



## Review of the Families of the Suborder Brachycera (Insecta: Diptera) of Bulgaria

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**Abstract:** Totally, 3368 species belonging to 84 families of the suborder Brachycera have been reported from Bulgaria. The families Tachinidae (425 species), Syrphidae (303 species), Muscidae (267 species), Phoridae (231 species) and Dolichopodidae (214 species) comprise the greatest number of species. Of the recorded species, 21 are pests on the forestry or agriculture and 49 species have a significance for the human or veterinary medicine. 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 (2275 species or 67.5 %). The brachycerans belong to 139 zoogeographical categories, divided into 2 supergroups: (1) species with Mediterranean type of distribution (384 species or 11.4 %) – 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 (2916 species or 86.6 %) – more eurybiontic and widely distributed. Totally, 68 (2.0 %) endemics have been found. The distribution of the zoogeographical categories per vegetation belts of Bulgaria is scrutinised.

**Key words:** Brachycera, Bulgaria, faunistic composition, vertical distribution, zoogeography

### Introduction

The economic importance of the biodiversity, the dynamic characteristics of the fauna and its conservation require a periodic update of the data on the faunistic diversity of various taxonomic groups. During the last 70 years, different parts of the country were under landscape changes and anthropogenic impacts. The Bulgarian dipteran fauna has been studied for 160 years. A vast amount of faunistic data has been accumulated from the territory of Bulgaria. The first data on dipterans from Bulgaria were reported by LÖW (1862, 1863), MEUNIER (1897) and JOAKIMOFF (1899). NEDELKOV (1912) reported new families and reviewed the knowledge on the dipteran fauna of Bulgaria. Various publications were

written by other authors (KOVACHEV 1905, DRENSKY 1920, 1922, 1923, 1936, BURESCH 1926, 1936, DRENSKY 1926, 1930, 1936, 1942, CZERNÝ 1930, SZILÁDY 1934, JACENTKOVSKY 1936, 1937, 1938, 1939, LINDNER 1936, BUHR 1941, DELKESKAMP 1942). Studies on certain families were reported by DRENSKY (1929, 1933, 1934, 1939, 1943, 1957, 1958). Numerous data on the plant pests and species of medical significance have been presented in the agricultural and medical entomological literature. The number of publications increased after the Second World War. Volumes of the series *Fauna of Bulgaria* and catalogues of certain families have been published (BESCHOVSKI 1985, 2009, 2013; LAVČIEV 2003; KECHEV et al. 2020). Faunistic studies were performed by both Bulgarian and foreign research-

ers. The hydrobiological studies were important to elucidate the species composition of the water-related dipterans. The investigations of the cave fauna contributed to the study of several families. In many monographs and catalogues related to the Diptera of the various geographical areas, taxa from Bulgaria without accurate localities have been mentioned.

An overview of the families reported from Bulgaria was made by BESCHOVSKI (1976). Data on the vertical distribution of dipterans refer to several families. There are data in some publications (BURESCH & ARNDT 1926, BERON 1969, HUBENOV 1993, LANGOUROV 2021), volumes of the series *Fauna of Bulgaria* (BESCHOVSKI 1985, 2009), catalogues (LAVČIEV 2003, BESCHOVSKI 2013) and in some dissertations (DZHAMBAZOV 2000, LANGOUROV 2001, KEČEV 2007). In the publications on the Diptera from the Pirin, Rila, Vitosha and Vrachanska Planina Mts., the vertical distribution of 1502 species of 57 brachyceran families has been analysed (HUBENOV 2015b, 2016, 2017, 2018, 2019a, 2019b). In 1249 publications, there are data related to the diversity of the suborder Brachycera in Bulgaria.

The aim of this work is to present the Bulgarian fauna of the suborder Brachycera and to analyse the distribution of the taxa according to the vegetation belts and the zoogeographical units in this country.

## Materials and Methods

All species reported from Bulgaria were included based on the available literature referring to the Diptera from Bulgaria. The classification of the Diptera was based on the works of SOÓS & PAP (1984-1993), McALPINE (1989), WOODLEY (1989), NAGATOMI (1996), PAPP & DARVAS (1997, 1998, 2000a, 2000b), YEATES & WIEGMANN (1999), NARTSHUK (2003), ZIEGLER (2003), OOSTERBROEK (2006), YEATES et al. (2007) and PAPE et al. (2011).

A nomenclatural system of the natural territories of Bulgaria was used to represent the distribution of the species in Bulgaria (HUBENOV 1997, 2021, 2022). This was a hierarchical system (Table 1), which allowed using larger or smaller number of territorial units. The first letter in the abbreviations corresponded to the region, the second – to the sub-region, and the figure – to a smaller territorial unit.

The vertical distribution was presented according to the vegetation belts. The vegetation of Bulgaria had been 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 (1300) 1500–1600 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. Depending on the relief, climate, exposure and human activities, there are mixed (transitional) zones, which extend up to 200–300 m a. s. l. in-between “clear” belts.

The classification of the areas was based on the available literature and recent electronic issues. A zoogeographical analysis for the taxa categorisation was used. This method allowed obtaining data information about species complexes with different zoogeographical characters based on the published data regarding species distribution and results of the faunistic research. These complexes contained zoogeographical information about the taxonomic groups, which, combined with the origin of the ranges, determined 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 were scrutinised. The classification of the areas was based on the works by GEPTNER (1936), DARLINGTON (1957), KRZYZHANSKY (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 Palearctic along the Yenisei River were used.

## Results

A total of 3368 species of Brachycera (28.8 % of the European species) belonging to 84 families have been recorded in Bulgaria so far (Table 2). The families Tachinidae (425 species), Syrphidae (303 species), Muscidae (267 species), Phoridae (231 species) and Dolichopodidae (214 species) comprise the greatest number of species. The other families contain less than 200 species. Of the 100 families known in Europe (OOSTERBROEK 2006), 16 have not been found in Bulgaria (Rachiceridae, Hilari-morphidae, Brachystomatidae, Mydidae, Opetiidae, Pseudopomyzidae, Tanypezidae, Strongylophthal-

