenko, 2012] were based on this paper only.

Republic of Tyva (Tuva) borders northwestern Mongolia and occupies the basin of the upper Yenisey River. The length of the republic territory from north to south is 450 km, from west to east — 700 km, land area — 170.427 sq. km. Its relief consists of two broad basins, the Tuva and Todzha, drained by two main tributaries of the Yenisey River. High mountain ranges, including the Eastern Sayan and Western Sayan mountains to the north, enclose the basins. A continuous series of ranges also enclose the republic on the west, south, and southeast: the Altai, Tannu-Ola, and Sangilen mountains. The highest point is Mongun-Taiga (3976 m) in the extreme southwest. The climate is generally of the dry, sharply continental type, with severe winters and warm summers. Vegetation ranges from dry steppe in the basins to dense coniferous forests to alpine meadows that are succeeded by bare rock and snow at the highest elevations [Srednyaya Sibir', 1964].

This paper based on the material collected by M.Yu. Proshchalykin and V.M. Loktionov in 2013 in nine sites of South-Eastern Tuva (Fig. 1): **I** — Tore-Khol Lake, (50°04,696' N, 95°08,675' E); **II** — 25 km SE Erzin, Tes-Khem River (50°04,788' N, 95°21,179' E); **III** — 13 km SW Samagaltai, Dyttyg-Khem River (50°31,130' N, 94°53,199' E); **IV** — 12 km NEE Samagaltai, Kaldak-Khamar Pass (50°37,141' N, 95°10,135' E); **V** — Shuurmak, Shuurmak River (50°38,199' N, 95°19,315' E); **VI** — 18 km E Kyzyl, Malyi Enisey River (51°42,429' N, 94°41,557' E); **VII** — 16 km N Boyarovka (51°40,677' N, 95°22,556' E); **VIII** — Tardam (51°42,728' N, 95°19,580' E); **IX** — Ubsu-Nur Lake (50°38,567' N, 93°02,639' E). Totally 481 specimens have been studied. All materials are deposited in the collection of the Institute of Biology and Soil Science, Vladivostok, Russia (IBSS). New distribution records for the region are asterisked (*).

The subgeneric classification follows Williams et al. [2008]; the synonymy of species follows Williams [1998] and Williams et al. [2011], except *Bombus saltuarius* Skorikov, 1922, which is regarded as separate species. The general distribution the bumble bees follows the last papers [Polaszek, 2004; Byvaltsev, 2008; Proshchalykin, Kupianskaya, 2009; Williams et al., 2009, 2011; An et al., 2010, 2011; Williams, 2011; Proshchalykin, 2012; Levchenko, 2012; Kupianskaya et al., 2013].

List of species

Bombus (*Mendacibombus*) *margreiteri* Skorikov, 1910

Material. **III:** 11.VII.2013, 1♀.

Distribution. Russia: *Tuva, Altai, Transbaikalia, Kamchatka; Central Asia.

Bombus (*Subterraneobombus*) *amurensis* Radoszkowski, 1862

Material. **I:** 30.VI–3.VII.2013, 1♀; **IV:** 11.VII.2013, 1♀.

Distribution. Russia: *Tuva, south of Eastern Siberia; Mongolia, Northern China.

Bombus (*Subterraneobombus*) *distinguendus* Morawitz, 1869

Material. **V:** 11–12.VII.2013, 1♀; **VI:** 14.VII.2013, 1♀.

Distribution. Russia: *Tuva, south of Western and Eastern Siberia, Far East, South Ural, European part; Mongolia, Northern Kazakhstan, Europe, North America (Aleutian Islands, Alaska).

Bombus (*Subterraneobombus*) *melanurus* Lepeletier, 1836

Bombus melanurus: Panfilov et al., 1961: 109.

Bombus tschitscherini: Panfilov et al., 1961: 109.

Material. **I:** 30.VI–3.VII.2013, 5♀♀; **II:** 5.VII.2013, 1♀; **III:** 8–11.VII.2013, 19♀♀; **IV:** 29.VI.2013, 2♀♀; **VI:** 14.VII.2013, 2♀♀; **IX:** 7.VII.2013, 1♀.

