



*Original Contribution*

**PHENOLOGY OF THE HORSE FLIES (DIPTERA, TABANIDAE) FROM THE CENTRAL BALKAN MOUNTAINS, BULGARIA**

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**ABSTRACT**

The study was conducted in the Central Balkan Mountains in the 2010-2013 periods. On the basis of new and literature data it was summarized that the tabanid fauna in the region is represented by 41 species of 10 genera. The species *Tabanus leleani* Austen, 1920 is reported for the first time for the fauna of Bulgaria. The phenological features of 31 species of tabanids registered during the study in the region have been analyzed. The terms of activity of the most common tabanid species have been confirmed. The flight period of *Tabanus sudeticus* Zeller, 1842 in Bulgaria (from the middle of June to the middle of August) are marked.

**Key words:** tabanids, phenology, Central Balkan Mountains, Bulgaria

**INTRODUCTION**

The permanent interest in studies on the phenological features of tabanids, the range of variation of their activity duration and the factors influencing them, is provoked by the role of tabanids as mechanical or biological vectors of many infectious and invasive diseases in animals and humans.

Data on the activity of the different species are found in every faunal study, but the first summarized data on the activity periods of the Tabanidae family species, found in Bulgaria, were reported by (1). Later, (2-5) supplemented the information on the phenological characteristics of tabanids in Bulgaria, as a result of systematic studies on the fauna and ecology of the group in Stara Zagora region. However, the Balkan Mountains are one of the mountains in Bulgaria that has been poorly studied regarding the composition and activity of tabanids. The contradictory and fragmentary data on the tabanid fauna in its central part drew our attention to the initiation of such a study in the Central Balkan Mountains. As a result of the

research, conducted in the region for the period 2010-2011, (6, 7) published data on the species composition of the horsefly fauna and the parameters of their seasonal activity. They reported a total of 39 tabanid species from the study area (6) based on the literature data and the results of the study. (7) found out that tabanids began flying in the first half of May and flew until mid-September. The accumulated data on the species composition and activity of tabanids give them the reason to continue the research in the region in this direction. This will make it possible to make an in-depth analysis of the phenological features of the species identified from the tabanid complex in the Central Balkan Mountains, which is the purpose of this study.

**MATERIALS AND METHODS**

The present study is a part of a systematic research on the fauna and ecology of blood-sucking flies of the family Tabanidae (Diptera), conducted in the Central Balkan Mountains during the active season of tabanids for the period 2010-2013. Data on the composition and seasonal activity of the tabanid fauna in the Central Balkan Mountains in the period 2010-2011 have already been published by (6, 7).

Phenologically, the subject of research is only the adult horse flies phenology. The study on

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the imago phenological features is related to the processing of the collected data on tabanids activity during the entire four-year period of field observations (2010-2013). During this period, a total of 3560 tabanids were collected and identified. The material is collected from the three main localities (Panitsite locality, Enina village and Gorno Izvorovo village), two route crossings, Malesse trap and a gathering in the area of Kalofer Monastery. Detailed descriptions of the main localities in which the regular monthly collections were held have already been published by (6, 7).

### Sampling and processing of specimens

The horse flies were collected monthly by sweep net from 8 a.m. to 8 p.m. in the studied biotopes. The processing of the insects was carried out in the laboratory. The collected specimens were determined according to the keys of (8, 9).

A list of the studied localities is presented. The list of the localities indicates the altitude, the geographic coordinates, the collection dates and the total number of collected specimens from each locality. Altitude and geographical coordinates were obtained through measurement with Garmin GPS Navigator Etrex Vista HCx.

### List of localities

**Monastery, town of Kalofer**, 633 m a.s.l., 42°654 N, 24°958 E: 14.05.2010, 1 ♀.

**Malaise trap**, 535 m a.s.l., 42°642 N, 24°951E: 2-12.06.2010, 2 ♀; 12-21.06.2010, 4 ♀; 21.06.-1.07.2010, 4 ♀; 1.07.-10.07.2010, 5 ♀; 10.07.-20.07.2010, 6 ♀; 10.08.-20.08.2010, 2 ♀; 20.08.-1.09.2010, 2 ♀.

**Panitsite Site**, 749 m a.s.l., 42°661 N, 24°981E: 13.06.2010, 80 ♀; 11.07.2010, 54 ♀; 31.07.2010, 7 ♀; 7.08.2010, 49 ♀; 28.08.2010, 3 ♀; 9.07.2011, 223 ♀; 7.08.2011, 11 ♀.