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

The system of the natural geographic territorial units	Number of species		
	Nematocera (1672)	Brachycera (3368)	Total (5040)
<b>DANUBIAN PLAIN</b>	<b>328 (19.6)</b>	<b>566 (16.9)</b>	<b>894 (17.8)</b>
<b>Western Danubian Plain</b>	<b>219 (13.1)</b>	<b>227 (6.8)</b>	<b>446 (8.9)</b>
<b>Middle Danubian Plain</b>	<b>210 (12.6)</b>	<b>218 (6.5)</b>	<b>428 (8.5)</b>
<b>Eastern Danubian Plain</b>	<b>191 (11.4)</b>	<b>367 (11.0)</b>	<b>558 (11.1)</b>
Popovo-Provadiya district	154 (9.2)	184 (5.5)	338 (6.7)
Loudogorie-Dobroudzha district	144 (8.6)	271 (8.1)	415 (8.3)
<b>STARA PLANINA RANGE SYSTEM</b>	<b>719 (43.0)</b>	<b>1026 (30.7)</b>	<b>1745 (34.8)</b>
<b>Predbalkan</b>	<b>329 (19.7)</b>	<b>426 (12.7)</b>	<b>755 (15.0)</b>
Western Predbalkan	247 (14.8)	234 (7.0)	481 (9.6)
Middle Predbalkan	198 (11.8)	262 (7.8)	432 (8.6)
Eastern Predbalkan	19 (1.1)	24 (0.7)	43 (0.8)
<b>Stara Planina (Balkan) Mts.</b>	<b>542 (32.4)</b>	<b>884 (26.4)</b>	<b>1426 (28.4)</b>
Western Stara Planina (Balkan) Mts.	457 (27.3)	515 (15.4)	972 (19.4)
Middle Stara Planina (Balkan) Mts.	198 (11.8)	429 (12.8)	627 (12.5)
Eastern Stara Planina (Balkan) Mts.	23 (1.4)	246 (7.3)	269 (5.4)
<b>TRANSITIONAL REGION</b>	<b>781 (46.7)</b>	<b>1893 (56.6)</b>	<b>2674 (53.3)</b>
<b>Kraishte-Konyavo district</b>	<b>114 (6.8)</b>	<b>143 (4.3)</b>	<b>257 (5.1)</b>
Rouy Mt.		1 (0.03)	1 (0.02)
Trun Basin (Znepole)		17 (0.5)	17 (0.3)
Strazha-Cherna Gora-Rudini Mts.	29 (1.7)	1 (0.03)	30 (0.6)
Golo Burdo Mt.	8 (0.5)	15 (0.4)	23 (0.5)
Verila Mts.	2 (0.1)		2 (0.04)
Kraishte		41 (1.2)	41 (0.8)
Zemenska Planina Mt.	38 (2.3)	1 (0.03)	39 (0.8)
Konyavska Planina Mt.	53 (3.2)	23 (0.7)	76 (1.5)
Kyustendil Basin	71 (4.2)	77 (2.3)	148 (2.9)
<b>Vitosha district</b>	<b>561 (33.6)</b>	<b>1431 (42.8)</b>	<b>1992 (39.7)</b>
Sofia Basin	257 (15.4)	822 (24.6)	1079 (21.5)
Zavalska-Viskyar Mts.	1 (0.06)	2 (0.06)	3 (0.06)
Lyulin Mt.	18 (1.1)	66 (2.0)	84 (1.7)
Vitosha Mt.	329 (19.7)	972 (29.0)	1301 (25.9)
Plana Mts.	81 (4.8)	70 (2.1)	151 (3.0)
<b>Srednogorie-Podbalkan subregion</b>	<b>192 (11.5)</b>	<b>645 (19.3)</b>	<b>837 (16.7)</b>
Podbalkan Basins	107 (6.4)	397 (11.9)	504 (10.0)
Sredna Gora Mts.	101 (6.0)	352 (10.5)	453 (9.0)
Ihtimanska Sredna Gora Mts.	90 (5.4)	206 (6.1)	296 (5.9)
Lozenska Planina Mt.	65 (3.9)	158 (4.7)	223 (4.4)
Sushtinska Sredna Gora Mts.	19 (1.1)	77 (2.3)	96 (1.9)
Surnena Sredna Gora Mts.	8 (0.5)	95 (2.8)	103 (2.0)
<b>Thracian Lowland</b>	<b>200 (12.0)</b>	<b>528 (15.8)</b>	<b>728 (14.5)</b>
<b>Toundzha-Strandzha subregion</b>	<b>192 (11.5)</b>	<b>282 (8.4)</b>	<b>474 (9.4)</b>
Sakar-Toundzha district	87 (5.2)	53 (1.6)	140 (2.8)
Sakar Mt.	7 (0.4)	39 (1.2)	46 (0.9)
Bakadzhik-Bourgas district	28 (1.7)	66 (2.0)	94 (1.9)
Strandzha-Dervent district	119 (7.1)	236 (7.0)	355 (7.1)
Strandzha Mts.	119 (7.1)	236 (7.0)	355 (7.1)
<b>RILA-RHODOPE MASSIF</b>	<b>813 (48.6)</b>	<b>1871 (55.9)</b>	<b>2684 (53.5)</b>
<b>Osogovo-Belasitsa group</b>	<b>248 (14.8)</b>	<b>593 (17.7)</b>	<b>841 (16.8)</b>
Osogovska Planina Mts.	4 (0.2)	25 (0.7)	29 (0.6)
Vlahina Planina Mts.		2 (0.06)	2 (0.04)
Maleshevska Planina Mts.		22 (0.6)	22 (0.4)
Ograzhden Mts.		47 (1.4)	47 (0.9)
Belasitsa Mts.	14 (0.8)	201 (6.0)	215 (4.3)
Srednostroumska Valley	193 (11.5)	515 (15.4)	708 (14.1)
Boboshevo-Simitli Valley	159 (9.5)	172 (5.1)	331 (6.6)
Kroupnik-Sandanski-Petrich Valley	140 (8.4)	432 (12.9)	572 (11.4)
<b>Rila-Pirin group</b>	<b>525 (31.4)</b>	<b>1117 (33.4)</b>	<b>1642 (32.7)</b>
Rila Mts.	333 (19.9)	716 (21.4)	1049 (20.9)
Pirin Mts.	233 (13.9)	608 (18.2)	841 (16.7)
Slavyanka Mt.	14 (0.8)	231 (6.9)	245 (4.9)
Sturgach Mt.	1 (0.06)	42 (1.2)	43 (0.8)
Mesta Valley	114 (6.8)	107 (3.2)	221 (4.4)
<b>Rhodope Mts.</b>	<b>449 (26.8)</b>	<b>1184 (35.4)</b>	<b>1633 (32.5)</b>
Western Rhodope Mts.	385 (23.0)	1018 (30.4)	1403 (27.9)
Eastern Rhodope Mts.	153 (9.1)	383 (11.4)	536 (10.7)
<b>BLACK SEA COAST</b>	<b>367 (21.9)</b>	<b>1025 (30.6)</b>	<b>1392 (27.7)</b>
<b>Northern Black Sea Coast</b>	<b>285 (17.0)</b>	<b>710 (21.2)</b>	<b>995 (19.8)</b>
<b>Southern Black Sea Coast</b>	<b>165 (9.9)</b>	<b>646 (19.3)</b>	<b>811 (16.2)</b>

**Table 2.** The distribution of the Brachycera 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
<b>ORTHORRHAPHA (1552)</b>	<b>379 (24.4)</b>	<b>276 (12.1)</b>	<b>195 (11.7)</b>	<b>134 (8.8)</b>	<b>72 (8.9)</b>	<b>15 (5.7)</b>	<b>6 (13.9)</b>
<b>Xylophagomorpha (6)</b>	<b>2 (33.3)</b>	<b>1 (0.04)</b>	<b>1 (0.06)</b>	<b>1 (0.06)</b>			
Xylophagidae (5)	1 (20.0)	1 (0.04)	1 (0.06)				
Coenomyiidae (1)	1 (100.0)			1 (0.06)			
<b>Stratiomyomorpha (148)</b>	<b>51 (34.5)</b>	<b>43 (1.9)</b>	<b>23 (1.4)</b>	<b>12 (0.8)</b>	<b>3 (0.4)</b>		
Xylomyiidae (8)	1 (12.5)	1 (0.04)					
Stratiomyidae (140)	50 (35.7)	42 (1.8)	23 (1.4)	12 (0.8)	3 (0.4)		
<b>Tabanomorpha (1398)</b>	<b>326 (23.3)</b>	<b>232 (10.2)</b>	<b>171 (10.2)</b>	<b>121 (8.0)</b>	<b>69 (8.5)</b>	<b>15 (5.7)</b>	<b>6 (13.9)</b>
Rhagionidae (85)	18 (21.2)	10 (0.4)	8 (0.5)	10 (0.6)	4 (0.5)	1 (0.4)	
Athericidae (10)	2 (20.0)		2 (0.1)				
Tabanidae (220)	85 (38.6)	73 (3.2)	59 (3.5)	44 (2.9)	31 (3.8)	6 (2.3)	4 (9.3)
Vermileonidae (9)	1 (11.1)	1 (0.04)					
Nemestrinidae (13)	1 (7.7)	1 (0.04)					
Acroceridae (35)	2 (5.7)	1 (0.04)			1 (0.1)	1 (0.4)	1 (2.3)
Bombyliidae (340)	89 (26.2)	48 (2.1)	34 (2.0)	9 (0.6)	4 (0.5)		
Mythicomyiidae (30)	2 (6.7)	2 (0.09)					
Therevidae (100)	10 (10.0)	6 (0.3)	4 (0.2)	5 (0.3)			
Scenopinidae (16)	2 (12.5)	2 (0.09)	1 (0.06)				
Asilidae (540)	114 (21.1)	88 (3.9)	63 (3.8)	53 (3.5)	29 (3.6)	7 (2.6)	1 (2.3)
<b>EREMONEURA (2045)</b>	<b>494 (24.1)</b>	<b>274 (12.0)</b>	<b>167 (10.0)</b>	<b>209 (13.8)</b>	<b>108 (13.3)</b>	<b>17 (6.4)</b>	<b>1 (2.3)</b>
Empididae (810)	183 (22.6)	63 (2.8)	68 (4.1)	106 (7.0)	60 (7.4)	8 (3.0)	1 (2.3)
Hybotidae (440)	87 (19.8)	47 (2.1)	32 (1.9)	36 (2.4)	18 (2.2)	1 (0.4)	
Atelestidae (4)	2 (50.0)			2 (0.1)			
Microphoridae (16)	5 (31.2)	2 (0.09)	4 (0.2)	3 (0.2)			
Dolichopodidae (775)	214 (27.0)	162 (7.1)	63 (3.8)	62 (4.1)	30 (3.7)	8 (3.0)	
<b>CYCLORRHAPHA (8104)</b>	<b>2490 (30.7)</b>	<b>1725 (75.8)</b>	<b>1304 (78.3)</b>	<b>1173 (77.4)</b>	<b>629 (77.7)</b>	<b>232 (87.9)</b>	<b>37 (86.0)</b>
ASCHIZA (1693)	564 (33.3)	315 (13.8)	323 (19.4)	349 (23.0)	164 (20.3)	82 (31.1)	3 (7.0)
Platypzidae (45)	2 (4.4)		2 (0.1)	1 (0.06)			
Lonchopteridae (13)	4 (30.8)	4 (0.2)	3 (0.2)	3 (0.2)	2 (0.2)	1 (0.4)	
Phoridae (605)	231 (38.2)	87 (3.8)	123 (7.4)	160 (10.5)	92 (11.4)	64 (24.2)	
Pipunculidae (200)	26 (13.0)	18 (0.8)	13 (0.8)	8 (0.5)	7 (0.9)	1 (0.4)	1 (2.3)
Syrphidae (830)	303 (36.5)	206 (9.0)	182 (10.9)	177 (11.7)	63 (7.8)	16 (6.1)	2 (4.6)
SCHIZOPHORA (6411)	1925 (30.0)	1410 (62.0)	981 (58.9)	824 (54.3)	465 (57.5)	150 (56.8)	34 (79.1)
<b>Acalyptratae (3696)</b>	<b>941 (25.5)</b>	<b>719 (31.6)</b>	<b>417 (25.0)</b>	<b>335 (22.1)</b>	<b>200 (24.7)</b>	<b>90 (34.1)</b>	<b>21 (48.8)</b>
Micropezidae (22)	1 (4.5)	1 (0.04)	1 (0.06)				
Psilidae (50)	7 (14.0)	6 (0.3)	1 (0.06)	1 (0.06)	1 (0.1)		
Diopsidae (1)	1 (100.0)	1 (0.04)					
Conopidae (85)	41 (48.2)	33 (1.4)	26 (1.6)	21 (1.4)	7 (0.9)	1 (0.4)	
Lonchaeidae (100)	5 (5.0)	4 (0.2)	1 (0.06)		1 (0.1)		
Ulidiidae (29)	3 (10.3)	2 (0.09)	1 (0.06)	1 (0.06)	1 (0.1)		
Otitidae (76)	13 (17.1)	10 (0.4)	1 (0.06)				
Platystomatidae (20)	4 (20.0)	3 (0.1)	1 (0.06)				
Tephritidae (270)	79 (29.2)	61 (2.7)	29 (1.7)	17 (1.1)	9 (1.1)	4 (1.5)	
Pallopteridae (23)	1 (4.3)	1 (0.04)					
Piophilidae (30)	3 (10.0)	3 (0.1)	2 (0.1)	1 (0.06)	1 (0.1)		

