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RESULTS OF ARBOVIROLOGICAL EXAMINATION OF BIRDS OF THE FAMILY HIRUNDINIDAE IN CZECHOSLOVAKIA

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Abstract. Migratory birds (swallow, *Hirundo rustica*; sand martin, *Riparia riparia*; house martin, *Delichon urbica*) caught in southern Moravia (Czechoslovakia) in 1984–87 were examined for arbovirus infections. Isolation experiments were carried out using blood samples of 183 birds (52 swallows, 107 sand martins, and 24 house martins). The results were negative. Serological examinations of 136 birds (36 swallows, 86 sand martins, and 14 house martins) were made by haemagglutination-inhibition test (HIT) using 6 arboviral antigens of the genera *Alphavirus* (Sindbis – SIN) and *Flavivirus* (tick-borne encephalitis – TBE, West Nile – WN) and of the family Bunyaviridae (Ťahyňa – TAH, Čalovo, CVO, and Bhanja – BHA). Antibodies against all of the tested viruses were detected at different rates: SIN 2.9 %, TBE 1.5 %, WN 1.5 %, TAH 4.4 %, CVO 1.5 %, and BHA 2.2 %. The titres ranged from 1.20 to 1.80.

The role of migratory birds in the inter- and intracontinental dissemination of some arboviruses is well known (Ernek et al. 1977). The present paper deals with the occurrence of these viruses in the family Hirundinidae, namely in the species *Hirundo rustica* (swallow), *Riparia riparia* (sand martin), and *Delichon urbica* (house martin), which we considered to be interesting since they migrate up to the middle and southern Africa.

MATERIALS AND METHODS

Birds were caught into mist nets from April to August during 4 years in the course of their spring and autumn migration. South-Moravian localities in the district Břeclav (pond Nesyt near Sedlec; Valtice; Mušov reservoir near Dolní Věstonice) were chosen for this purpose, since this is an area of inundations creating optimum conditions for mosquitoes, as well as the rushes around the ponds (Juřicová et al. 1987).

Blood for isolation and serological examinations was collected by hematocrit microcapillaries (Juřicová et al. 1986) from vena ulnaris cutanea and samples of blood serum were tested by HIT.

Isolation examination of blood. Blood was collected by punction from vena ulnaris cutanea and diluted at the ratios of 1 : 1 – 1 : 3 in cooled PBS (pH 7.2) with bovalbumine (0.75 %), antibiotics (penicillin 200 i.u./ml and streptomycin 100 μg/ml), and heparin (10 u./ml). The samples were stored at – 60 °C until i.c. inoculations (0.02 ml) of 2-4-day-old SPF mice of randombred ICR strain (Velaz, Praha). The inoculated animals were observed for 21 days. Bacterial sterility of samples was tested simultaneously in beef-extract broth and thioglycollate broth (IMUNA, Šarišské Michalany). Blood samples used for the inoculation were mixtures made of blood of 1–3 birds of the same species and originating from the same locality.

Haemagglutination-inhibition test (HIT). The used standard micromethod was described in detail in our previous paper (Juřicová 1982). TBE antigen was a commercial product (Imuna), other antigens were prepared by cucrose-acetone extraction from brains of infected sucking mice after Clark and Casals (1958). Four haemagglutinin units were used in the test. Titres of 1 : 20 and higher were taken for positive.

RESULTS

A total of 183 birds (52 swallows, 107 sand martins, ad 24 house martins) were subjected to the isolation examinations. The results were negative.

Serological examinations were performed with 136 birds (36 swallows, 86 sand martins, and 14 house martins). The results are summarized in Table 1.

Antibodies against SIN virus were detected in 3 of the 36 swallows and in 1 of the 86 sand martins examined. They were not detected in the sera of house martins. Four of the 136 birds examined were positive (2.9%).

TBE virus infection was demonstrated in 1 of the 36 swallows and in 1 of the 86 sand martins examined. Antibodies against this virus were not detected in house martins. The total positivity was 1.5%.

Table 1. Records of antibodies against arboviruses in free-living birds detected by HI test

Species	Antibodies against arboviruses						
	SIN x/y	TBE	WN	TAH	CVO	BHA	pozitiv
Hirundo rustica	3/36	1/36	0/36	3/36	1/36	1/36	8/36[z]
Riparia riparia	1/86	1/86	1/86	3/86	1/86	2/86	8/86[z]
Delichon urbica	0/14	0/14	1/14	0/14	0/14	0/14	1/14
Total	4/136	2/136	2/136	6/136	2/136	3/136	19/136
Total positive findings (%)	2.9	1.5	1.5	4.4	1.5	2.2	12.5

x — Number of positive sera
y — Number of examined sera
z — Antibodies against two arboviruses were detected simultaneously in the same bird

Antibodies against WN virus were detected only in 1 of 86 sand martins (cross reaction with TBE antigen was not observed) and in 1 of 14 house martins, i.e. in 1.5% of the total number of birds examined.

TAH virus infection was the highest and antibodies against this virus were detected in 3 of the 36 swallows and in 3 of the 86 sand martins examined, which represents 4.4% positivity in the total number of birds.

Antibodies against CVO virus were detected in 1 of 36 swallows and in 1 of 86 sand martins, i.e. in 1.5% of the total number of birds examined.

