

DISTRIBUTION OF SARCOCYSTIS (PROTOZOA: SPOROZOA) IN VERTEBRATES

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Abstract. A survey of *Sarcocystis* species parasitizing members of 3 orders of vertebrates is given.

Parasitic Protozoa of the genus *Sarcocystis* Lankaster, 1872 belong to the group Toxoplasmaea. The taxonomic position of this group in the class Sporozoa is not yet quite clear, since the systematic relationship between these protozoans and coccidians is not known (Zasukhin and Kalyakin 1973). The sarcocysts were first described by Miescher in 1843 and since that time they have been found many times in the representatives of higher vertebrates, including man, on the territory of all parts of the world. In many hosts, including farm animals and man, the sarcocysts may cause pathological state of different gravity including fatal outcome (Zasukhin 1972). The new data on the life cycle of *Toxoplasma gondii* (Zasukhin et al. 1971, 1973) and subsequent revisions of the systematic position of Toxoplasmaea have increased the interest in the biology of *Sarcocystis* in recent years. Several authors showed that the representatives of this genus have the same life cycle as *Toxoplasma*, including the stage of gametogony, which is concluded by formation of oocysts of the same structure as that of *Coccidia* of the genus *Isospora* (Rommel et al. 1972, Rommel and Heydorn 1972; Faeyr and Leek 1973; Vetterling et al. 1973; Wallace 1973; Vershinin 1973, 1974). In our opinion, the protozoologists and parasitologists should pay more attention to the genus *Sarcocystis* than they have done up till now.

In comparison with other toxoplasmas (*Toxoplasma*, *Besnoitia*)*, the genus *Sarcocystis* includes numerous species and most of them (if not all) show a pronounced host specificity. It should be mentioned that no extensive and purposeful investigations into the distribution of these organisms in different animals and elucidation of the specificity of these parasites using experimental methods have hitherto been carried out. A survey of this group was published by Yakimov (1931) and Babudieri (1932) and these organisms in birds were dealt with in the paper by Erickson (1940). All these papers are out of date and many new data have been assembled since their publication. In the present paper we wish to give a survey of hitherto obtained data on the distribution of *Sarcocystis* in different animals and discuss the questions concerning the understanding of species concept of these protozoans.

Table 1 summarizes hitherto available data on all species of *Sarcocystis*, their different vertebrate hosts and geographical distribution of these parasites. It should be

*) We do not mention here the genus *Globidium*, since these forms have been little studied and it has not yet been stated whether they do belong to *Toxoplasma*.

Table 1. Species of vertebrates serving as natural hosts of *Sarcocystis*

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
Class Reptilia Order Chelonia Fam. Kinosternidae <i>Kinosternon scorpioides</i>	<i>S. gracilis</i>	Brazil, Marayo Island	Lainson, Shaw, 1971
Order Squamata Fam. Iguanidae <i>Uta stansburiana</i> <i>Sceloporus occidentalis</i> <i>biseriatus</i>	<i>S. lacertae utae</i> <i>S. platydactyli</i> <i>scelopori</i>	USA (California) USA (California)	Ball, 1944 Ball, 1944
Fam. Agamidae <i>Amphibolurus</i> <i>barbatus</i>	<i>S. sp.?</i>	Australia	(see Frank, 1966)
Fam. Chamaeleontidae <i>Chamaeleo fischeri</i> <i>multituberculatus</i>	<i>S. chamaeleonis</i>	Tanzania	Frank, 1966
Fam. Gekkonidae <i>Tarentola mauritanica</i>	<i>S. platydactyli</i>	Balearic Islands	Bertram, 1892 (see Frank, 1966)
Fam. Lacertidae <i>Lacerta ocellata</i> <i>L. muralis</i>	<i>S. gongyli</i> <i>S. sp.</i> <i>S. lacertae</i>	Italy, Sicily Italy (Lombardia) France (Clermont-Ferrand)	Trinci, 1910 Lübe, 1900 (see Sénaud, Puytorac, 1964) Babudieri, 1932 Sénaud, Puytorac, 1964
Fam. Boidae <i>Python spilotes</i> <i>(Morelia argus)</i>	<i>S. pythonis</i>	Australia	Tiegs, 1931 (see Frank, 1966)
Fam. Colubridae <i>Natrix natrix</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
Fam. Viperidae <i>Atractaspis leucomelas</i>	<i>S. atractaspidis</i>	Africa	Parenzan, 1944 — 1946 (see Frank, 1966)
Class Aves Order Falcones Fam. Accipitridae <i>Leucopternis sp.</i> <i>Leucopternis ghiesbrechti costaricensis</i> <i>Accipiter gentilis</i> <i>Buteo buteo</i>	<i>S. sp.</i> <i>S. sp.</i> <i>S. sp.</i> <i>S. tenella</i> <i>S. sp.</i>	Panama Panama USSR (Byelorussia) GDR, USSR, (Byelorussia)	Darling, 1915 Takos, 1957 Dylko, 1962 Eble, 1961, Dylko 1962

Table I. (Continuation 1.)

