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NATURAL FOCUS OF MICROSPOROSIS CAUSED BY MICROSPORUM CANIS BODIN

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Abstract. The authors discovered a natural focus of microsporosis caused by the dermatophyte *Microsporum canis* Bodin. An adult man and four children were afflicted by this dermatophytosis.

Symptomatic and inapparent forms of the disease in the focus were also detected in several cats and dogs. Homeless cats were found to be the source of the causative agent and its permanent hosts. A chainlike transmission from these cats was triggered to home-kept cats and dogs and to family members of their owners. Both, the clinical picture of the disease and characteristics of the strains isolated corresponds with the published data. The authors summed up the evidence collected to date on the epidemiology of microsporoses caused by *M. canis*.

Microsporum canis Bodin is a zoophilic dermatophyte transmissible to man and causing a typical form of superficial mycosis — microsporosis. It is a representative of cosmopolitan dermatophytes but frequency of their occurrence in particular geographical regions varies considerably (Table 1).

The survey shows that there are regions in which *M. canis* is epidemiologically the most significant (e.g. Southern Australia) or significant (Western and Southern Europe) dermatophyte, or large territories, in which it ranks as second among other dermatophytes (Africa, Eastern Europe). We suppose that beside geographic and climatic factors also biotic factors play an important role in the distribution of this dermatophyte. In Western and Southern Europe *M. canis* is an important dermatophyte in metropolitan areas (e.g. Paris, Brussels, Rome). Morganti et al. (1976) demonstrated that in urban areas the infection caused by *M. canis* is being spread primarily by cats, in a lesser degree by dogs. Badillet (1977), who investigated the source of 1386 human cases, concluded that 80% of infections appeared due to contact with cats and about 10% due to contact with dogs. Mantovani and Morganti (1977) pointed out the increasing importance of *M. canis* in urban areas, primarily infections in children who came into contact with infected cats and dogs.

From the epidemiological aspect, of particular importance is the carriage of this pathogenic agent in the healthy animal hair. Woodgyer (1977) found inapparent *M. canis* carriage in 8% of cats, Stepanova and Davydov (1970) in 2% of cats, Sheklakov et al. (1972) in 2.4% of cats, Marcelou-Kinty et al. (1977) in 17% of cats and 5% of dogs. Castro et al. (1976) made an interesting discovery when they diagnosed inapparent *M. canis* forms in all cats examined in the area of an epizootic of manifest microsporosis in dogs of Saint Bernard breed. Stepanishcheva (1959), studying the dynamics of the clinical changes development in microsporosis cases, designated the inapparent forms of the disease as initial and postsymptomatic states of this dermatophytosis and pointed out that the whole course of the disease may run as long as 18 months.

Apart from cats and dogs many other mammals of the orders Carnivora, Rodentia, Lagomorpha, Perissodactyla, Artiodactyla and Primates are afflicted by *M. canis*

Table 1. Percentage of *Microsporum canis* in dermatophytes isolated from human lesions in different countries

	Author	Place	Number of dermatophytes isolated	Number of *M. canis* isolated	Percentage
Europe	Kaben 1967	Rostock and environs(GDR)	5 590	4	0.07
	Prochacki 1970	Poland	10 089	527	5.0
	Badillet 1977	Paris (France)	10 423	1 386	13.6
	Song et al. 1974	Brussels (Belgium)	2 128	542	25.5
	Morganti et al. 1976	Rome (Italy)	628	291	46.4
Asia	Kalra et al. 1964	Delhi (India)	454	2	0.5
America	Mc Caffree et al. 1969	Philadelphia (USA)	2 307	42	1.8
	Ricard et al. 1971	Montreal (Canada)	66	46	69.7
	Martínez et al. 1972	Mexico	993	41	4.1
Africa	Vanbreuseghem 1966	Somalia	179	2	1.1
	Verhagen and Maniar 1969	Kenya	460	9	1.9
	Segretain 1968	Marocco	175	10	5.5
Australia	Durie and Frey 1968	Australia	755	262	34.7
	Donald et al. 1965	Southern Australia	1 819	1 211	66.6

(Otčenášek 1978). Particularly in animals kept in captivity in a small area (zoological gardens, fur-bearing animal farms) epizootics may occur with a wide range of afflicted host species (Knutze et al. 1967, Böhm 1966, Nikiforov 1976).

