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New Data on Sand Flies (Diptera, Psychodidae, Phlebotominae) of the Crimean Peninsula

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Abstract—Sticky traps and an aspirator were used to assess the species composition and abundance of sand flies (Phlebotominae) in 14 coastal localities and their environs on the Crimean Peninsula. Sand flies were found only in four localities: Parkovoe, Gurzuf, Sudak, and Kurortnoe. Altogether, 942 specimens of 5 species were collected: *Phlebotomus papatasi* (0.7%), *P. similis* (0.1%), *P. neglectus* (64.7%), *P. perfiliewi* (33.1%), and *P. longiductus* (1.4%). The highest species diversity of sand flies was observed in Kurortnoe locality where 4 species were trapped (*P. similis*, *P. neglectus*, *P. perfiliewi*, and *P. longiductus*) and also in Parkovoe locality where 3 species were trapped (*P. neglectus*, *P. perfiliewi*, and *P. longiductus*). *Phlebotomus perfiliewi* and *P. neglectus* were the prevalent species on the southeast and south coasts of the peninsula (94.7 and 95.8%, respectively). PCR methods are recommended for more accurate identification of sand flies from the subgenera *Larroussius* and *Adlerius*, since they are rather similar in morphological characters.

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Sand flies (Phlebotominae) attract the attention of researchers not only as annoying bloodsuckers but also as vectors of a number of human and animal diseases: sand fly fevers, bartonellosis, and leishmaniases. The Crimean Peninsula was in the past endemic for pappataci fever (Dolmatova and Okulov, 1951), and sporadic local cases of visceral leishmaniasis were also reported (Kellina, 1977; Rymarenko et al., 2013; Baranets et al., 2017); this determines the special importance of the study territory. Our previous review of the Crimean sand flies (Baranets et al., 2016) summarized the results of earlier entomological observations, mainly for 1941–1960. In view of the new classification developed by Artemyev (1990), we performed revision of the regional sand fly fauna and mapped the distribution of the most abundant species. According to these data, 7 species from 2 genera and 5 subgenera of sand flies occurred in Crimea: *Phlebotomus* (*Phlebotomus*) *papatasi* Scopoli, 1786, *P.* (*Paraphlebotomus*) *similis* Perfiliew, 1963, *P.* (*Par.*) *alexandri* Sinton, 1928, *P.* (*Larroussius*) *neglectus* Tonnoir, 1921, *P.* (*Lar.*) *perfiliewi* Parrot, 1930, *P.* (*Adlerius*) *balcanicus* Theodor, 1958, *P.* (*Adl.*) *longiductus* Parrot, 1928, and *Sergentomyia* (*Sergentomyia*) *dentata* Sinton, 1933.

Our research was focused on the current species composition, abundance, and distribution of sand flies on the Crimean Peninsula.

MATERIALS AND METHODS

Observations were performed in June–August 2017. The following settlements and their environs were examined for the presence of sand flies: Sevastopol (Cape Fiolent), Balaklava, Parkovoe (southern slope, section 13 of Opolznevskoe forestry, Yalta Mountain Forest Nature Reserve), Simeiz, Alupka, Gurzuf, Partenit, Alushta, Rybachye, Sudak, Fox Bay Landscape Reserve, Kurortnoe (T.I. Vyazemsky Karadag Scientific Station—Nature Reserve of the Russian Academy of Sciences), Koktebel, and Feodosiya (Fig. 1).