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
Fam. Cathartidae <i>Cathartes aura septentrionalis</i> <i>Coragyps atratus</i>	<i>S. sp.</i> <i>S. sp.</i> <i>S. sp.</i>	USA Panama Panama	Osterud, Bascom, 1928 Clark, 1920 (see Takos, 1957) Clark, 1920 (see Takos, 1957)
Order Gressores Fam. Ardeidae <i>Ardea herodias</i>	<i>S. sp.</i>	USA (Maryland)	Clark, 1958
Order Anseres Fam. Anatidae <i>Anas platyrhynchos</i>	<i>S. rileyi</i>	USA USA USA	Riley, 1869; Leidy, 1875; Stiles, 1893 (see Erickson 1940) Crawley, 1911 Riley, 1931; Green, Shillinger, 1933, 1935; Shillinger, Wetmore, 1938 (see Erickson, 1940) Krause, Goranoff, 1933 (see Erickson, 1940) Erickson, 1940 Salt, 1958
	<i>S. anatina</i>	Bulgaria	Chabreck, 1965
	<i>S. rileyi</i>	USA (Minnesota) Canada (Edmonton) USA (Louisiana)	v. Betegh, Dorcich, 1912 (see Erickson, 1940) Hall, 1925 (see Erickson, 1940)
<i>Anas platyrhynchos domestica</i>	<i>S. sp.</i> <i>S. rileyi</i>	Germany USA (Washington)	Mathews, 1930; Gower, 1938; Beaudette, 1941; Clark, 1957) Erickson, 1940; McDonald, 1961 (see Chabreck, 1965) Chabreck, 1965
<i>Anas rubripes</i>	<i>S. rileyi</i>	USA (Indiana, Michigan, New Jersey, Maryland)	Erickson, 1940; McDonald, 1961 (see Chabreck, 1965) Chabreck, 1965
<i>Anas strepera</i>	<i>S. rileyi</i>	USA (Minnesota, Utah, Louisiana)	Erickson, 1940; McDonald, 1961 (see Chabreck, 1965) Chabreck, 1965
<i>Anas acuta</i>	<i>S. rileyi</i>	USA (Minnesota, Utah, Louisiana)	Erickson, 1940; McDonald, 1961 (see Chabreck, 1965) Chabreck, 1965
<i>Anas discors</i>	<i>S. rileyi</i>	USA (Minnesota, Louisiana)	Erickson, 1940; Chabreck, 1965
<i>Anas carolinensis</i>	<i>S. rileyi</i>	USA (Utah, Louisiana)	McDonald, 1961 (see Chabreck, 1965); Chabreck, 1965
<i>Anas clypeata</i>	<i>S. rileyi</i>	USA USA (Utah, Louisiana, Minnesota) USA Canada	Stiles, 1893 (see Erickson, 1940) Riley, 1931; McDonald, 1961 (see Chabreck, 1965); Erickson, 1940; Chabreck, 1965 Eisenstein, Innes, 1956 Cornwell (see Chabreck, 1965)

Table I. (Continuation 2.)

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
<i>Mareca americana</i>	<i>S. rileyi</i>	USA (Louisiana)	Chabreck, 1965
<i>Aythya fuligula</i>	<i>S. rileyi</i>	USA (Louisiana)	Chabreck, 1965
<i>Aythya affinis</i>	<i>S. rileyi</i>	USA (Louisiana)	Chabreck, 1965
<i>Aythya americana</i>	<i>S. rileyi</i>	Canada (Manitoba)	Cornwell, 1963 (see Chabreck, 1965)
<i>Aythya valisineria</i>	<i>S. rileyi</i>	Canada (Manitoba)	Cornwell, 1963 (see Chabreck, 1965)
<i>Bucephala clangula</i>	<i>S. rileyi</i>	Canada (Manitoba)	Cornwell, 1963 (see Chabreck, 1965)
Wild duck (species not identified)	<i>S. sp.</i>	USA	Eisenstein, Innes, 1956
Order Galli Fam. Phasianidae <i>Phasianus colchicus</i>	<i>S. sp.?</i>		Clapham, 1957 (see Salt, 1958)
<i>Alectoris rufa</i>	<i>S. sp.?</i>		Clapham, 1957 (see Salt, 1958)
<i>Gallus gallus</i>	<i>S. sp.</i>	Germany	Kühn, 1865 (see Erickson, 1940)
	<i>S. rileyi</i>	USA	Stiles, 1893, 1894 (see Erickson, 1940)
	<i>S. horwathi</i>	Hungary	v. Ratz, 1908 (see Erickson, 1940)
	<i>S. gallinarum</i>	Bulgaria	Krause, Goranoff, 1933 (see Erickson, 1940)
	<i>S. rileyi</i>	USA (Michigan)	Hawkins, 1943
	<i>Sarcocystis?</i>	India	Levine, Beamer, Simon, 1965
<i>Perdix perdix</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
<i>Lyrurus tetrix</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
<i>Tetrastes bonasia</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
<i>Centrocercus urophasianus</i>	<i>S. rileyi</i>	Canada (South Alberta)	Salt, 1958
Fam. Meleagridae <i>Meleagris gallopavo</i>	<i>S. sp.</i>	Panama	Clark, 1920 (see Takos, 1957)
Order Cuculi Fam. Cuculidae <i>Guira guira</i> <i>Piaya cayana</i> <i>thermophila</i>	<i>S. corderoi</i> <i>S. sp.</i>	Uruguay Panama	Vogelsang, 1929 Takos, 1957
Order Grues Fam. Rallidae <i>Aramides saracura</i>	<i>S. aramidis</i>	Brazil	Splendore, 1907 (see Babudieri, 1932)

Table I. (Continuation 3.)

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
Order Laro-Limico- lae Fam. Charadriidae <i>Vanellus vanellus</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
Fam. Scolopacidae <i>Gallinago delicata</i> <i>Scolopax rusticola</i> <i>Philomachus pugnax</i> <i>Actitis hypoleucos</i>	<i>S. rileyi</i> <i>S. sp.</i> <i>S. sp.</i> <i>S. sp.</i>	USA USSR (Byelorussia) USSR (Byelorussia) USSR (Byelorussia)	Erickson, 1940 Dylko, 1962 Dylko, 1962 Dylko, 1962
Order Columbae Fam. Columbidae <i>Columba sp.</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
Order Psittaci Fam. Psittacidae <i>Forpus passerinus</i> <i>Eupsittulla</i> (= <i>Ara- tinga</i>) <i>auricapillus</i>	<i>S. oliverioi</i> <i>S. sp.</i>	Brazil the Netherlands (zoological garden)	Pessoa, 1935 (see Takos, 1957) Rodhain, 1956
Order Striges Fam. Strigidae <i>Bubo virginianus</i>	<i>S. sp.</i>	USA (Iowa)	Vusse, 1966
Order Coraciae Fam. Upupidae <i>Upupa epops</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
Order Colii Fam. Collidae <i>Colius</i> (= <i>Urocolius</i>) <i>indicus</i>	<i>S. colii</i>	Africa	Fantham, 1913
Order Pici Fam. Picidae <i>Dendrocopos major</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
Fam. Ramphastidae <i>Pteroglossus torquatus</i> <i>Ramphastos piscivorus</i> <i>brevicarinatus</i> <i>Ramphastos ariel</i>	<i>S. sp.</i> <i>S. sp.</i> <i>S. sp.</i>	Panama Panama Yugoslavia (zoolo- gical garden)	Takos, 1957 Takos, 1957 Herczeg, Huber, 1967
Order Passeres Fam. Furnariidae <i>Synallaxis erythrotho- rax</i>	<i>S. sp.</i>	Mexico	Selander, 1955

Table I. (Continuation 4.)