**Enina village**, 537 m a.s.l., 42°395 N, 25°261E: 16.05.2010, 7 ♀; 29.05.2010, 3 ♀, 3 ♂; 16.06.2010, 15 ♀; 27.06.2010, 45 ♀, 1 ♂; 17.07.2010, 83 ♀, 7 ♂; 1.08.2010, 100 ♀, 3 ♂; 14.08.2010, 21 ♀, 8 ♂; 29.08.2010, 3 ♀; 22.05.2011, 10 ♀; 22.06.2011, 195 ♀, 5 ♂; 1.07.2011, 1 ♀; 16.07.2011, 28 ♀, 15 ♂; 17.07.2011, 85 ♀, 13 ♂; 28.08.2011, 54 ♀, 5 ♂; 11.09.2011, 10 ♀; 20.05.2012, 3 ♀; 17.06.2012, 57 ♀, 4 ♂; 15.07.2012, 22 ♀, 15 ♂; 05.08.2012, 60 ♀, 6 ♂; 01.09.2012, 5 ♀; 19.05.2013, 8 ♀;

16.06.2013, 117 ♀, 1 ♂; 14.07.2013, 155 ♀, 100 ♂; 11.08.2013, 9 ♂; 01.09.2013, 2 ♀.

**Gorno Izvorovo village**, 643 m a.s.l., 42°390N, 25°283 E: 16.05.2010, 42 ♀; 29.05.2010, 25 ♀; 17.06.2010, 12 ♀; 3.07.2010, 114 ♀; 18.07.2010, 91 ♀, 4 ♂; 2.08.2010, 13 ♀; 15.08.2010, 86 ♀, 1 ♂; 21.05.2011, 98 ♀; 23.06.2011, 262 ♀, 1 ♂; 16.07.2011, 233 ♀; 14.08.2011, 93 ♀, 3 ♂; 11.09.2011, 7 ♀; 20.05.2012, 2 ♀; 26.05.2012, 8 ♀; 16.06.2012, 103 ♀, 4 ♂; 14.07.2012, 46 ♀, 1 ♂; 22.07.2012, 1 ♀; 04.08.2012, 168 ♀; 22.08.2012, 1 ♀; 01.09.2012, 5 ♀; 13.09.2012, 1 ♀, 19.09.2012, 1 ♀; 19.05.2013, 11 ♀; 15.06.2013, 51 ♀; 13.07.2013, 128 ♀, 3 ♂; 10.08.2013, 13 ♀.

### Route collection – localities (2011)

By the river, before the fork in the road to the village of **Radino**, 42°829 N, 25°455 E: 16.07.2011, 12 ♀, 1 ♂.

Town of **Plachkovtsi**, Minkino district, 42°808N, 25°510 E: 16.07.2011, 10 ♀; 17.07.2011, 114 ♀, 1 ♂.

After the fork in the road to the village of **Radevtsi**, in the direction of the Krastets chalet, 42°803 N, 25°498 E: 16.07.2011, 2 ♀.

**Predela Site**, between the towns of Gabrovo and Tryavna, 42°858 N, 25°423 E: 17.07.2011, 10 ♀.

After the village of **Zhaltesh**, in the direction of Gabrovo, 42°858 N, 25°367 E: 17.07.2011, 6 ♀.

In the region of Mount **Buzludzha**, 42°740 N, 25°376 E: 17.07.2011, 12 ♀.

### Route collection – localities (2012)

A meadow located east of the village of **Sheynovo**, Kazanlak municipality, 07.07.2012, 1 ♀.

A meadow located northwest of the village of **Asen**, Pavel Banya municipality, 07.07.2012, 3 ♀.

A meadow by the river Gabrovnitsa, village **Skobelevo**, Pavel Banya municipality, 07.07.2012, 1 ♀.

A meadow located north of the village of **Tazha**, Pavel Banya municipality, 07.07.2012, 12 ♀.

**Panitsite Site**, 749 m a.s.l., 42°661 N, 24°981E: 07.07.2012, 6 ♀.

**RESULTS AND DISCUSSION**

A total of 3560 specimens of tabanids were collected and identified; 2426 of which for the period 2010-2011, already published by (6) and 1134 for the period 2012-2013 (new data). Totally, 20 species of 5 genera were identified for the period 2012-2013: *Atylotus* (1 species), *Hybomitra* (2 species), *Tabanus* (14 species), *Haematopota* 2 species) and *Philipomyia* (1 species). From the analysis of the literature data and the results obtained it was established that the species *Tabanus leleani* Austen 1920 was reported for the first time for the fauna of Bulgaria.

