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INVESTIGATIONS OF HEMORRHAGIC FEVER WITH RENAL SYNDROME (HFRS)
IN YUGOSLAVIA

MIDTERM REPORT

ANA GLIGIC

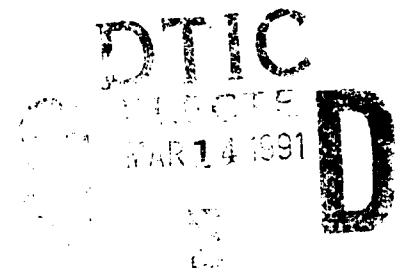
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19. ABSTRACT (Continue on reverse if necessary and identify by block number) Five hundred and forty four rodents and small mammals were trapped in various regions of Yugoslavia and examined. Antihantaviruses, immunofluorescent (IF) antibodies were detected in the blood samples of 129 animals. Antigens were detected in the lung samples of 139 animals. Sixty-seven animals tested positive for both the presence of antibodies in the sera and antigens in the lungs. Studies on the immune status of healthy people in various HFRS endemic areas were conducted. Blood samples from over 700 forest workers, farmers, and other individuals with considerable outdoor exposure were collected and tested serologically for antibodies to hantaviruses. Approximately 336 individuals possessed hantaviral antibodies. In 1989, an HFRS epidemic occurred throughout Yugoslavia, over 600 individuals were hospitalized and 15 deaths occurred. The epidemic occurred in all six republics and two provinces of Yugoslavia, in both previously recognized and newly recognized foci areas. The greatest number of HFRS patients were from the Republics of Bosnia, Herzegovina, and Serbia. In the beginning of the epidemic, it was determined that					
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19. Abstract (continued)

the most severe cases of HFRS, and ultimately the highest lethality rate, occurred in those individuals with a specific immune response against Hantaan rather than Puumala. More detailed data are currently being gathered and analyzed.

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✓ In conducting research using animals, the investigator(s) adhered to the "Guide for the Care and Use of Laboratory Animals," prepared by the Committee on Care and Use of Laboratory Animals of the Institute of Laboratory Resources, National Research Council (NIH Publication No. 86-23, Revised 1985).

For the protection of human subjects, the investigator(s) adhered to policies of applicable Federal Law 45 CFR 46.

In conducting research utilizing recombinant DNA technology, the investigator(s) adhered to current guidelines promulgated by the National Institute of Health.

Ana Glisic, May 7, 1990.

PI Signature

Date

Table 1.

Small mammals captured in endemic areas in Yugoslavia tested for IF antibodies to Hantaan and Puumala viruses and hantaviruses antigens

Location	Species	Number of Trapped	Number of Ang. Positive	Number of Ant. Positive	Number of Ang. & Ant. Positive
Čačak	Apodemus flavicollis	1	1/1	0/1	0
	A. sylvaticus	90	14/90	4/90	3
	A. agrarius	44	6/44	2/44	2
	A. microps	5	1/5	1/5	1
	Sorex araneus	1	0/0	0/1	0
	Crocidura subalveolens	8	2/8	0/2	0
Ivanjica	A. flavicollis	12	3/12	2/12	1
	A. sylvaticus	17	4/17	0/17	0
	Clethrionomys glareolus	1	1/1	1/1	1
	Pitimus subterraneus	1	1/1	0/1	0
	Mus musculus	7	3/7	0/7	0
	Sorex araneus	2	1/2	0/0	0
	Neomys fodiens	2	2/2	0/0	0
	A. flavicollis	11	1/11	1/11	1
Požarevac	A. sylvaticus	24	5/24	2/24	1
	A. agrarius	20	4/20	2/20	2
	A. microps	1	0/1	0/0	0
	P. subterraneus	2	0/2	0/0	0
	M. arvalis	2	0/1	0/1	0
	Mus musculus	21	8/20	6/18	4
	Rattus norvegicus	5	5/5	4/5	4
	Crocidura subalveolens	5	1/5	0/0	0
Karlovac and Oštarije	A. flavicollis	1	1/1	0/1	0
	A. sylvaticus	1	1/1	0/1	0
	R. Norvegicus	16	4/16	7/16	2
Novo Mesto	A. flavicollis	3	2/3	0/3	0
	A. sylvaticus	6	1/6	0/6	0
	P. subterraneus	1	0/1	0/1	0
Plitvice Lakes	A. flavicollis	84	17/84	27/83	9
	Cl. glareolus	60	18/60	30/58	14
	Sorex alpinus	1	1/1	0/1	0
Olovo	A. flavicollis	28	7/28	12/25	5
	A. sylvaticus	6	1/6	3/6	1
	Mus musculus	1	1/1	1/1	1
Hadžići	A. flavicollis	49	21/49	24/49	15
	A. sylvaticus	2	0/2	0/2	0
	Cl. glareolus	2	1/2	0/2	0
	M. species	1	0/1	0/1	0
T O T A L		544	139/541	129/516	67