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
Fam. Tyrannidae <i>Tyrannus tyrannus</i>	<i>S. sp.</i>	USA (Iowa)	Vusse et al., 1966
Fam. Troglodytidae <i>Campylorhynchus</i> <i>ruftinucha</i>	<i>S. sp.</i>	Mexico	Selander, 1955
<i>Campylorhynchus</i> <i>chiapensis</i>	<i>S. sp.</i>	Mexico	Selander, 1955
Fam. Mimidae <i>Toxostoma rufum</i> <i>rufum</i>	<i>S. sp.</i>	USA (Iowa)	Vusse et al., 1966
Fam. Turdidae <i>Turdus merula</i>	<i>S. turdi</i>	Europe	Rivolta, 1874; Brumpt, 1913 (see Babudieri, 1932)
Fam. Icteridae <i>Molothrus bonariensis</i> <i>Quiscalus quisqualis</i>	<i>S. debonci</i> <i>S. sp.</i>	Uruguay USA (Maryland, Pennsylvania)	Vogelsang, 1929 Clark, 1958; Zeve et al., 1966; Fayer, Kocan, 1971
<i>Cassidix mexicanus</i> <i>Sturnella magna</i> <i>Agelaius phoeniceus</i>	<i>S. sp.</i> <i>S. sp.</i> <i>S. sp.</i>	USA (Florida) USA (Maryland) USA (Maryland)	Simpson, Forrester, 1973 Clark, 1958 Clark, 1958
Fam. Parulidae <i>Setophaga ruticilla</i>	<i>S. setophagae</i>	USA	Crawley, Stiles, 1894; Crawley, 1914 (see Erickson, 1940)
<i>Compsothlypis</i> (= <i>Parula</i>) <i>pitiayumi</i>	<i>S. sp.</i>	Argentina	Barrows (see Erickson, 1940)
Fam. Fringillidae <i>Fringilla coelebs</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
<i>Cannabina cannabina</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
<i>Emberiza sp.</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
<i>Saltator coerulescens</i> <i>Ammodramus manimbe</i> (= <i>Myospiza humeralis meridiana</i>)	<i>S. sp.</i> <i>S. ammodrami</i>	Mexico Brazil	Selander, 1955 Splendore, 1907 (see Babudieri 1932)
<i>Hedymeles</i> (= <i>Pheucticus</i>) <i>ludovicianus</i> <i>Junco hyemalis</i> <i>Volatinia jacarina</i>	<i>S. fulcatula</i> <i>S. sp.</i> <i>S. jacarinae</i>	USA USA (Maryland) Brazil	Stilles, 1893 (see Erickson, 1940) Clark, 1958 Barretto, 1940 (see Takos, 1957)
Fam. Ploceidae <i>Passer domesticus</i>	<i>S. corderoi</i>	Uruguay	Vogelsang, 1929
Fam. Oriolidae <i>Oriolus oriolus</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962

Table I. (Continuation 5.)

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
Fam. Corvidae <i>Garrulus glandarius</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
<i>Corvus cornix</i>	<i>S. sp.</i>	USSR (Byelorussia)	Dylko, 1962
Class Mammalia Order Marsupialia Fam. Didelphidae <i>Marmosa murina</i>	<i>S. marmosae</i>	Brazil	Shaw, Lainson, 1969
<i>Caluromys philander</i>	<i>S. garhami</i>	Brazil	Mandour, 1965; Shaw, Lainson, 1969
<i>Didelphis marsupialis</i>	<i>S. didelphidis</i> (most probably <i>Besnoitia</i> was concerned) <i>S. garhami</i>	Venezuela	Scorza, Torrealba, Dager, 1957
<i>Didelphis aurita</i>	<i>S. darlingi</i> (most probably <i>Besnoitia</i>)	British Honduras Brazil (Sao Paulo)	Mandour, 1965 Mater, Barretto, 1940 (see Mandour, 1965)
<i>Didelphis azarae</i>	<i>S. darlingi</i> (most probably <i>Besnoitia</i>)	Brazil (Rio Grande do Sul)	Helly Lage, 1968
Fam. Dasyuridae <i>Dasyurus</i> (= <i>Satanellus</i>) <i>hallucatus</i>	<i>S. sp.</i>	Australia	Mackerras, 1958
Fam. Peramelidae <i>Thylacis obesulus</i>	<i>S. sp.</i>	Australia	Mackerras, 1958
Fam. Macropodidae <i>Bettongia lesneur</i>	<i>S. bettongiae</i>	Australia	Bourne, 1934 (see Mackerras, 1958)
<i>Petrogale penicillata</i>	<i>S. mucosae</i> (syn. <i>Ileocystis macropodis</i> , <i>Haplogastrocystis m.</i> , <i>Lymphocystis m.</i>)	Australia	Blanchard, 1885 (see Mackerras, 1958)
<i>Macropus bennetti</i>	<i>S. sp.</i>	Australia	Triffitt, 1926, 1927 (see Mackerras, 1958)
Order Insectivora Fam. Soricidae <i>Sorex araneus</i>	<i>S. muris</i> <i>S. sp.</i> (but not <i>S. muris</i>)	Czechoslovakia USSR (Moscow)	Čatár et al., 1967 Kalyakin (unpublished results)
Order Primates Fam. Cercopithecidae <i>Macaca mulatta</i>	<i>S. sp.</i> <i>S. kortei</i>	laboratory laboratory	De Korte, 1906 (see Mandour, 1969) Castellani, Chalmers, 1909 (see Mandour, 1969)

Table I. (Continuation 6.)