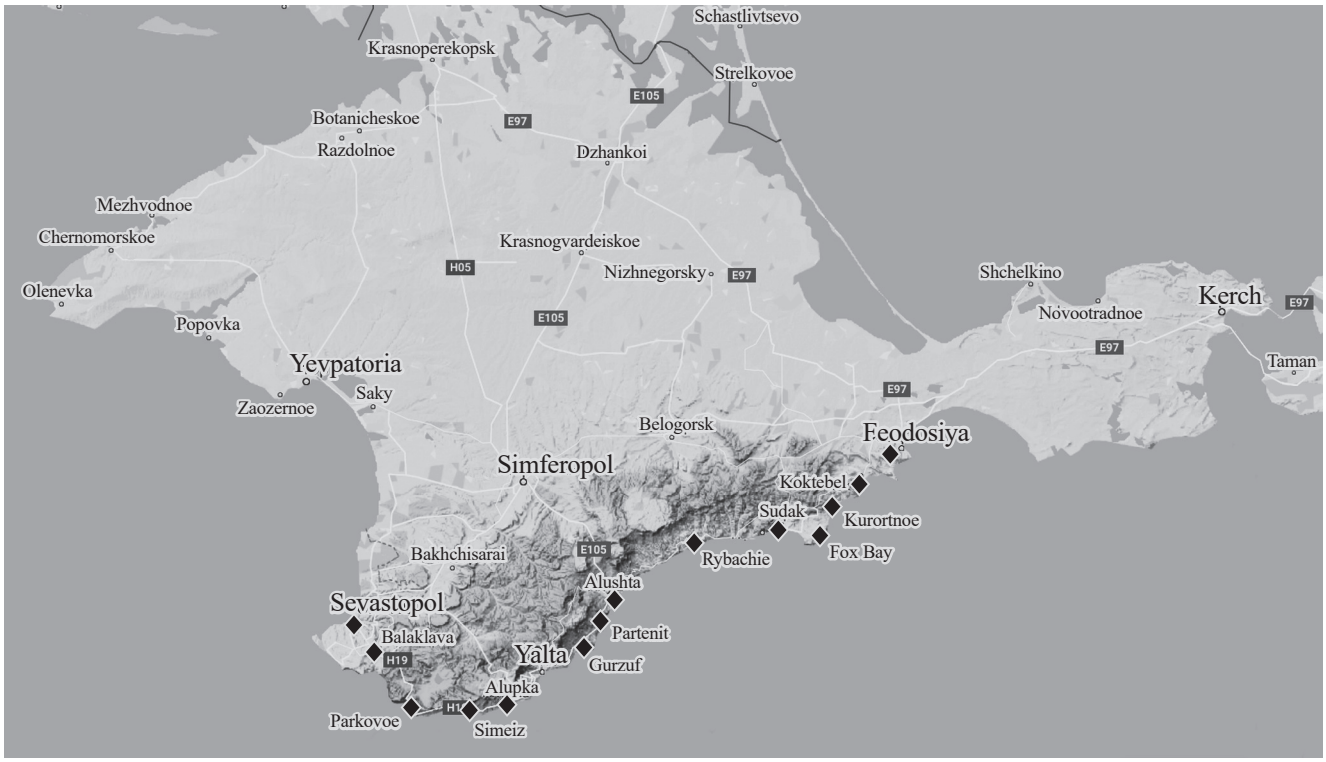

Fig. 1. Sites of insect collection in Crimea.

