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Review of the Families of the Suborder Nematocera (Insecta: Diptera) of Bulgaria

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Abstract: A total of 1672 species of the suborder Nematocera, belonging to 26 families, has been reported from Bulgaria so far. The families Chironomidae (327 species), Mycetophilidae (263 species), Cecidomyiidae (262 species) and Limoniidae (221 species) comprise the greatest number of species. Of the established species, 40 are pests on the forestry or agriculture and 26 species have a human or veterinary medical significance. The distribution of dipterans in the different regions of Bulgaria is presented. The greatest number of species has been found in the zone of the xerothermic oak forests (1087 species or 65.0%). The Nematocera belong to 104 zoogeographical categories, divided into 2 supergroups: 1) species with Mediterranean type of distribution (131 species or 7.8%) – more thermophilic and distributed mainly in the southern parts of the Palaearctic and the lower parts of the mountains; 2) species with Palaearctic and Eurosiberian type of distribution (1541 species or 92.2%) – more eurybiontic and widely distributed. A total of 60 (3.6%) endemics has been found. The distribution of the zoogeographical categories in the separate vegetation belts of Bulgaria is scrutinised.

Key words: Nematocera, Bulgaria, faunistic composition, vertical distribution, zoogeography

Introduction

The Bulgarian dipteran fauna has been studied for 159 years (Löw 1862). Since then, a vast material of faunistic data from the territory of Bulgaria has been accumulated. During the last 70 years, different parts of the country have been under landscape changes and anthropogenic impact. Changes in the natural communities are caused by some alien species introduced in the last 100 years. The economic importance of the biodiversity, the dynamic character of the fauna and its protection necessitate a periodic updating of the data concerning the faunistic diversity of various taxonomic groups.

The first data on the Diptera from Bulgaria were reported by Löw (1862, 1863), Meunier (1897) and Joakimoff (1999). Nedelkov (1912) reported new families and a review of the dipteran fauna of Bulgaria. Various publications have been presented by other authors (Kovachev 1905, Vimmer 1916, Enderlein 1921, 1924, 1930, Komárek & Vimmer 1921, 1922, 1934, Konsuloff 1921a, 1921b, 1922a, 1922b, 1922c, 1923a, 1923b, Buresch 1924, 1926a, 1926b, 1928, 1930, Konsuloff & Paspalev 1924, 1925, Drensky 1926, 1939, Drensky & Drensky 1928, Drenowsky 1929a, 1929b, 1936, 1939, Czerný 1930, Szilády 1934, Zilahi 1934, Lackschewitz 1940a, 1940b, Valkanov 1941). Numerous data on the plant pests and species of medical significance are available in the applied entomological literature. The number of publications increased rapidly after the Second World War. Taxonomic and faunistic studies were performed by Bulgarian and foreign authors. The hydrobiological studies are important for elucidating the species composition of the water-related

dipterans. The investigations of the cave fauna contributed to the study of certain families. In many monographs and catalogues related to Diptera of the various geographical areas, taxa from Bulgaria without accurate localities have been mentioned.

An overview of the families reported from Bulgaria was presented by Beschovski (1993). Data on the vertical distribution of the Nematocera is available in separate publications (Dimitrova 1989, Bechev 2006, 2007, 2010, Pavlova 2020a, 2020b, 2020c). In the publications on the Diptera from the Pirin, Rila, Vitosha and Vrachanska Planina Mts., the vertical distribution of 773 species of 24 Nematocera families is analysed (Hubenov 2015b, 2016, 2017, 2018, 2019a, 2019b). In 569 publications, there are data related to the Nematocera in Bulgaria.

The aim of this work is to present the fauna, distribution according to the vegetation belts and zoogeography of the suborder Nematocera in Bulgaria.

Materials and Methods

All species reported from Bulgaria are included (as well as species given without localities in various foreign publications). The processing of the literary data has reviewed all data that refer to the Bulgarian Diptera. The classification of the Nematocera is based on the works of Soós & Pap (1984-1993), Wood & Borkend (1989), Papp & Darvas (1997, 2000a, 2000b), Nartshuk (2003), Ziegler (2003), Oosterbroek (2006), Yeates et al. (2007) and Pape et al. (2011).

Weaknesses in the literature data limiting the acquisition of an equivalent information when comparing territories and systematic groups include: different levels of study of the individual taxa; insufficient research of many families in the corresponding areas; a lack of exact localities for the part of the recorded species; insufficient data for the localities and vertical distribution; existence of rich synonymy; outdated data; a lack of generalised investigations; significant differences in the number of taxa in the separate areas; unexplored territories; prolonged periods of data accumulation for most regions; predominance of the ecological studies versus those of the fauna; priority research on groups of economic and medical significance. These weaknesses lead to six problems: 1) Continuous supplementation of an existing historical list of the fauna. As a result, species diversity in a given area is higher than in reality. 2) Incomparability of data in terms of time periods. Data comparisons between two areas very often cover different periods as it is not possible to study all taxonomic groups and territories simultaneously. 3) Inaccurate zoogeographical characteristic of some taxa due to the lack of information on their vertical distribution. 4) Incomplete reporting of the anthropogenic impact, successional and landscape changes on the communities in the separate regions. Thus, a number of well-studied areas in the past have already been significantly changed. 5) Prioritization of research in areas under monitoring or environmental protection legislation. 6) Workload of the specialists with environmental, medical and other applied investigations that do not allow them to devote time to faunistic research.

A system of natural territories is used to represent the species distribution in Bulgaria (Hubenov 1997). This is a hierarchical system (Fig. 1, Table 1), which allows using larger or smaller number of territorial units. The first letter in the abbreviations corresponds to the region; the second – to the subregion; and the figure – to a smaller territorial unit.

The vertical distribution is presented according to the vegetation belts. The vegetation of Bulgaria is differentiated in a system of six vegetation belts (Stojanov 1966, Velchev et al. 1982, 1989, Velchev & Tonkov 1986, Bondev 1991, 1997, 2002, Velchev 1997, 2002): 1) Xerothermic oak forests (sub-Mediterranean vegetation) – up to 600-700 m a.s.l.; 2) Mesophylic and xeromesophylic mixed (oak-hornbeam) forests – from 600-700 m to 900-1000 m a.s.l.; 3) Beech forests – from 900-1000 m to 1500-1600 m a.s.l.; 4) Coniferous forests – from 1500 (1300)-1600 m to 2000-2200 m a.s.l.; 5) Subalpine vegetation – from 2000-2200 m to 2500 m a.s.l.; 6) Alpine vegetation – over 2400-2500 m a.s.l. The boundaries between the vegetation belts are not defined clearly and depending on the relief, climate, exposure and human activities there are mixed zones up to 200-300 m a.s.l.

The classification of the areas is based on the available literature and recent electronic issues. Zoogeographical analysis for the taxa categorisation was used. This method allows obtaining data information about species complexes with different zoogeographical character based on the published data regarding species distribution and results of the faunistic research. These complexes contain zoogeographical information about the taxonomic groups which, combined with the origin of the ranges, determines the zoogeographical character of the fauna. The distribution of the species according to the zoogeographical categories in the different vegetation belts and the distribution of the zoogeographical categories in each belt are scrutinised. The classification of the areas is based on the works of Geptner (1936), Darlington (1957), Kryzhanovsky (1965, 1976, 2002), de Lattin (1967),

Müller (1974, 1980), Udvardi (1975), Crosskey & White (1977), Malicky et al. (1983), Gorodkov (1984), Grehan (1988, 1993), Vigna Taglianti et al. (1999), Procheş & Ramdhani (2012), Holt et al. (2013), Ficetola et al. (2017) and Emeljanov (2018). The traditional nomenclature of the areas and the border between the Western and Eastern Palaearctic along the Yenisei River is accepted.

Results

A total of 1672 species of the Nematocera (22.4% of the European species) belonging to 26 families has been established in Bulgaria (Table 2). The families Chironomidae (327 species), Mycetophilidae (263 species), Cecidomyiidae (262 species) and Limoniidae (221 species) comprise the greatest number of species. The other families contain less than 100 species. Of the 32 families known from Europe (Oosterbroek 2006), Axymyiidae, Pachyneuridae, Pleciidae, Mycetobiidae, Synneuridae and Canthyloscelidae have not been recorded in Bulgaria; most of them are represented by one or two species in Europe, and the Mycetobiidae is represented by four species. Usually, the families studied in Bulgaria (with some exceptions) include over 25% of the European species. Of the largest families – Cecidomyiidae (1640 species), Chironomidae (1190 species) and Mycetophilidae (945 species), in Bulgaria are found 16.0%, 27.5% and 27.8% of the European species. The mosquitoes of the family Limoniidae are well represented – 39.5% of the European taxa. The family Culicidae (47 species established) has been studied for the longest time and most systematically in Bulgaria, which includes 44.8% of the European species. The families Scatopsidae and Thaumaleidae are the most poorly studied in Bulgaria. Of these families, in Bulgaria are known 4.0% and 5.3% of the European taxa. Of the larger families, Ceratopogonidae and Sciaridae are poorly studied, of which from 11.2% to 13.5% of the European species are known in Bulgaria. Some old data about the Chironomidae family, collected in the hydrobiological studies, are problematic (in some cases incorrect identification is not excluded as an accurate determination of the larvae by species is not always possible). The infraorders of the Nematocera, represented in Bulgaria (Table 2), include from 17.7% (Psychodomorpha) to 33.3% (Ptychopteromorpha) of the European taxa.