Otčenášek et al. (1974) noted a long-term *M. canis* absence in Czechoslovakia, where this dermatophyte was rarely found in the past years. In the last four years it was encountered among 1132 dermatophytes isolated from human lesions only seven times (0.6%). Five cases originated from the natural focus mentioned in the present paper, one case (a child's infection) having been reported from other locality in East Bohemia, the last case having been diagnosed within examination of a family microsporosis at Ostrava. Also in animals afflicted by dermatophytoses this agent was found very rarely. Only in two cases *M. canis* was cultivated from skin lesions of dogs. Very rarely *M. canis* was found in healthy hair of cats and dogs examined: although we examined the hair of over 1000 individuals, we suceeded in isolating the agent from two cats only.

PERSONAL OBSERVATIONS

In September 1978 we had the opportunity of examinnig a few cases of suspect dermatophytosis in the inhabitants of the village Tuněchody (district of Chrudim). The affliction was found in one adult man and two school children, in one child of pre-school age and in one infant. The case histories and clinical data are given below as follows:

1. Patient F. C., b. 1919, pig-tender, keeps Persian cats. A 1.5 cm oval redish lesion, with heavily inflamed reddish margin. A marked desquamation at the edge of the lesion.

2. Patient J. H., b. 1967, whose parents own two cats and dogs. A few days before dermatosis manifestation the patient slept with a kitten lying on his chest. First examination showed 22 small lesions 0.5—2 cm large, localized on chest (Fig. 1). Subsequent examinations revealed a fresh lesion in the lock of hair behind the ear.

3. Patient M. U., b. 1975. A vague alopecic lesion in the hair characterized by microlamellous desquamation of epidermis and by presence of short hair stumps. Also small lesions on throat and in the back.

4. Patient J. U., b. 1977. Two small lesions with a brightly red inflamed margin on the forehead. Other three similar lesions on the chest. Two vague lesions in the hairy part of head discovered later; their characteristics were similar to that in patient No.3. Both patients—brothers lived temporarily together in the home of patient No. 2.

5. Patient J. P., b. 1970. Three erytematosquamous circular lesions, large as one crown coin on the chest. Wood's light examination of lesions in the scalp of patients Nos. 2,3 and 4 showed a typical yellow-green fluorescence.

We examined five cats and seven dogs in the homes of patients and their neighbours. Moreover, we registered the infection in six animals, originating from a numerous population of homeless cats. Only two of these animals could be examined, the remaining lot being too shy to be captured, and the disease showed on them in typical skin lesions. Positive results were registered in four cats and two dogs (Table 2).

Table 2. A survey of animals examined

Animal species	Sex	Clinical changes	Examination result
cat*)	♂	lesions around muzzle, eye and external ears	*M. canis*
cat*)	♂	lesions on muzzle and external ears	*M. canis*
cat**)	♀	alopecia on external ear	*M. canis*
cat**)	♀	no lesions	*M. canis*
cat**)	♀	no lesions	negative
cat	♂	no lesions	negative
cat	♀	no lesions	negative
dog	♂	lesion on jaw	*M. canis*
dog	♀	lesion on throat	*M. canis*
dog	♀	no lesions	negative
dog	♂	no lesions	negative
dog	♀	no lesions	negative
dog	♀	no lesions	negative
dog**)	♂	no lesions	negative

Explanations: *) homeless animal
**) juvenile animal

In two cats examined in detail the disease was characterized by alopetic lesions, partly fusing and localized around muzzle, eye and ear (Fig. 5). The centre of lesion was covered with a minute squamous crust with remnants of broken hairs. The loss of hair in cat examined was observed only on the outer part of its external ear. Clinical changes in dogs examined were found in two Alsatians. One of them had an alopetic lesion on throat, in the other the lesion developed on the lower jaw in the healing wound inflicted by Norway rat bite (Fig. 2). A crust with bleeding basis developed in the wound, with signs of inflamation at its rim.

