Invited Review

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Checklist of Haemosporidian and Piroplasmid Parasites (Apicomplexa: Haemospororida and Pirolasmorida) of Man and Animals in Bulgaria

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Abstract: Investigations on protozoan parasites of man and vertebrate animals from Bulgaria started in the beginning of 20th Century. Data for a total of 65 haemoparasite species from man and vertebrate animals (mainly birds and mammals) from Bulgaria have been published. These are 60 taxa identified to the species level and five taxa identified to the generic level. The majority belongs to the order Haemospororida (50 species), followed by the order Piroplasmorida (15 species). Two species of the genus *Anaplasma* are included as *incertae sedis*. Data for the hosts of the recorded protozoan haemoparasites in Bulgaria and their distribution in the country are presented.

Keywords: Apicomplexa**,** Haemospororida, Piroplasmorida, Checklist, Bulgaria

Introduction

Protozoan apicomplexan haemoparasites of man and vertebrate animals are a large group of unicellular organisms. Their life cycle includes two obligatory hosts: an invertebrate definitive host (or vector) and intermediate hosts. According to the accepted zoological classification, the protozoan haemoparasites belong to a distinct superior taxon, the class Aconoidasida of the phylum Apicomplexa Levine, 1970 (= Sporozoa) (see Perkins *et al.* 2000, Addle *et al.* 2012). The principle characteristic of all the members of the Apicomplexa is the presence of an apical complex of organelles at the anterior end that facilitates the penetration into the host cells during certain stages of the life cycle. The apical complex is better developed in some protozoan parasites of the class Conoidasida such as gregarines and coccidians, as compared to the haemoparasitic species of the class Aconoidasida. All species belonging to the phylum Apicomplexa are parasitic and many of them are agents of severe diseases of man and animals such as human malaria, coccidiosis, toxoplasmosis, sarcocystosis, piroplasmosis and others.

The protozoan haemoparasites of man and animals of the class Aconoidasida include two speciose orders, Haemospororida Danilewsky, 1885 and Piroplasmorida Wenyon, 1926 (Mehlhorn *et al.* 1980). Due to historical reasons, studies on them have started in Bulgaria relatively late, since the beginning of 20th Century.

The first studies on haemosporidian parasites from Bulgaria were on the agents of the human malaria. The presence and distribution of human malaria in Europe (including in Bulgaria) had been known for centuries. However, the first Bulgarian publications on therapy and vectors of this disease in the country were published by Stambolski (1874), Mihailov (1888), Pranchov (1904), Manoloff (1907), Mollow (1907a, 1907b, 1908, 1909, 1910), Markov (1929), Slivenski (1928, 1935) and others [cited after Slivenski (1928, 1935), Tashev *et al.* (1961), Stanchev, Todorov (1967), Petrov (1990, 1997), Kurdova *et al.* (2001)]. Summarising these data, four species of human haemosporidians were observed in Bulgaria. Two of them, *Plasmodium*

vivax and *P. falciparum*, were more frequent and widely distributed in the country, while *P. malariae* was relatively rare; only few cases of *P. ovale* were reported, probably occasionally introduced in the country by individuals coming to Bulgaria from tropical countries. In addition, the piroplasmid parasite *Babesia* sp. has also been recorded as a single case, most probably imported (Kurdova 2003).

Most of the papers on the Haemospororida from Bulgaria concern the clinic, pathology, prevention and therapy of the human malaria and they are not cited in the present article. In the proposed checklist, I include only publications containing data on the first report of taxonomic identifications and observations on taxa, as well as some general monographs, books and taxonomic publications on the human haemosporidians. Since 1965, the human malaria was eradicated in Bulgaria and afterwards only some rare cases of imported malaria were reported (Petrov 1990, Kurdova *et al.* 2001).