*Tabanus leleani* was registered on the territory of Central Balkan Mountains on the basis of 1 ♀ specimen caught in the area of the village of Enina on 16.06.2013. According to (10), the species is known for Europe (Romania, Greece, Turkey and Cyprus), for certain areas of the former USSR, Asia and North Africa. With the registration of *Tabanus leleani* on the territory of the Central Balkan Mountains, the number of tabanids, known for the fauna of Bulgaria, increases to 78 species.

The species *Tabanus indrae* Hauser, 1939 was reported for the first time from the territory of the Central Balkan Mountains, and the species *Hybomitra bimaculata* (Macquart, 1826), *Tabanus exclusus* Pandellé, 1883 and *Tabanus miki* Brauer, 1880 - for the first time from the studied localities.

Thus, based on the results of four-year studies and available literature data, it has been established that the tabanid fauna of the Central Balkan Mountains was represented by 41 species of 10 genera: *Nemorius* (1 species), *Chrysops* (3 species), *Atylotus* (3 species), *Therioplectes* (1 species), *Hybomitra* (3 species), *Tabanus* (21 species), *Heptatoma* (1 species), *Haematopota* (6 species), *Dasyrhamphis* (1 species) and *Philipomyia* (1 species). Of these, 31 species were identified in the Central Balkan Mountains during the study. These species are the subject of comment in this publication regarding their phenological features (**Table 1**).

**Table 1.** Phenodates of the adult horse flies in the region of the Central Balkan Mountains (2010-2013)

Species	Panitsite		Enina		Gorno Izvorovo		Other data from the region	
	beginning	end	beginning	end	beginning	end	beginning	end
<i>Chrysops caecutiens</i> (Linnaeus, 1758)	-	-	-	-	3.07.10	3.07.10	-	-
	-	-	-	-	-	-	16.07.11	17.07.11
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Chrysops ludens</i> Loew, 1858	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	17.07.11	17.07.11
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Chrysops viduatus</i> (Fabricius, 1794)	-	-	29.05.10	29.05.10	-	-	-	-
	-	-	22.06.11	22.06.11	23.06.11	23.06.11	-	-
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Atylotus loewianus</i> (Villeneuve, 1920)	7.08.10	28.08.10	1.08.10	14.08.10	15.08.10	15.08.10	-	-
	7.08.11	7.08.11	28.08.11	28.08.11	16.07.11	14.08.11	17.07.11	17.07.11
	-	-	15.07.12	01.09.12	14.07.12	04.08.12	07.07.12	07.07.12
	-	-	14.07.13	11.08.13	13.07.13	10.08.13	-	-
<i>Therioplectes gigas</i> (Herbst, 1787)	-	-	-	-	-	-	-	-
	-	-	-	-	23.06.11	23.06.11	-	-
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Hybomitra bimaculata</i> (Macquart, 1826)	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	17.07.11	17.07.11
	-	-	-	-	16.06.12	16.06.12	-	-
	-	-	-	-	-	-	-	-

