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PROBLEMS OF CONSERVATION AND SUSTAINABLE USE OF NATIVE BEES IN RUSSIA

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ABSTRACT

At the present time in Russia populations of many species of bees, including bumble bees, are strongly influenced by various anthropogenic factors. For example, there were 31 bumble species in Moscow region 50 years ago, by now 7 species have disappeared, populations of 8 species have been severely reduced, those of 5 species have been moderately reduced, and only 9 bumble bee species remain stable. Thirty-seven endangered bee species, including 18 bumble bees species, are included in The Moscow region Red Data Book and 10 bees species are included in The Russia Red Data Book. In Russia the Red Data Book lists form a legal basis for bee conservation in State Natural Reserves, National Parks and in smaller reserve. Two principal uses of native bees in Russia are in pollination of forage legumes and crops. In Russia over 40 species of solitary bees are active pollinators of alfalfa flowers and more than 30 bumble bee species are the best pollinators of red clover. Curiously, Russian farmers actively imported Megachile *rotundata* from North America for alfalfa pollination. Since the 1970s there are several firms breeding *Osmia* and *Megachile* in USSR. But nowadays these programs have ceased for economical reasons. The studies on effective use of bumble bees for crop pollination and rearing of bumble bee colonies in laboratory conditions in Russia began early this century. Since 1994 some Russian greenhouse agrofirms began importing bumble bee colonies of *Bombus terrestris* from Western Europe for pollination of tomatoes and other Solanaceae. Recently some Russian firms have begun producing bumble bee colonies.

INTRODUCTION

Native bees are among the most significant insect pollinators of many entomophilous plants and, therefore, have an important role in the terrestrial ecosystems.

There are more than 2000 bee species inhabiting the former USSR (Radchenko and Pesenko 1994). The main Russian studies on bee diversity and significance of natural bee populations for cross-pollination of crops were carried out in the last 80 years (Gubin 1933; Pesenko 1982 and others). In Russia over 40 species of solitary bees are active pollinators of alfalfa flowers (*Medicago sativa*) including *Rophitoides canus* (Eversmann), *Melitturga clavicornis* (Latr.), *Melitta leporina* (Panzer), *Halictus quadricinctus Fabricius*, *Andrena ovatula* (Kirby), *Megachile centuncularis* (L.) and others (Pesenko 1982). More than 30 bumble bee species, particularly *Bombus pascuorum* Scopoly, *B. lapidarius* (L.) and *B. hortorum* (L.), are the best pollinators of red clover (*Trifolium pratense*). At the present time in Russia populations of many species of bees, including bumble bees, are strongly influenced by various anthropogenic factors, the most important of which are destruction of habitats and food resources, chemical pollution of the environment and recreational pressure on biotopes.

For example, there were 31 bumble species in Moscow region (47 OOO km2) 50 years ago, by now 7 species have disappeared, populations of 8 species have been severely reduced, those of 5 species have been moderately reduced, and only 9 bumble bee species remained stable (Table 1). In contrast, *Bombus terrestris* (L.) increased in number, while *Bombus schrencki* F. Morawitz was recorded for the first time in the region (Berezin *et al.* 1995; Panfilov 1957). Thirty-seven endangered bee species, including 18 bumble bees species, are included in The Moscow region Red Data Book

(1998) and 10 solitary native bee species are included in The Russia Red Data Book (1997). There were 20 bee species in The USSR Red Data Book (1984). The total number of protected bee species in some regions of Russia is listed in Table 2. The Red Data Book lists form a legal basis for bee conservation in Russia. Generally, conservation measures for native bees include protection of food sources and nesting sites. In Russia it takes place in State Natural Reserves, National Parks and in smaller reserve (microreserve) - Protected Natural Areas of lower status.

Protected Natural Areas for bees incorporate nesting sites, usually with large nest aggregations or colonies of solitary bees and sites with food plants. For example, in Moscow region all nest aggregations of large solitary bees from Anthophoridae and Megachilidae families consisting of over 20 nests (except some common bees, such as *Osmia rufa*), colonies of some spring Andrenidae species (over100 nests), and melittid *Dasypoda* species (over1000 nests) should be protected (Berezin *et al.*1988). Smaller nest aggregations should be protected in case the nesting species is included in the Red Data Book list. Some special parasitic species of bees require protection. Searching for the bee colonies and habitats needing protection are executed successfully by schoolboys, students and volunteers according to the non-governmental Programme "BIOSHIELD" of The All-Russian Society of Nature Conservation (Berezin 1988). Two principal uses of native bees in Russia are in pollination of forage legumes and crops. Seed production of red clover and alfalfa requires bumble bees and Megachilidae bees, especially *Megachile rotundata* imported from Canada and USA, while some species of *Osmia* (e.g. *O. rufa*) are applied in pollination of crops. Since the 70s there are several firms breeding *Osmia* and *Megachile*, mainly in southern Russia (Krasnodar region) and West Siberia. There was also an experimental factory for producing artificial nests and equipment for breeding of megachilid bees (Pesenko 1982). But nowadays these programs ceased because of economic reasons.