No. positive/No. examined

IF = immunofluorescent test; NT = not tested; Ang. = antigen; Ant. = antibody

Table 2.
Percentage of hantavirus antigen (IFA) in different species of small mammals
according to different endemic foci of HFRS in Yugoslavia during epidemic in 1989

Endemic Foci	CACAK		IVANJICA		POZAREVAC		KARLOVAC		N. MESTO		PLITVICE		OLOVO		HADICI		TOTAL	
	%1	Ag+2	%1	Ag+2	%1	Ag+2	%1	Ag+2	%1	Ag+2	%1	Ag+2	%1	Ag+2	%1	Ag+2	%1	Ag+2
Small Mammals																		
APODEMUS AGRARIUS	29.5	15.9	-	-	22.2	20.0	-	-	-	-	-	-	-	-	-	-	11.8	17.2
A. FLAVICOLLIS	0.7	100.0	28.6	25.0	12.2	9.1	5.5	100.0	30.0	66.7	57.9	20.2	80.0	20.0	90.7	44.9	34.8	28.6
A. MICRIPS	3.4	20.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	20.0
A. SYLVATICUS	60.4	15.5	40.5	23.5	26.6	20.8	5.5	100.0	60.0	16.7	-	-	17.1	16.7	3.7	-	26.9	17.8
CLETHRIONOMYS GLAREOLUS	-	-	2.4	100.0	-	-	-	-	-	-	41.4	30.0	-	-	3.7	50.0	11.6	31.7
MICROTUS ARVALIS	-	-	-	-	2.2	-	-	-	-	-	-	-	-	-	-	-	0.4	-
MICROTUS SPECIES	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8	-	0.2	-
PITIMYS SUB.	-	-	2.4	100.0	2.2	-	-	-	10.0	-	-	-	-	-	-	-	0.7	25.0
MUS MUSCULUS	-	-	16.6	42.8	23.3	40.0	-	-	-	-	-	-	2.8	100.0	-	-	5.3	32.1
RATTUS NORVEGICUS	-	-	-	-	5.5	100.0	88.9	25.0	-	-	-	-	-	-	-	-	3.9	42.8
CROCIDURA SUB	5.4	25.0	-	-	5.5	20.0	-	-	-	-	-	-	-	-	-	-	2.4	23.1
SOREX ALPINUS	-	-	-	-	-	-	-	-	-	-	0.7	100.0	-	-	-	-	0.2	100.0
SOREX ARANEUS	0.7	-	4.8	50.0	-	-	-	-	-	-	-	-	-	-	-	-	0.6	50.0
NEOMIS FODIENS	-	-	4.8	100.0	-	-	-	-	-	-	-	-	-	-	-	-	0.4	100.0
TOTAL No.	149	24	42	15	90	24	18	6	10	3	145	36	35	9	54	23	543	140
%	100.0	16.1		35.7	26.6		33.3		30.0		24.8		25.7		42.3		25.8	

Ag = hantavirus antigen

"1" = % from the number of trapped small mammals

"2" = % Ag positive from total number of investigated species

TABLE 3
Presence of hantavirus antigen and antibody in different species of small mammals
according to age and sex during epidemic of HFRS in Yugoslavia in 1989

Mammals	Ag	Ab	Ag and Ab	Juvenile form	Subadult form	Adult form	Male	Female
APODEMUS AGRARIUS	11 / 64	6 / 64	6 / 64	3	36	25	31	33
A. FLAVICOLLIS	54 / 189	66 / 184	33 / 184	3	20	166	112	77
A. MICROPS	1 / 4	1 / 4	1 / 4	0	1	4	1	4
A. SYLVATICUS	26 / 146	9 / 146	6 / 146	3	31	112	89	57
CL. GLAREOLUS	20 / 63	31 / 61	15 / 61	0	3	60	18	45
MICROTUS ARVALIS	0 / 1	0 / 1	0 / 1	0	1	1	2	0
MICROTUS SPECIES	0 / 1	0 / 1	0 / 1	0	0	1	1	0
PITIMYS SUB.	1 / 4	0 / 2	0 / 2	0	1	3	0	4
MUS MUSCULUS	9 / 29	5 / 26	5 / 26	4	7	18	15	14
RATTUS NORVEGICUS	9 / 21	11 / 21	6 / 21	6	0	15	8	13
CROCIDURA SUB.	3 / 13	0 / 2	0 / 2	0	2	11	7	6
SOREX ALPINUS	1 / 1	0 / 1	0 / 1	0	0	1	1	0
SOREX ARANEUS	1 / 2	0 / 1	0 / 1	0	1	2	1	2
NEOMIS FODIENS	2 / 2	0 / 0	0 / 0	0	0	2	1	1
TOTAL	139 / 540	129 / 516	67 / 516	19	103	421	287	256

