

## ACTUAL INFECTIOUS DISEASES IN BULGARIAN PIG INDUSTRY\*

Angel Mortrovski\*\*, Nedelcho Nedelchev, Stoil Karadzhov  
National Diagnostic and Research Veterinary Institute, Sofia, Bulgaria

### Abstract

At the moment the most important diseases for Bulgarian pig industry are classical swine fever and Aujeszky's disease in respect of which we are obliged to meet the requirements of the European Union (EU) as well as Porcine reproductive and respiratory syndrome and Porcine circovirus type 2, which cause big losses on pig farms. According to the experts on pig diseases we are now in the era of multifactorial diseases. The emergence of porcine reproductive and respiratory syndrome (PRRS) and porcine circovirus type 2 (PCV2) in the last 15 years also lead to alteration of the pig pathology and increased the importance of multifactor diseases. Also, the diseases important for pig production in Bulgaria are the diseases: porcine parvovirus (PPV), swine influenza virus (SIV), *Mycoplasma hyopneumonia* (M hyo) and *Actinobacillus pleuropneumoniae* (APP), the infections that often joined with above mentioned causative agents.

**Key words:** infectious diseases, pig, Bulgaria

---

\* Rad je saopšten na 8. kongresu veterinara Srbije, 15-19. septembra 2009. godine, Beograd  
\*\* E mail: angelmortovski@yahoo.com

# INFEKTIVNE BOLESTI U INDUSTRIJSKOJ PROIZVODNJI SVINJA U BUGARSKOJ

Angel Mortrovski, Nedelcho Nedelchev, Stoil Karadzhov  
Nacionalni dijagostički i istraživački veterinarski institut, Sofija, Bugarska

## Kratak sadržaj

Trenutno, najvažnija bolest u industrijskoj proizvodnji svinja u Bugarskoj su klasična kuga svinja i Aujeckijeva bolest, u pogledu kojih smo obavezni da ispunimo zahteve Evropske unije (EU), kao i za respiratorni sindrom svinja i cirkovirus svinja tip 2, koji izazivaju velike gubitke na farmama. Prema mišljenju stručnjaka za bolesti svinjarstva, sada su aktuelne multifaktorijalne bolesti. Pojava reproduktivno respiratornog sindroma svinja (PRRS) i cirkovirusa svinja tip 2 (PCV2) u poslednjih 15 godina takođe je dovela do promene i u patologiji svinja i istaklo uticaj multifaktorijalnih bolesti. Bolesti koje takođe utiču na proizvodnju svinja u Bugarskoj takođe su značajne parvovirus (PPV), virus influence svinja (SVI), *Mycoplasma hyopneumonia* (M hyo) i *Actinobacillus pleuropneumoniae* (APP), infekcije koje se često javljaju uz gore spomenute uzročnike.

**Ključne reči:** infektivne bolesti, svinja, Bugarska

## INTRODUCTION

Bulgarian pig industry has some features which influence the infectious diseases. Since 1990 the number of farms and pigs has been considerably reduced, and the tendency of declining in pig industry is still continuing. Yet, the largest number of pigs is raised on large farms, what contributes the occurrence of many infectious diseases.

Table 1: Current state of Bulgarian pig industry

Category of farms	Farms No.	Pigs No.
Industrial farms	61	425 260
Family farms type A	79	24 331
Family farms type B	1341	38 697
Back yards	50 787	97 535
East Balkan breed	107	8584
Total	52 375	594 407
Wild boars	-	63 963

Besides reduced pig production, the following factors influence on the occurrence of infective disease:

- breeding farms are renewed periodically by sows and boars, purchased from other farms, which creates conditions for persisting of infectious agents;
- the import of animals is usually done from two or more sources, which enhances the risk of penetration of the infection;
- on some farms the animals are reared in the open air, which creates a possibility for contact with birds and wandering animals;
- in all the farms continuous farrowing is going on, which constantly provides susceptible animals on the farm;
- on all the farms a closed circle of performance is going on and the fatteners serve as a reservoir of persisting infections;
- boars are reared on farms. On some farms natural insemination (mating) is carried out and boars play an important role in spreading of infections;
- "all in – all out" management is often neglected;
- there are pigs reared in back yards;
- there is a population of East Balkan bread pigs, reared on pastures;
- the existence of a population of wild boars.

**Classical swine fever (CSF)** has been a constant problem in the past with periodical epizootics that lasted for several years each. The mass vaccination was an important measure for limiting the losses. After 2002 there is a constant tendency of decreasing the outbreaks in domestic pigs, excluding 2006 when 3 new outbreaks appeared. The last outbreak in wild boars took place in 2004 and 2005. The outbreaks in domestic pigs were recovered by "stamping out".