Distribution. Russia: Tuva, Altai, Transbaikalia; Mongolia, North-Eastern China, Armenia, Nepal, Pakistan, Afghanistan, India, Lebanon, Central Asia.

Bombus (*Subterraneobombus*) *subterraneus* (Linnaeus, 1758)

Bombus subterraneus: Panfilov et al., 1961: 108.

Material. **I:** 30.VI–3.VII.2013, 1♀; **IV:** 11.VII.2013, 1♀; **V:** 11–12.VII.2013, 3♀♀; **VII:** 15.VII.2013, 3♀♀.

Distribution. **Russia:** Tuva, south of Western and Eastern Siberia, South Ural, European part; Northern Mongolia, Kazakhstan, Caucasus, Europe, Iran.

Bombus (*Megabombus*) *consobrinus* Dahlbom, 1832

Bombus consobrinus: Panfilov et al., 1961: 107.

Material. **IV:** 11.VII.2013, 23♀♀; **VI:** 14.VII.2013, 1♀; **VII:** 15.VII.2013, 1♀; **VIII:** 15.VII.2013, 1♀.

Distribution. Russia: Tuva, Western and Eastern Siberia, Far East, European part; Eastern Kazakhstan, Mongolia, Northern China, Northern Europe.

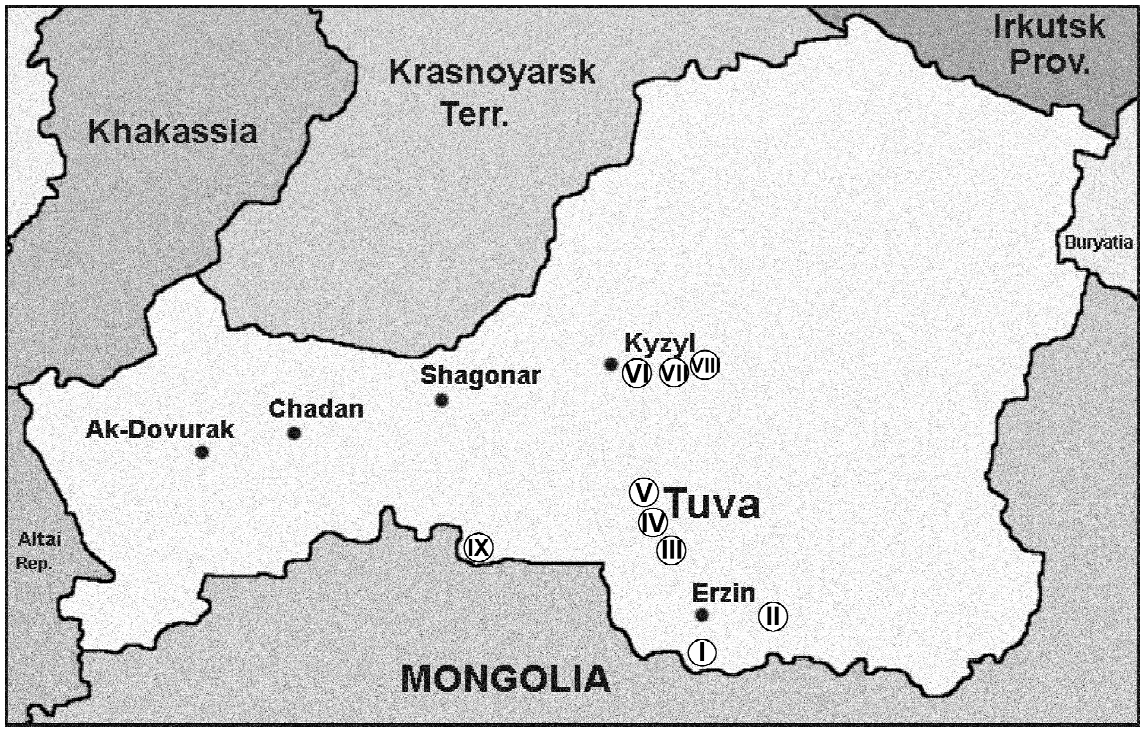

Fig. 1. The collecting sites of the bumble bees in Tuva. I — Tore-Khol Lake; II — 25 km SE Erzin, Tes-Khem River; III — 13 km SW Samagaltai, Dyttyg-Khem River; IV — 12 km NEE Samagaltai, Kaldak-Khamar Pass; V — Shuurmak, Shuurmak River; VI — 18 km E Kyzyl, Malyi Enisey River; VII — 16 km N Boyarovka; VIII — Tardam; IX — Ubsu-Nur Lake.

Рис. 1. Места сбора шмелей в Туве. I — оз. Торе-Холь; II — 25 км ЮВ Эрзина, р. Тес-Хем; III — 13 км ЮЗ Самагалтая, р. Дыттыг-Хем; IV — 12 км СВВ Самагалтая, пер. Калдак-Хамар; V — Шуурмак, р. Шуурмак; VI — 18 км В Кызыла, р. Малый Енисей; VII — 16 км С Бояровки; VIII — Тардан; IX — оз. Убсу-Нур.

Bombus (*Megabombus*) *hortorum* (Linnaeus, 1761)

Bombus hortorum: Panfilov et al., 1961: 107.

Material. **IV:** 11.VII.2013, 38♀♀; **VII:** 15.VII.2013, 1♀; **VIII:** 15.VII.2013, 4♀♀.