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
<i>Macaca mulatta</i>	<i>S. sp.</i>	laboratory	Offutt, Telford, 1945; Dubin, Wilcox, 1947; Habermann, Williams, 1957
	<i>S. kortei</i> and <i>S. nesbitti</i>	Northern India	Mandour, 1969
<i>Cercopithecus mitis</i>	<i>S. kortei</i>	laboratory	Castellani, Chalmers, 1909 (see Mandour, 1969)
		Africa	Mandour, 1969
<i>Cercopithecus</i> (= <i>Erythrocebus</i>) <i>patas</i>	<i>S. kortei</i>	laboratory	Castellani, Chalmers, 1909 (Mandour, 1969)
		Africa	Mandour, 1969
<i>Innus sp.</i>	<i>S. sp.</i>	laboratory	De Korte, 1905 (see Babu- dieri, 1932)
Species not given	<i>S. sp.</i>	laboratory	Lussier, Marois, 1964
Species not given	<i>S. sp.</i>	laboratory?	Eisenstein, Innes, 1956
Fam. Pongidae Species not given	<i>S. sp.</i>		Teichmann, 1910, 1912 (see Mandour, 1969)
Fam. Hominidae <i>Homo sapiens</i>	<i>S. sp.</i> <i>S. lindemanni</i> (syn. <i>S. hominis</i> Rosenberg, 1892)	Russia Italy	Lindemann, 1863 Rivolta, 1878 (see Yaki- mov, 1931) Later on, <i>Sarcocystis</i> were found in man many times in different countries
Order Edentata Fam. Myrmecophagi- dae <i>Tamandua tetradac- tyla</i>	<i>S. sp.?</i>	Brazil	Artigas, Oria, 1931 (see Helly Lage, 1968)
Fam. Bradypodidae <i>Choloepus didactylus</i>	<i>S. sp.</i>	Panama	Darling, 1915
Fam. Dasypodidae Species not given	<i>S. sp.</i>	zoological garden	Eisensten, Innes, 1956
Order Lagomorpha Fam. Leporidae <i>Sylvilagus floridanus</i> <i>Sylvilagus nuttalli</i> <i>Oryctolagus cuniculus</i>	<i>S. leporum</i> <i>S. leporum</i> <i>S. sp.</i> <i>S. cuniculi</i> (syn. <i>S. leporum</i> Craw- ley, 1914)	USA (Iowa) USA	Vusse, 1967 Frenkel, 1956 Mauz, 1867 (see Babudie- ri, 1932) Brumpton, 1913 (see Babu- dieri, 1932)
Fam. Lagomyidae <i>Ochotona daurica</i>	<i>S. dogeli</i>	USSR (Irkutsk region)	Machulskii, 1947

Table I. (Continuation 7.)

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
Order Rodentia Fam. Sciuridae <i>Marmota marmota</i> <i>Marmota caudata</i> <i>Eutamias asiaticus</i> <i>utahensis</i>	<i>S. sp.</i> <i>S. tenella</i> <i>S. cutamisi</i>	France (the Alps) USSR (Gissar ridge) Japan	Joyeux, 1927 Muratov, Kuyma, 1966 Taname, Oninami, 1940 (see Kudo, 1956)
Fam. Cricetidae <i>Pitymys savii</i> <i>Microtus arvalis</i> <i>Microtus agrestis</i> <i>Clethrionomys glareolus</i> <i>Lemmus sibiricus</i> <i>Arvicola terrestris</i> <i>Cricetus cricetus</i> <i>Cricetus griseus</i> <i>Tatera sp.</i> <i>Thallomys moggi</i> <i>Oryzomys goeldi</i> <i>Oryzomys capito</i>	<i>S. pitymyssi</i> <i>S. sp.</i> <i>S. muris</i> <i>S. sp.</i> <i>S. sp.</i> <i>S. muris</i> <i>S. sp.</i> <i>S. sp.</i> <i>S. sp.</i> <i>S. cricetuli</i> <i>S. sp.</i> <i>S. sp.</i> <i>S. muris</i> <i>S. azevedoi</i> and <i>S. oryzomyos</i>	Italy Czechoslovakia Czechoslovakia USSR (Saratov region) Czechoslovakia Czechoslovakia USSR (Yamal) USSR (Saratov region) USSR (Saratov region) China Republic of South Africa Republic of South Africa Brazil (Para) Brazil (Para and Amapa)	Splendore, 1918 (see Mandour, 1965) Šebek, 1960 Čatár et al., 1967 Krasnova, 1971 Šebek, 1960 Čatár et al., 1967 Kalyakin, unpublished results Krasnova, 1971 Krasnova, 1971 Patton, Hindle, 1926 Viljoen, 1921 (see Neitz, 1965) Viljoen, 1921 (see Neitz, 1965) Helly Lage, 1968 Shaw, Lainson, 1969
Fam. Muridae <i>Mus musculus</i> <i>Apodemus sylvaticus</i> <i>Apodemus flavicollis</i> <i>Rattus norvegicus</i>	<i>S. muris</i> <i>S. muris</i> <i>S. muris</i> <i>S. sp.</i> <i>S. sp.</i> <i>S. sp.</i> <i>S. muris</i> <i>S. muris</i>	Czechoslovakia Czechoslovakia Mexico USSR (Saratov region) USSR (Saratov region) USSR (Byelorussia) Australia Czechoslovakia	Blanchard, 1885 (see Babudieri, 1932) Čatár, 1958; Čatár et al., 1967 Šebek, 1960 Martinez, Roch, Varela, 1967 Krasnova, 1971 Krasnova, 1971 Dylko, 1962 Blanchard, 1885 (see Babudieri, 1932) Mayer, 1921 (see Mackerras, 1958) Šebek, 1960

Table I. (Continuation 8.)

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
<i>Rattus n. javanicus</i> <i>Rattus rattus</i>	<i>S. tenella</i> <i>S. muris</i>	Indonesia (Java)	Holz, Liem Jan Sioe, 1965 Blanchard, 1885 (see Babudieri, 1932)
<i>Rattus r. diardi</i>	<i>S. sp.</i>	Australia	Pope, Bicks, Cook, 1957
<i>Rattus r. brevicaudatus</i>	<i>S. tenella</i>	Indonesia (Java)	Holz, Liem Jan Sioe, 1965
<i>Rattus assimilis</i> <i>Lophuromys fluvo-punctatus</i>	<i>S. sp.</i> <i>S. pitymyi</i>	Australia Kenya, Malawi	Pope, Bicks, Cook, 1957 Mandour, 1965, 1969
Fam. Hystriidae <i>Hystrix africae</i> <i>australis</i>	<i>S. sp.</i>	Republic of South Africa	Viljoen, 1921 (see Neitz, 1965)
Fam. Caviidae <i>Cavia cobaya</i>	<i>S. sp.</i>		Seaglia, 1930 (see Seorza et al., 1957)
Fam. Echimyidae <i>Proechimys guyanensis</i>	<i>S. proechimys</i>	Brazil (Amapa, Belem and Para)	Shaw, Lainson, 1969
Order Cetacea Fam. Balaeopteridae <i>Balaenoptera borealis</i>	<i>S. balaenopteralis</i>	not given	Akao, 1970
Order Carnivora Fam. Canidae <i>Canis familiaris</i>	<i>S. sp.</i>	Germany	Krause, 1863
<i>Nyctereutes procyonoides</i>	<i>S. sp.</i>	India (Madia-Pradesh) USSR (Primorye)	Sahasrabudhe, Shah, 1966 Britov, 1970
Fam. Mustelidae <i>Mellivora capensis</i>	<i>S. sp.</i>	Republic of South Africa	Viljoen, 1921 (see Neitz, 1965)
Fam. Viverridae <i>Helogale parvula</i>	<i>S. sp.</i>	Republic of South Africa	Viljoen, 1921 (see Neitz, 1965)
<i>Mungo mungo</i>	<i>S. sp.</i>	Republic of South Africa	Viljoen, 1921 (see Neitz, 1965)
Fam. Felidae <i>Felis catus</i> (f. domestica)	<i>S. sp.</i>	Germany	Krause, 1863
<i>Panthera leo</i>	<i>S. sp.</i>	USA India (zoological garden)	Eisenstein, Innes, 1956 Bhadavdekar, Purchit, 1963