Table 2: Epizootiological state of Bulgarian pig industry in respect to CSF (Kamenov, 2009).

Year	Commercial farms		East Balkan pigs		Back yards		Occasions in wild boars
	No of infected herds	No of infected pigs	No of infected herds	No of infected pigs	No of infected herds	No of infected pigs	
2002	10	41	-	-	-	-	-
2003	5	34	2	24	4	5	-
2004	1	3	1	19	-	-	48
2005	-	-	-	-	-	-	88
2006	3	68	-	-	4	5	-
2007	1	41	2	46	-	-	-
2008	1	8	-	-	-	-	-
2009	-	-	-	-	-	-	-

From January 1, 2007 the vaccination of domestic pigs is forbidden. In 2005 started the Program for Control and Eradication of CSF, approved by EU, which includes (Kamenov, 2009):

- active surveillance of pig holdings aimed to as early as possible detection of CSF clinical symptoms;
- passive surveillance by investigation of blood samples for antibodies;
- three vaccination campaigns of wild boars with two vaccinations, each in 40 km zone, along the western and northern border;
- control of the wild boars by investigation of tissue samples for virus and blood samples for vaccine – induced antibodies.

**Aujeszky's disease (AD)** is a basic problem for Bulgarian pig industry as after stopping the vaccination against CSF it remains the most important obstacle for export of pigs in EU. The results of virological investigations (virus isolation in tissue culture), performed in National Diagnostic and Research Veterinary Institute (NDRVMI), during the recent 11 years, show that during all the years AD outbreaks have appeared: 62.26% of investigated animals were positive. The biggest number investigated (29) and positive (72.41%) were amongst the sucking piglets, which is the proof that the virus persists amongst the sows. The confirmation of this statement is the fact that both foetuses investigated were positive. All the investigated dogs during this period were positive which shows that apart from clinical manifestation AD maintains itself in sows as a latent infection and the virus exists in the organs and meat in clinically healthy, in many occasions vaccinated animals (Table 3).

Table 3: Results from virological investigations

Year	No.farms investigated	Number positive/number investigated				
		sucklers	weaners	fetuses	dogs	Total
1998	1	-	1/1	-	-	1/1
1999	3	8/8	-	-	-	8/8
2000	1	-	1/1	-	-	1/1
2001	3	-	0/5	1/1	-	1/6
2002	3	0/3	0/4	-	-	0/7
2003	1	4/4	-	-	-	4/4
2004	6	5/9	0/1	1/1	5/5	11/16
2005	1	2/2	-	-	-	2/2

In the previous period AD was proved by virological investigation in sheep and cattle, which shows that AD virus in infected pigs presents a constant threat for other animal species.

Although little, the above mentioned virological investigations are not in the frame of monitoring program, but on occasion of disease suspicion. In many of the cases of suspicion no samples were sent for investigation and that is why the disease was not registered.

Serological screening was also not performed, but the imported animals were preliminary investigated, but the results were not significant. The investigation, performed 10 years ago on 20 blood samples from each of 14 industrial farms, show that more than 42% of the farms and more than 34% of the animals were infected. Almost all the farms and most of the animals were positive, which is a proof of vaccination (Motovski et al,1999). Because of a small number of investigated animals it is not possible to say that the other farms were not infected. As a result of many year vaccination and sharp decrease of animals on the farms, it is possible that some of them got free from the virulent virus.

The National Program for AD Eradication includes intensive vaccination with gE – negative and TK – negative high – titer adjuvanted vaccines, which allow distinguishing the vaccinated from infected animals and create strong immunity which limits the virus spread. The disclose of AD infected farms would be performed by complementary (gE) ELISA, which distinguishes vaccinated from infected animals. Recovering of the infected farms would be fulfilled by gradual slaughter of the infected animals and replacing them by AD free ones. The country will be considered AD free two years after the last case of AD. The recovered farms will be controlled yearly by serologic investigation. The National program was presented to EU for approval and financing.

***Porcine reproductive and respiratory syndrome (PRRS).*** Yordanov and Chenchev (2000) found antibodies on farms with reproductive disorders and respira-

tory diseases. In the following years this infection took a wide spread and caused great economical losses (Motovski, 2001). Most often the first signal for penetration of the disease into the farm were abortions irrespective the antibiotic treatment against leptospirosis, which in other cases are effective. Premature farrowing (before 112<sup>th</sup> day of pregnancy), stillborn and increased mortality in pigs before weaning were dominating symptoms in the infected farms. Respiratory diseases in weaned pigs were common symptoms of this infection. In some farms we observed reproductive disorders only, in others respiratory diseases in growers and on the thirds – sudden death in fatteners. The clinical symptoms vary very much in severity on different farms depending on the difference of existing conditions – stress, concurrent infections, environment and probably the virulence of the field strain of PRRS virus (Motovski, 2004). On many farms we observed periodical exacerbation of the disease, which shows that the herds were not equal in immunological respect (Benfield et al., 1997).