Distribution. Russia: Tuva, Yakutia, south of Western and Eastern Siberia, South Ural, European part; Northern Mongolia, mountains of Central Asia, Caucasus, Europe, Iran, New Zealand (introduced).

Bombus (*Thoracobombus*) *filchnerae* (Vogt, 1908)

Bombus adventor: Panfilov et al., 1961: 107.

Material. **VII:** 15.VII.2013, 1♀; **VIII:** 15.VII.2013, 2♀♀.

Distribution. Russia: Tuva, south of Eastern Siberia; Mongolia, China.

Bombus (*Thoracobombus*) *humilis* Illiger, 1806

Bombus subbaicalensis: Panfilov et al., 1961: 108.

Material. **III:** 8–11.VII.2013, 1♀♀; **VII:** 15.VII.2013, 1♀; **VIII:** 15.VII.2013, 3♀♀.

Distribution. Russia: Tuva, south of Western and Eastern Siberia, southern part of Far East, European part; Kazakhstan, Mongolia, Northern China, Korea, Europe, Iran.

Bombus (*Thoracobombus*) *muscorum* (Linnaeus, 1758)

Bombus muscorum: Panfilov et al., 1961: 108.

Material. **III:** 8–11.VII.2013, 16♀♀; **VI:** 14.VII.2013, 6♀♀.

Distribution. Russia: Tuva, south of Western and Eastern Siberia, southern part of Far East, European part; Northern Mongolia, North-Eastern China, mountains of Central Asia, Europe.

Bombus (*Thoracobombus*) *pascuorum* (Scopoli, 1763)

Bombus agrorum: Panfilov et al., 1961: 108.

Material. **III:** 8–11.VII.2013, 1♀; **IV:** 11.VII.2013, 15♀♀; **V:** 11–12.VII.2013, 18♀♀.

Distribution. Russia: Tuva, south of Western and Eastern Siberia, Far East, South Ural, European part; Mongolia, Northern Kazakhstan, Northern China, Korea, Caucasus, Northern Iran, Europe.

Bombus (*Thoracobombus*) *pseudobaicalensis* Vogt, 1911

Material. **V:** 11–12.VII.2013, 3♀♀; **VI:** 14.VII.2013, 6♀♀.

Distribution. Russia: *Tuva, south of Western and Eastern Siberia, southern part of Far East; Mongolia, North-Eastern China, North Korea, Japan (Hokkaido).