Microscopic examination of preparations with samples taken from human and animal lesions revealed typical elements of the causative agent. In epidermal scales cleared

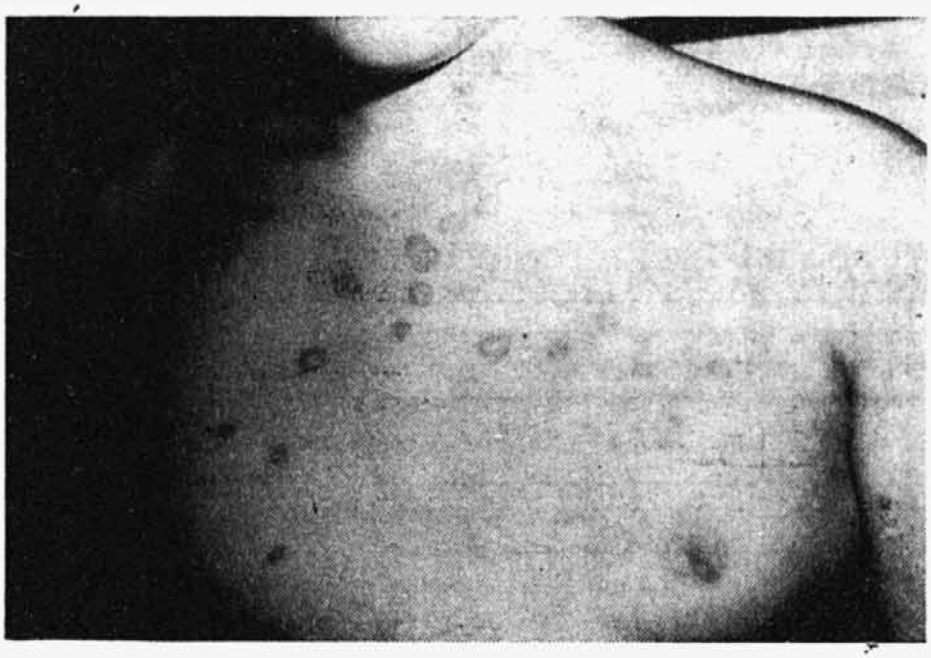

Fig. 1. Numerous lesions of microsporosis on the chest of patient No. 2.

Fig. 2. Microsporosis lesion in dog, developed in the healing wound inflicted by Norway rat bite.

in 20% KOH, abundantly branched septate filaments of dermatophytes were found (Fig. 3). Follicular hair parts were surrounded with sheaths of arthrospores 2—3 μm large. The arthrospores formed mosaic-like structures in extrafollicular hair parts (Fig. 4). Sporadically short septate filaments were encountered on the hair surface.

The cultivation of human and animal samples yielded several identical strains of dermatophyte, which was also isolated from brushings taken from healthy hair of two cats.

The causative agent began to grow on Sabouraud's dextrose agar with chloramphenicole and actidion after three-day incubation at 27 °C. Fine downy relatively fast growing colonies of radiate appearance formed on the agar surface (Fig. 6). After ten

Fig. 3. Filaments of the causative agent in epidermal scale from a lesion in chest. Preparation cleared by KOH (× 250).