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<i>Hybomitra ciureai</i> (Séguy, 1937)	-	-	27.06.10	27.06.10	18.07.10	18.07.10	-	-
	-	-	22.06.11	22.06.11	21.05.11	16.07.11	17.07.11	17.07.11
	-	-	17.06.12	15.07.12	16.06.12	16.06.12	07.07.12	07.07.12
	-	-	16.06.13	14.07.13	15.06.13	13.07.13	-	-
<i>Hybomitra distinguenda</i> (Verrall, 1909)	13.06.10	13.06.10	-	-	18.07.10	18.07.10	-	-
	-	-	-	-	23.06.11	23.06.11	-	-
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Tabanus autumnalis</i> Linnaeus, 1761	13.06.10	13.06.10	16.05.10	1.08.10	17.06.10	17.06.10	-	-
	-	-	22.06.11	17.07.11	16.07.11	16.07.11	-	-
	-	-	-	-	16.06.12	16.06.12	-	-
	-	-	16.06.13	14.07.13	19.05.13	19.05.13	-	-
<i>Tabanus bovinus</i> Linnaeus, 1758	-	-	-	-	15.08.10	15.08.10	-	-
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Tabanus bromius</i> Linnaeus, 1758	13.06.10	7.08.10	16.06.10	29.08.10	3.07.10	15.08.10	12- 21.06.10	12- 21.06.10
	9.07.11	7.08.11	22.06.11	28.08.11	23.06.11	14.08.11	16.07.11	17.07.11
	-	-	17.06.12	01.09.12	16.06.12	01.09.12	07.07.12	07.07.12
	-	-	16.06.13	11.08.13	15.06.13	10.08.13	-	-
<i>Tabanus cordiger</i> Meigen, 1820	-	-	16.05.10	1.08.10	18.07.10	18.07.10	-	-
	-	-	28.08.11	28.08.11	21.05.11	21.05.11	-	-
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Tabanus exclusus</i> Pandellé, 1883	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
	-	-	-	-	04.08.12	04.08.12	-	-
	-	-	-	-	-	-	-	-
<i>Tabanus glaucopsis</i> Meigen, 1820	31.07.10	28.08.10	17.07.10	17.07.10	-	-	1-10.07.10	20.08- 1.09.10
	9.07.11	7.08.11	17.07.11	17.07.11	23.06.11	11.09.11	16.07.11	17.07.11
	-	-	05.08.12	05.08.12	14.07.12	22.08.12	-	-
	-	-	14.07.13	14.07.13	-	-	-	-
<i>Tabanus indrae</i> Hauser, 1939	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
	-	-	15.07.12	15.07.12	04.08.12	04.08.12	-	-
	-	-	-	-	-	-	-	-
<i>Tabanus leleani</i> Austen, 1920	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
	-	-	16.06.13	16.06.13	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Tabanus maculicornis</i> Zetterstedt, 1842	13.06.10	7.08.10	16.06.10	17.07.10	17.06.10	3.07.10	1-10.07.10	1- 10.07.10
	9.07.11	9.07.11	22.06.11	17.07.11	-	-	16.07.11	17.07.11
	-	-	17.06.12	17.06.12	16.06.12	16.06.12	07.07.12	07.07.12
	-	-	16.06.13	14.07.13	15.06.13	15.06.13	-	-
<i>Tabanus miki</i> Brauer, 1880	-	-	-	-	2.08.10	2.08.10	-	-
	-	-	-	-	-	-	-	-
	-	-	15.07.12	15.07.12	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Tabanus quatuornotatus</i> Meigen, 1820	13.06.10	13.06.10	16.05.10	27.06.10	16.05.10	29.05.10	14.05.10	14.05.10
	-	-	22.05.11	22.06.11	21.05.11	23.06.11	-	-
	-	-	20.05.12	17.06.12	20.05.12	20.05.12	-	-
	-	-	19.05.13	16.06.13	19.05.13	15.06.13	-	-