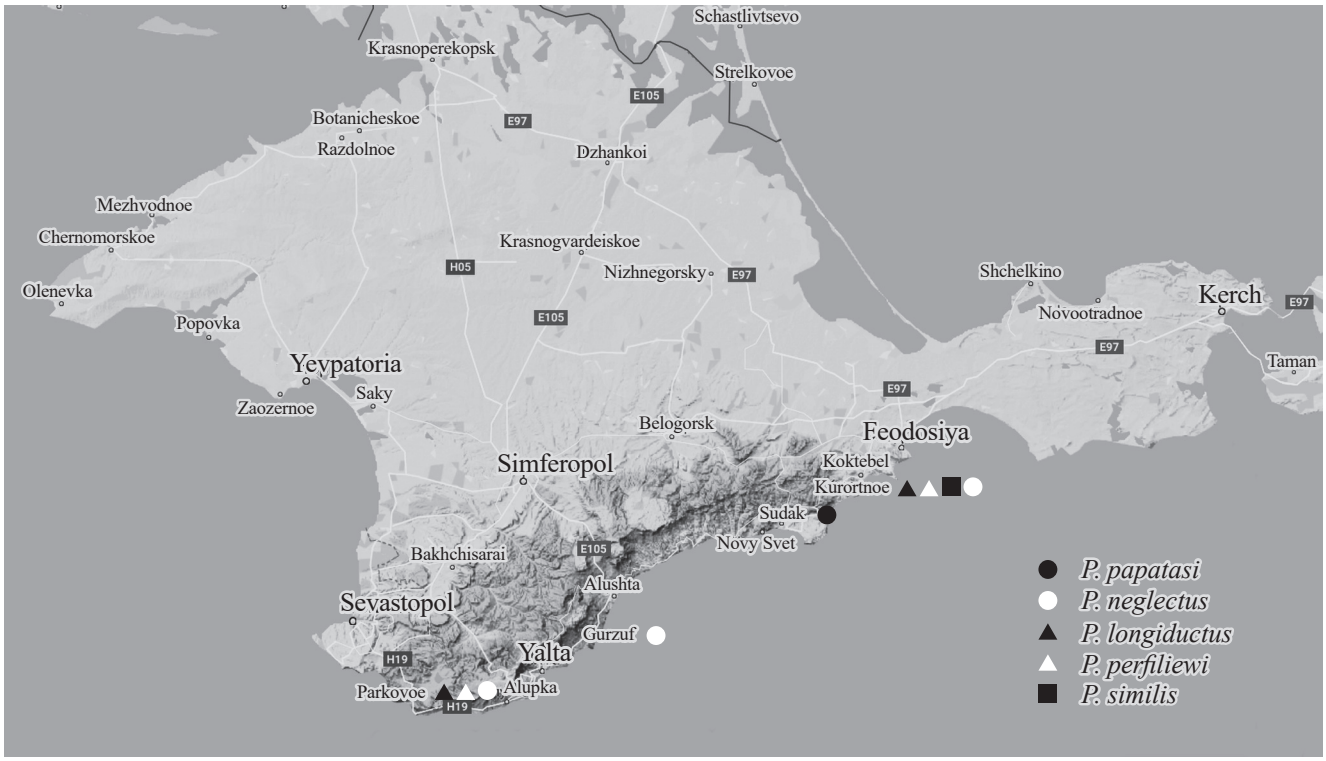

Fig. 2. Distribution of sand fly species in Crimea.

Table 1. Species composition of sand flies on the Crimean Peninsula

Localities	Coordinates	Collection dates	Number of specimens captured									
			P. papatasi		*P. similis*		*P. neglectus*		*P. perfiliewi*		*P. longiductus*	
			%	♂/♀	%	♂/♀	%	♂/♀	%	♂/♀	%	♂/♀
Gurzuf	44.543736°N 34.281504°E	28.VI–01.VII	–	–	–	–	100	12/11	–	–	–	–
Sudak	44.865756°N 34.959128°E	10–11.VII	100	7/0	–	–	–	–	–	–	–	–
Kurortnoe	44.915982°N 35.203842°E	12–16.VII	–	–	0.3	0/1	2.3	5/2	96.7	185/112	0.7	0/2
Parkovoe	44.398039°N 33.930006°E	18–22.VII	–	–	–	–	95.7	364/215	2.5	3/12	1.8	10/1

% is the fraction of the species in the given locality.

Sand flies were captured by the standard technique, using sticky traps made of A4 sheets of butter or tracing paper with castor oil applied on both sides (Artemyev and Neronov, 1984). Such sheets were suspended indoors: in living rooms, lavatories, household buildings, sheds, basements, and abandoned buildings, and also in open biotopes: among building boards, in fence gaps, near sewage wells, in rush thickets, dry river beds, house yards, ruins of ancient fortresses and buildings, on netting outside the cages in poultry houses, and in places of livestock keeping. Sand flies attracted to artificial light were also captured by placing sticky traps close to electric lamps, both indoors and outdoors: in house yards, parks, forests tent camps, and tourist stopping places. Traps were installed an hour before sunset, and the insects were collected at dawn. In addition, sand flies were collected indoors at night with an aspirator.

Sand flies were picked off the sticky trap sheets with entomological needles and stored in vials with 96° alcohol. For species identification, permanent preparations in Faure medium (Petrishcheva, 1961) were made in the laboratory.

Altogether, 942 sand fly specimens (356 females and 586 males) were captured in 638 sticky traps; of these, 106 specimens (67 females and 39 males) were captured in 90 sticky traps set close to artificial light sources, and 20 specimens (19 females and 1 male) were collected with an aspirator. All the specimens were identified to species by morphological characters using the available keys (Perfiliev, 1966; Artemyev and Neronov, 1984).

The abundance of sand flies was assessed using the standard formula: the number of specimens captured divided by the number of sticky traps (Petrishcheva, 1961).

RESULTS AND DISCUSSION

Our study showed that sand flies were non-uniformly distributed over the coastal areas of Crimea. Sand flies were recorded only in 4 out of 14 examined localities (Fig. 2): (1) within the transformed natural territory of T.I. Vyazemsky Karadag Scientific Station in the eastern part of Kurortnoe; (2) in section 13 of Opolznevskoe Forestry of Yalta Mountain Forest Nature Reserve, near Parkovoe; (3) in a house yard in Gurzuf; (4) in a poultry house within a private housing area on the northern outskirts of Sudak (Asret urban district). All the captured sand flies belonged to one genus *Phlebotomus*, 4 subgenera (*Phlebotomus*, *Paraphlebotomus*, *Larroussius*, and *Adlerius*), and 5 species: *P. neglectus* (609 specimens), *P. perfiliewi* (312), *P. longiductus* (13), *P. papatasi* (7), and *P. similis* (1) (Fig. 2). The first three species are confirmed vectors of visceral leishmaniasis in other endemic countries (Artemyev and Neronov, 1984); it remains unknown which of them acts as vector in Crimea.