Ag+ = No. hantavirus antigen positive / No of investigated
Ab+ = No. hantavirus antibody positive / No of investigated

TABLE 4

Percentage of hantavirus antigen and antibody positive small mammals according age and sex in correlation with different foci of HFRS in Yugoslavia in 1989

FOCI	CACAK	IVANJICA	POZAREVAC	KARLOVAC	NOVO MESTO	PLITVICE	OLOVO	HADICI	TOTAL
Ag+	16.2	35.7	26.6	33.3	30.0	24.8	25.7	42.6	25.8
Ab+	4.9	7.9	16.6	38.8	0.0	40.1	50.0	44.4	25.0
Ag+ and Ab+	4.2	5.2	15.4	11.1	0.0	16.2	21.8	27.7	12.9
Juvenile	2.1	0.0	6.6	33.3	10.0	1.4	0.0	1.8	3.5
Subadult	40.9	4.7	22.2	0.0	10.0	13.8	5.7	1.9	18.9
Adult	55.7	95.3	71.2	66.7	80.0	84.8	94.3	96.3	77.6
Male	63.7	33.3	46.7	44.4	60.0	44.8	71.4	66.7	52.8
Female	36.3	66.7	53.3	55.6	40.0	55.2	28.6	33.3	47.2

Ag+ = No. of Antigen positive

Ab+ = No. of Antibody positive

TABLE 5

Hantavirus antigen and antibody positive small mammals in CACAK region according to age and sex

CACAK	No. trapped	Ag+	Ab+	Ag+ and Ab+	Juvenile form	Subadult form	Adult form	Male	Female
APODEMUS AGRARIUS	44	7	2	2	1	27	16	22	22
A. FLAVICOLLIS	1	0	0	0	0	0	1	1	0
A. MICROPS	5	1	1	1	0	1	4	1	4
A. SYLVATICUS	90	14	4	4	2	26	62	67	23
CROCIDURA SPEC.	8	2	0	0	0	6	2	4	4
SOREX ARANEUS	1	0	0	0	0	0	1	1	0
TOTAL No.	149	24	7	7	3	60	86	96	53

Ag+ = No. of Antigen positive

Ab+ = No. of Antibody positive

TABLE 6

Hantavirus antigen and antibody positive small mammals in
IVANJICA region according to age and sex

IVANJICA	No. trapped	Ag+	Ab+	Ag+ and Ab+	Juvenile form	Subadult form	Adult form	Male	Female
APODEMUS FLAVICOLLIS	12	3	2	1	0	0	12	4	8
A. SYLVATICUS	17	4	0	0	0	1	16	6	11
CL. GLAREOLUS	1	1	1	1	0	0	1	0	1
PITIMYS SUBTERRANEUS	1	1	0	0	0	0	1	0	1
MUS MUSCULUS	7	3	0	0	0	0	7	3	4
SOREX ARANEUS	2	1	0	0	0	1	1	0	2
NEOMIS FODIENS	2	2	0	0	0	0	2	1	1
TOTAL No.	42	15	3	2	0	2	40	14	28

Ag+ = No. of Antigen positive

Ab+ = No. of Antibody positive

TABLE 7

Hantavirus antigen and antibody positive small mammals in
POZAREVAC region according to age and sex

POZAREVAC	No. trapped	Ag +	Ab+	Ag+ and Ab+	Juvenile form	Subadult form	Adult form	Male	Female
APODEMUS AGRARIUS	20	4	2	2	2	8	10	9	11
A. FLAVICOLLIS	11	1	1	1	0	1	10	6	5
A. MICRIPS	1	0	0	0	0	0	1	0	1
A. SYLVATICUS	24	5	2	1	0	2	22	9	15
MICROTUS ARVALIS	2	0	0	0	0	1	1	2	0
PITIMYS SUBTERRANEUS	2	0	0	0	0	1	1	0	2
MUS MUSCULUS	21	8	4	4	4	7	10	11	10
RATTUS NORVEGICUS	5	5	4	4	0	0	5	2	3
CROCIDURA SUB.	5	1	0	0	0	0	5	3	2
TOTAL No.	91	24	13	12	6	20	65	42	49