The studies on effective use of bumble bees for crop pollination in Russia began early this century. They are based on the method of free attraction of overwintering bumble bee queens to artificial nests placed on protected territories (Skorikov 1922; Grebennikov 1982 and others). In different years the average efficiency of this method was less than 30% (Grebennikov 1982). Another method includes the "compulsory" nesting of natural bumble bee queens in laboratory with preservation of their free foraging outdoors (Rechkin and Dolgov 1984). But all these methods cannot be determined as breeding sensu stricto for use of bumble bee queens removed from natural ecosystems. The methods were adapted for application under open ground conditions where their efficiency was masked by low level of agrotechnology. More recently, a method for bumble bee gardening "Bomboretum" was proposed in West Siberia by Bogatyrev (Bogatyrev 1992).

On the other side, the studies on artificial bumble bee breeding in some European and Canadian agricultural firms and Universities have resulted in the highly efficient technology for industrial bumble bee keeping and bumble bee pollination, especially for greenhouse use (Eijnde 1990). So in 1994-96 approximately 70 Russian greenhouse agrofirms imported about 7000 bumble bee colonies of *Bombus terrestris* from Israel, Holland, Belgium, mainly for pollination of tomatoes and other Solanaceae. Recently some Russian agrofirms have begun producing bumble bee colonies (mainly *B. terrestris*) for crop pollination. More attention should be given to the problems of gene and parasite introduction from imported greenhouse bumble bee populations to natural populations and vice versa.

Another problem of native bees' conservation is the impact of beekeeping on wild bee populations. Wild bees suffer from dense populations of honey bees in competition for nectar and pollen. For example, at the Prioksko-Terrasnyi State Reserve (Moscow

region) mass honey bee foraging has a strong depressing effect on native populations of anthophorid and megachilid bees (Beiko 1990; Beiko and Volkova 1993).

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TABLE 1: Changes in *Bombus* populations of the Moscow region for the last 50 years.

Bombus type of species	Years 1947-1952	1981-1997 (by: Panfilov)	changes (original)
1. *B. confusus*	3	0	not found
2. *B. maculidorsis*	4		decreased
3. *B. veteranus*	6	3	decreased
4. *B. silvarum*	5	3	decreased
5. *B. ruderarius*	4	4	stable
6. *B. solstitialis*	5	2	decreased
7. *B. tristis*	3	2	decreased*
8. *B. subbaicalens*	2	2	stable
9. *B. muscorum*	2	2	stable
10. *B. schrencki*	0	2	increased
11. *B. pascuorum*	6	6	stable
12. *B. hortorum*	5	5	decreased*
13. *B. ruderatus*	1	0	not found
14. *B. consobrinus*	1	1	stable
15. *B. pomorum*	3	2	decreased*
16. *B. distinguendus*	3	3	stable
17. *B. subterraneus*	5	3	decreased
18. *B. fragrans*	1	0	not found
19. *B. lucorum*	6	6	stable
20. *B. patagiatus*	1	0	not found
21. B. sporadicus	1	0	not found
22. *B. terrestris*	1	3	increase
23. *B. soroensis*	3	2	decreased*
24. *B. semenoviellus*	2	1	decreased
25. *B. serrisquama*	1	1	stable
26. *B. lapidarius*	5	5	stable
27. *B. sicheli*	1	0	not found
28. *B. hypnorum*	5	4	decreased*
29. *B. jonellus*	3	1	decreased
30. *B. modestus*	1	0	not found
31. *B. pratorum*	5	3	decreased

* - the quantitative change is probably insignificant

Interpretation of grades of bumble bee relative abundance:

0 not found
1 found locally, rare in all biotopes
2 found everywhere, rare in all biotopes
3 found everywhere, rare or common
4 found everywhere, common everywhere
5 found everywhere, locally numerous
6 found everywhere, numerous everywhere

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TABLE 2: Species composition of Bees in some Regional Red Data books of Russia.

Taxons	Regions and Publication Years							
	Russia	Moscow	Mid-Russia	Orenburg	Saratov	Archan-gelsk	Kare-lia	Ural
	1984	1999	1998	1996	1998	1996	1995	1995
INSECTA	202	95	281	34	31	72	50	221
HYMENOPTERA	24	24	44	7	8	12	9	44
BEES	20	10	37	7	5	9	9	7
Colletidae	0	0	1	0	0	0	0	0
Andrenidae	1	0	2	0	0	1	0	3
Halictidae	1	0	2	0	0	1	0	0
Megachilidae	1	0	2	0	0	1	0	1
Anthophoridae	2	1	10	0	2	1	1	0
Apidae	15	9	18	7	3	5	8	3