Table I. (Continuation 9.)

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
Order Pinnipedia Fam. Otariidae <i>Otaria</i> (= <i>Zalophus</i>) <i>californiana</i>	<i>S. sp.</i> <i>S. hueti</i>		Huet, 1882 (see Babudieri, 1932) Blanchard, 1885 (see Babudieri, 1932)
Fam. Phocidae <i>Phoca richardi</i> <i>Palaemon rectirostris</i>	<i>S. richardii</i> <i>S. sp.?</i>	Bering Sea	Hadwen, 1922 Henneguy, 1882 (see Babudieri, 1932)
Order Perissodactyla Fam. Equidae <i>Equus caballus</i> <i>Equus asinus</i> <i>E. caballus</i> × <i>E. asinus</i> <i>Equus burchelli</i>	<i>S. bertrami</i> <i>S. bertrami</i> <i>S. bertrami</i> <i>S. sp.</i>	Italy Panama Tanzania (Serengeti)	Doflein, 1901 (see Babudieri, 1932) Babudieri, 1932 Darling, 1915 Kalinin et al., 1971
Order Artiodactyla Fam. Suidae <i>Sus scrofa domestica</i> <i>Hylochoerus meinertzhageni</i> <i>Phacochoerus aethiopicus</i>	<i>S. miescheriana</i> <i>S. sp.</i> <i>S. sp.</i>	Germany Kenya Congo (South Catanga) Uganda Tanzania (Serengeti)	Kühn, 1865 (see Babudieri, 1932) Since that time <i>Sarcocystis</i> have been found in pigs many times in many countries. Kalinin et al., 1971 Thiis, Déom, Fagard, 1960 Robins, 1968 (Sachs, Sachs, 1968) Sachs, Sachs, 1968
Fam. Camelidae <i>Camelus dromedarius</i> <i>Lama glama</i>	<i>S. cameli</i> <i>S. sp.</i> <i>S. aucheniæ</i>	Egypt zoological garden zoological garden	Mason, 1910 (see Babudieri, 1932) Rievel, Behrens, 1904 Brumpt, 1913 (see Babudieri, 1932)
Fam. Tragulidae <i>Cervulus sp.</i>	<i>S. sp.</i>	Indonesia (Sumatra)	Jough, 1913 (see Babudieri, 1932)

Table I. (Continuation 10.)

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
Fam. Cervidae			
<i>Cervus elaphus</i>	<i>S. gracilis</i>	Germany and Hungary	Ratz, 1908 (see Babudieri, 1932)
<i>C. e. sibiricus</i>	<i>S. grueneri</i> <i>S. sp.</i>	USSR (Altai) USSR (Altai)	Yakimov, Sokolov, 1934 Levchenko, 1964
<i>C. e. bactrianus</i>	<i>S. sp.</i>	USSR (Tajikistan)	Krylov, Sapozhnikov, 1965
<i>Cervus dama</i>	<i>S. sp.</i>		Brooks, 1903 (see Babudieri, 1932)
<i>Odocoileus virginianus</i>	<i>S. sp.</i>	USA	Eisenstein, Innes, 1956
Deer (species not given)	<i>S. cervi</i>	Vietnam	Destombes, 1957
<i>Capreolus capreolus</i>	<i>S. sibirica</i> <i>S. capreoli</i>	USSR (Buryatia) USSR (Kirghizia, Kochkar region)	Machulskii, 1947 Levchenko, 1963
<i>Alces alces</i>	<i>S. sp.</i>		Brooks, 1903 (see Babudieri, 1932)
<i>Rangifer tarandus</i>	<i>S. sp.</i>	Sweden (Laplandia)	Bergman, 1902, 1913 (see Gruener, 1927) Gruener, 1927
	<i>S. grueneri</i> <i>S. sp.</i>	USSR (West Siberia) USSR USSR (Amur region)	Yakimov, Sokolov, 1934 Britov, 1970
Fam. Giraffidae			
<i>Giraffa camelopardalis</i>	<i>S. sp.</i>	Tanzania (Serengeti)	Sachs, Sachs, 1968; Kaliner et al., 1971
Fam. Bovidae			
<i>Capra sibirica</i>	<i>S. orientalis</i>	USSR (Transbaikalie) and Mongolia	Machulskii, Miskaryan, 1958
<i>Capra hircus</i>	<i>S. hirsuta</i> (<i>S. moulei</i> Neveu-Lemaire, 1912) <i>S. tenella</i>	Europe Ceylon	Moulé, 1887 (see Badudieri, 1932) Samarawcera, Kulasiri, 1969
<i>Ovis ammon</i>	<i>S. gusevi</i>	USSR (Pamir)	Krylov, Sapozhnikov, 1965
<i>Ovis aries</i>	<i>S. tenella</i> (<i>S. gigantea</i> Railliet, 1886)		Railliet, 1886 (see Babudieri, 1932) Since that time <i>Sarcocystis</i> have been found in sheep in many countries.
<i>Bos taurus</i>	<i>S. fusiformis</i> (<i>S. blanchardi</i> Doflein, 1901; <i>S. cruzi</i> Hasselmann, 1926)		Railliet, 1897 (see Babudieri, 1932) Since that time <i>Sarcocystis</i> have been found in cattle in many countries
<i>Bos indicus</i>	<i>S. fusiformis?</i>		Castellani, Sturgess (see Scott, 1930)

Table I. (Continuation 11.)

