

Seasonal population fluctuations of *Culicoides* midges in the Smolenskaya, Pskovskaya and Vladimirskaya provinces of Western Russia in 2013

Alexander Sprygin^{1*}, Olga Fiodorova², Yurii Babin¹, Vasilii Pavelko¹, Glenn Bellis³ and Alexander Kononov¹

¹ Federal Center for Animal Health, Vladimir, Russia.

² Russian Research Institute for Veterinary Entomology and Arachnology Rosselhozakademii, Tyumen, Russia.

³ Australian Quarantine and Inspection Service Northern Australia Quarantine Strategy, GPO Box 3000 Darwin, NT 0801 Australia.

*Corresponding author at: Federal Center for Animal Health, 600901 Yur'evets, Vladimir, Russia. Tel.: +4922 26 15 51, e-mail: sprygin@arriah.ru.

Veterinaria Italiana 2016, **52** (3-4), 231-234. doi: 10.12834/VetIt.254.2305.3

Accepted: 16.11.2015 | Available on line: 30.09.2016

IV International Conference on *Bluetongue and Related Orbiviruses*. November 5-7, 2014 - Rome, Italy - Selected papers

Keywords

Culicoides,
Light trap,
Midges,
Russia.

Summary

Light trapping for biting midges was performed on cattle farms in 3 provinces of Western Russia in 2013. A total of 9,272, 2,457, and 10,245 *Culicoides* midges were collected from farms in Smolenskaya, Pskovskaya, and Vladimirskaya provinces, respectively. More than 99% of collected midges belonged to either the *Obsoletus* or *Pulicaris* complexes. Species belonging to the *Obsoletus* complex were the most abundant in Pskovskaya, whereas species from the *Pulicaris* complex dominated the catches in Vladimirskaya and Smolenskaya provinces. The seasonal duration of adult activity in all 3 regions was approximately 4.5 months.

Distribuzione stagionale (2013) delle specie di *Culicoides* dei complessi *Obsoletus* e *Pulicaris* in alcune province della Russia occidentale

Parole chiave

Culicoides,
Moscerini,
Russia,
Trappole luminose.

Riassunto

In questo articolo si riporta uno studio entomologico effettuato utilizzando trappole CDC UV in allevamenti bovini situati in 3 regioni della Russia occidentale nell'anno 2013. Sono stati raccolti 9.272, 2.457 e 10.245 *Culicoides* rispettivamente nelle regioni di Smolenskaya, Pskovskaya e Vladimirskaya. Tra le catture di *Culicoides*, le specie appartenenti al complesso *Obsoletus* sono risultate le più abbondanti a Pskovskaya, mentre le specie del complesso *Pulicaris* (principalmente *Culicoides punctatus*) nelle regioni di Vladimirskaya e Smolenskaya. In tutte le regioni esaminate l'attività dei *Culicoides* non ha superato i 4,5 mesi.

Culicoides biting midges play an important role in transmitting arboviral infections to ruminants, such as Bluetongue (BTV) and Schmallenberg (SBV) viruses (Mellor 1990, Mellor *et al.* 2000, Elbers *et al.* 2011, Elbers *et al.* 2013). The recent emergence of these diseases in Europe has stimulated numerous studies on the vectors of these viruses (Mellor *et al.* 2000). Outbreaks of SBV in Estonia (EFSA technical report, May 2013), of serotype 14 of the BTV (BTV-14) in Smolensk, Western Russia (Panferova *et al.* 2012), and their potential impact on cattle trade have

raised concerns about the likely spread of these viruses further Eastwards into Russia.

Species of *Culicoides* implicated as vectors of these viruses are widespread in Russia (Sprygin *et al.* 2015), but the diversity and seasonality of species is not known for many regions, including Smolenskaya, where BTV-14 was recently detected (Panferova *et al.* 2012). This lack of systematic entomological surveillance in high-risk zones impedes the understanding of the risks posed by these diseases.

The aim of this study was to investigate the seasonal diversity and abundance of biting midges in 3 provinces in Western Russia.

Midges were collected using CDC UV light traps powered by a 12-V battery. Traps were set 1.5 meters from the ground inside a barn on a cattle farm for each province (Smolenskaya, Pskovskaya, and Vladimirskaya) (Figure 1). Traps were operated from sunset to sunrise, for 1 night approximately every 3 weeks, from May to September. The barn at the farm in Pskovskaya province was screened with mesh to prevent the entry of mosquitoes, but the barns on the farms in Smolenskaya and in Vladimirskaya were unscreened.