Of the established in Bulgaria species of the suborder Nematocera, 26 species have a human or veterinary medical significance and 40 are pests on the forestry or agriculture (Appendix 1). Most representatives of medical significance includes the family Culicidae, followed by Ceratopogonidae, Psychodidae and Simuliidae. The main part of the vegetation pests belongs to the family Cecidomyiidae. Only 5 species are shared out among Tipulidae, Bibionidae and Sciaridae.

Discussion

The distribution of the Nematocera on the territory of Bulgaria (Table 1) is related to the specific natural conditions of the respective regions, the peculiarities of the families and their study. The wide distribution of Diptera assumes a similar fauna of the different regions after a good research. Most dipterans have vast ranges and the endemics are poorly represented. The taxa presence is connected with the exploration of the corresponding parts of the country. This is evident when comparing the established species with regard to the separate regions in Bulgaria. There are no data for the mountains Rouy, Vlahina, Maleshevska, Ograzhden and the Trun Basin. For the fifteen natural territories (1-29 species known) there are single reports (Eastern Predbalkan, Eastern Stara Planina Mts., the mountains of Kraishte, Viskyar and Zavalska, Sushtinska and Surnena Sredna Gora Mts., Sakar Mt., Bakadzhik-Bourgas district, Osogovska Planina Mts., Belasitsa Mts., Slavyanka Mt. and Sturgach Mt.). Several areas with better research of the Nematocera fauna are outlined. These are natural areas located near research centres, included in the national and nature parks, or areas subject of dissertation works for separate families. Among the territories with better study of the fauna with respect to more systematic groups (represented by over 14% of the species found in Bulgaria) are the Western Predbalkan, Western Stara Planina Mts., Sofia Basin, Vitosha Mt., Rila Mts., Western Rhodope Mts. and the Northern Black Sea Coast (from 14.8% to 27.3% of the Nematocera, established in Bulgaria). In the Western Stara Planina Mts. and Vitosha Mt. dissertation works have been performed on the large families – Mycetophilidae and Cecidomyiidae. There is a decreasing tendency of the level of research from west to east and from north to south, which is clearly followed in the Danubian Plain, the Stara Planina Range system, Sredna Gora Mts., the Rila-Rhodope massif and the Black Sea coast. An exception of this tendency are the mountains in the western part of the Transitional Region (west of Sofia) which are traditionally neglected by the most zoologists and despite their vicinity to the capital, are poorly studied. Regarding to the main territorial units, it is impressive the close species diversity between the Danubian Plain

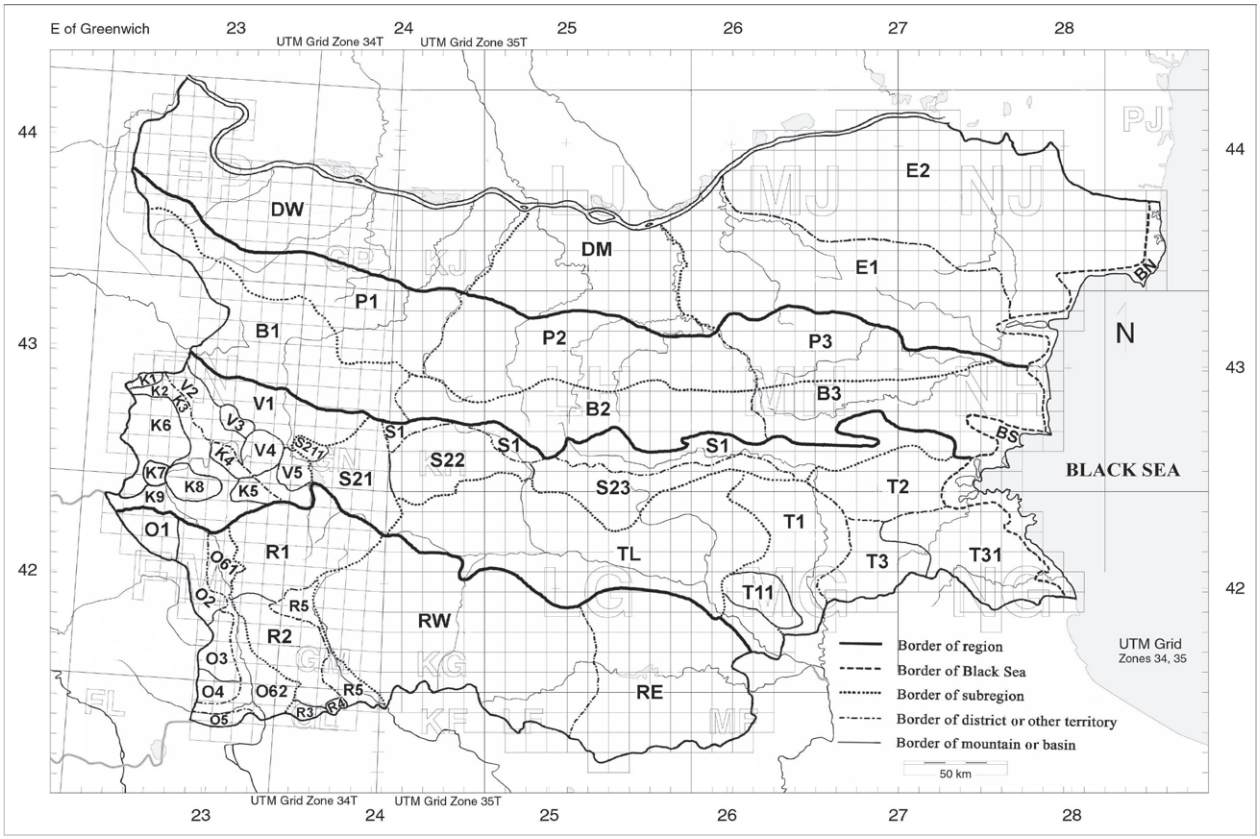

Fig. 1. Natural geographical territorial units of Bulgaria. **Abbreviations used: B** – Black Sea Coast; **B1** – Western Stara Planina (Balkan) Mts.; **B2** – Middle Stara Planina (Balkan) Mts.; **B3** – Eastern Stara Planina (Balkan) Mts.; **BN** – Northern Black Sea Coast; **BS** – Southern Black Sea Coast; **D** – Danubian Plain; **DM** – Middle Danubian Plain; **DW** – Western Danubian Plain; **E1** – Popovo-Provadiya district; E2 – Loudogorie-Dobroudzha district; **P1** – Western Predbalkan; **K1** – Rouy Mt.; **K2** – Trun Basin (Znepole); **K3** – Strazha-Cherna Gora-Rudini Mts.; **K4** – Golo Burdo Mt.; **K5** – Verila Mts.; **K6** – Kraishte; **K7** – Zemenska Planina Mt.; **K8** – Konyavska Planina Mt.; **K9** – Kyustendil Basin; **O1** – Osogovska Planina Mts.; **O2** – Vlahina Planina Mts.; **O3** – Maleshevska Planina Mts.; **O4** – Ograzhden Mts.; **O5** – Belasitsa Mts.; **O6** – Srednostroumska Valley; **O61** – Boboshevo-Simitli Valley; **O62** – Kroupnik-Sandanski-Petrich Valley; **P2** – Middle Predbalkan; **P3** – Eastern Predbalkan; **R** – Rila-Rhodope Massif; **R1** – Rila Mts.; **R2** – Pirin Mts.; **R3** – Slavyanka Mt.; **R4** – Sturgach Mt.; **R5** – Mesta Valley; **RE** – Eastern Rhodope Mts.; **RO** – Osogovo-Belasitsa group; **RP** – Rila-Pirin group; **RR** – Rhodope Mts.; **RW** – Western Rhodope Mts.; **S** – Stara Planina Range System; **S1** – Podbalkan Basins; **S2** – Sredna Gora Mts.; **S21** – Ihtimanska Sredna Gora Mts.; **S211** – Lozenska Planina Mt.; **S22** – Sushtinska Sredna Gora Mts.; **S23** – Surnena Sredna Gora Mts.; **SB** – Stara Planina (Balkan) Mts.; **SP** – Predbalkan; **T** – Transitional Region; **T1** – Sakar-Toundzha district; **T11** – Sakar Mt.; **T2** – Bakadzhik-Bourgas district; **T3** – Strandzha-Dervent district; **T31** – Strandzha Mts.; **TK** – Kraishte-Konyavo district; **TL** – Thracian Lowland; **TS** – Srednogorie-Podbalkan subregion; **TT** – Toundzha-Strandzha subregion; **TV** – Vitosha district; **V1** – Sofia Basin; **V2** – Zavalska-Viskyar Mts.; **V3** – Lyulin Mt.; **V4** – Vitosha Mt.; **V5** – Plana Mts.