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
Lauxaniidae (160)	21 (13.1)	9 (0.4)	2 (0.1)	1 (0.06)			
Cremifaniidae (2)	1 (50.0)					1 (0.4)	
Chamaemyiidae (110)	29 (26.4)	22 (1.0)	15 (0.9)	15 (1.0)	9 (1.1)	5 (1.9)	1 (2.3)
Coelopidae (3)	3 (100.0)	2 (0.09)					
Dryomyzidae (4)	2 (50.0)	2 (0.09)	2 (0.1)	2 (0.1)	1 (0.1)		
Sciomyzidae (140)	36 (25.7)	24 (1.0)	10 (0.6)	1 (0.06)			
Phaemyiidae (3)	1 (33.3)		1 (0.06)				
Helcomyzidae (2)	1 (50.0)	1 (0.04)					
Sepsidae (50)	11 (22.0)	7 (0.3)	3 (0.2)	2 (0.1)	1 (0.1)		
Acartophthalmidae (3)	2 (66.7)	1 (0.04)	1 (0.06)		1 (0.1)		
Oдиниidae (14)	2 (14.3)	2 (0.09)					
Agromyzidae (910)	190 (20.9)	119 (5.2)	82 (4.9)	74 (4.9)	28 (2.5)	11 (4.2)	2 (4.6)
Opomyzidae (33)	7 (21.2)	6 (0.3)	6 (0.4)	6 (0.4)	4 (0.5)	3 (1.1)	1 (2.3)
Anthomyzidae (30)	5 (16.7)	3 (0.1)					
Aulacigastridae (4)	1 (25.0)	1 (0.04)					
Periscelididae (4)	1 (25.0)	1 (0.04)	1 (0.06)	1 (0.06)			
Asteiidae (18)	3 (16.7)	3 (0.1)	1 (0.06)				
Braulidae (3)	3 (100.0)	1 (0.04)					
Carnidae (40)	8 (20.0)	4 (0.2)	5 (0.3)	5 (0.3)	6 (0.7)	2 (0.7)	1 (2.3)
Tethinidae (35)	7 (20.0)	7 (0.3)					
Canacidae (4)	1 (25.0)	1 (0.04)					
Milichiidae (45)	8 (17.8)	7 (0.3)	4 (0.2)	2 (0.1)	1 (0.1)	1 (0.4)	
Chloropidae (395)	166 (42.0)	150 (6.6)	109 (6.5)	92 (6.1)	67 (8.3)	31 (11.7)	5 (11.6)
Siphonellopsidae (3)	2 (66.7)	2 (0.09)	1 (0.06)				
Heleomyzidae (150)	51 (34.0)	32 (1.4)	26 (1.6)	25 (1.6)	15 (1.8)	7 (2.6)	
Trioxscelididae (25)	1 (4.0)	1 (0.04)					
Chyromyidae (60)	1 (1.7)	1 (0.04)	1 (0.06)				
Sphaeroceridae (260)	60 (23.1)	36 (1.6)	12 (0.7)	11 (0.7)	9 (1.1)	3 (1.1)	
Curtonotidae (1)	1 (100.0)	1 (0.04)					
Camillidae (8)	1 (12.5)	1 (0.04)	1 (0.06)				
Drosophilidae (120)	17 (14.2)	14 (0.6)	6 (0.4)	3 (0.2)	2 (0.2)	1 (0.4)	1 (2.3)
Campichoetidae (7)	2 (28.6)	3 (0.1)	1 (0.06)				
Diastatidae (9)	4 (44.4)	3 (0.1)	2 (0.1)	2 (0.1)			
Ephyridae (335)	135 (40.3)	127 (5.6)	62 (3.7)	52 (3.4)	36 (4.4)	20 (7.6)	10 (23.2)
<b>Calyptrae (2715)</b>	<b>985 (36.3)</b>	<b>691 (30.4)</b>	<b>564 (33.8)</b>	<b>489 (32.2)</b>	<b>265 (32.7)</b>	<b>60 (22.7)</b>	<b>13 (30.2)</b>
Hippoboscidae (30)	12 (40.0)	10 (0.4)	6 (0.4)	4 (0.3)	3 (0.4)	3 (1.1)	
Strebliidae (1)	1 (100.0)	1 (0.04)	1 (0.06)				
Nycteribiidae (15)	7 (46.7)	7 (0.3)	7 (0.4)	4 (0.3)			
Scathophagidae (160)	11 (6.9)	4 (0.2)	3 (0.2)	5 (0.3)	1 (0.1)		1 (2.3)
Anthomyiidae (480)	53 (11.0)	34 (1.5)	25 (1.5)	22 (1.4)	13 (1.6)		
Fanniidae (82)	27 (32.9)	22 (1.0)	18 (1.1)	18 (1.2)	8 (1.0)	2 (0.7)	1 (2.3)
Muscidae (575)	267 (46.4)	190 (8.3)	162 (9.7)	167 (11.0)	132 (16.3)	30 (11.4)	7 (16.3)
Calliphoridae (115)	41 (35.6)	36 (1.6)	20 (1.2)	14 (0.9)	9 (1.1)	1 (0.4)	
Sarcophagidae (310)	122 (39.3)	107 (4.7)	47 (2.8)	39 (2.6)	32 (3.9)	9 (3.4)	
Rhinophoridae (45)	8 (17.8)	6 (0.3)	2 (0.1)	1 (0.06)			
Oestridae (8)	2 (25.0)	2 (0.09)	1 (0.06)				

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
Hypodermatidae (8)	4 (50.0)	4 (0.2)	2 (0.1)	1 (0.06)			
Gasterophilidae (6)	4 (66.7)	3 (0.1)	3 (0.2)	3 (0.2)			
Tachinidae (880)	425 (48.3)	265 (11.6)	267 (16.0)	211 (13.9)	67 (8.3)	15 (5.7)	4 (9.3)
<b>BRACHYCERA (11701)</b>	<b>3368 (28.8)</b>	<b>2275 (67.5)</b>	<b>1666 (49.5)</b>	<b>1516 (45.0)</b>	<b>809 (24.0)</b>	<b>264 (7.8)</b>	<b>43 (1.3)</b>

**Note:** After the names of the families, the number of the species recorded in Europe (according to OSTERBROEK 2006) is given in parentheses. The classification of the Diptera based on the works of SOÓS & PAP (1984–1993), MCALPINE (1989), WOODLEY (1989), NAGATOMI (1996), PAPP & DARVAS (1997, 1998, 2000a, 2000b), YEATES & WIEGMANN (1999), NARTSHUK (2003), ZIEGLER (2003), OOSTERBROEK (2006), YEATES et al. (2007) and PAPE et al. (2011).

myiidae, Megamerinidae, Heterocheilidae, Pyrgotidae, Stenomicridae, Xenasteiidae, Cryptochetidae, Chiropteromyzidae and Cnemospithidae). They are represented in Europe by 1–3 species (with the exception of Brachystomatidae and Mydidae, represented by 4–13 species). Usually, the families studied in Bulgaria include over 30 % of the European species. Of the largest families (over 800 species in Europe) – Empididae, Syrphidae, Agromyzidae and Tachinidae, 22.6 %, 36.5 %, 20.9 % and 46.8 %, respectively, of the European species have been recorded in Bulgaria. The families Tabanidae, Syrphidae, Conopidae, Calliphoridae and Sarcophagidae are well-represented, by 36.5–48.2 % of the European taxa. In Bulgaria, the families Chloropidae, Ephydriidae and Muscidae had been studied for the longest time and more systematically; they are represented by 40.3–46.4 % of the European species. The families Platypezidae, Micropezidae, Lonchaeidae, Pallopteridae, Trixoscelididae and Chyromyidae are the most poorly studied in Bulgaria; of these families, 1.7–5.0 % of the European taxa have been recorded in Bulgaria. Of the larger families, Scathophagidae and Anthomyiidae are poorly studied, with 6.9 % and 11.0 % of the European species, respectively, known from Bulgaria. Of the family Bombyliidae, 89 species have been found (26.2 % of the European forms) but 32 of them have been reported for Bulgaria based on their distribution in neighbouring countries. In reality, 57 species (16.8 % of the European species) have been established in Bulgaria and the family can be considered poorly studied. In the last ten years, two new families have been found for the Bulgarian fauna: Cremifaniidae (PAPP 2010) and Diopsidae (KUTSAROV & HUBENOV 2019). The infraorders of Brachycera, represented

in Bulgaria (Table 2), include from 24.0 % to 30.5 % of the European taxa [Orthorrhapha – 24.4 %, Eremoneura – 24.0 % and Cyclorrhapha – 30.5 % (Acalyptratae – 25.4 % and Calyptratae – 35.8 %)].