Because of their pathogenic importance, haemoparasitic protozoans of domestic and wild animals in Bulgaria, particularly the Piroplasmorida, were studied by many biologists and veterinarians. Early reports on the piroplasmorids of domestic animals (cattle, horses, sheep) were published by Ginchev (1899), Bachvarov (1901), Tachev (1903), Angelov (1905), Bichev (1907, 1908), Boikinov (1911), Markoff (1914, 1916, 1919, 1921) and Dobrev (1928); they showed the importance of the diseases caused by them in the country. Later, more extensive investigations on the Piroplasmorida of domestic and wild animals were published by Markovich (1937), Tomov (1938), Janev (1938a, 1938b, 1960), Pavlov (1944, 1948, 1949), Cherepova (1958), Angelov, Cherepova (1963), Denev (1960), Mincheva, Georgiev (1961), Ivanov *et al.* (1963, 1964), Donev (1964), Kyurtov (1968, 1969), Halacheva (1970a, 1970b). Compendious works on Pirolasmorida of domestic animals and their vectors in Bulgaria were published by Pavlov (1948), Matov (1956), Mincheva *et al.* (1965) and Kamburov *et al.* (1994).

Studies on the Haemospororida of wild birds from Bulgaria successfully started over the last two decades and showed rich biodiversity of this parasitic protozoans. As a result of the studies by Drenovski (1936), Golemansky *et al.* (1998), Valkiunas *et al.* (1999, 2007, 2008, 2014), Shurulinkov, Golemansky (2002, 2003), Shurulinkov (2004, 2005), Shurulinkov, Chakarov (2007), Zehtindjiev *et al.* (2008, 2009a, 2009b), Shurulinkov, Ilieva (2009), Dimitrov *et al.* (2010, 2013, 2014) and Bobeva *et al.* (2013, 2014, 2015), more than 45 protozoan haemoparasites were identified in the country. The recent molecular studies, particularly on the Haemospororida of wild birds, revealed substantial genetic diversity of the genera *Haemoproteus*, *Leucocytozoon* and *Plasmodium* and some genetic lineages were linked to a newly-described species. I believe that similar studies on the Haemospororida and Piroplasmorida in Bulgaria will be useful for improving the knowledge on the protozoan fauna not only in the country, but also as a large-scale contribution.

Since the start of the investigations on Haemospororida and Piroplasmorida in Bulgaria, more than 200 scientific publications were released. Many of them are in Bulgarian language and inaccessible for many Bulgarian and foreign researchers. Taxonomic assessment of the identification of the reported genera and species was not possible because of the lack of precise descriptions and documentation (photos, deposited voucher slides, etc.). Species names in the present checklist are as given by authors. Data included are those published by the end of 2014.

The aim of the proposed checklist is to summarise the published information on the diversity and the distribution of the taxa (families, genera and species) of Haemospororida and Piroplasmorida reported in Bulgaria. I hope that the present checklist will facilitate the future studies on these important and relatively poorly studied haemoparasitic protozoans. It might also be useful as a basis for future investigations, taxonomic corrections and additional records for the parasite fauna of Bulgaria.

The site of infection of all the species reported in this review is blood.

Checklist

Phylum Apicomplexa Levine, 1970

Class Aconoidasida Mehlhorn, Peters and Haberkorn, 1980

Order Haemosporida Danilewsky, 1885

Family Haemoproteidae Doflein, 1916

1. *Haemoproteus* Kruse, 1890

***Haemoproteus anthi* Mello, 1935**

Hosts: Aves: Passeriformes*: Anthus trivialis*.

Distribution: Tutrakan (Nova Cherna).

Records: Shurulinkov, Golemansky (2002).

***Haemoproteus attenuatus* Valkiunas, 1989**

Hosts: Aves: Passeriformes: *Luscinia luscinia*, *Erithacus rubecula.*

Distribution: Tutrakan (Nova Cherna), Sofia (Chelopechene).

Records: Shurulinkov, Golemansky (2002), Dimitrov *et al.* (2010).

***Haemoproteus belopolskyi* Valkiunas, 1989**

Hosts: Aves: Passeriformes: *Acrocephalus arundinaceus*, *A. palustris*, *A. schoenobaenus*, *A. scirpaceus*, *Sylvia nisonia*, *S. borin*, *S. atricapilla*, *S. curruca*, *Hippolais icterina*, *Phylloscopus trochilus*, *Phylloscopus sibilatrix*.

Distribution: Tutrakan (Nova Cherna), Sofia (Vrana, Chelopechene, Petarch), Sandanski (Rupite), Dragoman.

Records: Valkiunas *et al.* (1999), Shurulinkov, Golemansky (2002), Shurulinkov, Chakarov (2007), Shurulinkov, Ilieva (2009).