Ag+ = No. of Antigen positive

Ab+ = No. of Antibody positive

TABLE 8

Hantavirus antigen and antibody positive small mammals in
KARLOVAC region according to age and sex

KARLOVAC	No. trapped	Ag+	Ab+	Ag+ and Ab+	Juvenile form	Subadult form	Adult form	Male	Female
APODEMUS FLAVICOLLIS	1	1	0	0	0	0	1	1	0
A. SYLVATICUS	1	1	0	0	0	0	1	1	0
RATTUS NORVEGICUS	16	4	7	2	6	0	10	6	10
TOTAL No.	18	6	7	2	6	0	12	8	10

Ag+ = No. of Antigen positive

Ab+ = No. of Antibody positive

TABLE 9

Hantavirus antigen and antibody positive small mammals in
NOVO MESTO region according to age and sex

NOVO MESTO	No. trapped	Ag+	Ab+	Ag+ and Ab+	Juvenile form	Subadult form	Adult form	Male	Female
APODEMUS SYLVATICUS	6	1	0	0	1	1	4	4	2
PITIMYS SUBTERRANEUS	1	0	0	0	0	0	1	0	1
RATTUS NORVEGICUS	3	2	0	0	0	0	3	2	1
TOTAL No.	10	3	0	0	1	1	8	6	4

Ag+ = No. of Antigen positive

Ab+ = No. of Antibody positive

TABLE 10
Hantavirus antigen and antibody positive small mammals in
PLITVICE region according to age and sex

PLITVICE	No. trapped	Ag+	Ab+	Ag+ and Ab+	Juvenile form	Subadult form	Adult form	Male	Female
APODEMUS FLAVICOLLIS	64	17	27	9	2	17	65	47	37
CI. GLAREOLUS	60	18	30	14	0	3	57	18	42
SOREX ALPINUS	1	1	0	0	0	0	1	0	1
TOTAL No.	145	36	57	23	2	20	123	65	80

Ag+ = No. of Antigen positive
Ab+ = No. of Antibody positive

TABLE 11
Hantavirus antigen and antibody positive small mammals in
OLOVO region according to age and sex

OLOVO	No. trapped	Ag+	Ab+	Ag+ and Ab+	Juvenile form	Subadult form	Adult form	Male	Female
APODEMUS FLAVICOLLIS	28	7	12	5	0	2	26	22	6
A. SYLVATICUS	6	1	3	1	0	0	6	2	4
MUS MUSCULUS	1	1	1	1	0	0	1	1	0
TOTAL No.	35	9	16	7	0	2	33	25	10

Ag+ = No. of Antigen positive
Ab+ = No. of Antibody positive

TABLE 12

Hantavirus antigen and antibody positive small mammals in
HADICI region according to age and sex

HADICI	No. trapped	Ag+	Ab+	Ag+ and Ab+	Juvenile form	Subadult form	Adult form	Male	Female
APODEMUS FLAVICOLLIS	49	22	24	15	1	0	48	35	14
A. SYLVATICUS	2	0	0	0	0	1	1	0	2
C. GLAREOLUS	2	1	0	0	0	0	2	0	2
MICROTUS SPECIES	1	0	0	0	0	0	1	1	0
TOTAL No.	54	23	24	15	1	1	52	36	18

Ag+ = No. of Antigen positive

Ab+ = No. of Antibody positive

TABLE 13

Percentage of hantavirus antigen and antibody positive

APODEMUS FLAVICOLLIS by age and sex in different foci of HFRS in 1989

APODEMUS FLAVICOLLIS	CACAK	IVANJICA	POZAREVAC	KARLOVAC	NOVOMESTO	PLITVICE	OLOVO	HADICI	TOTAL
No. trapped	1	12	11	1	3	84	28	49	189
%	0.7	28.6	12.2	5.5	30.0	57.9	80.0	90.7	33.8
%Ag+	100.0	25.0	9.1	100.0	66.7	20.2	25.0	44.4	28.6
%Ab+	0.0	16.7	9.1	0.0	0.0	32.5	48.0	48.9	35.9
%Ag+ and Ab+	0.0	8.3	9.1	0.0	0.0	10.7	17.8	30.6	17.9
% Juvenile	0.0	0.0	0.0	0.0	0.0	2.4	0.0	2.1	1.6
% Subadult	0.0	0.0	9.1	0.0	0.0	20.2	7.1	0.0	10.5
% Adult	100.0	100.0	90.9	100.0	100.0	77.4	92.9	97.9	87.9
Male	100.0	35.0	54.5	100.0	66.6	55.9	78.6	71.4	58.9
Female	0.0	65.0	45.5	0.0	33.3	44.1	21.4	28.6	41.1