and the Black Sea coast (19.6-21.9% of all species established) on the one hand and the Stara Planina Range system, the Transitional Region and the Rila-Rhodope Massif (43.0-48.6% of the species established) from another. The Rila-Rhodope massif has the greatest species composition but it includes some of the most visited and studied territories, such as the valley of the Struma River with the Kresna Gorge and the Rila, Pirin and Western Rhodope Mts. For Sredna Gora Mts. it can be noted that the main part of the taxa (65 species – 64.3%) are found in the Lozenska Planina Mt. (a small part of Ihtimanska Sredna Gora Mts., located near Sofia) whereas the Sushtinska Sredna Gora Mts. (18.8% of the species) and Surnena Sredna Gora Mts. (7.9% of the species) are poorly studied. The situation is similar in the Toundzha-Strandzha subregion where the most taxa (62%) are found in Strandzha Mts. (100% of the species of the Strandzha-Dervent district). In the Rila-Pirin group the taxa reported from the Rila (63.4%) and Pirin (44.4%) Mts. prevail while for Slavyanka Mt. and Sturgach Mt. there are single reports. The

Table 1. Distribution of the Nematocera in the natural geographic territorial units of Bulgaria

The system of the natural geographic territorial units	Abbreviations	Number of species	Percents
DANUBIAN PLAIN	**D**	**328**	**19.6**
Western Danubian Plain	**DW**	**219**	**13.1**
Middle Danubian Plain	**DM**	**210**	**12.6**
Eastern Danubian Plain	**DE**	**191**	**11.4**
Popovo-Provadiya district	E1	154	9.2
Loudogorie-Dobroudzha district	E2	144	8.6
STARA PLANINA RANGE SYSTEM	**S**	**719**	**43.0**
Predbalkan	**SP**	**329**	**19.7**
Western Predbalkan	P1	247	14.8
Middle Predbalkan	P2	198	11.8
Eastern Predbalkan	P3	19	1.1
Stara Planina (Balkan) Mts.	**SB**	**542**	**32.4**
Western Stara Planina (Balkan) Mts.	B1	457	27.3
Middle Stara Planina (Balkan) Mts.	B2	198	11.8
Eastern Stara Planina (Balkan) Mts.	B3	23	1.4
TRANSITIONAL REGION	**T**	**781**	**46.7**
Kraishte-Konyavo district	**TK**	**114**	**6.8**
Rouy Mt.	K1		
Trun Basin (Znepole)	K2		
Strazha-Cherna Gora-Rudini Mts.	K3	29	1.7
Golo Burdo Mt.	K4	8	0.5
Verila Mts.	K5	2	0.1
Kraishte	K6		
Zemenska Planina Mt.	K7	38	2.3
Konyavska Planina Mt.	K8	53	3.2
Kyustendil Basin	K9	71	4.2
Vitosha district	**TV**	**561**	**33.6**
Sofia Basin	V1	257	15.4
Zavalska-Viskyar Mts.	V2	1	0.06
Lyulin Mt.	V3	18	1.1
Vitosha Mt.	V4	329	19.7
Plana Mts.	V5	81	4.8
Srednogorie-Podbalkan subregion	**TS**	**192**	**11.5**
Podbalkan Basins	S1	107	6.4
Sredna Gora Mts.	S2	101	6.0
Ihtimanska Sredna Gora Mts.	S21	90	5.4
Lozenska Planina Mt.	S211	65	3.9
Sushtinska Sredna Gora Mts.	S22	19	1.1
Surnena Sredna Gora Mts.	S23	8	0.5
Thracian Lowland	**TL**	**200**	**12.0**
Toundzha-Strandzha subregion	**TT**	**192**	**11.5**
Sakar-Toundzha district	T1	87	5.2
Sakar Mt.	T11	7	0.4
Bakadzhik-Bourgas district	T2	28	1.7
Strandzha-Dervent district	T3	119	7.1
Strandzha Mts.	T31	119	7.1
RILA-RHODOPE MASSIF	**R**	**813**	**48.6**
Osogovo-Belasitsa group	**RO**	**248**	**14.8**
Osogovska Planina Mts.	O1	4	0.2
Vlahina Planina Mts.	O2		

Table 1. Continuation.

The system of the natural geographic territorial units	Abbreviations	Number of species	Percents
Maleshevska Planina Mts.	O3		
Ograzhden Mts.	O4		
Belasitsa Mts.	O5	14	0.8
Srednostroumska Valley	O6	193	11.5
Boboshevo-Simitli Valley	O61	159	9.5
Kroupnik-Sandanski-Petrich Valley	O62	140	8.4
Rila-Pirin group	**RP**	**525**	**31.4**
Rila Mts.	R1	333	19.9
Pirin Mts.	R2	233	13.9
Slavyanka Mt.	R3	14	0.8
Sturgach Mt.	R4	1	0.06
Mesta Valley	R5	114	6.8
Rhodope Mts.	**RR**	**449**	**26.8**
Western Rhodope Mts.	RW	385	23.0
Eastern Rhodope Mts.	RE	153	9.1
BLACK SEA COAST	**B**	**367**	**21.9**
Northern Black Sea Coast	**BN**	**285**	**17.0**
Southern Black Sea Coast	**BS**	**165**	**9.9**

difference in the number of species between the valleys of the rivers Struma (193 species – 11.5%) and Mesta (114 species – 6.8%) is determined both by the specific natural conditions and the many studies of the Sandanski-Petrich Valley and Kresna Gorge compared to the limited research (mostly hydrobiological) in the valley of the Mesta River. The difference between the Western (385 species – 23.0%) and Eastern Rhodope Mts. (153 species – 9.1%) is also related to the natural conditions and prevailing interest of the specialists in the Western Rhodope Mts. Vitosha Mt. is the most well-studied Bulgarian mountain with a taxonomic diversity (329 species – 19.7%) comparable to that of the Rila and Western Rhodope Mts. despite its smaller area. In the better studied families (Limoniidae and Simuliidae) the differences among the Vitosha, Rila and Pirin Mts. are not big (Hubenov 2019b). Further studies of the Pirin Mts. would like increase the number of the dipterans and it might exceed most of the Bulgarian mountains. This is related to the wide variety of natural habitats, as well as the geographical location which the mountain occupies in Southwest Bulgaria.

In the xerothermic oak forests belt, the biggest number of species (1087 – 65.0%) has been established (Table 2). This is due to the specificity of the separate families and the position of the most localities below 1000 m a.s.l. In the next two belts – the mesophilic and xeromesophilic mixed forests (932 species – 55.7%) and beech forests (756 species – 45.2%), the number of species decrease with 10% each. In the other vegetation belts the number of species decreases sharply, especially in the subalpine and alpine vegetation belts (represented by 9 to 4 families). There is an exception in the families Limoniidae, Pediciidae, Trichoceridae, Mycetophilidae, Bolitophilidae, Sciaridae, Cecidomyiidae, Simuliidae and Chironomidae (well represented in the beech and coniferous forests belts), which are studied in the mountains and are well represented in the mountainous areas. This explains the percentage increase of Tipulomorpha (20.8% – 32.1%) and Culicomorpha (24.9% – 58.3%) from the beech to the subalpine vegetation belt. In Bibionomorpha, the percentage increase is greatest in the beech forests belt (49.3%). This is related to the research of the superfamily Sciaroidea in the Vitosha and Western Stara Planina Mts. Most hydrobiological studies are concentrated in the first 2-3 vegetation belts (mainly below 1300 m a.s.l.) and are connected with the large families Tipulidae, Simuliidae and Chironomidae. The specific features and the medical significance of Culicidae, Ceratopogonidae and separate species of Simuliidae are connected with a predominant distribution in the first vegetation belt, in which the main part of the population is. Often there are open spaces in which species from the surrounding valleys penetrate and the fauna of the first two vegetation belts is similar. The families Cylindrotomidae, Blephariceridae and Hesperinidae have not been established in the belt of the xerothermic oak forests. Most families (24 each) are represented in the belts