***Haemoproteus balmorali* Pierce, 1984**

Hosts: Aves: Passeriformes*: Muscicapa striata*, *Luscinia luscinia*, *Saxicola rubetra*, *Erithacus rubecula*, *Phoenicurus phoenicurus*.

Distribution: Tutrakan (Nova Cherna), Sofia (Chelopechene).

Records: Shurulinkov, Golemansky (2002).

***Haemoproteus caprimulgi* Williams, Bennet and Mahrt, 1975**

Hosts: Aves: Caprimulgidae*: Caprimulgus europaeus.*

Distribution: Tutrakan (Nova Cherna).

Records: Shurulinkov, Golemansky (2002).

***Haemoproteus concavocentralis* Dimitrov, Zehtindjiev, Bensch, Ilieva, Iezhova and Valkiunas, 2014**

Hosts: Aves: Fringillidae: *Coccothraustes coccothraustes.*

Distribution: Tutrakan (Nova Cherna).

Records: Dimitrov *et al.* (2014).

***Haemoproteus coraciae* Mello and Alonso, 1935**

Hosts: Aves: Corraciidae: *Corracias garrulus*.

Distribution: Tutrakan (Nova Cherna).

Records: Shurulinkov, Golemansky (2002).

***Haemoproteus dolniki* Valkiunas and Iezhova, 1992**

Hosts: Aves: Passeriformes*: Fringilla coelebs.*

Distribution: Sofia (Vrana).

Records: Shurulinkov, Golemansky (2002).

***Haemoproteus danilewskii* Kruse, 1890**

Hosts: Aves: Passeriformes: *Passer domesticus*, *Carduelis carduelis*, *Spinus spinus*, *Chloris chloris*, *Parus major*, *Cyanistes caeruleus*, *Alauda arvensis*, *Pica pica*, *Emberiza hortulana*, Falconiformes: *Falco tinnunculus.*

Distribution: Burgas.

Records: Drenovski (1936).

Remarks: This species is currently recognised mostly as a parasite of corvid birds. According to Valkiunas (2005), "the name *H. danilewskii* (*=H. danilewskyi*) was used by many authors for haemoproteids recorded in various birds, without comparing the morphology of the parasites. It is certain that many species of the haemoproteids were mentioned in the literature under the name *H. danilewskii*". Therefore, most of the host records published by Drenovski (1936) need additional confirmation. In view of the current knowledge on the host specificity of haemosporidians (Valkiunas 2005), the record in falconiform birds has to be regarded as erroneous.

***Haemoproteu5s fringillae* Labbe, 1894**

Hosts: Aves: Passeriformes: *Fringilla coelebs*, *Coccothraustes coccotraustes.*

Distribution: Tutrakan (Nova Cherna), Sofia (Vrana).

Records: Shurulinkov, Golemansky (2002).

***Haemoproteus herodiadis* Mello, 1935**

Hosts: Aves: Ciconiformes: *Ixobrichus minutus*.

Distribution: Tutrakan (Nova Cherna).

Records: Shurulinkov, Golemansky (2002).

***Haemoproteus hirundinis* Sergent and Sergent, 1905**

Hosts: Aves: Passeriformis: *Delichon urbica.*

Distribution: Sofia (Vrana), Tutrakan (Nova Cherna).

Records: Shurulinkov, Golemansky (2002), Valkiunas *et al.* (2014).

***Haemoproteus homovelans* Dimitrov, Zehtindjiev, Bensch, Ilieva, Iezhova and Valkiunas, 2014**

Hosts: Aves: Piciformes: *Picus canus.*

Distribution: Brodilovo (Strandja Mountain).

Records: Dimitrov *et al.* (2014).

***Haemoproteus lanii* Mello, 1936**

Hosts: Aves: Passeriformes*: Lanius collurio*.

Distribution: Tutrakan (Nova Cherna), Russe (Nissovo), Burgas (Atanasovsko Lake), Sofia (Chelopechene).

Records: Shurulinkov, Golemansky (2002), Dimitrov *et al.* (2010).

***Haemoproteus majoris* Laveran, 1902**

Hosts: Aves: Passeriformes*: Sylvia atricapilla*.

Distribution: Bulgaria (locality not mentioned).

Records: Dimitrov *et al.* (2010).