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
<i>Bubalus bubalis</i>	<i>S. siamensis</i> (<i>S. babuli</i> Willey, Chalmers et Marshall, 1904)		v. Linstov, 1903 (see Babudieri, 1932) Since that time <i>Sarcocystis</i> have been found in buffaloes in many countries
<i>Bubalus cookei</i>	<i>S. bubalis</i>	East Africa	Dogel, 1916
<i>Syncerus caffer</i>	<i>S. sp.</i>	Uganda	Bindernagel, 1968; Robins, 1968 (see Kaliner et al., 1971)
		Tanzania (Serengeti)	Sachs, Sachs, 1968; Kaliner et al., 1971
<i>Gazella thomsoni</i>	<i>S. sp.</i>	Tanzania (Serengeti)	Brooks, 1961 (see Kaliner et al., 1971); Sachs, Sachs, 1968
		Kenya	Kaliner et al., 1971
<i>Gazella granti</i>	<i>S. woodhousei</i>	East Africa	Dogel, 1916
	<i>S. sp.</i>	Tanzania (Kilimanjaro and Serengeti)	Benko, 1968; Sachs, Sachs 1968
		Kenya	Kaliner et al., 1971
<i>Gazella rufifrons</i>	<i>S. gazellae</i>		Balfour, 1913 (see Babudieri, 1932)
<i>Gazella gutturosa</i>	<i>S. mongolica</i>	Mongolia	Machulskii, 1947; Machulskii, Miskaryan, 1958
<i>Gazella subgutturosa</i>	<i>S. sp.</i>	USSR	Levchenko, 1964
<i>Gazella sp.</i>	<i>S. sp.</i>	Kenya	Mugera, 1968 (see Kaliner et al., 1971)
<i>Kobus (Adenota) kob</i>	<i>S. sp.</i>	Uganda	Kaliner et al., 1971
<i>Kobus ellipsiprymnus</i>	<i>S. sp.</i>	Kenya	Kaliner et al., 1971
<i>Kobus defassa</i>	<i>S. sp.</i>	Tanzania (Serengeti)	Sachs, Sachs, 1968
		Kenya	Kaliner et al., 1971
<i>Sylvicapra grimmia</i>	<i>S. sp.</i>	Congo (Catanga)	Thils, Déom, Fagard, 1960
		East Africa	Kaliner et al., 1971
<i>Rhynchotragus kirkii</i>	<i>S. sp.</i>	Kenya	Kaliner et al., 1971
<i>Raphicerus capensis</i>	<i>S. sp.</i>	Republic of South Africa	Viljoen, 1921 (see Neitz, 1965)
<i>Redunca arundinum</i>	<i>S. sp.</i>	Republic of South Africa	Viljoen, 1921 (see Neitz, 1965)
<i>Oreotragus oreotragus</i>	<i>S. sp.</i>	Republic of South Africa	Viljoen, 1921 (see Neitz, 1965)
<i>Alcelaphus buselaphus</i>	<i>S. sp.</i>	Tanzania (Serengeti)	Sachs, Sachs, 1968
		Tanzania and Kenya	Kaliner et al., 1971
<i>Damaliscus korrigum</i>	<i>S. sp.</i>	Tanzania (Serengeti)	Sachs, Sachs, 1968
		East Africa	Kaliner et al., 1971
<i>Connochaetes taurinus</i>	<i>S. sp.</i>	Tanzania (Serengeti)	Sachs, Sachs, 1968
		East Africa	Kaliner et al., 1971

Table 1. (Continuation 12.)

Host species	<i>Sarcocystis</i> species	Investigated region	Authors
<i>Taurotragus oryx</i>	<i>S. sp.</i>	Kenya	Kaliner et al., 1971
<i>Aepycerus melampus</i>	<i>S. sp.</i>	Kenya	Mugera, 1968 (see Kaliner et al., 1971)
		Tanzania and Kenya	Kaliner et al., 1971
<i>Tragelaphus scriptus</i>	<i>S. sp.</i>	Congo	Thils, Déom, Fagard, 1960
<i>Cervicapra arundinum</i>	<i>S. sp.</i>	Africa	Fantham, 1920—1922 (see Babudieri, 1932)
Antelope (species not given)	<i>S. ruandae</i>	Ruanda-Urundi	Chiwiy-Colback, 1926 (see Babudieri, 1932)

mentioned that the bibliography on *Sarcocystis* comprises many old papers published in the last century, as well as those published in special editions, so that we sometimes had no possibility to study the original sources. In such cases we had to use the references cited in more recent papers of other authors.

As it may be seen from the table, *Sarcocystis* is widely distributed among reptiles, birds and mammals.*

At present, there are 11 species of reptiles belonging to 9 families and 2 orders, which serve as natural hosts of *Sarcocystis*. The reptiles are parasitized by 9 species of *Sarcocystis*, though *S. lacertae* Babudieri, 1931 may be considered a synonym of previously described *S. gongyli* Tzinci, 1910.

Among birds, there are 71—72 species of 28 families and 14 orders in which 15 species of *Sarcocystis* were found. However, 3 of them seem to be synonyms of the species described earlier. These are *S. anatina* Krause et Goranoff, 1933, *S. horwati* Ratz, 1908 and *S. gallinarum* Krause et Goranoff, 1933 (they are synonyms of *S. rileyi* Stiles, 1893). Besides, the name *S. tenella* proposed for a species of *Sarcocystis* parasitizing domestic sheep (Railliet 1886) was used in the description of the form parasitizing common buzzard, *Buteo buteo* (Eble 1961).

The mammals reported as natural hosts of *Sarcocystis* belong to 105—109 species of 33 families and 11 orders. They are infected with 45 species of these parasites. Some of them are synonyms of previously described species, as *S. hominis* Rosenberg, 1892; *S. leporum* Crawley, 1914; *S. capreoli* Levstchenko, 1963; *S. moulei* Neveu-Lemaire, 1912; *S. gigantea* Railliet, 1886; *S. blanchardi* Dofflein, 1901; *S. cruzi* Hasselmann, 1926; *S. bubali* Willey, Chalmers et Marshall, 1904; *S. woodhousi* Dogiel, 1916 and, possibly, some others.