Bombus (*Thoracobombus*) *ruderarius* (Müller, 1776)

Bombus derhamellus: Panfilov et al., 1961: 107.

Material. **III:** 8–11.VII.2013, 1♀; **IV:** 11.VII.2013, 11♀♀; **VI:** 14.VII.2013, 1♀.

Distribution. Russia: Tuva, south of Western and Eastern Siberia, European part; Kazakhstan, mountains of Central Asia, Europe, Caucasus, Iran, Northern Africa.

Bombus (*Thoracobombus*) *veteranus* (Fabricius, 1793)

Material. **VII:** 15.VII.2013, 1♀.

Distribution. Russia: *Tuva, south of Western and Eastern Siberia, South Ural, European part; North-Eastern Kazakhstan, Northern Mongolia, mountains of Central Asia, Europe.

Bombus (*Psithyrus*) *barbutellus* (Kyrby, 1802)

Material. **V:** 11–12.VII.2013, 1♀.

Distribution. Russia: *Tuva, south of Western and Eastern Siberia, South Ural, south of Primorskii Territory, European part; Kazakhstan, Northern Mongolia, Northern China, Caucasus, Europe.

Bombus (*Psithyrus*) *bohemicus* Seidl, 1838

Material. **VI:** 14.VII.2013, 3♂♂.

Distribution. Russia: *Tuva, south of Western and Eastern Siberia, Far East, European part; Mongolia, North-Eastern China, Pamir, Kashmir, Europe.

Bombus (*Psithyrus*) *campestris* (Panzer, 1801)

Material. **IV:** 11.VII.2013, 1♀.

Distribution. Russia: *Tuva, south of Western and Eastern Siberia, southern part of Far East, European part; North-Eastern China, Europe.

Bombus (*Psithyrus*) *rupestris* (Fabricius, 1793)

Bombus rupestris: Panfilov et al., 1961: 110.

Material. **III:** 8–11.VII.2013, 1♀.

Distribution. Russia: Tuva, south of Western and Eastern Siberia, Far East, European part; Northern Kazakhstan, Mongolia, North-Eastern China, Europe.

Bombus (*Pyrobombus*) *hypnorum* (Linnaeus, 1758)

Bombus hypnorum: Panfilov et al., 1961: 109.

Material. **III:** 8–11.VII.2013, 1♀; IV, 11.VII.2013, 14♀♀; V, 11–12.VII.2013, 2♂♂, 12♀♀.

Distribution. Russia: Tuva, south of Western and Eastern Siberia, Far East, Ural, European part; Norht-Eastern Kazakhstan, Japan (Hokkaido), Korea, China, Europe, Mongolia, India, Nepal, Myanmar.

Bombus (*Pyrobombus*) *jonellus* (Kirby, 1802)

Bombus jonellus: Panfilov et al., 1961: 109.

Material. **V:** 11–12.VII.2013, 1♂.

Distribution. Russia: Tuva, Western and Eastern Siberia, Far East, European part; Mongolia, Caucasus, Europe, North America.

Bombus (*Pyrobombus*) *modestus* Eversmann, 1852

Bombus modestus: Panfilov et al., 1961: 110.

Material. **IV:** 11.VII.2013, 6♀♀; **V:** 11–12.VII.2013, 4♂♂, 7♀♀.

Distribution. Russia: Tuva, Western and Eastern Siberia, Far East, European part; China (Hebei), South Korea.

Bombus (*Bombus*) *cryptarum* (Fabricius, 1775)

Material. **I:** 30.VI–3.VII.2013, 1♀; **III:** 8–11.VII.2013, 14♀♀; **IV:** 11.VII.2013, 4♀♀; **V:** 11–12.VII.2013, 32♀♀; **VI:** 14.VII.2013, 8♀♀; **VII:** 15.VII.2013, 1♀.

Distribution. Russia: *Tuva, Western and Eastern Siberia, Far East, European part; Japan (Hokkaido), North-Eastern China, Eastern Kazakhstan, Europe, Iran, Nepal, India (Kashmir), North America.