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<i>Tabanus regularis</i> Jaenicke, 1866	-	-	14.08.10	14.08.10	18.07.10	18.07.10	-	-
	-	-	16.07.11	17.07.11	16.07.11	14.08.11	-	-
	-	-	15.07.12	05.08.12	14.07.12	14.07.12	07.07.12	07.07.12
	-	-	-	-	13.07.13	13.07.13	-	-
<i>Tabanus rupium</i> (Brauer, 1880)	-	-	27.06.10	27.06.10	3.07.10	3.07.10	-	-
	-	-	17.07.11	17.07.11	-	-	-	-
	-	-	17.06.12	17.06.12	-	-	-	-
	-	-	14.07.13	14.07.13	13.07.13	13.07.13	-	-
<i>Tabanus sudeticus</i> Zeller, 1842	-	-	27.06.10	14.08.10	18.07.10	18.07.10	-	-
	9.07.11	9.07.11	22.06.11	22.06.11	23.06.11	14.08.11	16.07.11	17.07.11
	-	-	15.07.12	15.07.12	16.06.12	04.08.12	-	-
<i>Tabanus tergestinus</i> Egger, 1859	13.06.10	7.08.10	16.06.10	14.08.10	17.06.10	15.08.10	2-12.06.10	10-20.07.10
	9.07.11	7.08.11	22.06.11	28.08.11	23.06.11	14.08.11	16.07.11	17.07.11
	-	-	17.06.12	05.08.12	16.06.12	01.09.12	07.07.12	07.07.12
	-	-	16.06.13	11.08.13	15.06.13	10.08.13	-	-
<i>Tabanus unifasciatus</i> Loew, 1858	-	-	17.07.10	14.08.10	18.07.10	15.08.10	-	-
	7.08.11	7.08.11	22.06.11	17.07.11	23.06.11	14.08.11	-	-
	-	-	17.06.12	05.08.12	16.06.12	04.08.12	07.07.12	07.07.12
<i>Heptatoma pellucens</i> (Fabricius, 1776)	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	17.07.11	17.07.11
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Haematopota grandis</i> Meigen, 1820	-	-	29.08.10	29.08.10	-	-	-	-
	-	-	28.08.11	11.09.11	11.09.11	11.09.11	16.07.11	16.07.11
	-	-	01.09.12	01.09.12	04.08.12	19.09.12	-	-
	-	-	01.09.13	01.09.13	-	-	-	-
<i>Haematopota italica</i> Meigen, 1804	-	-	-	-	16.05.10	29.05.10	-	-
	-	-	-	-	21.05.11	21.05.11	17.07.11	17.07.11
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Haematopota longeantennata</i> (Olsufjev, 1937)	-	-	-	-	-	-	-	-
	-	-	-	-	11.09.11	11.09.11	-	-
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Haematopota pluvialis</i> (Linnaeus, 1758)	13.06.10	13.06.10	16.05.10	14.08.10	16.05.10	15.08.10	-	-
	9.07.11	9.07.11	22.05.11	28.08.11	21.05.11	14.08.11	-	-
	-	-	20.05.12	17.06.12	20.05.12	04.08.12	-	-
	-	-	19.05.13	14.07.13	19.05.13	13.07.13	-	-
<i>Dasyrhamphis ater</i> (Rossi, 1790)	-	-	-	-	-	-	-	-
	-	-	22.06.11	22.06.11	-	-	-	-
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
<i>Philipomyia graeca</i> (Fabricius, 1794)	13.06.10	13.06.10	16.06.10	27.06.10	-	-	2.06.- 12.06.10	2.06.- 12.06.10
	9.07.11	9.07.11	-	-	16.07.11	16.07.11	16.07.11	17.07.11
	-	-	17.06.12	17.06.12	16.06.12	16.06.12	-	-
	-	-	16.06.13	16.06.13	-	-	-	-

Six of the 31 registered tabanid species were the most abundant (*Tabanus bromius*, *T. tergestinus*, *T. maculicornis*, *T. quatuornotatus*, *Atylotus loewianus* and *Haematopota pluvialis*), five were scarce species (*Hybomitra*

*ciureai*, *Tabanus glaucopis*, *T. sudeticus*, *T. unifasciatus* and *Haematopota grandis*), and the rest are rare. The data collected on the activity of the adult horse flies allow marking the variation limits of the phenodates of 17

tabanid species (**Table 1**). These were the most common species, the scarce species and 6 of the rare species (*Tabanus autumnalis*, *T. cordiger*, *T. regularis*, *T. rupium*, *Haematopota italica* and *Philipomyia graeca*). In addition, phenological data were collected for the remaining 14 rare species, 8 of which were registered once in only one of the localities studied (**Tables 1 and 2**), and the remaining 6 species were also observed once, but in more than one locality or in more than one year of the study (**Table 1**).

A complete coincidence of the adult activation date was reported for *Tabanus glaucopsis* in the pasture at Enina but only in 2010 and 2011 (17.07., **Table 1**), and during the next two years of the study the difference in the appearance of specimens of the species is about 22 days.

Small differences in the initial phenodates (between 1 and 6 days) were registered for 8 species: *Philipomyia graeca* (in Enina, 16.6.2010 and 2013 and 17.6.2012), *Tabanus maculicornis* (in G. Izvorovo, 15.6.-17.6. 2010-2013; in Enina, 16.6.2010 and 2013 and between 17.6-22.6.2011-2012), *T. tergestinus* (in Enina, 16.6.2010 and 2013 and between 17.6. and 22.6.2011 and 2013), *T. regularis* (in G. Izvorovo, between 14.7. and 18.7.2010-2012), *T. quatuornotatus* (in Enina and G. Izvorovo, between 16.5. and 22.5.2010-2013), *Haematopota italica* (in G. Izvorovo, 16.5.2010-21.5.2011), *H. pluvialis* (in Enina and G. Izvorovo, between 16.5. and 22.5. 2010-2013) and *H. grandis* (in Enina, 28.8.-1.9.2010-2013) (**Table 1**). In other species, the terms of their appearance in the studied localities vary between 6 and 45 days, but most often between 6 and 33 days. The longest period of emergence of the first specimens was found for *T. cordiger* (104 days, **Table 1**). The species was registered in 2010 on 16.5., and in 2011 - on 28.8. (**Table 1**). *T. cordiger* is a rare species for the region, whose relative number represents 0.29% of the total number of all specimens caught for the 2010-2011 period.