Besides, *S. darlingi* and *S. didelphidis*, described in South America from three species of opossums, namely *Didelphis marsupialis*, *D. aurita* and *D. azarae* (see Table 1), according to their taxonomic characters do not belong to *Sarcocystis*, but *Besnoitia* and should be synonymized with *Besnoitia darlingi* Brumpt, 1913. Probably also some other species, especially those found previously, may have been mistaken for related organisms.

*) There was a paper reporting on *Sarcocystis* infection of 2 fish species, *Salvelinus fontinalis* and *Zoarces angularis* (Fantham and Porter 1943). However, this single finding has not been confirmed by any of the numerous subsequent studies.

Thus the total number of *Sarcocystis* is now 70 species and 14 of them seem to be synonyms. It should be mentioned that the organisms found in most birds and mammals were described under the name *Sarcocystis* sp. and were not exactly identified. Obviously far more species of *Sarcocystis* exist in nature than it has been known till now, since a majority of species of higher vertebrates have not yet been examined for parasites. An important characteristic of parasites, which helps to determine successfully their taxonomic position, is the degree of their specificity to the vertebrate hosts. In none of the papers available on *Sarcocystis* the host specificity has been considered, i.e. there are different ideas about the species concept and its criteria. As an example of contrary opinions on this question may serve the views of Alekseev (1913) and some other authors (including the contemporary ones) assuming that all forms of *Sarcocystis* belong to a single species, in contrast to the authors like Mandour (1969), who described in one host species (*Macaca mulatta*) two species of *Sarcocystis*, *S. kortei* and *S. nesbitti*, on the basis of differences in their morphology and location, or Shaw and Lainson (1969), who also described two *Sarcocystis* species (*S. azevedoi* and *S. oryzomyos*) from a single host (*Oryzomys capito*).

Recent papers dealing with the life cycle of *S. tenella*, *S. miescheriana* and *S. fusiformis* gave evidence that there are different species of *Sarcocystis* parasitizing various species of animals and differing from one another not only in their morphology, location in the host organism and association with different species of vertebrate hosts, but also in their biological properties and details of life cycles. The previously described species of *Sarcocystis* have not been studied from these aspects and therefore only data on their morphology, association with the host species and location in their organism have been used as criteria for species determination. The data on morphology of zoites (spores, merozoites) of different *Sarcocystis* species are given in Table 2 in the same sequence as in Table 1.

As it follows from the present knowledge of *Sarcocystis* organisms parasitizing different vertebrate animals, they differ considerably in the size of merozoites and this character is sufficient evidence of the existence of many species of *Sarcocystis*. Of importance are also the differences in the form, size and peculiarities of the location of cysts of these protozoans (for details see Zasukhin et al. 1972, 1973). The above-mentioned papers dealing with the elucidation of the life cycles of some species of *Sarcocystis* supply an important material for further study of these parasites and elucidation of their systematic position. These papers, along with those devoted to the cultivation of these organisms in tissue cultures (Fayer 1970; Fayer and Kocan 1971; Simpson and Forrester 1973; Vetterling et al. 1973), revealed the possibility of experimental study of *Sarcocystis*. They also showed that for further study of the distribution of *Sarcocystis*, their ability to parasitize various species of vertebrates and their host specificity and, finally, for understanding of the species concept of *Sarcocystis* it is necessary to study all stages of the life cycle of these protozoans, including the sexual ones. The host specificity of *Sarcocystis* should be studied not only within individual systematical units (taxons of one or another rank), but also within biocenotical units, i.e. associations of species, primarily associations of species most closely related trophically.

Very interesting are the data on the peculiarities of sporulation of *S. fusiformis* (Fayer and Leek, 1973; Vershinin 1974) and *S. tenella* (Vershinin 1973). According to these authors, characteristic for *Sarcocystis* is the sporulation of oocysts and destruction of their envelopes still in the intestine of the host, so that already sporulated sporocysts with a marked envelope (about 0.5 μ thick) are discharged along with the feces in the outer environment. On the other hand, with the coccidia of the genus *Iscospora*, the oocysts of which are in principle identical with those of *Sarcocystis*, the sporulation occurs inside the oocysts with a thick envelope, in the outer environment. How much charac-

Table. 2. Morphological characters of different species of *Sarcocystis*.

Species of <i>Sarcocystis</i>	Size of zoites (merozoites, spores) in μ	Original vertebrate hosts
<i>S. gracilis</i> Lainson et Shaw, 1971	18.4 $\times$ 1.4	<i>Kinosternon scorpioides</i>
<i>S. chameleonis</i> Frank, 1966	10–13 $\times$ 2 (in muscles) 10–14 $\times$ 3–3.8 (in blood)	<i>Chamaeleo fischeri</i> <i>Tarentola mauritanica</i>
<i>S. platydactyli</i> Bertram, 1892	3–4 $\times$ 1; (4–10 according to Weber, 1909)	
<i>S. gongyli</i> Trinci 1910	4–6 $\times$ 0.5	<i>Lacerta ocellata</i>
<i>S. lacertae</i> Babudieri, 1931	6.5–7.3 $\times$ 1.5–2	<i>Lacerta muralis</i>
<i>S. pythonis</i> Tiegs, 1931	4–7	<i>Morelia argus</i>
<i>S. atractaspidis</i> Parenzan, 1944– 1946	data not known	<i>Atractaspis leucomelas</i>
<i>S. rileyi</i> Stiles, 1893	14–16 $\times$ 2–3 (8.15 $\times$ 1.63)	<i>Anas platyrhynchos</i>
<i>S. corderoi</i> Vogelsang, 1929	3–6 $\times$ 1–2	<i>Guira guira</i>
<i>S. aramis</i> Splendore, 1907	4–6	<i>Aramideis saracura</i>
<i>S. jacarinae</i> Barretto, 1940	10.9–12.4 $\times$ 1.8–2.5	<i>Volatinia jacarina</i>
<i>S. oliverioi</i> Pessoa, 1935	3 $\times$ 1.5	<i>Forpus passerinus</i>
<i>S. colii</i> Fantham, 1913	of two types: 5–7 and 1.5–2.5	<i>Colius indicus</i>
<i>S. turdi</i> Brumpt, 1913	data not known	<i>Turdus merula</i>
<i>S. debonei</i> Vogelsang, 1929	6 $\times$ 4	<i>Molothrus bonariensis</i>
<i>S. setophaga</i> Crawley et Stilles, 1894	4.50–5.0 $\times$ 0.75–1	<i>Setophaga ruticilla</i>
<i>S. ammodrami</i> Splendore, 1907	6 $\times$ 4	<i>Myospiza humeralis</i>
<i>S. falcata</i> Stiles, 1893	5–6 $\times$ 2	<i>Pheucticus ludovicianus</i>
<i>S. marmosae</i> Shaw et Lainson, 1969	7.5 $\times$ 2.36	<i>Marmosa murina</i>
<i>S. garnhami</i> Mandour, 1965	5.3–6.9 $\times$ 1.3–1.9	<i>Caluromys philander</i> (<i>Philander opossum</i>)
<i>S. bettongiae</i> Bourne, 1934	data not known	<i>Bettongia lesneur</i>
<i>S. mucosae</i> Blanchard, 1885	9–12 $\times$ 4–5.5	<i>Petrogale penicillata</i>
<i>S. kortei</i> Castellani et Chalmers, 1909	9–14 $\times$ 3–4	<i>Macaca mulatta</i>
<i>S. nesbitti</i> Mandour, 1969	7–9 $\times$ 2–3	<i>Macaca mulatta</i>
<i>S. lindemanni</i> Rivolta, 1878	4–5 $\times$ 1–2 (up to 8–9 in length)	<i>Homo sapiens</i>
<i>S. cuniculi</i> Brumpt, 1913	13–16 $\times$ 5–6	<i>Oryctolagus cuniculus</i>
<i>S. dogeli</i> Matshulsky, 1947	14.4–19.2 $\times$ 3.8–4.8 (18.0 $\times$ 4.0)	<i>Ochotona daurica</i>
<i>S. cutamis</i> Tanama et Oninami, 1940	data not known	<i>Eutamias asiaticus</i>
<i>S. pitymyi</i> Splendore, 1918	5–9 $\times$ 2–5	<i>Pitymys savii</i>
<i>S. cricetuli</i> Patton et Hindle, 1926	8–10 $\times$ 2	<i>Cricetus griseus</i>
<i>S. azevedoi</i> Shaw et Lainson, 1969	6.8 $\times$ 1.45	<i>Oryzomys capito</i>
<i>S. oryzomyos</i> Shaw et Lainson, 1969	9.93 $\times$ 3.28	<i>Oryzomys capito</i>