***Haemoproteus minutus* Valkiunas and Iezhova, 1992**

Hosts: Aves: Passeriformes: *Turdus merula*.

Distribution: Tutrakan (Nova Cherna).

Records: Shurulinkov, Golemansky (2002).

***Haemoproteus motacillae* Bennet and Pierce, 1990**

Hosts: Aves: Passeriformes; *Motacilla flava*, *Anthus trivialis*.

Distribution: Tutrakan (Nova Cherna).

Records: Shurulinkov, Golemansky (2002), Dimitrov *et al.* (2013).

***Haemoproteus noctuae* Celli and Sanfelice, 1891**

Hosts: Aves: Strigiformes: *Asio otus*.

Distribution: Tutrakan (Nova Cherna).

Records: Shurulinkov, Golemansky (2002).

***Haemoproteus nucleocondensus* Krizanauskiene, Iezhova, Palinauskas, Valkiunas, 2012**

Hosts: Aves: Passeriformes: *Acrocephalus arundinaceus*.

Distribution: Tutrakan (Nova Cherna).

Records: Asghar *et al.* (2015).

Remarks: This species was firstly identified as *Haemoproteus payevskyi* Valkiunas, Iezhova and Chernetzov, 1994 (Bensch *et al.* 2007), later described as a new species (Krizanauskiene *et al.* 2012).

***Haemoproteus orioli* Mello, 1936**

Hosts: Aves: Passeriformes: *Oriolus oriolus.*
Distribution: Tutrakan (Nova Cherna).
Records: Shurulinkov, Golemansky (2002).

***Haemoproteus pallidus* Valkiunas and Iezhova, 1991**

Hosts: Aves: Passeriformes*: Muscicapa striata.*
Distribution: Tutrakan (Nova Cherna).
Records: Shurulinkov, Golemansky (2002).

***Haemoproteus parabelopolskyi* Valkiunas, Krizanauskiene, Iezhova, Hellgren and Bensch, 2007**

Hosts: Aves: Passeriformes: *Sylvia nisoria.*
Distribution: Tutrakan (Nova Cherna).
Records: Valkiunas *et al.* (2014).

***Haemoproteus passeris* Kruse, 1890**

Hosts: Aves: Passeriformes*: Passer hispaniolensis.*
Distribution: Tutrakan (Nova Cherna).
Records: Shurulinkov, Golemansky (2002).

***Haemoproteus pastoris* Mello, 1935**

Hosts: Aves: Passeriformes: *Sturnus vulgaris.*
Distribution: Tutrakan (Nova Cherna).
Records: Valkiunas *et al.* (2014).

***Haemoproteus payevskyi* Valkiunas, Iezhova and Chernetsov, 1994**

Hosts: Aves: Passeriformes: *Acrocephalus arundinaceus*, *A. palustris*, *A. scirpaceus*.
Distribution: Tutrakan (Nova Cherna), Sofia (Chelopechene, Petarch), Dragoman.
Records: Valkiunas *et al.* (1999), Shurulinkov, Golemansky (2002), Shurulinkov, Chakarov (2007), Shurulinkov, Ilieva (2009).

***Haemoproteus picae* Coatney and Roudabush, 1937**

Hosts: Aves: Passeriformes: *Garrulus glandarius.*
Distribution: Sandanski (Rupite).
Records: Shurulinkov, Golemansky (2002).

***Haemoproteus syrnii* (Mayer, 1910)**

Hosts: Aves: Strigiformes: *Otus scops.*
Distribution: Tutrakan (Nova Cherna).
Records: Valkiunas *et al.* (2014).

***Haemoproteus velans* Coatney and Rodabush, 1937**

Hosts: Aves: Piciformes*: Dendrocopus syriacus.*
Distribution: Sandanski (Rupite).
Records: Shurulinkov, Golemansky (2002).

***Haemoproteus wenyoni* Mello, Sa, Sousa, Dias and Naronha, 1916**

Hosts: Aves: Passeriformes: *Sylvia atricapilla.*
Distribution: Sandanski (Rupite).
Aurthors: Shurulinkov, Golemansky (2002).

***Haemoproteus* sp.**

Hosts: Aves: Passeriformes: *Acrocephalus agricola.*
Distribution: Black Sea Coast (Durankulashko Lake).
Records: Zehtindjiev *et al.* (2009a, 2009b).