Bombus (*Bombus*) *patagiatus* Nylander, 1848

Bombus patagiatus: Panfilov et al., 1961: 107.

Material. **V:** 30.VI–3.VII.2013, 1♀; **II:** 8–11.VII.2013, 27♀♀; **IV:** 11.VII.2013, 10♀♀; **V:** 11–12.VII.2013, 3♂♂,

27♀♀; **VI:** 14.VII.2013, 3♂♂, 8♀♀; **VII:** 15.VII.2013, 7♀♀; **VIII:** 15.VII.2013, 1♀.

Distribution. Russia: Tuva, south of Western and Eastern Siberia, southern part of Far East, Ural, European part; Korea, mountains of North-Eastern China, Europe.

Bombus (*Bombus*) *sporadicus* Nylander, 1848

Material. **IV:** 11.VII.2013, 2♂♂, 11♀♀; **V:** 11–12.VII.2013, 2♀♀; **VI:** 14.VII.2013, 1♀.

Distribution. Russia: *Tuva, Western and Eastern Siberia, Far East, European part; Eastern Kazakhstan, Mongolia, Northern China, North Korea, North Europe.

Bombus (*Melanobombus*) *sichelii* Radoszkowski, 1859

Bombus sichelii: Panfilov et al., 1961: 109.

Material. **I:** 30.VI–3.VII.2013, 4♀♀; **II:** 5.VII.2013, 1♀; **III:** 8–11.VII.2013, 1♂, 2♀♀; **IV:** 11.VII.2013, 5♀♀; **V:** 11–12.VII.2013, 41♀♀; **VI:** 14.VII.2013, 11♀♀; **VII:** 15.VII.2013, 5♀♀; **VIII:** 15.VII.2013, 3♀♀.

Distribution. Russia: Tuva, Western and Eastern Siberia, Far East, European part; Northern Kazakhstan, Mongolia, Northern China, North Korea, Europe.

Bombus (*Sibiricobombus*) *sibiricus* (Fabricius, 1781)

Bombus sibiricus: Panfilov et al., 1961: 109.

Material. **I:** 30.VI–3.VII.2013, 1♀; **VI:** 14.VII.2013, 17♀♀; **VIII:** 15.VII.2013, 1♀.

Distribution. Russia: Tuva, south of Eastern Siberia; Kazakhstan, Mongolia, North-Eastern China.

Bombus (*Cullumanobombus*) *semenoviellus* Skorikov, 1910

Bombus semenoviellus: Panfilov et al., 1961: 109.

Material. **IV:** 11.VII.2013, 1♀; **V:** 11–12.VII.2013, 2♀♀; **VIII:** 15.VII.2013, 2♀♀.

Distribution. Russia: Tuva, south of Western and Eastern Siberia; Eastern Kazakhstan, Central and Northern Europe.

Patterns of diversity

Twenty seven species of bumble bees have been identified based on the material collected in 2013, ten species are newly recorded from Tuva. The list of the bumble bee species is increased up to 33 (Table 1). In the future next additional species which are known from the adjacent territories can be found in Tuva: *Bombus soroeensis* (Fabricius, 1776) (Northern Kazakhstan, south of Western Siberia, and Northern Mongolia), *B. confusus* Schenck, 1861 (Khakassia, south of Western Siberia, Kazakhstan), *B. deuteronymus* Schulz, 1906 (south of Western and Eastern Siberia, Mongolia, Northern China), *B. sylvarum* (Linnaeus, 1761) (Khakassia, south of Western Siberia), *B. oberti* Morawitz, 1883 (Kazakhstan, Western China), *B. keriensis* Morawitz, 1887 (Kazakhstan, Mongolia, Western China). In mountains of Tuva *B. lapponicus* (Fabricius, 1793), which is known from mountains of Altai and Transbaikalia, can habits also.