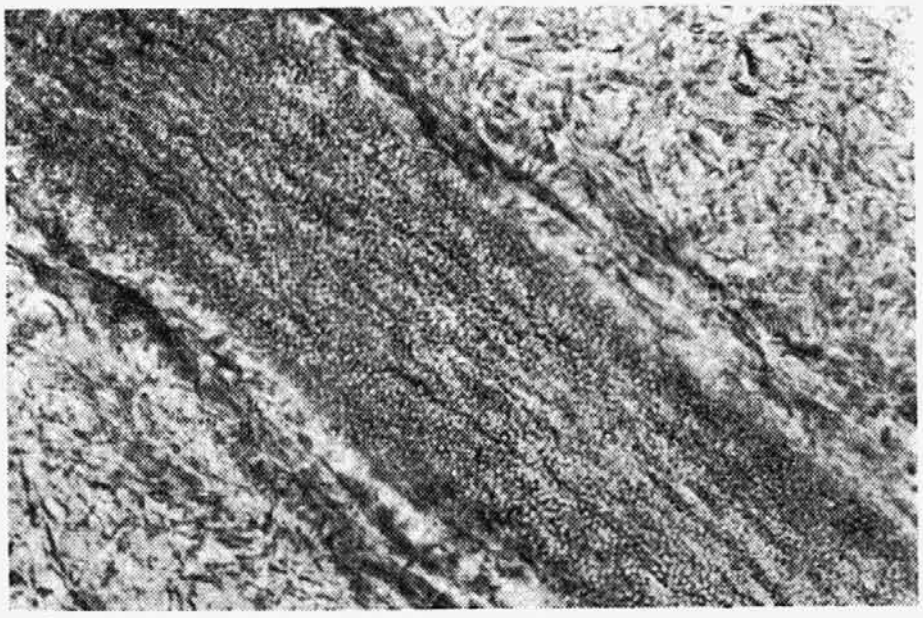

Fig. 4. Mode of parasitism in human hair in vivo (× 250).

days they measured 48 mm in diameter. The colonies were of yellowish colour, in downy zones squalide white. The reverse was intensively yellow, in older cultures it was orange. Diffusion of the yellow pigment into agar was very weak. The yellow colouring was also observed in subcultures on cooked rice.

Microscopically the cultures were characterized by the presence of numerous 6-10-celled macroconidia, with thick finely verruculose walls (Fig. 7). Macroconidia measured 49—69.2 × 14.7—17.3 μm (59.8 × 16.4 μm). The cultures moreover contained relatively few microconidia and racquet-like mycelium. Judging by the appearance of colonies and their micromorphology the agent was identified as *Microsporum canis* Bodin 1902. The clinical picture of lesions and the mode of hair parasitism corresponded with the species identification of this dermatophyte.

Fig. 5. Characteristic lesion on the muzzle of stray cat.

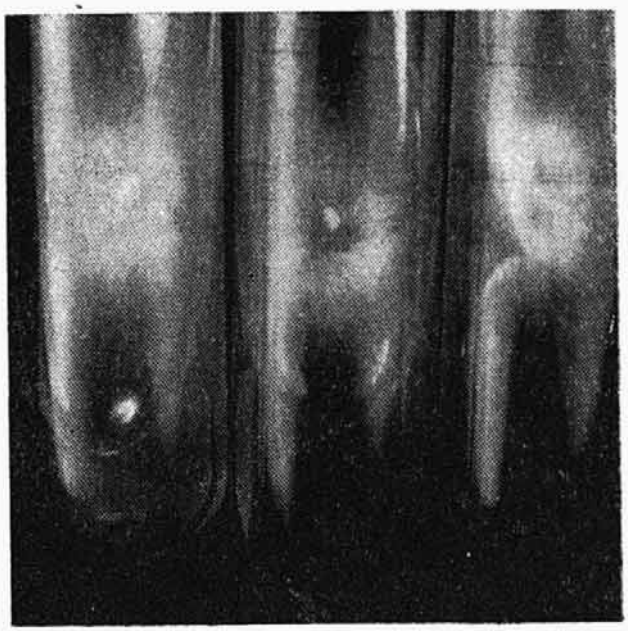

Fig. 6. Primoisolate of *M. canis* on SDA with chloramphenicol after 10-day cultivation at 27 °C.