Of the recorded species of the suborder Brachycera in Bulgaria, 49 species have a human or veterinary medical significance and 21 are pests on the forestry or agriculture (Appendix 1). Most representatives of medical significance include the families Muscidae and Tabanidae, followed by Sarcophagidae, Calliphoridae, Hypodermatidae, Gasterophilidae, Fanniidae, Hippoboscidae, Oestridae, Piophilidae, Braulidae and Anthomyiidae. The main part of the plant pests belongs to Anthomyiidae, Tephritidae and Chloropidae. With one species each are represented Psilidae, Lonchaeidae, Agromyzidae, Opomyzidae, Heleomyzidae and Ephydriidae. The specific features and medical significance of Oestridae, Hypodermatidae and Gasterophilidae and some species of Tabanidae, Piophilidae, Hippoboscidae, Calliphoridae and Sarcophagidae are connected with the predominant distribution in the first two or three vegetation belts where the main part of the population is concentrated.

## Discussion

The distribution data of the suborder Brachycera on the territory of Bulgaria (Table 1) are related to the specific natural conditions of the respective regions, the peculiarities of the families and the level of their examination. The wide distribution of the Diptera assumes a similar fauna of the different regions after an extensive literature review. Most dipterans have vast ranges and the endemics are poorly represented. The taxon presence is connected with

the degree of the examination of the corresponding parts of the country. This is evident when comparing the established species with regard to certain regions in Bulgaria. There are no data for Verila Mts. One or two species are known from each of the mountains Rouy, Strazha, Cherna Gora, Rudini, Zemenska, Zavalska, Viskyar and Vlahina. For five natural territories (below 30 species known), there are single reports (Eastern Predbalkan, Golo Burdo, Konyavska, Osogovska and Maleshevska Planina Mountains). Several areas with more detailed research of the fauna of the Brachycera are outlined. These are natural areas located near research centres, included in the national and nature parks, or areas subject of dissertation works on certain families. Several areas are among the territories with more complete studies on the dipteran fauna, with respect to more systematic groups (represented by over 15 % of the species found in Bulgaria): Western Stara Planina Mts., Sofia Basin, Vitosha Mt., Thracian Lowland, Rila Mts., Pirin Mts., Western Rhodope Mts. and the Black Sea Coast (between 15.4 % and 30.4 % of the Brachycera species recorded in Bulgaria). In the Vitosha Mt., Thracian Lowland, Srednostroumska Valley, Western Rhodope Mts. and along the Black Sea Coast, dissertation works have been performed on the families Tabanidae, Empididae, Dolichopodidae, Phoridae and Tachinidae. There is a decreasing tendency of the level of research from west to east and from north to south, which is followed in the Stara Planina Range system, the Rila-Rhodope massif and along the Black Sea coast. Exceptions of this trend are the mountains in the western part of the Transitional Region (west of Sofia), which are traditionally neglected by zoologists and are poorly studied. Investigations on the synanthropic forms of the families Fanniidae, Muscidae, Calliphoridae and Sarcophagidae have enriched the faunistic composition of the Brachycera in the Eastern Danubian Plain, Sofia Basin, Surnena Sredna Gora Mts., Thracian Lowland and along the Black Sea Coast. Regarding the main territorial units, it is impressive the close species diversity between the Transitional Region and the Rila-Rhodope massif (55.9–56.6 % of all species recorded), on the one hand, and the Stara Planina Range system and the Black Sea coast (30.6–30.7 % of the species established), on the other. The most visited and explored territories such as Sofia Basin, Vitosha Mt., Struma River Valley and the Rila, Pirin and Western Rhodope Mts., are in the Transitional Region and the Rila-Rhodope massif. For Sredna Gora Mts., it can be noted that a significant part of the taxa (158 species or 44.9 %) are found in the Lozenska Planina Mt. (a small part of

the Ihtimanska Sredna Gora Mts., which is located near Sofia), while the other parts of the same range – Sushtinska Sredna Gora (20.9 % of the species) and Surnena Sredna Gora Mts. (27.0 % of the species) – are poorly studied. The situation is similar in the Toundzha-Strandzha subregion where most species (83.7 %) are found in the Strandzha Mts. Of the mountains of the Osogovo-Belasitsa group, most species are known from Belasitsa. The Rila-Pirin group is dominated by the taxa found in the Rila (64.1 %) and Pirin (54.4 %) Mts., while there are only few reports for Slavyanka and Sturgach Mts. The difference in the numbers of species between the valleys of the rivers Struma (516 species – 15.4 %) and Mesta (107 species – 3.2 %) is determined by both specific natural conditions and the great number of studies in the Sandanski-Petrich Valley and Kresna Gorge compared to the limited research in the valley of the Mesta River. The difference between the Western (1018 species – 30.4 %) and Eastern Rhodope Mts. (383 species – 11.4 %) is also related to the natural conditions and prevailing interest of the specialists in the Western Rhodope Mts.

Vitosha Mt., situated at the border of the city of Sofia, is the most completely studied Bulgarian mountain, with a taxonomic diversity (972 species – 29.0 %) comparable to that of the Rila and Western Rhodope Mts. despite its smaller area. In the better studied families, the differences among the Vitosha, Rila and Pirin Mts. are not great (HUBENOV 2019b). Further studies of the Pirin Mts. would 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 occupied by this mountain in Southwest Bulgaria. The Sofia Basin is the best studied area (822 species or 24.6 % of the species established in Bulgaria). A comparison of Brachycera with Nematocera (HUBENOV 2021) shows differences among certain territorial units (Table 1), which reach to 12.3 % in the Stara Planina Range System.

The biggest number of species (2275 – 67.5 %) has been recorded in the xerothermic oak forests belt (Table 2). This is due to the specificity of certain families and the position of most localities below 1000 m a. s. l. In the next two belts, i.e. the mesophilic and xeromesophilic mixed forests (1666 species – 49.5 %) and beech forests (1516 species – 45.0 %), the number of species decreases with 18.2 % and 4.5 %. In the other vegetation belts, the number of species decreases almost twice in the coniferous belt (809 species – 24.0 %) and sharply in the subalpine and alpine vegetation belts (264 species – 7.8 % and 43 species – 1.3 %). There is an exception

in the families Phoridae, Chloropidae, Ephydriidae, Muscidae, Sarcophagidae and Tachinidae (well-represented from the beech to the coniferous forests belts), which have numerous taxa in the mountainous areas. This explains the percentage increase of Aschiza (23.0 % – 31.1 %), Schizophora (54.3 % – 79.1 %), Acalyptratae (22.1 % – 48.8 %) and the strong presence of Calyptratae (22.7 % – 32.7 %) from the beech to the alpine vegetation belts. The infraorder Cyclorrhapha (from 75.8 % to 87.9 %) determines the faunistic diversity of all belts. 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 Coenomyiidae, Athericidae, Atelestidae and Platypezidae have not been recorded in the belt of the xerothermic oak forests. Most families (80 and 64) are represented in the belts of the xerothermic oak forests and the mesophilic and xeromesophilic mixed forests. In the next 3 belts, the diversity decreases with ten families each (from 50 in the beech belt to 30 in the subalpine belt) and the species composition is determined by the larger families (Empididae, Dolichopodidae, Phoridae, Syrphidae, Agromyzidae, Chloropidae, Ephydriidae, Muscidae, Sarcophagidae and Tachinidae). The upper limit of the coniferous forests gradually passes into the subalpine vegetation 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. In the alpine belt, 17 families are presented, of which Tabanidae, Chloropidae, Ephydriidae, Muscidae and Tachinidae determine the faunistic diversity. Of the species found in the alpine vegetation belt, *Didea alneti* (Fallén, 1817), a Holarctic species of Syrphidae, and *Eudorylas jenkinsoni* Coe, 1966 (European species of Pipunculidae) are typical only for it. The other three species that have been recorded in the subalpine belt [*Hilara discoidalis* Lundbeck, 1910; *Scatophila despecta* (Haliday, 1839); *Norellisoma armipes* (Meigen, 1826)] are also known from 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 studies in the subalpine belt of the Rila and Pirin Mts. are insufficient and fragmentary.

Regarding the hypsometric belts, there are significant variations in the maximum number of species among the families in the different 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, the maximum number of species has been found between 400 and 1000 m a. s. l. as there are differences in the mountains of  $\pm 200$  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 conditional character; it 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 the 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 Bulgarian mountains 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 2015b, 2016, 2017, 2018, 2019b).