Ag+ = Antigen positive

Ab+ = Antibody positive

TABLE 14

Percentage of hantavirus antigen and antibody positive

APODEMUS SYLVATICUS by age and sex in different foci of HFRS in 1989

	CACAK	IVANJICA	POZAREVAC	KARLOVAC	NOVO MESTO	PLITVICE	OLOVO	HADICI	TOTAL
No. trapped	90	17	24	1	6	0	6	2	146
%	60.4	40.5	26.7	6.3	60.0	0.0	17.1	3.7	26.9
% Ag+	15.5	23.5	20.8	100.0	16.7	0.0	16.7	0.0	17.8
% Ab+	4.4	0.0	8.3	0.0	0.0	0.0	50.0	0.0	6.2
% Ag+ and Ab+	4.4	0.0	4.2	0.0	0.0	0.0	16.7	0.0	4.1
% Juvenile	2.2	0.0	0.0	0.0	16.7	0.0	0.0	0.0	2.1
% Subadult	28.8	5.9	8.3	0.0	16.7	0.0	0.0	50.0	21.2
% Adult	69.0	94.1	91.7	100.0	66.6	0.0	100.0	50.0	76.7
Male	34.4	35.3	37.5	100.0	66.6	0.0	33.4	0.0	60.9
Female	25.6	64.7	62.5	0.0	33.4	0.0	66.6	100.0	39.1

Ag+ = Antigen positive

Ab+ = Antibody positive

TABLE 15

Percentage of hantavirus antigen and antibody positive

APODEMUS AGRARIUS by age and sex in different foci of HFRS in 1989

	CACAK	IVANJICA	POZAREVAC	KARLOVAC	NOVO MESTO	PLITVICE	OLOVO	HADICI	TOTAL
No. trapped	44	0	20	0	0	0	0	0	64
%	29.5	0.0	22.2	0.0	0.0	0.0	0.0	0.0	11.8
% Ag+	15.9	0.0	20.0	0.0	0.0	0.0	0.0	0.0	17.2
% Ab+	4.5	0.0	10.0	0.0	0.0	0.0	0.0	0.0	9.4
% Ag+ and Ab+	4.5	0.0	10.0	0.0	0.0	0.0	0.0	0.0	9.4
% Juvenile	2.3	0.0	10.0	0.0	0.0	0.0	0.0	0.0	4.7
% Subadult	61.4	0.0	40.0	0.0	0.0	0.0	0.0	0.0	56.2
% Adult	36.3	0.0	50.0	0.0	0.0	0.0	0.0	0.0	39.1
Male	50.0	0.0	45.0	0.0	0.0	0.0	0.0	0.0	48.4
Female	50.0	0.0	55.0	0.0	0.0	0.0	0.0	0.0	51.6

Ag+ = Antigen positive

Ab+ = Antibody positive

TABLE 16

Percentage of hantavirus antigen and antibody positive
CLETHRIONOMYS GLAREOLUS by age and sex in different foci of HFRS in 1989

CLETHRIONOMYS GLAREOLUS	CACAK	IVANJICA	POZAREVAC	KARLOVAC	NOVO MESTO	PLITVICE	OLOVO	HADICI	TOTAL
No. trapped	0	1	0	0	0	60	0	2	63
%	0.0	2.4	0.0	0.0	0.0	41.2	0.0	4.1	11.6
% Ag+	0.0	100.0	0.0	0.0	0.0	30.0	0.0	50.0	31.7
% Ab+	0.0	100.0	0.0	0.0	0.0	51.7	0.0	0.0	50.8
% Ag+ and Ab+	0.0	100.0	0.0	0.0	0.0	24.1	0.0	0.0	24.6
% Juvenile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% Subadult	0.0	0.0	0.0	0.0	0.0	5.0	0.0	50.0	4.8
% Adult	0.0	100.0	0.0	0.0	0.0	95.0	0.0	50.0	95.2
Male	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0	28.6
Female	0.0	100.0	0.0	0.0	0.0	70.0	0.0	100.0	71.4

Ag+ = Antigen positive
Ab+ = Antibody positive

TABLE 17

Percentage hantavirus antigen and antibody positive
MUS MUSCULUS by age and sex in different foci of HFRS in 1989