The sand fly fauna was the most diverse in Kurortnoe where 4 species were recorded; 3 species were found in Parkovoe, and only 1 species in each of the two other localities (Table 1).

The dominant sand fly species at Karadag Scientific Station was *P. perfiliewi* (96.7%), which was captured in

Table 2. Biotopic distribution of sand flies on the Crimean Peninsula

Locality	Biotope	Capture method (number of sticky sheets given in parentheses)	Number of sand flies captured									
			P. papatasi		*P. similis*		*P. neglectus*		*P. perfiliewi*		*P. longiductus*	
			%	ind.	%	ind.	%	ind.	%	ind.	%	ind.
Kurortnoe: Karadag Scientific Station, Feodosiya urban district			Indoors									
	Living rooms and household buildings	Sticky traps (40) at light	–	–	–	–	–	–	100	0.75	–	–
		Aspirator	–	–	–	–	–	–	95	–	5	–
	Basements	Sticky traps (12)	–	–	–	–	–	–	100	0.58	–	–
	Household buildings	Sticky traps (32)	–	–	–	–	11	0.16	89	1.22	–	–
			Outdoors									
	House yard	Sticky traps (15) at light	–	–	–	–	–	–	100	4.07	–	–
	Building boards near dwelling buildings	Sticky traps (84)	–	–	–	–	–	–	100	0.68	–	–
	Gaps in a fence	Sticky traps (73)	–	–	3	0.02	–	–	94	0.36	3	0.02
	Near sewage wells	Sticky traps (14)	–	–	–	–	5	0.14	95	2.50	–	–
	Near dry river bed	Sticky traps (34)	–	–	–	–	–	–	100	0.29	–	–
	Rush thickets	Sticky traps (50)	–	–	–	–	–	–	100	0.26	–	–
Parkovoe: section 13 of Opolznenskoe Forestry, Yalta Mountain Forest Nature Reserve			Outdoors									
	Forest tent camp	Sticky traps (35) at light	–	–	–	–	–	–	100	0.43	–	–
	Poultry house	Sticky traps (130)	–	–	–	–	100	4.25	–	–	–	–
			Indoors									
	Basements	Sticky traps (95)	–	–	–	–	70	0.27	–	–	30	0.12
Sudak: Asret District			Outdoors									
	Poultry house	Sticky traps (13)	100	0.53	–	–	–	–	–	–	–	–
Gurzuf: Korovina Street			Outdoors									
	Residential estate	Sticky traps (11)	–	–	–	–	100	2.09	–	–	–	–

% is the fraction of the species in the given biotope.

all the biotopes; the highest abundance of 4.07 ind. per sticky trap was recorded when sand flies were attracted to light in a house yard. *Phlebotomus neglectus* (2.3%) and *P. longiductus* (0.7%) were captured in small numbers. In addition, one female of *P. similis* was found between boards of a fence, close to the Karadag Scientific Station hostel.

In Opolznevskoe Forestry the dominant species was *P. neglectus* (95.7%), with the highest abundance of 4.25 ind. per trap recorded in the poultry house. *Phlebotomus neglectus* and *P. longiductus* (1.8%) were mostly recorded in basements of household buildings; *P. perfiliewi* (2.5%) was captured only when attracted to light in the natural forest area near temporary camping sites.

The biotopic distribution of sand flies in settlements and their environs is given in Table 2.

Only one species of sand flies, *P. perfiliewi*, was captured in illuminated traps, there being more females (63.2%) than males (36.8%). Captures with regular sticky traps yielded a different sex ratio: 65.4% of males and 34.6% of females.

CONCLUSIONS

The above data should be regarded as preliminary since observations during a single season are not sufficient to draw final conclusions. However, they demonstrate that the fauna of sand flies in Crimea as well as distribution and relative abundance of different species have changed under the impact of anthropogenic and climatic factors since the last study in the 1960s. Distribution of sand flies along the Black Sea coast of Crimea is non-uniform. At present, sand flies reach high abundance only in settlements located close to protected natural areas and are only occasionally recorded in other settlements. In big towns sand flies were found only on the outskirts, in a poultry house close to the forest. According to the literature data, *P. similis* earlier inhabited only the south coast of Crimea; at present, its range has shifted to the southeast, whereas in the south the species was not recorded at all. *Phlebotomus papatasi*, previously a dominant species in all the big towns, has also disappeared from the south coast.

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