The bumble bees fauna of Tuva has most similarity with ones of Western Siberian Plain (26 common species) and Khakassia (25), somewhat less with

Table 1. The list of bumble bees of Tuva
Таблица 1. Список шмелей Тувы

N	Species	Panfilov et al., 1961	Current data
1	*Bombus amurensis* Radoszkowski, 1862		+
2	*B. armeniacus* Radoszkowski, 1877	+	
3	*B. barbutellus* (Kirby, 1802)		+
4	*B. bohemicus* Seidl, 1838		+
5	*B. campestris* (Panzer, 1801)		+
6	*B. consobrinus* Dahlbom, 1832	+	+
7	*B. cryptarum* (Fabricius, 1775)		+
8	*B. distinguendus* Morawitz, 1869		+
9	*B. exil* (Skorikov, 1923)	+	
10	*B. filchnerae* (Vogt, 1908)	+	+
11	*B. hortorum* (Linnaeus, 1761)	+	+
12	*B. humilis* Illiger, 1806	+	+
13	*B. hypnorum* (Linnaeus, 1758)	+	+
14	*B. jonellus* (Kirby, 1802)	+	+
15	*B. laesus* Morawitz, 1875	+	
16	*B. lucorum* (Linnaeus, 1761)	+	
17	*B. margreiteri* Skorikov, 1910		+
18	*B. melanurus* Lepeletier, 1836	+	+
19	*B. modestus* Eversmann, 1852	+	+
20	*B. muscorum* (Linnaeus, 1758)	+	+
21	*B. pascuorum* (Scopoli, 1763)	+	+
22	*B. patagiatus* Nylander, 1848	+	+
23	*B. pseudobaicalensis* Vogt, 1911		+
24	*B. ruderarius* (Müller, 1776)	+	+
25	*B. rupestris* (Fabricius, 1793)	+	+
26	*B. saltuarius* (Skorikov, 1922)	+	
27	*B. schrencki* Morawitz, 1881	+	
28	*B. semenoviellus* Skorikov, 1910	+	+
29	*B. sibiricus* (Fabricius, 1781)	+	+
30	*B. sichelii* Radoszkowski, 1859	+	+
31	*B. sporadicus* Nylander, 1848		+
32	*B. subterraneus* (Linnaeus, 1758)	+	+
33	*B. veteranus* (Fabricius, 1793)		+

Table 2. Number of bumble bee species in the Palaearctic regions
Таблица 2. Число видов шмелей в регионах Палеарктики

Region and references	Number of species of bumble bees in the region / Number of species common with Tuva	Ratio of Tuvan species (in %)
West Siberian Plain [Byvaltsev, 2008]	39/26	67
Transbaikalia [Proshchalykin, Kupianskaya, 2009]	34/24	71
Khakassia [Kupianskaya et al., 2013]	32/25	78
Mongolia [Ascher, Pickering, 2014]	34/23	68

Transbaikalia (24) and Mongolia (23) (Table 2). In Khakassia the ratio of Tuvan species is 78 %, in Transbaikalia — 71 %, in Mongolia — 68%, in Western Siberian Plain — 67 %. The bumble bee fauna of Tuva is a typical to southern Siberia.

Acknowledgements

We thank V.M. Loktionov (IBSS), E.N. Akulov (Krasnoyarsk, Russia), A.N. Kuksin, N.A. Goreva (Ubsunur Biosphere Reserve, Kyzyl, Russia) and A.D. Saaya (Tuvan Institute for Exploration of Natural Resources, Kyzyl, Russia) for the help during field survey in the Republic of Tyva in 2013. The work was supported by President grant for government support of young Russian scientist of the Russian Federation (grant number МК–411.2013.4) and President grant for government support of the Leading Scientific Schools of the Russian Federation (НШ–150.2014.4), the Russian Funds for Basic Research (grant number 14–04–00649), and the Far Eastern Branch of the Russian Academy of Sciences (grants numbers 12-III-A-06-074, 12-I-П-30-03, 12-I-ОБН-02, 12-III-A-06-069).

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Поступила в редакцию 23.1.2014