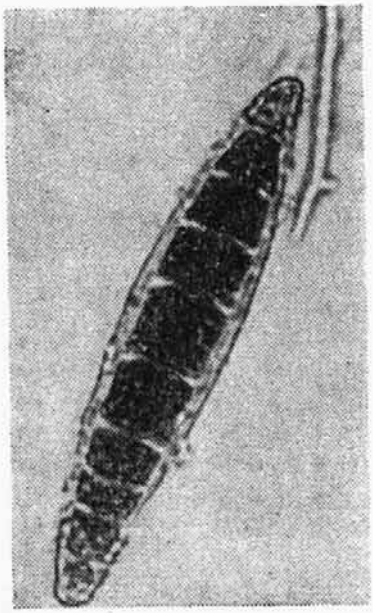

Fig. 7. Macroconidie of *M. canis* on Sabouraud's dextrose agar after 10-day cultivation at 27 °C. (x1250).

The patients were treated with griseofulvin (Gricin VEB Arzeneimittelwerk-Dresden) used perorally according to weight of patients. Antibiotic treatment was supplemented with the local treatment of lesions with Myco-Decidin (Galena) preparation in solution. The lesions in three patients healed completely only after four months. Lesions in the locks persisted for the longest period.

The two dogs were treated with Mycoceton spray (Galena). The lesions healed completely within one month. The afflicted cats were killed by their owners, and homeless cats were liquidated by the village inhabitants.

DISCUSSION

The microsporosis under study, caused by the dermatophyte *M. canis* in a rural natural focus, is characterized by group cases of this type, described by foreign authors (e.g. Lapchevich et al. 1972, Door 1968, Pambor and Krentel 1965, Winkler 1970, Gaál et al. 1977). The close connection between patients No. 2, 3 and 4 in our cases also confirms the possible occurrence of this dermatophytosis within families (Blaschke-Hellmessen et al. 1973). In the opinion of these authors as source of human infection is considered to be an animal; the transmission of *M. canis* through interhuman contact is only exceptional (Door 1968). Likewise, the source of pathogenic agent in our cases were homeless cats, from which microsporosis spread in a chain-like manner to other cats and dogs kept in homes. Finally, the contact with such animals has led to human infection. The transmission man—animal was not observed in the natural focus, although this route of infection is possible. Kaplan (1967) e.g. points out the importance of this route of transmission in the increased virulence of the fungus.

Our observation confirm the earlier published suggestions that *M. canis* afflicts primarily young, very old or otherwise weak animals (Otčenášek et al. 1980). Two of the afflicted cats were juvenile, two homeless cats were undernourished and neglected. A probable moment of predisposition to microsporosis in one of the dogs examined was a previous injury of the site afflicted by infection.

The outbreak of dermatophytosis was also promoted by the way of life of homeless cats. The roaming of these animals is often mentioned as an important factor promoting the acquisition of dermatophyte infection (Stepanishcheva 1959, Gaál et al. 1977, Dvoretzky et al. 1978).

From the aspect of natural focality a very interesting problem is the *M. canis* survival in periods between rarely demonstrated occurrences of this dermatophyte. We must either suppose that for long periods this agent was really absent in our territory and that rare cases were caused by a dermatophyte brought in from other territories, or we must admit a possible long-term *M. canis* survival in nature which has not yet been demonstrated.

The first possibility is supported by the case microsporosis reported from Slovakia, where the source of infection was a kitten from a litter of Persian cats imported from England (Buchvald 1976), as well as our *M. canis* isolation from the hair of two dogs imported from the Federal Republic of Germany. Particularly thoroughbred cats and dogs are constantly and extensively transported on intercontinental scale (international exhibitions, import of animals etc.). Because such activities are under strict veterinary control which would not overlook manifest infection, of greatest importance here may be inapparent forms of afflicted animal hair.