MUS MUSCULUS	CACAK	IVANJICA	POZAREVAC	KARLOVAC	NOVO MESTO	PLITVICE	OLOVO	HADICI	TOTAL
No. trapped	0	0	21	0	0	0	1	0	22
%	0	0	23.3	0	0	0	2.8	0	4.1
% Ag+	0	0	40.0	0	0	0	100.0	0	32.1
% Ab+	0	0	22.2	0	0	0	100.0	0	19.2
% Ag+ and Ab+	0	0	22.2	0	0	0	100.0	0	19.2
% Juvenile	0	0	19.1	0	0	0	0.0	0	18.2
% Subadult	0	0	33.3	0	0	0	0.0	0	31.8
% Adult	0	0	47.6	0	0	0	100.0	0	50.0
Male	0	0	52.4	0	0	0	100.0	0	50.0
Female	0	0	47.6	0	0	0	0.0	0	50.0

Ag+ = Antigen positive
Ab+ = Antibody positive

TABLE 18
Percentage hantavirus antigen and antibody positive
RATTUS NORVEGICUS by age and sex in different foci of HFRS in 1989

RATTUS NORVEGICUS	CACAK	IVANJICA	POZAREVAC	KARLOVAC	NOVO MESTO	PLITVICE	OLOVO	HADICI	TOTAL
No trapped	0	0	5	16	0	0	0	0	21
%	0	0	5.5	88.9	0	0	0	0	3.9
%Ag+	0	0	100.0	25.0	0	0	0	0	42.8
%Ab+	0	0	80.0	43.7	0	0	0	0	52.4
% Ag+ and Ab+	0	0	80.0	12.5	0	0	0	0	28.6
% Juvenile	0	0	0.0	37.5	0	0	0	0	28.6
% Subadult	0	0	0.0	0.0	0	0	0	0	0.0
% Adult	0	0	100.0	62.5	0	0	0	0	71.4
Male	0	0	40.0	37.5	0	0	0	0	38.1
Female	0	0	60.0	62.5	0	0	0	0	61.9

Ag+ = Antigen positive
Ab+ = Antibody positive

TABLE 19
Percentage hantavirus antigen and antibody positive
CROCIDURA SPECIES by age and sex in different foci OF HFRS in 1989

CROCIDURA SPECIES	CACAK	IVANJICA	POZAREVAC	KARLOVAC	NOVO MESTO	PLITVICE	OLOVO	HADICI	TOTAL
No trapped	8	0	5	0	0	0	0	0	13
%	5.4	0	5.5	0	0	0	0	0	2.4
% Ag+	25.0	0	20.0	0	0	0	0	0	23.1
%Ab+	0.0	0	0.0	0	0	0	0	0	0.0
% Ag+ and Ab+	0.0	0	0.0	0	0	0	0	0	0.0
% Juvenile	0.0	0	0.0	0	0	0	0	0	0.0
% Subadult	75.0	0	0.0	0	0	0	0	0	15.4
% Adult	25.0	0	100.0	0	0	0	0	0	84.6
Male	50.0	0	60.0	0	0	0	0	0	53.8
Female	50.0	0	40.0	0	0	0	0	0	46.2

Ag+ = Antigen positive
Ab+ = Antibody positive

Table 20.

ANTIBODIES TO HANTAN AND PUUMALA VIRUSES IN HEALTHY
RESIDENTS OF YUGOSLAVIA IN 1989.

Location	No.sera positive No.sera tested	% positive	No. of HFRS cases
Ivanjica	45/84	54	> 12
Požarevac	6/12	50	4
Foča	22/73	20.5	> 10
T o t a l	73/169	42,0	> 26

Table 21.

ANTIBODIES TO HANTAN AND PUUMALA VIRUSES IN HEALTHY RESIDENTS
OF OLOVO AND HADŽIĆI IN 1989.

Location	No.sera tested	No.sera positive		HNT + Puumala	% positive	No.of HFRS cases
		HNT	Puumala			
Olovo	78	8	3	5	20.5	> 30
Hadžići	75	14	3	1	24.0	> 40
T o t a l	153	22	6	6	22.2	> 80

Table 22.

ANTIBODIES TO HANTAAAN AND PUUMALA VIRUSES IN HEALTHY PERSONS
FROM YUGOSLAVIA IN 1989.

Occupation of persons	No. sera tested	No. of positive		% positive	No. of HFRS cases
		HNT	Puumala HNT + Puumala		
Residents of Oštarije place	193	10	-	5.2	3
Forest workers near Oštarije	45	-	1	2.2	-
Soldiers from all around Yugoslavia	201	5	6	5.9	223
T o t a l	439	15	6	5.2	226

T A B L E 23.