After sunrise, trapped insects were placed in 70% ethanol and transported to the laboratory. Midges were identified using the morphological keys of Glukhova (Glukhova 1989) and Mirzaeva (Mirzaeva 1989). Since females of *Culicoides obsoletus* and *Culicoides scoticus* and of several members of the Pulicaris complex are difficult to distinguish morphologically, these species were recorded as the Obsoletus and Pulicaris complexes, respectively (Meiswinkel et al. 2004).



Figure 1. Map of Russia showing the locations of farms: 1 - Pskovskaya province, 2 - Smolenskaya province, 3 - Vladimirskaya province. Different shades denote the Federal districts.

A total of 9,272, 2,457, and 10,245 midges were captured on the farms in Smolenskaya, Pskovskaya, and Vladimirskaya provinces, respectively (Table I). Apart from a low number of *Culicoides fascipennis*, detected on the farm in Vladimirskaya province and identified as other *Culicoides*, all collected specimens belonged to species from either the Obsoletus or Pulicaris complexes. Species belonging to the Obsoletus complex dominated collections

Table I. Seasonal abundance of *Culicoides* midges at single farms in 3 provinces of Western Russia, in 2013.

Province	Collection date	Total <i>Culicoides</i>	Obsoletus complex	%	<i>C. pulicaris</i>	%	Other <i>Culicoides</i>	%
Smolenskaya	28.05	8,953	3,236	36.1	5,717	63.9		
	27.06	67	28	41.8	39	58.2		
	23.07	101	11	10.9	90	89.1		
	27.08	151	0	0	151	100		
	15.09	0						
	25.09	0						
Total Smolenskaya		9,272	3,275	35.3	5,997	64.7		
Pskovskaya	29.05	1,104	1,009	91.4	95	8.6		
	23.06	41	41	100				
	4.07	243	243	100				
	25.07	973			973	100		
	2.08	62			62	100		
	30.08	34	34	100				
	17.09	0						
	27.09	0						
Total Pskovskaya		2,457	1,327	54	1,130	42.9		
Vladimirskaya	13.05	24	24	100				
	31.05	194	140	72.2	54	27.8		
	23.06	9,586	41	0.4	9,545	99.6		
	4.07	335			335	100		
	2.08	106	20	18.9	62	58.5	24*	22.6
	30.08	0						
	19.09	0						
	29.09	0						
Total Vladimirskaya		10,245	225	2.2	9,996	97.6	24	0.2

* identified as *C. fascipennis*.

at the farm in Pskovskaya province, while species from the Pulicaris complex dominated the catches in Vladimirskaya and Smolenskaya provinces. Peak activity was observed in May for Smolensk, in June for Vladimir, while in Pskovskaya, 2 peaks were observed in late May and late July (Table I).

The number of midges in all regions gradually decreased during Autumn. By September, the traps did not detect any flight activity. Onwards no single midge was captured until Winter months, suggesting a vector free period from September (data not shown). At all sites, midges were already active by the end of May, although they could not be detected in September indicating that the period of adult nocturnal activity lasted at least for 4.5 months and appeared to stop by September. This period is shorter than the 5.5 months reported in the relevant literature (Brodskaya 1992, Krivosheina 1956, Remm 1955, Truchan 1975). This may be due to environmental variables or, more likely, differences in surveillance methods. The present study employed light traps, which only sample midges flying at sunset or night. Previous studies deployed bed-curtains or insect nets, which may be used to collect insects at other times, so the absence of midges in light traps may just indicate a reluctance to fly at night, which may occur as temperatures decrease during Autumn. Similarly, some previous studies (Remm 1955, Krivosheina 1956, Truchan 1975) showed bimodal peaks in abundance over Summer, which was not reflected in our results.

The low diversity of species in the collections was surprising, especially as previous studies reported a higher species diversity in these provinces.

For example, in Pskovskaya province, Brodskaya (Brodskaya 1992) found the dominant species to be *C. obsoletus*, *C. pallidicornis*, *Culicoides punctatus*, and *Culicoides griseus*, with *C. obsoletus* and *C. pallidicornis* showing a preference for cattle.

Data are not available on the midge diversity or abundance in Vladimirskaya province, but results from the neighbouring and geographically and climatically similar provinces of Moscovskaya and Ivanovskaya reveal several species which were not collected during our survey. For example, Isaev (Isaev 1970, Isaev 1975) found *Culicoides stigma* and *Culicoides nubeculosus* in Ivanovskaya province, while Molev (Molev 1955) found *C. nubeculosus*, *C. fascipennis*, and *C. stigma* to be amongst the most abundant species in Moscovskaya province. Isaev also reported that *C. obsoletus* and *Culicoides chiopterus* dominated the catches on both sheep and cattle, whereas *C. pulicaris*, *C. stigma*, *C. nubeculosus*, and *C. punctatus* were most abundant on cattle (Isaev 2011).