Table 2. The distribution of the Nematocera according to the vegetation belts of Bulgaria

Families	Total number	Vegetation belts of Bulgaria					
		Xerothermic oak forests – up to 500-700 m	Mesophyllic and xeromesophyllic oak-hornbeam forests – from 600-700 m to 900-1000 m	Beech forests - from 900-1000 to 1500-1600 m	Coniferous forests – from 1500-1600 m to 2000-2200 m	Subalpine vegetation – from 2000-2200 m to 2500 m	Alpine vegetation – over 2400-2500 m
Tipulomorpa (1146)	**343 (29.9)**	**171 (15.7)**	**144 (15.4)**	**157 (20.8)**	**84 (26.7)**	**27 (32.1)**	**4 (28.6)**
Tipulidae (470)	89 (18.9)	50 (4.6)	38 (4.1)	18 (2.4)	6 (1.9)	4 (4.8)	1 (7.1)
Limoniidae (560)	221 (39.5)	117 (10.8)	100 (10.7)	118 (15.6)	66 (21.0)	21 (25.0)	3 (21.4)
Pediciidae (60)	25 (41.7)	3 (0.3)	3 (0.3)	16 (2.1)	10 (3.2)	2 (2.4)	
Cylindrotomidae (6)	1 (16.6)			1 (0.1)	1 (0.3)		
Trichoceridae (50)	7 (14.0)	1 (0.09)	3 (0.3)	3 (0.4)	1 (0.3)		
Blephariceromorpha (38)	**8 (21.0)**		**5 (0.5)**	**3 (0.4)**	**1 (0.3)**		
Blephariceridae (38)	8 (21.0)		5 (0.5)	3 (0.4)	1 (0.3)		
Bibionomorpha (3409)	**687 (20.1)**	**396 (36.4)**	**441 (47.3)**	**373 (49.3)**	**113 (36.0)**	**7 (8.3)**	
Bibionidae (47)	13 (27.6)	10 (0.9)	9 (1.0)	2 (0.3)	1 (0.3)		
Hesperinidae (1)	1 (100.0)		1 (0.1)	1 (0.1)			
Mycetophilidae (945)	263 (27.8)	135 (12.4)	192 (20.6)	172 (22.7)	58 (18.5)	3 (3.6)	
Ditomyiidae (3)	3 (100.0)	2 (0.2)	2 (0.2)	2 (0.3)			
Bolitophilidae (36)	10 (27.8)	4 (0.4)	7 (0.7)	7 (0.9)	5 (1.6)		
Diadocidiidae (5)	3 (60.0)	1 (0.09)	2 (0.2)	3 (0.4)	2 (0.6)		
Keroplatidae (110)	48 (43.6)	38 (3.5)	31 (3.3)	23 (3.0)	16 (5.1)		
Sciaridae (620)	84 (13.5)	38 (3.5)	52 (5.6)	40 (5.3)	3 (1.0)		
Cecidomyiidae (1640)	262 (16.0)	168 (15.5)	145 (15.6)	123 (16.3)	28 (8.9)	4 (4.8)	
Psychodomorpha (617)	**109 (17.7)**	**75 (6.9)**	**48 (5.1)**	**35 (4.6)**	**14 (4.5)**	**1 (1.2)**	
Psychodidae (500)	102 (20.4)	71 (6.5)	45 (4.8)	33 (4.4)	14 (4.5)	1 (1.2)	
Anisopodidae (10)	3 (30.0)	1 (0.09)	3 (0.3)	1 (0.1)			
Scatopsidae (100)	4 (4.0)	3 (0.3)		1 (0.1)			
Ptychopteromorpha (15)	**5 (33.3)**	**3 (0.3)**	**2 (0.2)**		**1 (0.3)**		
Ptychopteridae (15)	5 (33.3)	3 (0.3)	2 (0.2)		1 (0.3)		
Culicomorpha (2231)	**521 (23.3)**	**442 (40.7)**	**292 (31.3)**	**188 (24.9)**	**101 (32.2)**	**49 (58.3)**	**10 (71.4)**
Dixidae (32)	2 (6.2)	2 (0.2)	1 (0.1)				
Chaoboridae (9)	1 (11.1)	1 (0.09)	1 (0.1)	1 (0.1)			
Culicidae (105)	47 (44.8)	46 (4.2)	22 (2.4)	15 (2.0)	3 (1.0)	1 (1.2)	
Thaumaleidae (75)	4 (5.3)	1 (0.09)	2 (0.2)	1 (0.1)	1 (0.3)		
Simuliidae (230)	74 32.2)	40 (3.7)	47 (5.0)	42 (5.5)	33 (10.5)	20 (23.8)	
Ceratopogonidae (590)	66 (11.2)	61 (5.6)	35 (3.7)	7 (0.9)	3 (1.0)	2 (2.4)	1 (7.1)
Chironomidae (1190)	327 (27.5)	291 (26.8)	184 (19.7)	122 (16.1)	61 (19.4)	26 (31.0)	9 (64.3)
Total - 7456	**1672 (22.4)**	**1087 (65.0)**	**932 (55.7)**	**756 (45.2)**	**314 (18.8)**	**84 (5.0)**	**14 (0.8)**

Note. After the names of the families, the number of the species recorded in Europe (according to Osterbroek 2006) is given in parentheses.

of the mesophilic and xeromesophilic mixed forests and beech forests. In the coniferous belts (314 species – 18.8%), 20 families have been found and the species composition is determined by the larger ones (Limoniidae, Mycetophilidae, Keroplatidae, Cecidomyiidae, Simuliidae and Chironomidae). The upper limit of the coniferous forests gradually passes into the subalpine vegetation (84 species – 5.0%) with wide mixing zones. Thus, some of the species are common to both vegetation belts and the number of taxa established in the subalpine belt increases. Ten families are presented, of which Limoniidae,

Simuliidae and Chironomidae determine the faunistic diversity. Of the species found in the alpine vegetation belt (14 species – 0.8%), *Micropsectra radialis* Goet. (Palaearctic-Oriental species of Chironomidae, known from Rila Mts.) is typical only for it. The other species have been established in the subalpine belt and most of them in other vegetation belts as well. When comparing the generalised data for the mountains (Hubenov 2019b) it is seen that the fauna of the subalpine belt of the Vitosha Mt. is richer than the fauna of the Rila and Pirin Mts. This is due to the lower height of the Vitosha Mt. and the lack of a clear coniferous belt in the southern parts of the mountain. With the exception of some families, the investigations in this part of the Rila and Pirin Mts. are insufficient and fragmentary.

Regarding to the hypsometric belts, there are significant variations in the maximum number of species among the families in the separate mountains. In the Vrachanska Planina Mts., the maximum number of species was recorded between 300 and 600 m a.s.l. In the Vitosha and Pirin Mts. this number is located between 900 and 1300 m a.s.l., and in the Rila Mts. – between 1000 and 1500 m a.s.l. In general, for the whole country maximum number of species was established between 400 and 1000 m a.s.l. as there are differences in the mountains of ±200 m (Hubenov 1993, 2019b). In some cases, the finding of species at certain altitude is accidental. The lack of systematic research on many families, the unclear boundaries among the vegetation belts and the fragmentary data for most dipterans do not allow explicit conclusions about the adherence of the taxa to one or another vegetation zone to be made. The distribution of species in groups according to their presence in the vegetation belts has a relative character and depends on the specific features of taxa and research areas, as well as on the duration of the research. There is a correlation between the horizontal and vertical distribution of Diptera. The species with wide vertical distribution usually comprise large areas of the European, Eurosiberian, Palaearctic, Super Palaearctic and Cosmopolitan type. The dipterans found in the subalpine and alpine zones of the Rila and Pirin Mts. have Holarctic-Oriental, Holarctic, Transpalaearctic, West and Central Palaearctic, West Palaearctic, European-North African, Holoeurosiberian, West and Central Eurosiberian, West Eurosiberian, Disjunct Eurosiberian and European ranges (Hubenov 2017, 2019b).

The zoogeographical categorization of the species was made on the basis of current data about their distribution. Thus, the Nematocera were divided into 104 categories, combined into three main groups and six complexes (Table 3).