Family Plasmodiidae Mesnil, 1903

***2. Plasmodium* Marchiafava and Celli, 1885**

***Plasmodium ashfordi* Valkiunas, Zehtindjiev, Hellgren, Illieva, Iezhova and Bensch, 2007**

Hosts: Aves: Passeriformes*: Acrocephalus arundinaceus.*
Distribution: Tutrakan (Nova Cherna).
Records: Valkiunas *et al.* (2007).

***Plasmodium circumflexum* (Kikuth, 1931)**

Hosts: Aves: Passeriformes: *Turdus philomelos*, *Ficedula parva*.
Distribution: Bulgaria (the exact locality not mentioned).
Records: Dimitrov *et al.* (2010).

***Plasmodium elongatum* Huff, 1930**

Hosts: Aves: Passeriformes*: Acrocephalus arundinaceus.*
Distribution: Tutrakan (Nova Cherna).
Records: Valkiunas *et al.* (2008).

***Plasmodium falciparum* (Grassi et Feletti, 1892) Welch, 1897**

Host: Man **–** *Homo sapiens.*
Distribution: throughout the country.
Records: Mollov (1907a, b), Slivenski (1928, 1935), Tashev *et al.* (1961), Petrov (1990), Kurdova *et al.* (2001).

***Plasmodium malariae* (Laveran, 1881) Grassi and Feletti, 1890**

Hosts: Man – *Homo sapiens.*
Distribution: all country.
Records: Slivenski (1928, 1935), Tashev *et al.* (1961), Petrov (1990), Kurdova *et al.* (2001).
Remarks: Slivenski (1935) noted that *Malaria quartana* caused by *P. malariae* was relatively rare in Bulgaria, with prevalence 1-4%, mainly in late autumn and winter. This opinion was confirmed by Tashev *et al.* (1961), Petrov (1990), Kurdova *et al.* (2001).

***Plasmodium matutinum* Huff, 1937**

Hosts: Aves: Passeriformes: *Motacilla flava.*
Distribution: Tutrakan (Nova Cherna).
Records: Valkiunas *et al.* (1999).

***Plasmodium ovale* J. Stephens, 1922**

Hosts: *Homo sapiens.*
Distribution: rare in the country.
Records: Tashev *et al.* (1961) reported that *P. ovale* was found in Bulgaria by Ganov (1941). Later, it was recorded many times between 1966 and 2001 (89 cases) by Petrov (1990, 1997) and Kurdova *et al.* (2001) from Bulgarians and foreigners coming in the country from Africa or southern Asia.

***Plasmodium polare* Mannwell, 1934**

Hosts: Aves: Passeriformes: *Hirundo rustica.*
Distribution: Tutrakan (Nova Cherna).
Records: Shurulinkov, Golemansky (2003).

***Plasmodium relictum* Grassi and Feletti, 1891**

Synonym: *Plasmodium capistrani* Russel, 1932
Hosts: Aves: Passeriformes: *Acrocephalus arundinaceus*, *Lanius colurio*, *Passer montanus*, *Parus major*, *Panurus biarmicus.*
Distribution: Tutrakan (Nova Cherna), Black Sea Coast (Durankulashko Lake).
Records: Shurulinkov, Golemansky (2003), Zehtindjiev, Dimitrov (2009), Valkiunas *et al.* (2007).
Remarks: (1) Drenovski (1936) reported *Plasmodium capistrani* Russel, 1932 from *Serinus serinus* (Passeriformes) from Plovdiv. According to Manwell (1935), this species is a synonym of *Plasmodium relictum*. (2) Drenovski (1936) reported *Plasmodium praecox* Rafaele, 1936 from passeriform hosts (*Passer domesticus*, *Carduelis carduelis*, *C. spinus*, *C. chloris*, *Sturnus vulgaris*, *Sylvia hortensis*) from the regions of Burgas and Plovdiv. According to Garnham (1966), this species is not valid. Most probably, the records published by Drenovski (1936) are related to *Plasmodium relictum*.

***Plasmodium rouxi* Sergent, Sergent and Catanei, 1928**

Hosts: Aves: Passeriformes*: Passer domesticus.*
Records: Drenovski (1936).