Overall, the entomological findings reported herein show that the seasonal occurrence of *Culicoides* varies across and within different geographic zones. In Smolenskaya and Pskovskaya provinces, species of the *Obsoletus* complex were predominant. In contrast, species of the *Pulicaris* complex dominated the catches in Vladimirskaya province. The reasons for this variation could be attributed to different farming practices and environmental factors. For epidemiological studies, collected midges would be identified to species level using molecular tools to gain a better understanding of *Culicoides* ecology in western Russia.

References

- Brodskaya P.K. 1992. Phenology and seasonal variation in the number of common species of the genus *Culicoides* biting midges in the south of the Pskov region. *Parazitologiya*, **3**, 257-259 (in Russian).
- Elbers A.R., Meiswinkel R., Weezep E., van Oldruitenborgh-Oosterbaan M.M. & Kooi E.A. 2013. Schmallenberg virus in *Culicoides* spp. biting midges, the Netherlands. *Emerg Infect Dis*, **19**, 106-109.
- Elbers A.R., Meiswinkel R., Weezep E. & Kooi E.A., van der Poel W.H. 2013. Schmallenberg virus in *Culicoides* biting midges in the Netherlands in 2012. *Transbound Emerg Dis*. doi: 10.1111/tbed.12128.
- Gutsevich A.V. 1973. Blood-sucking midges (Ceratopogonidae). (Fauna of the USSR. Insects, Diptera. Volume 3, Issue 5). Leningrad. Nauka, 269 pp. (in Russian).
- Glukhova V.M. 1989. Blood-sucking midges genera *Culicoides* and *Forcipomyia* (Ceratopogonidae). (Fauna of the USSR. Insects, Diptera. Volume 3, Issue 5). Leningrad, Nauka. 408 pp. (in Russian).
- Isaev V.A. 1970. Blood-sucking midges (Diptera, Heleidae) of Ivanovo region. *Ivanovo State University Press*, **46**, 30-49 (in Russian).
- Isaev V.A. 1975. Diapause and other environmental issues of biting midges of Ivanovo region. Dissertation abstract. Leningrad. 22 pp. (in Russian).
- Isaev V.A. 2011. *Culicoides* midges in the European part of Russia and their role in spreading bluetongue virus. *Ivanovo State University Press*, **2**, 5-9 (in Russian).
- Krivosheina N.P. 1957. On the fauna of biting midges (Diptera, Heleidae) in the Oka floodplain. *Entomol Obozren*, **2**, 418-436 (in Russian).
- Meiswinkel R., Gomulski L., Delécolle J.C., Goffredo M. & Gasperi G. 2004. The biosystematics of *Culicoides* vector complexes - unfinished business. *Vet Ital*, **40** (3), 151-159.
- Mellor P.S. 1990. The replication of bluetongue virus in *Culicoides* vectors. *Curr Top Microbiol Immunol*, **162**, 143-161.
- Mellor P.S., Boorman J. & Baylis M. 2000. *Culicoides* biting midges: their role as arbovirus vectors. *Annu Rev Entomol*, **45**, 307-340.
- Mirzaeva A.G. 1989. Blood-sucking midges (Diptera, Ceratopogonidae) in Siberia and the Far East. Novosibirsk, 231 pp. (in Russian).
- Molev E.V. 1955. Ecology of midges (*Culicoides*) and their role as intermediate hosts of *Onchocerca cervicalis* and as vectors of horse onchocerciasis in Moscow and Ivanovo regions. Dissertation. Leningrad. 374 pp. (in Russian).
- Panferova A., Koltsov A., Novikova M., Tsybanov S., Kolbasov D. 2012. Detection of Bluetongue outbreak in Smolensk region of Russia in 2011. Proceedings of the 6th EPIZONE annual meeting.
- Remm X.J. 1955. The fauna of bloodsucking Diptera of the Estonian SSR. Dissertation abstract. Tartu. 15 pp.
- Sprygin A., Fiodorova O., Babin Y., Elatkin N., Mathieu B., England M. & Kononov A. 2014 *Culicoides* biting midges (Diptera, Ceratopogonidae) in various climatic zones of Russia and adjacent lands. *Jour of Vec Ecol*, **39**, 306-315.
- "Schmallenberg" virus: analysis of the epidemiological data TECHNICAL REPORT (May 2013). EFSA.
- Trukhan M.N. 1975. Blood-sucking midges Belarus. Minsk, 156 (in Russian).