Species distributed in the Palaearctic and beyond it. This complex (352 species – 21.0%) includes 28 categories, of which 21 combine species of northern type (widely distributed in the Holarctic and Palaearctic) and 7 – species of southern type (distributed only in the southern parts of the Palaearctic). The difference between the separate vegetation belts reaches 32.6% and varies from 24.5% (xerothermic oak forests) to 57.1% (alpine vegetation). Of the other areographical categories, this difference is the highest in the Palaearctic-Oriental (13.2%) and the Holarctic (8.6%) species. The establishment of other species of the group of the northern type in the subalpine and the alpine vegetation belts is very likely, owing to their distribution and insufficient studies of the higher parts of the mountains. It is known that the species of the northern type have vast areas and ecological flexibility. In the Super-Palaearctic complex, the Holarctic species prevail: [214 species – 12.8% (from 13.8% in the xerothermic oak forests to 21.4% in the alpine belt)]. Of the other areographical types, the Holarctic-Oriental [42 species – 2.3% (from 3 to 36 species, from 2.5% to 4.5% in the separate belts)] and the Palaearctic-Oriental [19 species – 1.1% (from 1 to 17 species, from 1.2% to 14.3%)] forms are better presented. The species of the southern type (14 species – 0.8%) are represented mainly in the first two vegetation belts (two species are found in the beech forests belt). The group is not important for the zoogeographical characteristic because of the small number of species (2-12 species, 0.3-1.1%). Usually the Super-Palaearctic complex is scantly presented and is not determinant for the zoogeographical characteristic of taxa in the Bulgarian terrestrial fauna (with the exception of the coastal fauna). Only in a highly mobile forms (such as Diptera), the complex was well presented and could reach 20-25% (Hubenov 2015a). In the Nematocera, it is best represented in percentages in the alpine belt and less in the other vegetation belts (Table 3). In the two-winged insects significant numbers of synanthropic and synbovil forms with cosmopolitan or subcosmopolitan distribution occur. They have anthropogenic areas, structured with the development of the human civilisation (before the contemporary studies).

Species distributed only in the Palaearctic but in more than one subregion (Palaearctic type). Taxa, whose areas include more than one Palaearctic subregion in latitudinal direction belong to this group. They are well represented in the high mobile groups and comprise about 20-25% of the species composition. A total of 24 areographical categories, including 344 species (20.6%) of the Bul-

Table 3. Zoogeographical characteristic of the Nematocera according to the vegetation belts in Bulgaria

Classification of the areas	Total number	Vegetation belts					
		Xerothermic oak forests – up to 600-700 m	Mesophyllic and xeromesophyllic oak-hornbeam forests – from 600-700 m to 900-1000 m	Beech forests – from 900-1000 to 1500-1600 m	Coniferous forests – from 1300 (1500)-1600 m to 2000-2200 m	Subalpine vegetation – from 2000-2200 m to 2500 m	Alpine vegetation – over 2400-2500 m
Species distributed in Palaearctic and out of it	**352 (21.0)**	**266 (24.5)**	**228 (24.5)**	**172 (22.7)**	**81 (25.8)**	**24 (28.6)**	**8 (57.1)**
North type	**338 (20.2)**	**254 (23.4)**	**224 (24.0)**	**170 (22.5)**	**81 (25.8)**	**24 (28.6)**	**8 (57.1)**
Cosmopolitan	4 (0.2)	3 (0.3)	3 (0.3)	3 (0.4)	1 (0.3)		
Semicosmopolitan	5 (0.3)	4 (0.4)	2 (0.2)	3 (0.4)	1 (0.3)		
Holarctic-Paleotropical-Neotropical	1 (0.06)	1 (0.09)	1 (0.1)				
Holarctic-Paleotropical-Australian	4 (0.2)	4 (0.4)	2 (0.2)				
Holarctic-Neotropical-Oriental	7 (0.4)	7 (0.6)	7 (0.7)	6 (0.8)	4 (1.3)	2 (2.4)	1 (7.1)
Holarctic-Neotropical-Australian	2 (0.1)		1 (0.1)	1 (0.1)			
Holarctic-Oriental-Australian	2 (0.1)	1 (0.09)	1 (0.1)	1 (0.1)			
Holarctic-Neotropical	5 (0.3)	5 (0.5)	3 (0.3)	1 (0.1)	1 (0.3)	1 (1.2)	1 (7.1)
Holarctic-Afrotropical	1 (0.06)	1 (0.09)	1 (0.1)	1 (0.1)	1 (0.3)	1 (1.2)	
Holarctic-Oriental	42 (2.5)	36 (3.3)	31 (3.3)	20 (2.6)	14 (4.5)	3 (3.6)	
Holarctic-Australian	7 (0.4)	4 (0.4)	2 (0.2)	3 (0.4)			
Palaearctic-Paleotropical-Australian	1 (0.06)	1 (0.09)					
Palaearctic-Oriental-Australian	1 (0.06)	1 (0.09)	1 (0.1)	1 (0.1)	1 (0.3)		
Palaearctic-Paleotropical	5 (0.3)	5 (0.5)	3 (0.3)	1 (0.1)			
Palaearctic-Afrotropical	3 (0.2)	2 (0.2)	2 (0.2)				
Palaearctic-Oriental	19 (1.1)	17 (1.6)	13 (1.4)	12 (1.6)	9 (2.9)	1 (1.2)	2 (14.3)
Palaearctic-Australian	1 (0.06)	1 (0.09)	1 (0.1)	1 (0.1)	1 (0.3)	1 (1.2)	1 (7.1)
West Palaearctic-Oriental	7 (0.4)	4 (0.4)	6 (0.6)	4 (0.5)			
Disjunct Palaearctic-Oriental	6 (0.3)	5 (0.5)	6 (0.6)	1 (0.1)	1 (0.3)		
West Palaearctic-Afrotropical	1 (0.06)	1 (0.09)					
Holarctic	214 (12.8)	151 (13.9)	138 (14.8)	111 (14.7)	47 (15.0)	15 (17.9)	3 (21.4)
South type	**14 (0.8)**	**12 (1.1)**	**4 (0.4)**	**2 (0.3)**			
South Palaearctic-Paleotropical	3 (0.2)	2 (0.2)	1 (0.1)	1 (0.1)			
South Palaearctic-Oriental	3 (0.2)	3 (0.3)	1 (0.1)				
Southwest Palaearctic-Oriental	3 (0.2)	3 (0.3)	1 (0.1)	1 (0.1)			
Paleotropical-Mediterranean	1 (0.06)	1 (0.09)					
Afrotropical-Mediterranean	2 (0.1)	1 (0.09)	1 (0.1)				
Oriental-East Mediterranean	1 (0.06)	1 (0.09)					
European-Neotropical-Oriental	1 (0.06)	1 (0.09)					
Species with Palaearctic distribution	**1320 (78.9)**	**821 (75.5)**	**704 (75.5)**	**584 (77.2)**	**233 (74.2)**	**60 (71.4)**	**6 (42.8)**
Palaearctic type	**344 (20.6)**	**269 (24.7)**	**226 (24.2)**	**151 (20.0)**	**58 (18.5)**	**24 (28.6)**	**1 (7.1)**
Holopalaearctic	5 (0.3)	5 (0.5)	5 (0.5)	2 (0.3)			
Transpalaearctic	49 (2.9)	40 (3.7)	30 (3.2)	18 (2.4)	9 (2.9)	2 (2.4)	
West and Central Palaearctic	34 (2.0)	30 (2.8)	27 (2.9)	18 (2.4)	10 (3.2)	4 ((4.8)	1 (7.1)
West Palaearctic	66 (3.9)	59 (5.4)	44 (4.7)	30 (4.0)	12 (3.8)	5 (5.9)	
Disjunct Palaearctic	41 (2.4)	31 (2.8)	26 (2.8)	19 (2.5)	6 (1.9)	1 (1.2)	
South Palaearctic	1 (0.06)	1 (0.09)	1 (0.1)				
European-Anatolian-North African	22 (1.3)	17 (1.6)	14 (1.5)	11 (1.4)	6 (1.9)	4 (4.8)	
European-North African	54 (3.2)	36 (3.3)	36 (3.9)	25 (3.3)	9 (2.9)	7 (8.3)	

Table 3. Continuation.