The zoogeographical categorisation of the species was made on the basis of current data about their distribution. Thus, the Brachycera were divided into 139 categories, combined into three main groups and six complexes (Table 3).

**Species distributed in the Palaearctic and beyond it.** This complex (846 species – 25.3 %) includes 42 categories. Of these categories, 31 combine species of northern type (widely distributed in the Holarctic and Palaearctic) and 11 include species of southern type (distributed only in the southern parts of the Palaearctic). The difference between the vegetation belts reaches 12.3 % and varies from 27.2 % (coniferous forests) to 39.5 % (alpine vegetation). Of the other areographical categories, this difference is the highest for the cosmopolitan (8.0 %) and the Holarctic (7.1 %) 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-Palaeartic complex, the Holarctic species prevail [318 species – 9.5 % (from 9.2 % in the xerothermic oak forests to 16.3 % in the alpine belt)]. Of the other areographical types, the Palaeartic-Oriental [136 species – 4.1 % (from 1 to 105 species, 2.3 % to 4.5 % in the certain belts)] and the Holarctic-Oriental [81 species – 2.4 % (from 7 to 63 species, 2.6 % to 4.1 %)] forms are better represented. The species of the southern type (43 species – 1.3 %) are represented mostly in the first two vegetation belts (only two species have been found in the coniferous belt). The group is not important for the zoogeographical characteristic because of the small number of species (2–36 species, 0.2–1.6 %). Usually, the Super-Palaeartic complex is scantily represented and is not determinant for the zoogeographical characteristic of taxa in the Bulgarian terrestrial fauna (with the exception of the coastal fauna). Only in highly mobile groups (such as Diptera), the complex is well presented and could reach 20 % (HUBENOV 2015a). In Brachycera, 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 synbovill 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 Palaeartic but in more than one subregion (Palaeartic type).** Taxa with areas that include more than one Palaeartic 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 31 areographical categories, including 856 species (25.6 %) of the Bulgarian Brachycera fauna, have been registered (Table 3). The character of the Palaeartic complex is determined by the Transpalaeartic [185 species – 5.5 % (4.5 % to 7.4 % in the different vegetation belts)], West Palaeartic [126 species – 3.8 % (2.3 % to 4.6 %)], European-North African [102 species – 3.0 % (1.9 % to 3.5 %)], West and Central Palaeartic [89 species – 2.6 % (2.2 % to 3.5 %)] and the Eurosiberian-Central Asian [67 species – 2.0 % (1.5 % to 2.3 %)] species. The Disjunct Palaeartic (51 species) and the European-Southwest Asian (35 species) taxa are well represented. The correlation of the mentioned categories is kept in the vegetation belts and varies from 1.1 % to 7.4 % (1 to 152 species). Fifty-one species (1.5 %) have a longitudinal disjunction of the areas with regard to Siberia and Central Asia – from 3 to 32 species per a vegetation

belt. Probably, some of these species are represented 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 23 %) belong to the Palaeartic complex. The difference between the vegetation belts (from 10 to 685 species) reaches 78.3 % and varies from 1.8 % (alpine vegetation) to 80.0 % (xerothermic oak forests) of the species. For the different areographical categories, this difference is the largest in the Holopalaeartic species (6.2 %). 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 Palaeartic complex (like the Super Palaeartic one) is better represented in the Vrachanska Planina Mts. (where it comprises 30.4 % of the recorded 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 Palaeartic.** This group (1643 species – 49.1 %) includes from 16 to 945 species (37.2 % to 47.7 %) per a vegetation belt. The group combines species with Eurosiberian and Mediterranean type of distribution (66 categories). Endemics also participate in this group. The Mediterranean-Central Asian species are also included here, following works by KRZYZHANOVSKY (1965, 2002) and LOPATIN (1989) proposing to combine the Mediterranean and Central-Asian subregions. The species with Mediterranean type of distribution are accepted in a general way and include sub-Mediterranean, sub-Iranian and Pontian faunistic elements that could also be considered separately from the Mediterranean ones (GRUEV & KUSMANOV 1994, 1999, GRUEV 1995, GRUEV & BECHEV 2000).

**The Eurosiberian species** include 17 areographical categories (1236 species or 36.9 %). These are from 14 to 661 (29.0 % to 43.1 %) species per a certain vegetation belt (Table 3). The European [712 species (21.3 %) – from 5 to 358 species (11.6 % to 24.2 %) per a belts], Disjunct Eurosiberian [107 species (3.2 %) – from 1 to 52 species (2.3 % to 3.8 %)] and the Holoeurosiberian [78 species (2.3

**Table 3.** Zoogeographical characteristic of the Brachycera 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
<b>Species distributed in Palaearctic and out of it</b>	<b>846 (25.3)</b>	<b>645 (28.3)</b>	<b>472 (28.3)</b>	<b>415 (27.4)</b>	<b>220 (27.2)</b>	<b>77 (29.2)</b>	<b>17(39.5)</b>
<b>NORTH TYPE</b>	<b>803 (24.0)</b>	<b>609 (23.6)</b>	<b>456 (27.4)</b>	<b>407 (26.8)</b>	<b>218 (26.9)</b>	<b>77 (29.2)</b>	<b>17(39.5)</b>
Cosmopolitan	42 (1.2)	39 (1.7)	25 (1.5)	20 (1.3)	14 (1.7)	9 (3.4)	4 (9.3)
Semicosmopolitan	21 (0.6)	18 (0.8)	11 (0.7)	9 (0.6)	6 (0.7)	2 (0.7)	1 (2.3)
Holarctic-Paleotropical-Neotropical	4 (0.1)	2 (0.09)	3 (0.2)	3 (0.2)	2 (0.2)	1 (0.4)	
Holarctic-Paleotropical-Australian	6 (0.2)	6 (0.3)	3 (0.2)	3 (0.2)	2 (0.2)		
Holarctic-Paleotropical	7 (0.2)	7 (0.3)	3 (0.2)	3 (0.2)	2 (0.2)	1 (0.4)	
Holarctic-Neotropical-Afrotropical	3 (0.09)	3 (0.1)	3 (0.2)	1 (0.06)			
Holarctic-Neotropical-Oriental	11 (0.3)	11 (0.5)	10 (0.6)	8 (0.5)	5 (0.6)	1 (0.4)	1 (2.3)
Holarctic-Neotropical-Australian	3 (0.09)	3 (0.1)	2 (0.1)	1 (0.06)	1 (0.1)		
Holarctic-Afrotropical-Australian	2 (0.06)	2 (0.09)					
Holarctic-Oriental-Australian	6 (0.2)	6 (0.3)	4 (0.2)	3 (0.2)			
Holarctic-Afrotropical	11 (0.3)	7 (0.3)	7 (0.4)	4 (0.3)	2 (0.2)	1 (0.4)	1 (2.3)
Holarctic-Oriental	81 (2.4)	63 (2.8)	55 (3.3)	57 (3.7)	33 (4.1)	7 (2.6)	
Holarctic-Neotropical	16 (0.5)	14 (0.6)	10 (0.6)	9 (0.6)	6 (0.7)	4 (1.5)	
Holarctic-Australian	6 (0.2)	6 (0.3)	5 (0.3)	1 (0.06)	1 (0.1)		
Holarctic	318 (9.5)	209 (9.2)	176 (10.6)	167 (11.0)	92 (11.4)	34 (12.9)	7 (16.3)
Palaearctic-Paleotropical-Neotropical	1 (0.03)	1 (0.04)					
Palaearctic-Paleotropical-Australian	11 (0.3)	10 (0.4)	6 (0.4)	5 (0.3)	2 (0.2)	1 (0.4)	
Palaearctic-Afrotropical-Neotropical	1 (0.03)	1 (0.04)	1 (0.06)	1 (0.06)	1 (0.1)		
Palaearctic-Afrotropical-Australian	2 (0.06)	2 (0.09)					
Palaearctic-Oriental-Australian	1 (0.03)	1 (0.04)	1 (0.06)	1 (0.06)			
Palaearctic-Paleotropical	37 (1.1)	33 (1.4)	16 (1.0)	14 (0.9)	6 (0.7)	4 (1.5)	1 (2.3)
Palaearctic-Afrotropical	16 (0.5)	14 (0.6)	9 (0.5)	8 (0.5)	3 (0.4)	3 (1.1)	1 (2.3)
Palaearctic-Oriental	136 (4.1)	105 (4.6)	79 (4.7)	69 (4.5)	35 (4.3)	8 (3.0)	1 (2.3)
Palaearctic-Neotropical	1 (0.03)						
West Palaearctic-Paleotropical	1 (0.03)	1 (0.04)	1 (0.06)	1 (0.06)			
West Palaearctic-Afrotropical	17 (0.5)	15 (0.7)	8 (0.5)	7 (0.5)	2 (0.2)		
West Palaearctic-Oriental	18 (0.5)	16 (0.7)	9 (0.5)	6 (0.4)	1 (0.1)		
West Palaearctic-Neotropical	1 (0.03)	1 (0.04)	1 (0.06)	1 (0.06)	1 (0.1)		
Disjunct Palaearctic-Afrotropical	1 (0.03)	1 (0.04)					
Disjunct Palaearctic-Oriental	18 (0.5)	9 (0.4)	7 (0.4)	5 (0.3)	1 (0.1)	1 (0.4)	
European-Oriental	4 (0.1)	3 (0.1)	1 (0.06)				
<b>SOUTH TYPE</b>	<b>43 (1.3)</b>	<b>36 (1.6)</b>	<b>16 (1.0)</b>	<b>8 (0.5)</b>	<b>2 (0.2)</b>		
South Palaearctic-Paleotropical-Australian	4 (0.1)	4 (0.2)	2 (0.1)	2 (0.1)			
Southwest Palaearctic-Neotropical-Afrotropical-Australian	1 (0.03)	1 (0.04)					
South Palaearctic-Paleotropical	8 (0.2)	8 (0.3)	3 (0.2)	1 (0.06)			
Southwest Palaearctic-Paleotropical	2 (0.06)		1 (0.06)				
South Palaearctic-Afrotropical	2 (0.06)	2 (0.09)	1 (0.06)	1 (0.06)			
Southwest Palaearctic-Afrotropical	6 (0.2)	5 (0.2)	2 (0.1)				
South Palaearctic-Oriental	8 (0.2)	6 (0.3)	4 (0.2)	3 (0.2)	2 (0.2)		
Paleotropical-Mediterranean	1 (0.03)						