Table 2 (Continued)

Species of <i>Sarcocystis</i>	Size of zoites (merozoites, spores) in μ	Original vertebrate hosts
<i>S. musculi</i> Blanchard, 1885	9-15 $\times$ 2-3	<i>Mus musculus</i>
<i>S. proechimys</i> Shaw et Lainson, 1969	8.67 $\times$ 3.35	<i>Proechimys guyanensis</i>
<i>S. balaenopteralis</i> Akao, 1970	5.0-13.0 $\times$ 1.0-5.0 (7.7 $\times$ 2.3)	<i>Balaenoptera borealis</i>
<i>S. hueti</i> Blanchard, 1885	4-5	<i>Zalophus californianus</i>
<i>S. richardii</i> Hadwen, 1922	5-7 $\times$ 2-3	<i>Phoca richardi</i>
<i>S. bertrami</i> Doflein, 1901	15-18 $\times$ 3-3.5	<i>Equus caballus</i>
<i>S. meischeriana</i> Kühn, 1865	13-16 $\times$ 2.0-7.3 (14.75 $\times$ 5.18)	<i>Sus scrofa domestica</i>
<i>S. cameli</i> Mason, 1910	data not known	<i>Camelus dromedarius</i>
<i>S. auchenia</i> Brumpt, 1913	6-8 $\times$ 2-3	<i>Lama glama</i>
<i>S. gracilis</i> Ratz, 1908	10.8-15.6 $\times$ 4.8-8.4	<i>Cervus elaphus</i>
<i>S. grueneri</i> Yakimoff et Sokoloff, 1934	7 $\times$ 1.75	<i>Cervus elaphus sibiricus</i>
<i>S. sibirica</i> Matchulski, 1947	9.6-15.2 $\times$ 5.6-7.2 (10.4 $\times$ 6.4)	<i>Capreolus capreolus</i>
<i>S. orientalis</i> Matchulski et Myskaryan, 1958	9.3-14.1 $\times$ 2.3-6.2	<i>Capra sibirica</i>
<i>S. hirsuta</i> Moulé, 1887	14.67-17.0 $\times$ 4.07-6.25 (15.51 $\times$ 4.6)	<i>Capra hircus</i>
<i>S. tenella</i> Railliet, 1886	13.04-16.3 $\times$ 3.26-6.25 (14.94 $\times$ 4.16)	<i>Ovis aries</i>
<i>S. gusevi</i> Kryloff et Sapognikoff, 1965	10.8-14.4 $\times$ 4.8-8.4	<i>Ovis ammon</i>
<i>S. fusiformis</i> Railliet, 1897	6-9 $\times$ 1-2 14-16 $\times$ 3.5-5.5 18-21 $\times$ 5-7	<i>Bos taurus</i>
<i>S. siamensis</i> v. Linstov, 1903	15-18 $\times$ 4.5	<i>Bubalus bubalis</i>
<i>S. woodhousei</i> Dogiel, 1916	12-14	<i>Gazella granti</i>
<i>S. gazellae</i> Balfour, 1913	13-15 $\times$ 3.0-4.5	<i>Gazella rufifrons</i>
<i>S. mongolica</i> Matchulski, 1947	12.0-17.6 $\times$ 3.2-4.9 (14.4 $\times$ 4.0)	<i>Gazella gutturosa</i>
<i>S. ruandae</i> Chiwy-Colback, 1926	9-12 $\times$ 1-5	antelope (species not given)

teristic are the peculiarities of sporulation for different species of *Sarcocystis* on one hand and *Isospora* on the other has not yet been elucidated. Neither is it known to what extent these peculiarities are present in various species and genera of *Toxoplasma* and how typical they are of these protozoans. Probably just a detailed study of this question in the biology of *Toxoplasma* and *Coccidia* will enable to determine the systematic relationship of these two groups of protozoans and will help gain an understanding of their taxonomic structure.

О РАСПРОСТРАНЕНИИ *SARCOCYSTIS* (PROTOZOA: SPOROZOA) У ПОЗВОНОЧНЫХ ЖИВОТНЫХ

В. Н. Калякин и Д. Н. Засухин

Резюме. Приводится перечень видов *Sarcocystis*, паразитирующих у представителей трех отрядов позвоночных.

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