Studies on the adult horse flies phenology have been conducted almost at the same time each year in the study area, but, nevertheless, differences in the initial phenodates of the same species in the same biotope and a different duration of their active season have been established (**Table 1 and Table 2**). The active period of the adult horse flies is marked by the first and last registered flight date of the species.

The initial and final phenodates of the species are not a constant value; therefore the duration of the flight period of a given species also varies, not only in different biotopes, but also in the same biotope during the different years (**Table 1**). The appearance of the adult horse flies and the duration of their flight period were largely influenced by fluctuations in the values of meteorological factors and especially by temperature. It can speed up or slow down the time of the imago appearance, prolong or shorten the active period of the species, but only within the genetically set phenodates of the species. In our opinion, the fluctuations in the values of meteorological factors (mainly temperature and precipitation) were one of the reasons for the reported different periods of occurrence and flight of the same species, both in different biotopes and in the same biotope during different years (**Table 1**). In addition, precise marking of phenodates largely depends on the abundance of species' populations in each biotope. The more numerous the population of a species, the greater the chances of catching specimens of the species and, accordingly, more precisely to fix the flight period of a given species. It follows that in rare or scarce species the specimens of a given species are much less likely to be encountered, which reflects on the precise determination of the phenodates of the adult's flight. This explains the short flight period that was registered for some species in different years or in the individual localities (*Tabanus rupium*; *T. sudeticus*, etc., **Table 1**). The small populations of the species may be at the same time the reason for the rather long periods of occurrence in some species recorded in the study area (*T. cordiger* - 104 days; *Atylotus loewianus* - 45 days; *Tabanus autumnalis* - 37 days, **Table 1**). The obtained extended terms of occurrence of these species may also be due to the fact that the first registration of the species during their active season is at the end of their flight period. This has been observed by us in the species *T. cordiger*. The first specimens of the species were caught in the pasture at Enina on 16.5.2010, and in the following year (2011) the appearance of the species was registered only on 28.8.2011 in the same biotope (**Table 1**). According to the literature (1-2 and 11), *T. cordiger* flies from May to the end of August - the first decade of September. It follows that the specimens caught on 28.8.2011, which are the first registered specimens of the species for 2011, were actually collected not at the

beginning, but at the end of the flight period of the species.

The summarized data from the study on tabanid activity on the territory of the Central Balkan Mountains for the period 2010-2013 show that the species *Tabanus quatuornotatus* (14.5.); *Tabanus autumnalis*, *T. cordiger*, *Haematopota italica* and *H. pluvialis* (16.05.); *Hybomitra*

*ciureai* (21.5.) and *Chrysops viduatus* (29.05.) are the first to become active in the region. Unlike them, *Haematopota grandis* was registered at the earliest in August (4.8.) in the localities of Enina and G. Izvorovo, but in the area of Plachkovtsi - on 16.7. This is the earliest emergence of the species for Bulgaria (**Table 1 and Table 2**).