Classification of the areas	Total number	Vegetation belts					
		Xerothermic oak forests – up to 600-700 m	Mesophyllic and xeromesophyllic oak-hornbeam forests – from 600-700 m to 900-1000 m	Beech forests – from 900-1000 to 1500-1600 m	Coniferous forests – from 1300 (1500)-1600 m to 2000-2200 m	Subalpine vegetation – from 2000-2200 m to 2500 m	Alpine vegetation – over 2400-2500 m
Eurosiberian-Anatolian-Central Asian	3 (0.2)	3 (0.2)	2 (0.2)	1 (0.1)			
Eurosiberian-Central Asian	15 (0.9)	8 (0.7)	6 (0.6)	5 (0.7)	3 (0.9)		
West Eurosiberian-Iran-Turanian	1 (0.06)			3 (0.4)			
West Eurosiberian-Anatolian-Turanian	1 (0.06)	1 (0.09)	1 (0.1)				
West Eurosiberian-Turanian	3 (0.2)	3 (0.2)	3 (0.3)	2 (0.3)			
European-Anatolian-Central Asian	3 (0.2)	2 (0.2)	2 (0.2)	1 (0.1)			
European-Central Asian	4 (0.2)	4 (0.4)	1 (0.1)	1 (0.1)	1 (0.3)		
European-West Central Asian	9 (0.5)	6 (0.5)	3 (0.3)	1 (0.1)			
European-Southwest Asian	4 (0.2)	3 (0.2)	3 (0.3)	2 (0.1)			
European-Anatolian-Iran-Turanian	1 (0.06)		1 (0.1)	1 (0.1)			
European-Iran-Turanian	1 (0.06)		1 (0.1)				
European-Anatolian-Iranian	7 (0.4)	3 (0.2)	5 (0.5)	4 (0.5)	1 (0.3)	1 (1.2)	
European-Anatolian-Turanian	2 (0.1)	2 (0.2)	2 (0.2)				
European-Iranian	8 (0.5)	5(0.5)	6 (0.6)	4 (0.5)			
European-Turanian	9 (0.5)	9 (0.8)	7 (0.7)	3 (0.4)	1 (0.3)		
East European-Turanian	1 (0.06)	1 (0.09)					
Species distributed in one subregion	**976 (58.4)**	**552 (50.8)**	**478 (51.3)**	**433 (57.2)**	**175 (55.7)**	**36 (42.9)**	**5 (35.7)**
Eurosiberian type	**799 (47.8)**	**440 (40.5)**	**431 (46.2)**	**382 (50.5)**	**156 (49.7)**	**33 (39.3)**	**4 (28.6)**
Holoeurosiberian	26 (1.6)	13 (1.1)	17 (1.8)	19 (2.5)	10 (3.2)	3 (3.6)	1 (7.1)
Transeurosiberian	22 (1.3)	14 (1.3)	13 (1.4)	12 (1.6)	6 (1.9)	1 (1.2)	
West and Central Eurosiberian	50 (3.0)	34 (3.2)	27 (2.9)	24 (3.2)	13 (4.1)	2 (2.4)	1 (7.1)
West Eurosiberian	60 (3.6)	31 (2.7)	36 (3.9)	33 (4.4)	16 (5.1)		
Disjunct Eurosiberian	87 (5.2)	51 (4.7)	54 (5.8)	47 (6.2)	24 (7.6)	3 (3.6)	1 (7.1)
European and South Siberian	1 (0.06)			1 (0.1)			
East European-Siberian	2 (0.1)	1 (0.1)	1 (0.1)				
European-Anatolian	44 (2.6)	21 (2.0)	26 (2.8)	22 (2.9)	10 (3.2)	2 (2.4)	
European	405 (24.2)	214 (19.3)	206 (22.1)	195 (25.8)	63 (20.1)	17 (20.2)	
Central and East European-Anatolian	2 (0.1)	1 (0.1)	1 (0.1)	2 (0.3)			
Central and East European	8 (0.5)	6 (0.6)	6 (0.6)	2 (0.3)			
East European	12 (0.7)	8 (0.8)	3 (0.3)		1 (0.3)		
Central and South European-Anatolian	5 (0.3)	4 (0.4)	4 (0.4)	2 (0.3)			
Central and Southeast European-Anatolian	4 (0.2)	3 (0.3)	2 (0.2)	2 (0.3)	1 (0.3)	1 (1.2)	
Central and South European	28 (1.7)	17 (1.5)	15 (1.6)	10 (1.3)	4 (1.3)	1 (1.2)	1 (7.1)
Central and Southeast European	43 (2.6)	22 (1.4)	20 (2.1)	11 (1.4)	8 (2.5)	3 (3.6)	
Mediterranean type	**117 (7.0)**	**83 (7.6)**	**35 (3.8)**	**30 (4.0)**	**8 (2.5)**	**3 (3.6)**	
Mediterranean-Central Asian	1 (0.06)	1 (0.09)	1 (0.1)				
East Mediterranean-Central Asian	1 (0.06)	1 (0.09)	1 (0.1)				
Mediterranean-West Central Asian	8 (0.5)	8 (0.7)	2 (0.2)	1 (0.1)			
North Mediterranean-Central Asian	1 (0.06)		1 (0.1)	1 (0.1)			
North Mediterranean-Iranian	2 (0.1)	1 (0.09)		1 (0.1)			

Table 3. Continuation.

Classification of the areas	Total number	Vegetation belts					
		Xerothermic oak forests – up to 600-700 m	Mesophyllic and xeromesophyllic oak-hornbeam forests – from 600-700 m to 900-1000 m	Beech forests – from 900-1000 to 1500-1600 m	Coniferous forests – from 1300 (1500)-1600 m to 2000-2200 m	Subalpine vegetation – from 2000-2200 m to 2500 m	Alpine vegetation – over 2400-2500 m
North Mediterranean and South Far East	1 (0.06)	1 (0.09)	1 (0.1)				
South European and South Far East	1 (0.06)	1 (0.09)	1 (0.1)				
Northeast Mediterranean-West Central Asian	2 (0.1)	2 (0.2)	1 (0.1)	1 (0.1)			
Northeast Mediterranean-Iranian	1 (0.06)						
Southeast European-Central Asian	4 (0.2)	2 (0.2)					
Southeast European and South Siberian	1 (0.06)	1 (0.09)	1 (0.1)	1 (0.1)			
Central (Middle) and South European-Iranian	2 (0.1)	2 (0.2)	1 (0.1)	1 (0.1)			
Central and Southeast European-Iranian	1 (0.06)	1 (0.09)	1 (0.1)	1 (0.1)			
Central (Middle) and South European-Turanian	2 (0.1)	2 (0.2)					
Central and Southeast European-Turanian	1 (0.06)	1 (0.09)	1 (0.1)	1 (0.1)			
Central and South European-Anatolian-North African	1 (0.06)	1 (0.09)					
Central and South European-North African	3 (0.2)	3 (0.2)	2 (0.2)	2 (0.3)	1 (0.3)		
South European-North African	5 (0.3)	4 (0.4)	2 (0.2)				
Southeast European-Anatolian-North African	1 (0.06)			1 (0.1)			
Southeast European-Iranian	1 (0.06)	1 (0.09)					
Southeast European-Turanian	1 (0.06)	1 (0.09)					
Central and Southeast European-Lebanonian	1 (0.06)	1 (0.09)					
Holomediterranean	10 (0.6)	9 (0.8)	1 (0.1)	1 (0.1)	1 (0.3)		
East Mediterranean	4 (0.2)	2 (0.2)	1 (0.1)	2 (0.3)	1 (0.3)	1 (1.2)	
North Mediterranean	3 (0.2)	2 (0.2)	1 (0.1)	1 (0.1)			
South European	7 (0.4)	3 (0.2)	3 (0.3)	1 (0.1)			
Northeast Mediterranean	1 (0.06)	1 (0.09)	1 (0.1)				
Southeast European-Anatolian	5 (0.3)	2 (0.2)	1 (0.1)	2 (0.3)			
Southeast European	28 (1.7)	18 (1.6)	6 (0.6)	7 (0.9)	2 (0.6)		
Balkan-Caucasian-Turanian	1 (0.06)	1 (0.09)					
Balkan-Caucasian	4 (0.2)	2 (0.2)	1 (0.1)	1 (0.1)			
Balkan-Anatolian	12 (0.7)	8 (0.7)	4 (0.4)	5 (0.7)	3 (0.9)	2 (2.4)	
Endemics	**60 (3.6)**	**29 (2.7)**	**12 (1.3)**	**21 (2.7)**	**11 (3.5)**	**1 (1.2)**	**1 (7.1)**
Balkan subendemics	2 (0.1)	1 (0.1)	1 (0.1)	1 (0.1)	1 (0.3)		
Balkan endemics	22 (1.3)	12 (1.1)	1 (0.1)	6 (0.8)	2 (0.6)		
Bulgarian endemics	23 (1.4)	9 (0.9)	5 (0.5)	9 (1.2)	6 (1.9)	1 (1.2)	1 (7.1)
Regional endemics	13 (0.8)	7 (0.7)	5 (0.5)	5 (0.7)	2 (0.6)		
Total	**1672**	**1087 (65.0)**	**932 (55.7)**	**756 (45.2)**	**314 (18.8)**	**84 (5.0)**	**14 (0.8)**