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
Afrotropical-Mediterranean	9 (0.3)	8 (0.3)	2 (0.1)				
Oriental-Mediterranean	1 (0.03)	1 (0.04)	1 (0.06)	1 (0.06)			
Oriental-East Mediterranean	1 (0.03)	1 (0.04)					
<b>Species with Palaearctic distribution</b>	<b>2500 (74.7)</b>	<b>1630 (71.6)</b>	<b>1194 (71.7)</b>	<b>1101 (72.6)</b>	<b>589 (72.8)</b>	<b>187 (70.8)</b>	<b>26(60.5)</b>
<b>PALAEARCTIC TYPE</b>	<b>856 (25.6)</b>	<b>685 (30.1)</b>	<b>488 (29.3)</b>	<b>394 (26.0)</b>	<b>203 (25.1)</b>	<b>62 (23.5)</b>	<b>10(23.2)</b>
Holopalaearctic	21 (0.6)	18 (0.8)	19 (1.1)	16 (1.0)	10 (1.2)	5 (1.9)	3 (7.0)
Transpalaearctic	185 (5.5)	152 (6.7)	124 (7.4)	101 (6.7)	48 (5.9)	12 (4.5)	2 (4.6)
West and Central Palaearctic	89 (2.6)	79 (3.5)	54 (3.2)	42 (2.8)	18 (2.2)	6 (2.3)	1 (2.3)
West Palaearctic	126 (3.8)	105 (4.6)	65 (3.9)	54 (3.6)	34 (4.2)	6 (2.3)	
Disjunct Palaearctic	51 (1.5)	32 (1.4)	27 (1.6)	18 (1.2)	11 (1.4)	7 (2.6)	3 (7.0)
South Palaearctic	1 (0.03)	1 (0.04)	1 (0.06)	1 (0.06)			
Southwest Palaearctic	14 (0.4)	10 (0.4)	6 (0.4)	4 (0.3)			
Eurosiberian-Anatolian-Central Asian	12 (0.3)	9 (0.4)	7 (0.4)	6 (0.4)	4 (0.5)	1 (0.4)	
Eurosiberian-Central Asian	67 (2.0)	46 (2.0)	38 (2.3)	31 (2.0)	14 (1.7)	4 (1.5)	1 (2.3)
Eurosiberian-Anatolian (esan)	3 (0.09)	2 (0.09)	2 (0.1)	2 (0.1)	1 (0.1)	1 (0.4)	
West Eurosiberian-Anatolian-Central Asian	3 (0.09)	3 (0.1)	1 (0.06)	1 (0.06)	1 (0.1)		
West Eurosiberian-Central Asian	11 (0.3)	11 (0.5)	9 (0.5)	6 (0.4)	4 (0.5)	3 (1.1)	
West Eurosiberian-West Central Asian	5 (0.1)	4 (0.2)	2 (0.1)				
West Eurosiberian-Iran-Turanian	2 (0.06)	2 (0.09)	2 (0.1)	2 (0.1)	1 (0.1)	1 (0.4)	
West Eurosiberian-Anatolian-Iranian	1 (0.03)	1 (0.04)	1 (0.06)	1 (0.06)	1 (0.1)	1 (0.4)	
West Eurosiberian-Anatolian-Turanian	2 (0.06)	2 (0.09)	1 (0.06)	1 (0.06)	1 (0.1)		
West Eurosiberian-Turanian	2 (0.06)	2 (0.09)	1 (0.06)				
West Eurosiberian-Anatolian	9 (0.3)	7 (0.3)	4 (0.2)	4 (0.3)	3 (0.4)	1 (0.4)	
European-Anatolian-North African	23 (0.7)	21 (0.9)	14 (0.8)	9 (0.6)	4 (0.5)	1 (0.4)	
European-North African	102 (3.0)	80 (3.5)	46 (2.8)	43 (2.8)	23 (2.8)	5 (1.9)	
European-Anatolian-Central Asian	11 (0.3)	9 (0.4)	5 (0.3)	2 (0.1)	2 (0.2)		
European-Central Asian	18 (0.5)	13 (0.6)	7 (0.4)	7 (0.5)	4 (0.5)	1 (0.4)	
European-West Central Asian	18 (0.5)	15 (0.7)	10 (0.6)	7 (0.5)	4 (0.5)	2 (0.7)	
European-Southwest Asian	35 (1.0)	26 (1.1)	18 (1.1)	20 (1.3)	11 (1.4)	4 (1.5)	
European-Anatolian-Iran-Turanian	7 (0.2)	6 (0.3)	4 (0.2)	2 (0.1)			
European-Iran-Turanian	3 (0.09)	2 (0.09)	2 (0.1)	1 (0.06)			
European-Anatolian-Iranian	12 (0.3)	11 (0.5)	6 (0.4)	4 (0.3)	2 (0.2)	1 (0.4)	
European-Anatolian-Turanian	2 (0.06)	2 (0.09)					
European-Iranian	10 (0.3)	5 (0.2)	4 (0.2)	5 (0.3)	1 (0.1)		
European-Turanian	8 (2)	7 (0.3)	7 (0.4)	4 (0.3)	1 (0.1)		
East European-Central Asian	3 (0.09)	2 (0.09)	1 (0.06)				
<b>Species distributed in one subregion</b>	<b>1643 (49.1)</b>	<b>945 (41.5)</b>	<b>706 (42.4)</b>	<b>707 (46.6)</b>	<b>386 (47.7)</b>	<b>125 (47.3)</b>	<b>16(37.2)</b>
<b>EUROSIBERIAN TYPE</b>	<b>1236 (36.9)</b>	<b>661 (29.0)</b>	<b>597 (35.8)</b>	<b>631 (41.6)</b>	<b>349 (43.1)</b>	<b>111 (42.0)</b>	<b>14(32.5)</b>
Holoeurosiberian	78 (2.3)	47 (2.1)	53 (3.2)	56 (3.7)	26 (3.2)	9 (3.4)	1 (2.3)
Transeurosiberian	45 (1.3)	30 (1.3)	27 (1.6)	30 (2.0)	16 (2.0)	2 (0.7)	