The other possibility mentioned is also probable. Stepanishcheva (1959) experimentally demonstrated that *M. canis* in pathologic material stored under laboratory conditions retains its pathogenic properties as long as 18 months. Other report

(Keep 1960) says that this dermatophyte remains to be viable on hairs of cats in extra-animal environment as long as 400 days. The agent's viability maintained in external environment is evidenced e.g. by the information of Andriasyan (1978), who isolated *M. canis* from soil and dust in places visited by cats and dogs, and also by the finding of the virulent *M. canis* strains from soil samples taken at a bathing place (Evolceanu and Alteras 1967).

A biologically highly differentiated dermatophyte such as *M. canis*, specialized to a parasitic way of life, cannot be supposed to proliferate actively in external environment. Although a perfect stage — *Nannizzia otae* Hasegawa et Usui 1975, was described in this species and its existence may be connected with the capability of soil saprophytism, we do not assume, that this stage could play a role in the agent's complete ontogenetic cycle as a developmental phase indispensable for its existence. Unlike geophilic dermatophytes (*Microsporum gypseum*), which live saprophytically in soil as part of their development, in specialized parasites the sexual reproduction is suppressed and soil saprophytism is not supposed to take place. Therefore in *M. canis* only time-limited maintenance of paratrophic phase elements in soil substrates is taken into account.

According to the classification of natural foci of mycoses (Rosický et al. 1980) the natural focus of dermatophytosis caused by *M. canis* belongs to vivarial foci characterized by the irradiation of the agent into human population from animal reservoirs which are, beside laboratory animals, also pets.

As far as their importance is concerned in Czechoslovakia these vivarial foci rank third behind bosquematic and domestical foci in which the species *Trichophyton mentagrophytes* and *T. verrucosum* play a role of pathogenic agents. In such cases they are typical anthropourgic foci, important in rural as well as urban areas.

In the near future the number of *M. canis* cases is likely to be incrased in Czechoslovakia. This prognosis is based on the general tendency toward the increasing percentage of *M. canis* among other zoophilic dermatophytes, observed in other countries. Besides, it may depend on the ever more favourable conditions for the formation of new foci; these conditions are being created primarily by the advancing urbanization of landscape and the increase of the number of cats kept as pets.

ПРИРОДНЫЙ ОЧАГ МИКРОСПОРИИ, ВЫЗЫВАЕМОЙ *MICROSPORUM CANIS* BODIN

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Резюме. Авторами обнаружен природный очаг микроспории, вызываемой дерматофитом *Microsporum canis* Bodin. Этим дерматофитозом заболели взрослый человек и четверо детей. Скрытые и явные формы заболевания в очаге также обнаружены у нескольких кошек и собак. Источником возбудителя и его постоянными хозяевами были определены бездомные кошки. От этих животных заболевание передавалось содержимым в жилых домах кошкам и собакам и членам семьи их хозяев. Клиническая картина заболевания и также характеристика выделенных штаммов соответствуют литературным данным. В работе подытожены полученные до сих пор данные по эпидемиологии вызываемых *M. canis* микроспорий.

ANDRIASYAN S. G., Some epidemiological features of anthropozoonotic microsporosis caused by *Microsporum canis*. Vest. Derm. Vener. 2: 78—81, 1978. (In Russian.)

BADILLET G., Population Parisienne et dermatophytes transmis par les animaux. Bull. Soc. Franc. Mycol. Med. 6: 109—114, 1977.

BLASCHKE-HELMESSEN R., Zur Dermatophytenflora im Bezirk Dresden. Arch. klin. exp. Derm. 224: 447—462, 1966.

—, BÜCHNER S., HERKOLTZ R., BOYE E., Familiäre Gruppenerkrangungen durch *Microsporum canis* Bodin 1902 im Bezirk Dresden. Derm. Mschr. 159: 391—397, 1973.

BÖHM K. H., Eine Mikrosporie bei Orang-Utans und Gorillas. Kleint. Prax. 11: 185—188, 1966.

BUCHVALD J., Mycological investigation of anthropozoonotic microsporosis (*Microsporum canis* Bodin, 1902). (First occurrence in Slovakia). Čs. derm. 51: 36—40, 1976.