**Table 2.** Flight duration of the tabanids in the Central Balkan Mountains (summarized data)

Species	Months				
	May	June	July	August	September
<i>C. caecutiens</i>	-	-	03.07...17.07.	-	-
<i>C. ludens</i>	-	-	• 17.07.	-	-
<i>C. viduatus</i>	29.05.....	23.06.	-	-	-
<i>A. loewianus</i>	-	-	07.07.....		01.09.
<i>Th. gigas</i>	-	• 23.06.	-	-	-
<i>H. bimaculata</i>	-	16.06.....	17.07.	-	-
<i>H. ciureai</i>	21.05.....		18.07	-	-
<i>H. distinguenda</i>	-	13.06.....	18.07.	-	-
<i>T. autumnalis</i>	16.05.....			01.08.	-
<i>T. bovinus</i>	-	-	-	• 15.08.	-
<i>T. bromius</i>	-	12.06.....			01.09.
<i>T. cordiger</i>	16.05.....			28.08.	-
<i>T. exclusus</i>	-	-	-	• 04.08.	-
<i>T. glaucopis</i>	-	23.06.....			11.09.
<i>T. indrae</i>	-	-	15.07.....	04.08.	-
<i>T. leleani*</i>	-	• 16.06.	-	-	-
<i>T. maculicornis</i>	-	13.06.....		07.08.	-
<i>T. miki</i>	-	-	15.07.....	02.08.	-
<i>T. quatuornotatus</i>	14.05.....	27.06.	-	-	-
<i>T. regularis</i>	-	-	07.07.....	14.08.	-
<i>T. rupium</i>	-	17.06.....	17.07.	-	-
<i>T. sudeticus</i>	-	16.06.....		14.08.	-
<i>T. tergestinus</i>	-	02.06.....			01.09.
<i>T. unifasciatus</i>	-	16.06.....		15.08.	-
<i>H. pellucens</i>	-	-	• 17.07.	-	-
<i>H. grandis</i>	-	-	16.07.....		19.09.
<i>H. italica</i>	16.05.....		17.07.	-	-
<i>H. longeantennata</i>	-	-	-	-	• 11.09.
<i>H. pluvialis</i>	16.05.....			28.08.	-
<i>D. ater</i>	-	• 22.06.	-	-	-
<i>Ph. graeca</i>	-	02.06.....	17.07.	-	-

The data in **Table 2** shows that 10 species are activated in June. The first tabanids that are active even in early June (2.6.) are *Tabanus tergestinus* and *Philipomyia graeca*, while the other 7 species begin flying in the second decade of June (12.6.-17.6.). Only *Tabanus glaucopis* is activated at the latest (23.6.), but it is a late-summer species which peak of abundance in August. In July, another 6 of the species registered in the tabanid community of the Central Balkan Mountains take off. Half of them are activated at the beginning of the month (3.7.-7.7.), and the rest - around the middle of

July (15.7.-16.7.) (**Table 2**) Eight of the species were observed once during the study in the area, and their distribution during the flight season of tabanids is as follows: *Th. gigas*, *T. leleani* and *D. ater* were registered in the second half of June, *C. ludens* and *H. pellucens* - in the second half of July, *T. bovinus* and *T. exclusus* - in the first half of August, and only *H. longeantennata* - in the first half of September (**Table 2**).

Data in **Table 2** shows that tabanids do not take off simultaneously, but in a certain sequence, which reflects on the composition of the tabanid

community during its active season. A similar change in the composition of the tabanid assemblages during the spring-summer period was found by (9 and 12-14). According to (9), the change of some tabanid species with others, during their active season, is explained by the difference in their flight period. However, while the different dates of their emergence determine the sequence of their take-off, the different duration of their active period influences the dynamics in the change of the community composition.

Phenological studies on the tabanid complex in the Central Balkan Mountains have established that some species fly throughout the tabanid active season, others - only at the beginning or only in the middle, and third - only at the end of their season (**Table 2**). The dominant species *Tabanus tergustinus*, *T. bromius* and *Haematopota pluvialis* and the rare species *T. cordiger* and *T. autumnalis* are active throughout the whole season and represent the permanent composition of the tabanid community. At the beginning of the season, they are joined by the subdominant *Tabanus quatuornotatus*, the scarce *Hybomitra ciureai* and the rare species *Chrysops viduatus*, *H. distinguenda*, *H. bimaculata*, *Haematopota italica* and *Philipomyia graeca* (**Table 2**).

Diversity in the tabanid community is achieved by the inclusion of species with short flight activity in mid-summer. For the region of the Central Balkan Mountains these are the rare species *Chrysops caecutiens*, *Tabanus indrae*, *T. miki*, *T. regularis* and *T. rupium*. At the end of the tabanid active season the subdominant species *Atylotus loewianus* and the scarce species *Haematopota grandis* are distinguished by a high number (**Table 2**).

According to (2), tabanids in Bulgaria can be divided into 5 phenogroups based on the adult phenological features. The main criterions, on the basis of which they are classified, are the months included in their active period. According to this criterion, the following tabanid phenogroups are distinguished: spring (April-May), early summer (May-June), summer (June-July-August), late summer (late July-August-September) and polyseasonal (May-September).

According to this criterion, the species, found in the Central Balkan Mountains, fall into 4 of the above mentioned groups: the groups of early summer (May-June), summer (June-July-August), late summer (late July-August-September) and the polyseasonal (May-September) species (**Table 3**).