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
West and Central Eurosiberian	59 (1.8)	37 (1.6)	38 (2.3)	38 (2.5)	22 (2.7)	6 (2.3)	2 (4.6)
West Eurosiberian	58 (1.7)	34 (1.5)	35 (2.1)	28 (1.8)	17 (2.1)	5 (1.9)	1 (2.3)
Disjunct Eurosiberian	107 (3.2)	52 (2.3)	45 (2.7)	49 (3.2)	31 (3.8)	10 (3.8)	1 (2.3)
European and South Siberian	11 (0.3)	8 (0.3)	7 (0.4)	5 (0.3)	2 (0.2)	1 (0.4)	
European-Anatolian	41 (1.2)	33 (1.4)	22 (1.3)	19 (1.2)	8 (1.0)	1 (0.4)	
European	712 (21.3)	358 (15.7)	313 (18.8)	351 (23.1)	191 (23.6)	64 (24.2)	5 (11.6)
East European-Siberian	6 (0.2)	2 (0.09)		2 (0.1)	1 (0.1)	1 (0.4)	
East European	9 (0.3)	8 (0.3)	6 (0.4)	5 (0.3)	2 (0.2)	1 (0.4)	1 (2.3)
Central and East European-Turanian	1 (0.03)	1 (0.04)	1 (0.06)	1 (0.06)	1 (0.1)		
Central and East European	5 (0.1)	2 (0.09)	2 (0.1)	1 (0.06)	1 (0.1)		
Central and South European and South Siberian	1 (0.03)		1 (0.06)	1 (0.06)			
Central and South European-Anatolian	9 (0.3)	8 (0.3)	7 (0.4)	4 (0.3)	2 (0.2)	1 (0.4)	1 (2.3)
Central and Southeast European-Anatolian	2 (0.06)	2 (0.09)	2 (0.1)				
Central and South European	54 (1.6)	28 (1.2)	25 (1.5)	28 (1.8)	18 (2.2)	6 (2.3)	2 (4.6)
Central and Southeast European	38 (1.1)	11 (0.5)	13 (0.8)	13 (0.8)	11 (1.4)	4 (1.5)	
<b>MEDITERRANEAN TYPE</b>	<b>340 (10.2)</b>	<b>241 (10.6)</b>	<b>97 (5.8)</b>	<b>63 (4.1)</b>	<b>26 (3.2)</b>	<b>9 (3.4)</b>	<b>2 (4.6)</b>
Mediterranean and South Siberian	2 (0.06)	1 (0.04)	2 (0.1)	1 (0.06)			
Mediterranean-Far East	1 (0.03)						
South European and South Far East	1 (0.03)						
Southeast European and South Far East	1 (0.03)						
Mediterranean-Central Asian	14 (0.4)	9 (0.4)	5 (0.3)	2 (0.1)	1 (0.1)	1 (0.4)	1 (2.3)
Mediterranean-West Central Asian	13 (0.4)	10 (0.4)	4 (0.2)	2 (0.1)			
Mediterranean-Iran-Turanian	12 (0.3)	7 (0.3)	5 (0.3)	2 (0.1)	1 (0.1)		
Mediterranean-Iranian	19 (0.6)	14 (0.6)	7 (0.4)	1 (0.06)			
Mediterranean-Turanian	8 (0.2)	4 (0.2)	2 (0.1)	2 (0.1)			
East Mediterranean-Central Asian	2 (0.06)	1 (0.04)					
East Mediterranean-Iran-Turanian	1 (0.03)	1 (0.04)					
East Mediterranean-Iranian	1 (0.03)	1 (0.04)					
North Mediterranean-Central Asian	2 (0.06)	1 (0.04)					
North Mediterranean-West Central Asian	9 (0.3)	8 (0.3)	4 (0.2)				
North Mediterranean-Iranian	6 (0.2)	5 (0.2)	3 (0.2)	1 (0.06)			
Northeast Mediterranean-Iran-Turanian	1 (0.03)	1 (0.04)					
Northeast Mediterranean-Iranian	1 (0.03)	1 (0.04)	1 (0.06)	1 (0.06)			
South European and South Siberian	1 (0.03)	1 (0.04)	1 (0.06)				
Southeast European-Central Asian	1 (0.03)					1 (0.4)	
Southeast European-West Central Asian	2 (0.06)	2 (0.09)					
Central and South European-West Central Asian	1 (0.03)	1 (0.04)	1 (0.06)	1 (0.06)			
Central and South European-Iran-Turanian	3 (0.09)	3 (0.1)	2 (0.1)	2 (0.1)			

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
Central (Middle) and South European-Iranian	5 (0.1)	2 (0.09)	2 (0.1)	2 (0.1)	1 (0.1)	1 (0.4)	
Central and Southeast European-Iranian	1 (0.03)	1 (0.04)					
Central (Middle) and South European-Turanian	2 (0.06)	2 (0.09)	2 (0.1)				
Central and South European-Lebanonian	1 (0.03)	1 (0.04)					
Central and Southeast European-Lebanonian	1 (0.03)	1 (0.04)	1 (0.06)	1 (0.06)			
Central and South European-North African	11 (0.3)	6 (0.3)	2 (0.1)	2 (0.1)	3 (0.4)	1 (0.4)	
South European-North African	32 (1.0)	25 (1.1)	7 (0.4)	5 (0.3)	3 (0.4)	1 (0.4)	1 (2.3)
Southeast European-Anatolian-North African	1 (0.03)						
Southeast European-North African	2 (0.06)			1 (0.06)	1 (0.1)		
Southeast European-Anatolian-Iranian	1 (0.03)		1 (0.06)	1 (0.06)			
Southeast European-Iranian	2 (0.06)	1 (0.04)					
South European-Turanian	2 (0.06)	1 (0.04)					
Southeast European-Turanian	1 (0.03)	1 (0.04)					
Holomediterranean	32 (1.0)	25 (1.1)	12 (0.7)	7 (0.5)	4 (0.5)	1 (0.4)	
East Mediterranean	11 (0.3)	6 (0.3)					
North Mediterranean	23 (0.7)	16 (0.7)	11 (0.7)	4 (0.3)	1 (0.1)		
South European	53 (1.6)	35 (1.5)	9 (0.5)	13 (0.8)	7	1 (0.4)	
Northeast Mediterranean	3 (0.09)	3 (0.1)	1 (0.06)				
Southeast European-Anatolian	13 (0.4)	10 (0.4)	5 (0.3)	4 (0.3)			
Southeast European	29 (0.9)	24 (1.0)	6 (0.4)	6 (0.4)	1 (0.1)	1 (0.4)	
Balkan-Caucasian-Iranian	1 (0.03)	1 (0.04)					
Balkan-Caucasian	3 (0.09)	2 (0.09)			1 (0.1)	1 (0.4)	
Balkan-Anatolian	8 (0.2)	7 (0.3)	1 (0.06)	2 (0.1)	2 (0.2)		
<b>ENDEMIC</b>	<b>68 (2.0)</b>	<b>43 (1.9)</b>	<b>12 (0.7)</b>	<b>13 (0.8)</b>	<b>11 (1.4)</b>	<b>5 (1.9)</b>	
Balkan subendemic	2 (0.06)	2 (0.09)					
Balkan endemic	17 (0.5)	13 (0.6)	4 (0.2)	2 (0.1)	1 (0.1)		
Bulgarian endemic	41 (1.2)	25 (1.1)	7 (0.4)	10 (0.7)	9 (1.1)	3 (1.1)	
Regional endemic	8 (0.2)	3 (0.1)	1 (0.06)	1 (0.06)	1 (0.1)	2 (0.7)	
<b>Total</b>	<b>3368</b>	<b>2275 (67.5)</b>	<b>1666 (49.5)</b>	<b>1516 (45.0)</b>	<b>809 (24.0)</b>	<b>264 (7.8)</b>	<b>43 (1.3)</b>

%) – from 1 to 56 species (2.1 % to 3.7 %) taxa are the most numerous. The West and Central Eurosi-berian, West Eurosiberian, Central and South Euro-pean, Transeurosiberian, and Central and Southeast European species are well represented. The ratio of these categories differs across the families (the Hol-oeurosiberian, Disjunct Eurosiberian and European species are almost equal in number as the Eurosi-

berian forms are 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 0.04 % to 24.2 % (1–358 species) and increases in percentage with height to 2000 m a. s. l. For the different areo-graphical categories, this difference is the largest in the European species (13.5 %). The greatest number

of Eurosiberian species (as a percentage) are found in the coniferous forests (349 species – 43.1 %). In the beech forests belt (631 species – 41.6 %) and the subalpine belt (111 species – 42.0 %), these species predominate over the other zoogeographical categories. In the alpine belt, the taxa with Super Palaearctic areas dominate (17 species – 39.5 %). The Euro-siberian species are poorly represented (14 species – 32.5 %) and include eight areogeographical categories. When compared to the mountains, from which the data on the Diptera are generalised, there is a small difference (HUBENOV 2019b). In the subalpine belt of the Vitosha Mt. (57.3 %) and the Rila Mts. (40.4 %), the Eurosiberian species predominate over the other zoogeographical categories, while they are poorly represented in the Pirin Mts. (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). The significant presence of Eurosiberian species in the first two vegetation belts (29.0 % and 35.8 %) is of great interest. This could be explained in three ways: 1) possibly, some of these species 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 such as Cerambycidae (Coleoptera), Tachinidae (Diptera) and Heteroptera (JOSIFOV 1963, 1976, GEORGIEV & HUBENOV 2006, HUBENOV 2008b). For Cerambycidae, this fact is due to the large afforestation of conifers in the first two vegetation belts. Probably, due to this, many boreomontane and montane species that feed on conifers go down below 1000 m a. s. l. It could be expected that, with further studies of the Diptera in the high parts of the mountains, the number of the Eurosiberian species will increase.

**The Mediterranean species** include 45 areogeographical categories (340 species or 10.2 %). These are from 2 to 241 (3.2 % to 10.6 %) species per a vegetation belt (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 28.5 % 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 areogeographical categories, the difference between the vegetation belts is the largest in the Mediterranean-Central Asian species (2.2 %). The South European (53 species – 1.6 %), South European-North African, Holomediterranean (32 species each – 1.0 %) and the Southeast European (29 species – 0.9 %) taxa are the most numerous. In the subalpine belt, nine species have been found, part of which could be Montane Mediterranean forms. There are no significant differences in the distribution of the well-presented areogeographical categories in the Mediterranean species of the mountains. When comparing Vitosha Mt. with the Rila and Pirin Mts., it makes an impression the higher percentage (3.6 % – 4.4 % – 5.5 %) of the Mediterranean taxa southwards (HUBENOV 2019b). 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 Brachycera is low (68 species or 2.0 %). The Bulgarian (41 species – 60.3 %) and Balkan (17 species – 25.0 %) endemic forms prevail. Endemics have not been established in the alpine vegetation belt. The main part of the endemic species is related to the xerothermic oak forests (43 species – 63.2 %). In the next two vegetation belts, their number significantly decreases (12–13 species or 17.6–19.1 %). Some of the endemics in the coniferous forests (11 species) and the subalpine belt (5 species) probably are Eurosiberian forms and can be considered as postglacial neoendemics. The endemics established in the first vegetation belt do not belong to this category (HUBENOV 2019b). Local endemics have not been established among the Brachycera. The endemic Diptera are often newly described taxa or rare species with unclear geographical range.