CASTRO R. M., FISCHMAN O., TALARICO S. F., LAU D., Epizootia por *Microsporum canis* en perros de raza San Bernardo. Castellania 4: 215—217, 1976.

DOOR W. C., An epidemic of microsporia caused by *Microsporon canis* (s. *felineum*). Ned. T. Geneesk. 112: 258—261, 1968.

DONALD G. F., BROWN G. W., SHEPPARD R. A. W., The dermatophytic flora of South Australia. A Survey of 1891 cases of tinea studied between 1954—1964. Austr. J. Derm. 8: 73—77, 1965.

DURIE E. B., FREY D., Fungus infections of the skin in Australia. Austr. J. Derm. 9: 232—236, 1968.

DVORETZKY I., SEMAH D., SOMMER B., FISCHER B. K., *Microsporum canis* infection: first epidemic in Israel. Sabouraudia 16: 79—81, 1978.

EVOLCEANU R., ALTERAS I., Isolierung von *Microsporum canis* aus Bodenproben in Rumänien (Bucharest). Mykosen 10: 243—246, 1967.

GAÁL T., GALGÓCZY J., HORWÁTH Z., Microsporiasis of cat, dog and man within a family. Mag. Állat. Lapja 32: 33—36, 1977.

HASEGAWA A., USUI K., *Nannizzia otae* sp. nov., the perfect state of *Microsporum canis* Bodin. Jap. J. Vet. Sci. 36: 447—449, 1975.

KABEN U., Verbreitung und Epidemiologie der Dermatomykosen tierischen Ursprungs. Mykosen 10: 47—60, 1967.

KALRA S. L., MOHAPATRA L. N., GUGNANI H. C., Etiology of dermatomycoses in Delhi. Ind. J. Med. Res. 52: 553—558, 1964.

KAPLAN W., Epidemiology and public health significance of ringworm in animals. Arch. Derm. 96: 404—408, 1967.

KEEP J. M., The viability of *M. canis* on isolated cat hair. Austr. Vet. J. 36: 377—378, 1960.

KNUTZE A., GEMEINHARDT H., BENSCH G. J., Über eine *Microsporum canis* Endemie bei Zootieren mit berufsbedingter Infection beim Menschen. Mykosen 10: 7—18, 1967.

LAPČEVIČ E., ČIRIĆ V., MARJANOVIĆ D., Dermatomycosis in man, dogs and cats caused by *Microsporum canis*. Vet. Glas. 4: 235—237, 1972.

MANTOVANI A., MORGANTI L., Dermatophytozoonoses in Italy. Vet. Sc. Comm. 1: 171—177, 1977.

MARCELOU-KINTI U., PAPAVASSILIOU J., KOUIMOUTSOPOULOS J., CAPETANAKIS J., Die Häufigkeit von Dermatophyten an Haaren gesunder Katzen und Hunde. Mykosen 20: 71—74, 1977.

MARTÍNEZ R. L., RUIZ E. M., MARIAT F., MOTTA C. N., Dermatofitos algunos de sus aspectes epidemiologicos. Rev. Med. IMSS. 11: 242—247, 1972.

MC CAFFREE D. L., FETHIERE A., BLANK F., Dermatophytic flora of Philadelphia. Dermatologica 138: 115—123, 1969.

MORGANTI L., BATTELLI G., BIANCHEDI M., Dermatophytes isolated from man, dog and cat in the city of Rome. Nuov. Ann. Ig. Micr. 27: 239—245, 1976.

NIKIFOROV L. I., Causative agents of dermatomycoses in fur bearing animals and rabbits. Bull. Vses. Inst. Eksp. Vet. 25: 74—75, 1976. (In Russian.)

OTČENÁŠEK M., Ecology of dermatophytes. Mycopathol. 65: 67—72, 1978.

—, KOMÁREK J., DVOŘÁK J., Cat and dog microsporia caused by the dermatophyte *Microsporum canis* Bodin. Vet. Med. 19: 169—173, 1974.