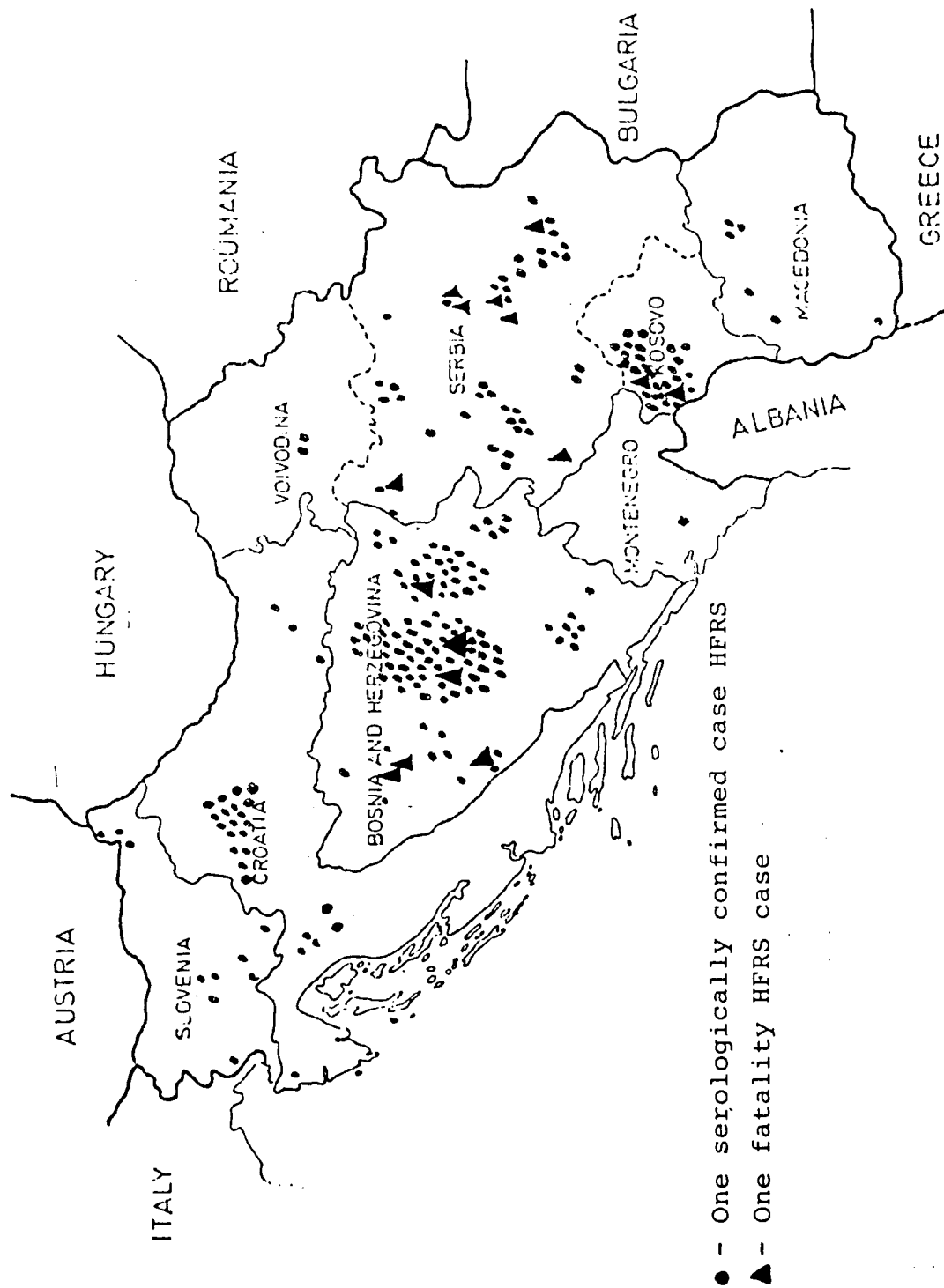
HFRS IN YUGOSLAVIA IN 1989 *

Republics and Provinces	No. clinically suspected HFRS	No. serologically positive	% positive	Lethality	%
SR BOSNIA AND HERZEGOVINA	226	108	40,6	6	5,5
SR CROATIA	47	27	57,5	-	-
SR MACEDONIA	15	6	40,0	-	-
SR MONTENEGRO	4	1	25,0	-	-
SR SLOVENIA	-	10	-	-	-
SR SERBIA	179	43	24,0	7	16,3
a) KOSOVO	83	29	28,6	2	6,9
b) VOJVODINA	15	2	13,3	-	-
TOTAL	609	226	37,1	15	6,6