**Table 3.** Composition of the tabanid phenogroups in the Central Balkan Mountains.

Spring IV-V	Early summer V-VI	Summer VI-VII-VIII	Late summer VII-VIII-IX	Polyseasonal V-IX
-	<i>C. viduatus</i>	<i>C. caecutiens</i>	<i>A. loewianus</i>	<i>T. bromius</i>
-	<i>T. autumnalis</i>	<i>C. ludens</i>	<i>T. glaucopis</i>	<i>T. cordiger</i>
-	<i>T. quatuornotatus</i>	<i>Th. gigas</i>	<i>H. longeantennata</i>	<i>T. tergustinus</i>
-	<i>H. italica</i>	<i>H. bimaculata</i>	<i>H. grandis</i>	<i>H. pluvialis</i>
-	-	<i>H. ciureai</i>	-	-
-	-	<i>H. distinguenda</i>	-	-
-	-	<i>T. bovinus</i>	-	-
-	-	<i>T. exclusus</i>	-	-
-	-	<i>T. indrae</i>	-	-
-	-	<i>T. leleani</i>	-	-
-	-	<i>T. maculicornis</i>	-	-
-	-	<i>T. miki</i>	-	-
-	-	<i>T. regularis</i>	-	-
-	-	<i>T. rupium</i>	-	-
-	-	<i>T. sudeticus</i>	-	-
-	-	<i>T. unifasciatus</i>	-	-
-	-	<i>H. pellucens</i>	-	-
-	-	<i>D. ater</i>	-	-
-	-	<i>P. graeca</i>	-	-

The phenogroup of summer species is distinguished by the greatest species diversity in the Central Balkan Mountains. It includes 19

species, including subdominant *T. maculicornis*, scarce species *H. ciureai*, *T. sudeticus* and *T. unifasciatus*, as well as 15 rare



species. The other three phenogroups (early summer, late summer, and polyseasonal species) are represented by 4 species each (**Table 3**). The three dominant species *Tabanus tergestinus*, *T. bromius* and *Haematopota pluvialis* form the main nucleus of the polyseasonal species group. They fly throughout the active season of tabanids, and the number of their populations varies not only in different years but also in different biotopes. Despite the fluctuations in their abundance, the populations of these species represent the main part of the tabanid community, which attacks the animals on the pastures in the area.

The results obtained in this study, regarding the phenology of the adult horse flies, are comparable with the data of (2 and 5) about the tabanids in Bulgaria and with those of (8-9 and 11) - respectively for Europe, for the territory of the former USSR and Romania. In most of the species, a complete or partial coincidence with the indicated phenological dates of the adult horse flies has been established by the authors cited above.

On the basis of the study conducted we report the activity of *Tabanus sudeticus* from mid-June to mid-August (**Table 2**). According to (1) the specimens of the species fly in June and (15) registered activity of the species in the region of Tvardishki Balkan Mountains in August. This gives us the reason to mark the flight period of *Tabanus sudeticus* in Bulgaria from mid-June to mid-August.

## CONCLUSIONS

On the basis of the systematic collection of material from the Central Balkan Mountains for four years and the analysis of the literature data, it can be summarized that the tabanid fauna of the region is represented by 41 species of 10 genera: *Nemorius* (1 species), *Chrysops* (3 species), *Atylotus* (3 species), *Therioplectes* (1 species), *Hybomitra* (3 species), *Tabanus* (21 species), *Heptatoma* (1 species), *Haematopota* (6 species), *Dasyrhamphis* (1 species) and *Philipomyia* (1 species).

The data on the composition of the tabanid fauna of Bulgaria and the Central Balkan Mountains have been updated. For the first time the species *Tabanus leleani* Austen 1920 was reported for the fauna of Bulgaria. *Tabanus indrae* Hauser, 1939 was reported for the first time from the study area. The species *Hybomitra bimaculata* (Macquart, 1826), *Tabanus exclusus* Pandellé, 1883 and *Tabanus*

*miki* Brauer, 1880 have been established for the first time in the studied localities in the Central Balkan Mountains.

As a result of the study in the Central Balkan Mountains 31 species have been registered and analyzed in terms of their phenological features. The flight period of the most common tabanid species has been confirmed. The phenological features of the rare species have been supplemented and the flight period of *Tabanus sudeticus* in Bulgaria have been marked (from the middle of June to the middle of August).

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