PAMBOR M., KRENTEL G., Microsporie durch *Microsporum canis* im Bezirk Magdeburg und ihre Behandlung mit Griseofulvin. Derm. Wochenschr. 151: 1151—1160, 1965.

PROCHACKI A., Mycological flora isolated from people in Poland. Mycopath. et Mycol. Appl. 40: 65—72, 1970.

RICARD P., MARTINEAU B., CARÉ J., AUGER P., Incidence des infections mycosiques superficielles à l'hospital Sainte-Justine de Montreal. L'un. Med. Canad. 100: 2345—2351, 1971.

ROSICKÝ B., OTČENÁŠEK M., DVOŘÁK J., Theoretical questions of the natural focality of mycoses. 1980. (In press.)

SHEKLAKOV N. D., STEPANOVA Zh. V., LESCHENKO W. M., Einige Fragen der Epidemiologie, Klinik und Behandlung der durch *Microsporum lanosum* bedingten Mikrosporie. Mykosen 15: 153—164, 1972.

SEGRETAIN G., Quelques données sur les champignons pathogènes pour l'homme au Maroc. Maroc. Méd. 48: 27—35, 1968.

SONG M., DEMOULIN L., WIAME L., ACH-

TEN G., Examens mycologiques en dermatologie et leurs enseigments. Arch. Belg. Der. 30: 241—248, 1974.
STEPANISHCHEVA Z. G., Experimental materials to the epidemiology of Microsporosis and biology of *Microsporum lanosum*. Autoref. Diss. Med. Inst. I. M. Setchenova, 21 pp. Moskva, 1959. (In Russian.)
STEPANOVA Zh. V., DAVYDOV V. I., On *Microsporum lanosum* carrier state in healthy animals. Vest. Derm. Vener. 3: 42—46, 1970. (In Russian.)
VANBREUSEGHEM R., Les teignes en République de Somalie. Bull. l'acad. Royal Med. (Belg.) 6: 247—260, 1966.
VERHAGEN A. R. H. B., MANIAR S. H., Dermatophytoses in Kenya. Trans. Royal. Soc. Trop. Med. Hyg. 63: 275—283, 1969
WINKLER A., Endemie durch *Microsporum canis* übertragen durch eine Siam-Katze. Mykosen 13: 45—48, 1970.
WOODGYER A. J., Asymptomatic carriage of dermatophytes by cats. New Zealand Vet. J. 25: 67—68, 1977.

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A. I. Cherepanov (Ed.): Transkontinentaľniye svyazi pereletnykh ptits i ikh roĺ v rasprostranenii arbovirusov. (Transcontinental connections of migratory birds and their role in the distribution of arboviruses.) *Publ. House Nauka, Novosibirsk 1978, 325 pp. Price 3.40 R.*

This volume contains papers presented at a symposium held in Novosibirsk July 28 — August 1, 1976 under the above mentioned title (see Daniel M., Folia parasit. (Praha) 24: 259—260, 1977). The proceedings are divided into 4 parts: Regional and transcontinental migrations of birds (40 papers), Biocenotic correlations of migratory birds (16 papers), Ecology of arboviruses and ways of their transmission in biocenosis (24 papers) and Parasites of birds — reservoirs and carriers of arboviruses (18 papers). The first part covers the ornithological problems and contains mainly contributions concerning migrations of Euro-Asiatic species of birds. The second part is devoted to various aspects of the role of birds in the ecology of arboviruses and in their circulation in natural foci of different geographical areas. The third part contains similar series of problems together with data on the incidence of some viroses in particular countries and results of experimental studies. The final part deals with various groups of bird ectoparasites, primarily from the faunistical point of view. All who are interested in the questions of interrelations between birds, arboviruses and their vectors, will find in these proceedings many suggestive papers. The study of these problems gives a new stimulus to a cooperation of virologists, ornithologists and parasitologists.

Dr. V. Černý, C.Sc.