Antibodies against BHA virus were detected in 1 of 36 swallows and in 2 of 86 sand martins. Three (2.2%) of the total number of birds examined were positive.

DISCUSSION

In the studied period (1984—87), the highest rate of bird infection was recorded in case of TAH and SIN viruses (4.4% and 2.9%, respectively), which are transmitted by mosquitoes. The infection with CVO and WN viruses was 1.5% and 1.5%, respectively. This situation may be caused by the fact that all the three species nested

near water reservoirs at the time of netting, i.e. at the places with optimum conditions for the occurrence of numerous mosquito species, which can be specific vectors of arboviruses.

The detection of abtibodies against TAH, SIN, CVO, and WN viruses is in agreement with earlier records by Ernek et al. (1971, 1975) in the same region or in Slovakia (Ernek et al. 1975, 1977) and with our observations from previous years (Juřicová et al. 1987). Antibodies against mosquito arboviruses were found in birds also in Austria (Aspöck 1973) and Bulgaria (Grešíková et al. 1962). It cannot be excluded that under suitable conditions and in a suitable biotope these viruses can circulate in Central Europe. This is indicated by the isolation of SIN virus (Ernek et al. 1973) and WN virus (Grešíková et al. 1975) in Slovakia in non-migratory and young migratory birds. However, it should be taken into consideration that the migratory birds may become infected by SIN and WN viruses in another country, either during migration or during overwintering.

The sand martins overwinter in the whole Africa, frequently already to the north from the equator, from Senegal to Ethiopia. The European and also Czechoslovak populations migrate to the south or south-east; the overwintering of birds from Czechoslovakia was confirmed only in Nigeria and over the territory of Czechoslovakia migrate only birds from FRG, GDR, Poland, and Sweden. The swallow overwinters in the whole tropical and southern Africa. The populations from Czechoslovakia overwinter mainly in equatorial Africa from Cameroun to Kenya, where they migrate, similarly as from the whole Europe, widely dispersed from the south-east across the Pyrenean Peninsula and West Africa up to south-east across Arabia and to East Africa. Over the territory of Czechoslovakia migrate the swallows of northern populations, from FRG over South Sweden up to Ukrainian SSR. The house martin overwinters in the whole Africa, south of the Sahara, where the European populations migrate in the direction between south-west and south-east. Birds from Czechoslovakia were caught only in North Africa. Across the territory of Czechoslovakia migrate also birds from northern Europe (Scandinavia), as it was reported by Moreau (1972), Hudec et al. (1983), and Glutz von Blotzheim and Bauer (1985).

The detection of antibodies against viruses transmitted by ticks revealed 1.5% infection in birds infected with TBE virus and 2.2% in birds infected with BHA virus. No ticks were found on the examined birds, but the ticks, particularly of the genus *Ixodes*, were abundant in the locality under study covered by inundated forests. Antibodies against TBE virus were detected in birds by Ernek et al. (1967, 1971, 1975, 1977) in our country. Antibodies against viruses of B group were reported by Porterfield and Ash (1966) in birds caught in Africa and by Filipe (1971) in birds caught in Portugal.

Our results concerning antibodies against BHA virus are similar to those obtained by Verani et al. (1970), who recorded 1.9% of positive birds using HIT. It is little probable that birds may act as hosts-amplifiers of BHA virus, but they may play a role in the introduction of infected ticks into the region of their migration (Hubálek and Rödl 1980). For instance, vectors of BHA virus, *Haemaphysalis punctata* and *Hyalomma marginatum*, were found in swallow (Hubálek et al. 1982). Interesting results were obtained by Bárdoš et al. (1983), who detected a high level of antibodies against BHA virus (24%) in *Corvus splendens* caught at the abattoir in Colombo, Sri Lanka.

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РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЯ ПТИЦ СЕМЕЙСТВА HIRUNDINIDAE В ЧЕХОСЛОВАКИИ НА ПРИСУТСТВИЕ АНТИТЕЛ К АРБОВИРУСАМ

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Резюме. Мигрирующих птиц (деревенская ласточка, *Hirundo rustica;* береговая ласточка, *Riparia riparia;* городская ласточка, *Delichon urbica*), отловленных в южной Моравии (Чехословакия) в 1984—1987 гг. исследовали на присутствие антител к арбовирусам. Опыты по выделению антител проводили с помощью образцов крови 183 птиц (52 деревенских ласточек, 107 береговых ласточек и 24 городских ласточек). Результаты были отрицательны. Серологические исследования 136 птиц (36 деревенских ласточек, 86 береговых ласточек и 14 городских ласточек) проводили с помощью теста торможения гемагглютинации и 6 антигенов арбовирусов родов *Alphavirus* (Sindbis — SIN), и *Flavivirus* (вирус клещевого энцефалита — TBE, вирус Западного Нила — WN) и семейства Bunyaviridae (вирус Тягиня — Tag, вирус Чалово — CVO и вирус Банджа — BHA). Количество обнаруженных антител к изучаемым вирусам было следующее: SIN 2,9 %, TBE 1,5 %, WN 1,5 %, TAH 4,4 %, CVO 1,5 %, BHA 2,2 %. Титры антител были от 1 : 20 до 1 : 80.

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