***Plasmodium vaughani* Navy and MacNeal, 1904**

Hosts: Aves: Passeriformes: *Turdus merula*, *Sylvia attricapilla*, *Acrocephalus schoenobaenus.*

Distribution: Tutrakan (Nova Cherna), Sandanski (Rupite), Varna.

Records: Shurulinkov, Golemansky (2003).

***Plasmodium vivax* (Grassi and Feletti, 1890)**

Hosts: *Homo sapiens.*

Distribution: all country.

Records: Mollov (1907a, b, 1909), Slivenski (1928, 1935), Tashev *et al.* (1961), Petrov (1990).

Remarks: According to Slivenski (1935), *Malaria tertiana* was known from Bulgaria before the 18th century. During the Russian-Turkish War (1877-1878), more than 320,000 Russian soldiers were infected by malaria along the Danube Riverside in Northern Bulgaria.

***Plasmodium* (*Haemamoeba*) sp. 1**

Hosts: Aves: Passeriformes*: Motacilla flava*, *Acrocephalus arundinaceus*, *A. scirpaceus*, *A. schoenobaenus*, *Passer domesticus.*

Distribution: Tutrakan (Nova Cherna), Dragoman, Sofia (Petarch).

Records: Valkiunas *et al.* (1999), Shurulinkov, Ilieva (2009).

***Plasmodium* (*Novyella*) sp. 2**

Hosts: Aves: Passeriformes: *Acrocephalus schoenobaenus*, *A. arundinaceus*, *A. scirpaceus.*

Distribution: Tutrakan (Nova Cherna), Dragoman, Sofia (Petarch).

Records: Shurulinkov, Chakarov (2007), Shurulinkov, Ilieva (2009).

Family Leucocytozoidae Fallis and Bennett, 1961

***3. Leucocytozoon* Sambon, 1908**

***Leucocytozoon bennetti* Valkiunas, 1993**

Hosts: Aves: Coraciiformes: *Coracias garrulus.*

Distribution: Tutrakan (Nova Cherna).

Records: Shurulinkov, Golemansky (2002).

***Leucocytozoon danilewskyi* Ziemann, 1898**

Hosts: Aves: Strigiformes: *Asio otus*.

Distribution: Tutrakan (Nova Cherna).

Records: Shurulinkov, Golemansky (2002).

***Leucocytozoon dubreuili* Mattis and Leger, 1911**

Hosts: Aves: Passeriformes: *Turdus merula*, *T. philomelos.*

Distribution: Sandanski (Rupite).

Records: Shurulinkov, Golemansky (2003).

***Leucocytozoon eurystomi* Kerandel, 1913**

Hosts: Aves: Coraciiformes: *Coracias garrulus*.

Distribution: Tutrakan (Nova Cherna).

Records: Shurulinkov, Golemansky (2002).

***Leucocytozoon fringillinarum* Woodcock, 1910**

Hosts: Aves: Passeriformes: *Acrocephalus schoenobaenus*, *Phylloscopus trochilus*, *Sylvia atricapilla*, *Anthus trivialis*, *Turdus merula.*

Distribution: Tutrakan (Nova Cherna), Sofia (Chelopechene).

Records: Valkiunas *et al.* (1999), Shurulinkov, Golemansky (2002).

***Leucocytozoon majoris* Laveran, 1902**

Hosts: Aves: Passeriformes*: Acrocephalus schoenobaenus*, *Turdus merula*, *Oriolus oriolus.*

Distribution: Tutrakan (Nova Cherna), Sofia (Chelopechene).

Records: Shurulinkov, Golemansky (2002).

Order Piroplasmorida Wenyon, 1926

Family Babesiidae Poche, 1913

1. *Babesia* Starcovici, 1893

Synonyms: *Piroplasma* Patton, 1895; *Babesiella* Mesnil, 1919

***Babesia biggemina* (Smith and Kilborne, 1893)**

Hosts: cattle.

Distribution: throughout the country.

Records: Bachvarov (1901), Tachev (1903), Janev (1938b), Pavlov (1949), Donev (1964), Mincheva *et al.* (1965).

***Babesia berbera* Sergent, Donatien, Parrot, Lestoquard, Plantureux and Rougebief, 1924**

Hosts: cattle.

Distribution: Sadovo, Lukovit, Pleven.

Records: Tomov (1938).