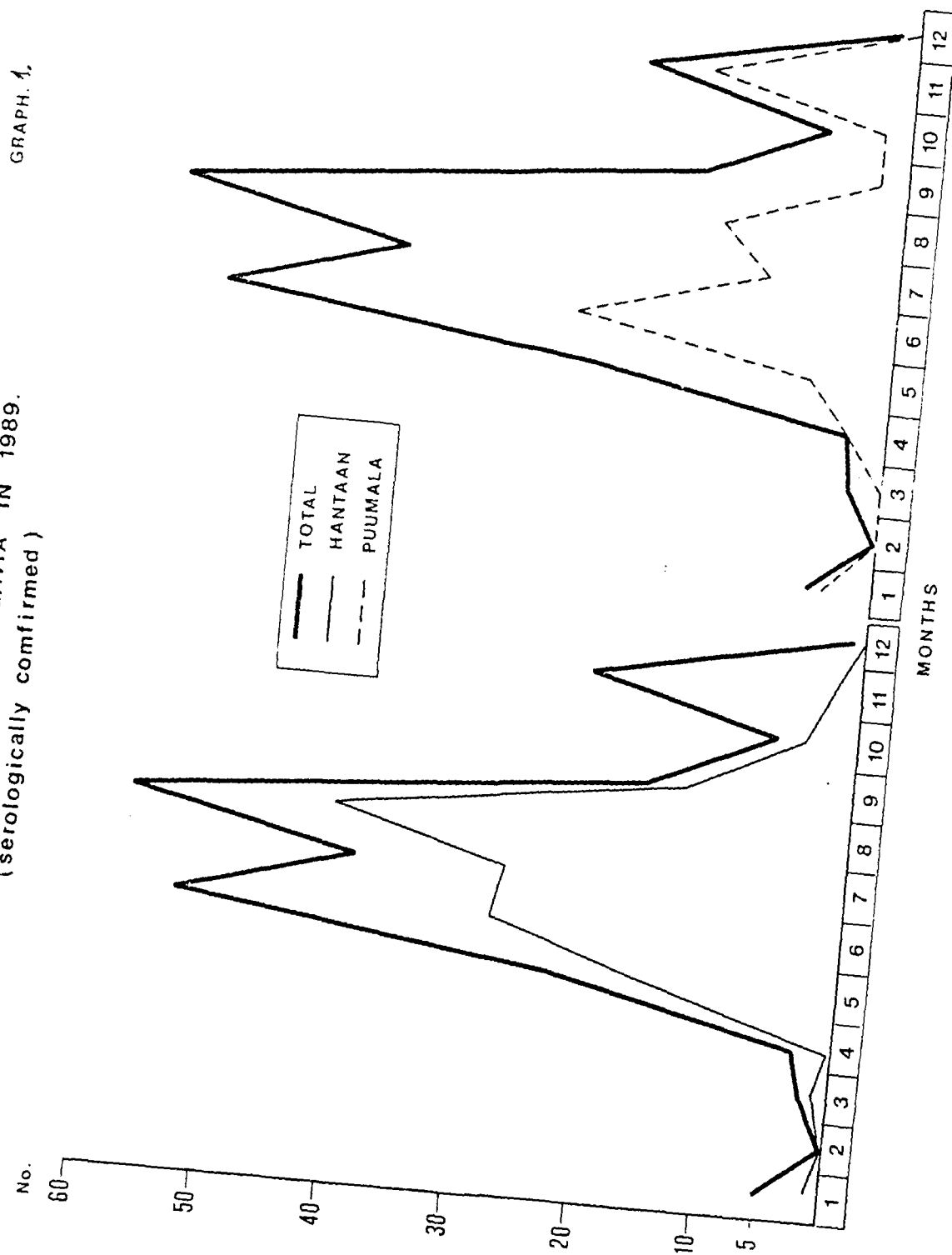
* These data were formed on the base of serologically examined sera in National Reference Laboratory for viral hemorrhagic fever in Belgrade, using immunofluorescent test and ELISA IgM test with Hantaan and Puumala antigens.

DISTRIBUTION OF SEROLOGICALLY CONFIRMED CASES OF HFRS in Yugoslavia in 1989

Map 1.



HFRS CASES IN YUGOSLAVIA IN 1989.
(serologically confirmed)



CART.

DISTRIBUTION OF HFRS CASES IN YUGOSLAVIA IN 1989.
(serologically confirmed)