garian Nematocera fauna, has been registered (Table 3). The character of the Palaearctic complex is determined by the Transpalaearctic [49 species – 2.9% (from 2.4% to 3.7% in the separate belts)], West and Central Palaearctic [34 species – 2.0% (from 2.4% to 7.1%)], West Palaearctic [66 species – 3.9% (from 3.9% to 5.9%)], Disjunct Palaearctic [41 species – 2.4% (from 1.2% to 2.8%)] and European-North African [54 species – 3.2% (from 2.9% to 8.3%)] species. The European-Anatolian-North African (22 species) and the Eurosiberian-Central Asian (15 species) taxa are well presented as well. In the alpine belt, the complex is represented only by *Culicoides pictipennis* (Staeger, 1839) – a West and Central Palaearctic species of the family Ceratopogonidae, distributed in all vegetation belts. The correlation of the mentioned categories is kept in the separate vegetation belts and varies from 0.09% to 8.3% (1 to 59 species). Forty-one species (2.4%) have a longitudinal disjunction of the areas with regard to Siberia and Central Asia – from 1 to 31 species in the separate vegetation belts. Probably some of these species are presented with sparse populations and will be studied in more detail as a result of further research. Most often a latitudinal disjunction of the areas of this complex is lacking (Gorodkov 1984, Josifov 1988, Hubenov 2015a). Rarely single boreomontane forms are presented. A significant part of the species with wide vertical distribution (above 20%) belong to the Palaearctic complex. The difference between the separate vegetation belts (from 1 to 269 species) reaches 21.5% and varies from 7.1% (alpine vegetation) to 28.6% (subalpine vegetation) of the species. For the different areographical categories this difference is the largest in the European-North African species (5.4%). The vast areas and wide vertical distribution of the taxa of this complex are an indication of the greater ecological flexibility of its species. From the mountains for which there are generalised studies on Diptera, the Palaearctic complex (like the Super Palaearctic one) is best represented in the Vrachanska Planina Mts. (where it comprises 30.4% of the established species) and poorly represented in the Vitosha, Rila and Pirin Mts. (where it comprises from 23.7% to 27.5% of the known species). This is probably related to the insufficient studies of the Vrachanska Planina Mts. Thus, owing to the lack of sufficient research and the non-systematic sampling, more common and widespread species have been collected (Hubenov 2019b).

Species distributed within one subregion of the Palaearctic. This group (976 species – 58.4%) includes from 5 to 552 species (35.7% to 57.2%) in the separate vegetation belts. The group combines species with Eurosiberian and Mediterranean type of distribution (48 categories). Endemics are also included in this group. The Mediterranean-Central Asian species are also included here according to Kryzhanovsky (1965, 2002) and Lopatin (1989), who combine the Mediterranean and Central Asian subregions. The species with Mediterranean type of distribution are accepted in a general way and include Submediterranean, Subiranian and Pontian faunistic elements that could be also considered separately from the Mediterranean ones (Gruev & Kusmanov 1994, 1999, Gruev 1995, Gruev & Bechev 2000).

The Eurosiberian species include 16 areographical categories (799 species or 47.8%). These are from 4 to 440 (28.6% to 39.7%) species in the separate vegetation belts (Table 3). The European [405 species (24.2%) – from 17 to 214 species (19.3% to 25.8%)], Disjunct Eurosiberian [87 species (5.2%) – from 1 to 54 species (3.6% to 7.6%)], West Eurosiberian [60 species (3.6%) – from 16 to 36 species (2.7% to 5.1%)] and the West and Central Eurosiberian [50 species (3.0%) – from 1 to 34 species (2.4% to 7.1%] taxa are the most numerous. The Holoeurosiberian, Transeurosiberian, European-Anatolian, Central and South European and Central and Southeast European species are well represented. The ratio of these categories is different for the separate families (the Holoeurosiberian, Disjunct Eurosiberian and European species are almost equal in number as the Eurosiberian forms are of about 50% in total, while in other families the Central and South European species are better represented). The number of taxa of these categories per vegetation belt varies from 0.1% to 25.8% (1-214 species) and increases in percentage with height to 2000 m a.s.l. For the different areographical categories this difference is the largest in the European species (6.5%). The greatest number of Eurosiberian species (as a percentage) are found in the beech forests and the coniferous belts (50.5% and 49.7%). In the beech forests belt these species predominate over the other zoogeographical categories. In the subalpine belt, a total of 33 (39.3%) species has been established. In the alpine belt taxa with Super Palaearctic areas dominate (57.1%). The Eurosiberian species are poorly represented (28.6%) and include 4 areographical categories. When compared to the mountains, from which the data on Diptera are generalised, there is a small difference (Hubenov 2019b). In the subalpine belt of the Vitosha (57.3%) and Rila (40.4%) Mts., the Eurosiberian species predominate over the other zoogeographical categories while in the Pirin Mts. they are poorly represented (35.4%).

In the alpine belt of the Rila Mts., the Eurosiberian species (42.0%) are better represented than in the Pirin Mts. (31.0%). The Eurosiberian complex includes a number of disjunctive areas – a longitudinal disjunction for Siberia and Central Asia and latitudinal disjunction with boreomontane, boreoalpine and arctic-alpine distribution (Gorodkov 1984, Josifov 1988, Hubenov 2015a). Of interest is the significant presence of Eurosiberian species in the first two vegetation belts (40.5% and 46.2%). This could be explained in three ways: 1) possibly a part of these species to have unclear Palaearctic distribution; 2) the humid mountain valleys characterised with cooler climate, have facilitated the migration of the above-mentioned forms to the lowlands; 3) predominant research of the lower parts of the mountain compared to the higher ones. Eurosiberian boreomontane forms at low altitudes have also been found for other groups as Cerambycidae (Coleoptera), Tachinidae (Diptera) and Heteroptera (Josifov 1963, 1976, Hubenov 1992, 2008b, Georgiev & Hubenov 2006). For Cerambycidae, this fact is due to the large afforestations of conifers in the first two vegetation belts. Probably because of this, many boreomontane and montane species that feed on conifers, go down below 1000 m a.s.l. It can be expected that, with the further research of the Diptera fauna in the high parts of the mountains, the number of the Eurosiberian species will increase.

The Mediterranean species include 30 areographical categories (117 species or 7.0%). These are from 3 to 83 (2.5% to 7.6%) species in the separate vegetation belts (Table 3). They are presented mainly in the first two (three) vegetation belts and their number rapidly decreases with the altitude. The Mediterranean species, established in one or two vegetation belts, prevail. The significant percentage of these species in the lower vegetation belts (70.9% in the first and 29.9% in the second belt) and their relatively scarce populations are due to the lower ecological flexibility of the Mediterranean forms in comparison with the previous ones. Because of the big variety of these areas, the group is divided into many subgroups with different origin, distribution and ecological peculiarities of the taxa. This complexity contributes to establishing of various zoogeographical classifications for Bulgaria (Josifov, 1981, 1986, 1988, 1999, Gruev 1988, 1995, 2000a, 2000b, 2000c, 2002, Heiss & Josifov, 1990, Gruev & Kusmanov, 1994, Hubenov 1996, 2008a, Gruev & Bechev, 2000, Popov, 2002). For the different areographical categories the difference between the vegetation belts is the largest in the Balkan-Anatolian species (1.7%). The Southeast European (28 species – 1.7%), Holomediterranean and Balkan-Anatolian (10-12 species each – 0.6-07%) and Mediterranean-West Central Asian (8 species – 0.5%) taxa are the most numerous. In the subalpine belt three species (two Balkan-Anatolian – *Tipula latifurca* Vermoolen, 1983; *Molophilus obsoletus* Lackschewitz, 1940 and one East Mediterranean – *Prosimulium petrosum* Rubtsov, 1955) have been found, distributed in 3 to 5 vegetation belts. One or two of these species could be Montane Mediterranean forms. There are no significant differences in the distribution of the well presented aerographical categories in the Mediterranean species of the mountains. When comparing with the Vitosha, Rila and Pirin Mts., it makes an impression the higher percentage (3.6% – 4.4% – 5.5%) of the Mediterranean taxa southwards. This is related to the natural conditions and the geographical location of the mountains. This does not apply to the Vrachanska Planina Mts. (5.0%), which is connected with the karst terrain, xerothermic habitats and lower altitude of the mountain.

Endemics. This category includes taxa, which are not distributed outside the Balkan Peninsula. The percentage of endemism in the Nematocera is low (60 species or 3.6%). The Bulgarian (23 species – 38.3%) and Balkan (22 species – 36.7%) endemic forms prevail. The main part of the endemic species is related to the xerothermic oak forests and beech belt (29 and 12 species, 48.3% and 20.0% respectively). Some of the endemics in the coniferous forests (11 species or 3.5%) and in the following vegetation belts can be connected with the Eurosiberian forms and can be considered as postglacial neoendemics. The endemics established in the first vegetation belt of the Vrachanska Planina and Pirin Mts. probably do not belong to this category (Hubenov 2019b). Local endemics have not been established among the Nematocera. The endemic Nematocera are often newly described taxa or rare species with unclear range.