***Babesia bovis* (Babes, 1888)**

Synonym*: B. bovis divergens* McFadyen and Stockmann, 1911

Hosts: cattle.

Distribution: all country.

Records: Angelov (1905), Markoff (1916), Janev (1938b), Pavlov (1949), Donev (1964), Mincheva *et al.* (1965).

***Babesia caballi* (Nuttall, 1910)**

Hosts: horses.

Distribution: Varna, South Bulgaria.

Records: Bichev (1908), Markoff (1914), Mincheva *et al.* (1965).

***Babesia microti* Franca, 1910**

Hosts: Mammalia: Rodentia: *Apodemus sylvaticus*.

Distribution: Varna (Kranevo).

Records: Sebek *et al.* (1968).

***Babesia ovis* Starcovici, 1893**

Hosts: sheep.

Distribution: all country.

Records: Markovich (1937), Mincheva, Georgiev (1961), Mincheva *et al.* (1965), Halacheva (1970a, 1970b, 1971).

***Babesia trautmanni* Knith and Tu Toit, 1921**

Hosts: swine.

Distribution: No data.

Records: Pavlov, Pashev (1946).

***Babesia* (*Piroplasma*) sp. 1**

Hosts: cattle, sheep, horses.

Distribution: all country.

Records: Tachev (1903), Bichev (1907, 1908), Boikinov (1911).

***Babesia* (*Piroplasma*) sp. 2**

Hosts: *Homo sapiens.*

Distribution: unknown.

Records: Kurdova (2003).

Remarks: The species was observed only in one patient coming from an African country.

2. *Francaiella* Yakimoff, 1926

***Francaiella colchica* Yakimov, 1927**

Hosts: cattle.

Distribution: Veliko Tarnovo, North Bulgaria.

Records: Pavlov (1949), Denev (1960), Mincheva *et al.* (1965).

3. *Nuttallia* Franca, 1909

***Nuttallia equi* (Laveran, 1901)**

Hosts: horses.

Distribution: Plovdiv, Stara Zagora, Haskovo, Burgas.

Records: Markoff (1914, 1919), Janev (1960), Mincheva *et al.* (1965).

Family Theileriidae Poch, 1913

4. *Theileria* Bettencourt, Franca and Borges, 1907

***Theileria annulata* (Džunkovský et Luhe, 1904)**

Hosts: cattle.

Distribution: all country.

Records: Tomov (1938), Janev (1960), Angelov, Cherepova (1963), Mincheva, Georgiev (1961), Valchovski, Pavlov (1970).

***Theileria dispar* Sergent, Donatien, Parrot, Lestoquard, Plantureux and Rougebief, 1924**

Hosts: cattle.

Distribution: Sofia, Southern Bulgaria.

Records: Tomov (1938), Pavlov (1949).

***Theileria mutans (*Theiler, 1906)**

Hosts: cattle.

Distribution: all country.

Records: Janev (1938b), Angelov, Cherepova (1963), Mincheva *et al.* (1965).

***Theileria recondita* (Lestoquard, 1929)**

Hosts: sheep, goats.

Distribution: Veliko Tarnovo, Gabrovo.

Records: Mincheva *et al.* (1965), Kyurtov (1969).

INCERTAE SEDIS

1. *Anaplasma* Theiler, 1908

***Anaplasma ovis* Lestoquard, 1924**

Hosts: sheep.

Distribution: Bansko, Velingrad, Veliko Tarnovo.

Records: Tomov (1938), Ivanov *et al.* (1963, 1964), Kyurtov (1968, 1969), Mincheva *et al.* (1965).

***Anaplasma marginale* Theiler, 1908**

Hosts: cattle.

Distribution: Plovdiv, Stara Zagora, Pleven, Burgas, Veliko Tarnovo.

Records: Janev (1938b), Mincheva *et al.* (1965).

Conclusion

The review on the studies on Haemospororida and Piroplasmorida in Bulgaria show the presence of a total of 65 species of eight genera and five families. Small part of them, five taxa, was identified at the generic level only; very likely, these five taxa belong to known species but it cannot be excluded that some of them represent undescribed species. The major part of the recorded taxa from the country belong to the order Haemospororida (47 identified species of three genera) and only 13 identified species of three genera belong to the order Piroplasmorida.

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