## Conclusion

Totally, 3368 species of suborder Brachycera, belonging to 84 families, have been recorded from Bulgaria. The families Tachinidae (425 species), Syrphidae (303 species), Muscidae (267 species), Phoridae (231 species) and Dolichopodidae (214 species) are the most numerous. Of the recorded species, 21 are pests on the forestry or agriculture and 49 species are significant for human or veterinary medicine. 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 (2275 species or 67.5 %). Brachycera can be divided into two supergroups: 1) species with Mediterranean type of distribution (384 species or 11.4 %) – 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 (2916 species or 86.6 %) – 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 fauna of Brachycera is determined by the second group. A total of 68 (2.0 %) endemics have been found. The distribution of the zoogeographical categories in the vegetation belts of Bulgaria is scrutinised. The South 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** (2275 species or 67.5 %). Of the species with Mediterranean type of distribution (277 species or 12.2 %), the South European, South European-North African, Holomediterranean and Southeast European taxa are the most numerous. Of the species with Palaearctic and Eurosiberian type of distribution (1955 species or 85.9 %), the European, Holarctic, Transpalaearctic, Palaearctic-Oriental and West Palaearctic taxa are better represented. This belt includes the greatest number of areographical categories – 128. The main part of the endemic forms has been established in this belt – 43 species (1.9 %). The Balkan and Bulgarian endemics prevail. Most Mediterranean species (241 species or 10.6 %) are represented.

**Xeromesophyllic and mesophyllic mixed (oak-hornbeam) forests** (1666 species or 49.5 %). Of the species with Mediterranean type of distribution (113 species or 6.8 %), the Holomediterranean

and North Mediterranean taxa are the most numerous and of the species with Palaearctic and Eurosiberian type of distribution (1541 species or 92.5 %) – the European, Holarctic, Transpalaearctic and Palaearctic-Oriental taxa. The percentage of the Mediterranean species (97 species or 5.8 %) and endemics (12 species or 0.7 %) decreases. The Bulgarian endemics prevail.

**Beech forests** (1516 species or 45.0 %). Of the species with Mediterranean type of distribution (71 species or 4.7 %), the South European, Holomediterranean and Southeast European taxa are the most numerous. Of the species with Palaearctic and Eurosiberian type of distribution (1432 species or 94.4 %), the European, Holarctic, Transpalaearctic, Palaearctic-Oriental, Holoeurosiberian, West Palaearctic and Disjunct Eurosiberian taxa are best represented. The number of the areographical categories decreases significantly. The percentage of the endemics slightly increases (13 species or 0.8 %). The Bulgarian endemics prevail.

**Coniferous forests** (809 species or 24.0 %). Of the species with Mediterranean type of distribution (28 species or 3.5 %) two Super-Palaearctic forms (South Palaearctic-Oriental) are represented. The Holomediterranean, Central and South European-North African and South European-North African taxa are the most numerous. Of the species with Palaearctic and Eurosiberian type of distribution (306 species or 97.5 %) the European, Holarctic and Transpalaearctic taxa prevail. The number of the areographical categories and the percentage of the Mediterranean forms decrease significantly. The Bulgarian endemics prevail.

**Subalpine vegetation** (264 species or 7.8 %). Of the species with Mediterranean type of distribution (9 species or 3.4 %), the Super-Palaearctic forms are not presented. All areographical categories are presented with one species each. Of the species with Palaearctic and Eurosiberian type of distribution (250 species or 94.7 %), the European and the Holarctic taxa prevail. The percentage of the Mediterranean forms is considerably decreased. The areographical categories are decreased. Three Bulgarian and two regional endemics are established. Thirty families are represented. It is of interest that *Cremifania bulgarica* Papp, 2010 (family Cremifaniidae, recorded from the Rila Mts. at 2250 m a. s. l.) is found and described; this is the third Palaearctic species of the family.

**Alpine vegetation** (43 species or 1.3 %). This zone is best presented in the Rila and Pirin Mts. Two species with Mediterranean type of distribution and 41 species with Palaearctic and Eurosiberian type of

distribution (22 areographical categories, of which 14 are represented by one species each) have been recorded. The Holarctic, European and cosmopolitan forms are represented by more species. Endemic species have not been found. Seventeen families have been observed. There is almost no studies on the two-winged insects in this zone of the Rila and Pirin Mts.

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

### Species with a human or veterinary medical significance:

**Tabanidae** [*Chrysops caecutiens* (Linnaeus, 1758); *Ch. italicus* Meigen, 1804; *Ch. relictus* Meigen, 1820; *Atylotus flavoguttatus* (Szilady, 1915); *Hybomitra ciureai* (Séguy, 1937); *Tabanus autumnalis* Linnaeus, 1761; *T. bovinus* Linnaeus, 1758; *T. bromius* Linnaeus, 1758; *Haematopota pluvialis* (Linnaeus, 1758)]; **Piophilidae** [*Piophila casei* (Linnaeus, 1758); *Stearibia nigriceps* (Meigen, 1826)]; **Braulidae** [*Braula coeca* Nitzsch, 1818]; **Hippoboscidae** [*Hippobosca equina* Linnaeus, 1758; *Lipoptena cervi* (Linnaeus, 1758); *Melophagus ovinus* (Linnaeus, 1758)]; **Anthomyiidae** [*Anthomyia pluvialis* (Linnaeus, 1758)]; **Fanniidae** [*Fannia canicularis* (Linnaeus, 1761); *F. incisurata* (Zetterstedt, 1838); *F. scalaris* (Fabricius, 1794)]; **Muscidae** [*Muscina levida* (Harris, 1780); *M. stabulans* (Fallén, 1817); *Hydrotaea armipes* (Fallén, 1825); *H. dentipes* (Fabricius, 1805); *Musca autumnalis* De Geer, 1776; *M. domestica* Linnaeus, 1758; *M. larvipara* Porchinskiy, 1910; *M. vitripennis* Meigen, 1826; *Pyrellia vivida* Robineau-Desvoidy, 1830; *Stomoxys calcitrans* (Linnaeus, 1758); *Haematobosca stimulans* (Meigen, 1824)]; **Calliphoridae** [*Calliphora vicina* Robineau-Desvoidy, 1830; *C. vomitoria* (Linnaeus, 1758); *Lucilia caesar* (Linnaeus, 1758); *L. sericata* (Meigen, 1826)]; **Sarcophagidae** [*Wohlfahrtia magnifica* (Schiner, 1862); *W. vigil* (Walker, 1849); *Ravinia pernix* (Harris, 1780); *Sarcophaga melanura* Meigen, 1826; *S. africa* (Wiedemann, 1824)]; **Oestridae** [*Oestrus ovis* Linnaeus, 1758; *Rhinoestrus purpureus* (Brauer, 1859)]; **Hypodermatidae** [*Hypoderma actaeon* Brauer, 1858; *H. bovis* (Linnaeus, 1758); *H. diana* Brauer, 1858; *H. lineatum* (Villers, 1789)]; **Gastrophilidae** [*Gasterophilus haemorrhoidalis* (Linnaeus, 1758); *G. inermis* (Brauer, 1858); *G. intestinalis* (De Geer, 1776); *G. pecorum* (Fabricius, 1794)].

### Pests on the forestry or agriculture:

**Psilidae** [*Chamaepsila rosae* (Fabricius, 1794)]; **Lonchaeidae** [*Silba virescens* Macquart, 1851]; **Tephritidae** [*Acanthiophilus helianthi* (Rossi, 1794); *Aciura coryli* (Rossi, 1794); *Carpomya schineri* (Loew, 1856); *Rhagoletis cerasi* (Linnaeus, 1758)]; **Agromyzidae** [*Liriomyza huidobrensis* (Blanchard, 1926)]; **Opomyzidae** [*Opomyza florum* (Fabricius, 1794)]; **Chloropidae** [*Oscinella frit* (Linnaeus, 1758); *Chlorops pumilionis* (Bjerkander, 1778); *Lasiosina herpini* (Guérin-Méneville, 1843); *Meromyza saltatrix* (Linnaeus, 1761)]; **Heleomyzidae** [*Suillia lurida* (Meigen, 1830)]; **Drosophilidae** [*Drosophila sukuzii* (Matsumura, 1931)]; **Ephydriidae** [*Hydrellia griseola* (Fallén, 1813)]; **Anthomyiidae** [*Delia antiqua* (Meigen, 1826); *D. floralis* (Fallén, 1824); *D. radicum* (Linnaeus, 1758); *Pegomya hyoscyami* (Panzer, 1809); *Phorbia fumigata* (Meigen, 1826); *Phorbia haberlandti* (Schiner, 1865)].