Conclusion

A total of 1672 species of the suborder Nematocera, belonging to 26 families, has been recorded from Bulgaria. The families Chironomidae (327 species), Mycetophilidae (263 species), Cecidomyiidae (262 species) and Limoniidae (221 species) are the most numerous. Of the established species, 40 are pests on the forestry or agriculture and 26 species have a human or veterinary medical significance. The distribution of dipterans in the different regions of Bulgaria is presented. The greatest number of species

has been found in the zone of the xerothermic oak forests (1087 species or 65.0%). The Nematocera fauna can be divided into 2 supergroups: 1) species with Mediterranean type of distribution (131 species or 7.8%) – more thermophilic and distributed mainly in the southern parts of the Palaearctic and the lower parts of the mountains. The species of the southern type, distributed in the Palaearctic and beyond it, can be formally related to this group as well; 2) species with Palaearctic and Eurosiberian type of distribution (1541 species or 92.2%) – more eurybiontic and widely distributed. The species of the northern type, distributed in the Palaearctic and beyond it, can be formally related to this group as well. The zoogeographical character of the Nematocera fauna is determined by the second group. A total of 60 (3.6%) endemics has been found. The distribution of the zoogeographical categories in the separate vegetation belts of Bulgaria is scrutinised. The Southeast European forms are the most numerous in the first group. The European and Holarctic taxa prevail in the second group. The variety of areographical categories decreases with altitude.

Xerothermic oak forests (1087 species or 65.0%). Of the species with Mediterranean type of distribution (95 species or 8.7%) the Southeast European, Holomediterranean and Mediterranean-West Central Asian are the most numerous. Of the species with Palaearctic and Eurosiberian type of distribution (992 species or 91.3%) – the Holarctic, Transpalaearctic, West Palaearctic, Disjunct Eurosiberian and European species are best represented. This belt includes the greatest number of areographical categories – 96. The main part of the endemic forms – 29 species (2.7%) has been established in this belt. The Balkan and Bulgarian endemics prevail. Most Mediterranean species (83 species or 7.6%) are represented.

Xeromesophyllic and mesophyllic mixed (oak-hornbeam) forests (932 species or 55.7%). Of the species with Mediterranean type of distribution (39 species or 4.2%) the South European, Southeast European and Balkan-Anatolian species are the most numerous. Of the species with Palaearctic and Eurosiberian type of distribution (893 species or 95.8%) – the Holarctic, West Palaearctic, European-North African, West Eurosiberian, Disjunct Eurosiberian and European species are best represented. The percentage of the Mediterranean species (35 species or 3.8%) and endemics (12 species or 1.3%) decreases. The Bulgarian and regional endemics prevail.

Beech forests (756 species or 45.2%). Of the species with Mediterranean type of distribution (32 species or 4.2%) the Southeast European and Balkan-Anatolian species are the most numerous. Of the species with Palaearctic and Eurosiberian type of distribution (724 species or 95.8%) – the Holarctic, West Palaearctic, West Eurosiberian, Disjunct Eurosiberian and European species are best represented. The areographical categories are decreased significantly. The percentage of the endemics increases (21 species or 2.7%). The Bulgarian endemics prevail.

Coniferous forests (314 species or 18.8%). Of the species with Mediterranean type of distribution (8 species or 2.5%), the Super-Palaearctic forms of southern type are not presented. The Southeast European and Balkan-Anatolian species are the most numerous. Of the species with Palaearctic and Eurosiberian type of distribution (306 species or 97.5%) the Holarctic, Disjunct Eurosiberian and European species prevail. The percentage of the Mediterranean forms decreases significantly. The areographical categories are decreased. The Bulgarian endemics prevail.

Subalpine vegetation (84 species or 5.0%). Of the species with Mediterranean type of distribution (3 species or 3.6%), one East Mediterranean and two Balkan-Anatolian species are represented. Of the species with Palaearctic and Eurosiberian type of distribution (81 species – 96.4%), the Holarctic and European species prevail. The percentage of the Mediterranean forms is considerably decreased. The areographical categories are decreased. One Bulgarian endemic (*Molophilus lautereri* Stary, 1974), recorded from the Rila Mts., is found. Ten families are represented.

Aipine vegetation (14 species or 0.8%). This zone is best presented in the Rila and Pirin Mts. Only species with Palaearctic and Eurosiberian type of distribution, belonging to 11 areographical categories (of which 9 are represented by 1 species each) have been established. The Bulgarian endemic *M. lautereri* is found. Four families (Tipulidae, Limoniidae, Ceratopogonidae and Chironomidae) are represented. With the exception of 4-5 families, studies on the two-winged insects in this zone of the Rila and Pirin Mts. are almost lacking.

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Appendix 1: Species of the suborder Nematocera in Bulgaria with medical or economic importance

Species with a human or veterinary medical significance:

Psychodidae [*Phlebotomus papatasi* (Scopoli, 1786); *Ph. sergenti* Parrot, 1917; *Ph. perniciosus* Newstead, 1911; *Ph. balcanicus* Theodor, 1958; *Sergentomyia minuta* (Rondani, 1843)]; **Culicidae** [*Anopheles atroparvus* van Thiel, 1927; *A. maculipennis* Meigen, 1818; *A. messeae* Falleroni, 1926; *A. sacharovi* Favre, 1903; *A. superpictus* Grassi, 1899; *Culiseta annulata* (Schrank, 1776); *Coquillettidia richiardii* (Ficalbi, 1889); *Aedes albopictus* (Skuse, 1894); *A. cantans* (Meigen, 1818); *A. caspius* (Pallas, 1771); *A. communis* (De Geer, 1776); *Culex pipiens* Linnaeus, 1758; *C. modestus* Ficalbi, 1890)]; **Simuliidae** [*Simulium colombaschense* (Scopoli, 1780)]; **Ceratopogonidae** [*Culicoides newsteadi* Austen, 1921; *C. pulicaris* (Linnaeus, 1758); *C. punctatus* (Meigen, 1804); *C. obsoletus* (Meigen, 1818); *C. nubeculosus* (Meigen, 1830); *C. puncticollis* (Becker, 1903); *C. schultzei* (Enderlein, 1908)].

Pests on the forestry or agriculture:

Tipulidae [*Tipula oleracea* Linnaeus, 1758; *T. paludosa* Meigen, 1830]; **Bibionidae** [*Bibio graecus* Duda, 1930; *B. hortulanus* (Linnaeus, 1758)]; **Sciaridae** [*Bradysia fenestralis* (Zetterstedt, 1838)]; **Cecidomyiidae** [*Hybolasioptera fasciata* (Kieffer, 1904); *Lasioptera rubi* (Schrank, 1803); *Apiomyia bergenstammi* (Wachtl, 1882); *Bremiola onobrychidis* (Bremi, 1847); *Dasineura crataegi* (Winnertz, 1853); *D. mali* (Kieffer, 1904); *D. napi* (Loew, 1850); *D. pyri* (Bouché, 1847); *D. ribis* Barnes, 1940; *Rabdophaga saliciperda* (Dufour, 1841); *Dryomyia circinans* (Giraud, 1861); *D. lichtensteinii* (F. Löw, 1878); *Fabomyia medicaginis* (Rübsaamen, 1912); *Janetiella oenephila* (Haimhoffen, 1875); *Kaltenbachiola strobi* (Winnertz, 1853); *Mayetiola destructor* (Say, 1817); *Mikiola fagi* (Hartig, 1839); *Asphondylia melanopus* Kieffer, 1890; *A. miki* Wachtl, 1880; *A. pruniperda* Rondani, 1867; *Contarinia festucae* Jones, 1940; *C. lentis* Aczél, 1944; *C. medicaginis* Kieffer, 1895; *C. merceri* Barnes, 1930; *C. nasturtii* (Kieffer, 1888); *C. onobrychidis* Kieffer, 1895; *C. pisi* (Loew, 1850); *C. pyrivora* (Riley, 1886); *C. tritici* (Kirby, 1798); *Stenodiplosis geniculati* Reuter, 1895; *Haplodiplosis marginata* (von Roser, 1840); *Putoniella pruni* (Kaltenbach, 1872); *Resseliella theobaldi* (Barnes, 1927); *Sitodiplosis mosellana* (Gehin, 1857); *Thecodiplosis brachyntera* (Schwägrichen, 1835)].