On the base of immunosuppression, caused by PRRS virus (Benfield et al., 1997; Thacker et al., 1999) we observed exacerbation of the persisting infections on the farms including such ones that didn't produce disease in the past. As an example of this is considerable increase of the severity of enzootic pneumonia in growers and finishers and the increase of clinical cases of *Str. suis* meningitis. In a case of acute running of PRRS we observed exacerbation of AD with high mortality in sucklers. On a large farm we observed exacerbation of porcine parvovirus with a lot of mummies and low fertility. Regardless to vaccination, leptospirosis emerged on farms where no clinical manifestation was earlier observed. Contrary to some statements we didn't observe self recovery of PRRS infected farms (Motovski, 2004).

An inactivated (Progressis, Merial) and live vaccine with European strain (Porcilis PRRS, Intervet) were examined. The vaccination with the live vaccine proved safe and effective – the increase of fertility ( $P < F_{2550.02}$ ), decrease of returns and abortions ( $P < F_{2550.001}$ ) and the increase of extra acquired piglets, which exceeded the price of the vaccine (Table 4). Now most of the farms vaccinate sows with the live vaccine every 3 or 4 months and some of them before or after weaning.

Table 4: Results from vaccination of sows against PRRS

Index	Nonvaccinated	Vaccinated from 0 to 45 days of pregnancy	Vaccinated 15 days before mating
No groups investigated	19	7	3
No of inseminated sows	437	161	69
% returns	21.51 2.43	17.39 3.4	18.84 3.13
% abortions	8.69 2.23	5.59 3.0	0
% farrowed	69.79 3.3	77.02 4.62	81.16 3.13
No of pigs born /sow (average)	8.53 0.15	9.08 0.15	9.83 0.21
No of pigs born/inseminated sow (average)	5.95	6.99	7.98
Cost of the vaccine/sow, leva	-	3.00	3.00
Cost of the pigs born/sow, leva	77.35	90.87	103.74

**PCV 2** entered Bulgarian pig industry and was established by complex investigations of organs from 36 pigs on 8 pig farms (Motovski et al., 2005). Out of the eight investigated farms we proved postweaning multisystemic wasting syndrome (PMWS) by pathologic investigation and *in situ* hybridisation (Segales, 2002) in 4 and porcine dermatitis and nephropathy syndrome on one farm where the pigs showed characteristic clinical symptoms and pathological lesions for these diseases. The diagnosis of PMWS was established in 4 out of 5 farms with high mortality in weaners, what confirms the important role of this disease in the mortality after weaning (Table 5).

Table 5: Results from the complex laboratory investigation in 8 farms for PCV2 (Motovski et al., 2005).

Farm	Kidneys – No			Lymph nodes – No.		
	Investig.	positive by.		Investig.	positive by	
		Histology	<i>In situ</i> hybridization		Histology	<i>In situ</i> hybridization
1	5	-	-	6	1	-
2	3	-	-	3	2	2
3	6	2	-	4	4	4
4	6	-	-	6	-	-
5	2	-	-	2	-	-
6	5	5	5	6	6	6
7	5	-	-	5	-	-

PCV2 took a wide spread and affected all the pig farms and most of the animals on them – in 60% to 96% (average 75.76%) of sows and pigs on ten investigated farms antibodies were found (Table 6). The spread of PCV2 in different age groups is displayed in Table 7.

Table 6: Prevalence of PCV2 in industrial pig farms (Milev et al., 2009).

Farm No.	No investigated	% positive
1	50	72.00
2	57	61.40
3	57	61.40
4	60	60.00
5	45	66.67
6	50	96.00
7	50	72.00
8	50	96.00

Table 7: Prevalence of PCV2 in age groups

Age group		No investigated	% positive
6 – weeks		55	90.91
10 - weeks		44	70.45
12 – weeks		30	63.33
14 – weeks		64	45.31
18 – weeks		49	42.86
22 – weeks		50	100
24 – weeks		40	100
Gilts		35	71.43
Sows		55	100
Total	No		
	%		

From the table it can be seen that all the age groups were affected. The piglets acquired colostral immunity, which faded away after 18 weeks of age and then the pigs became susceptible. Some of the gilts were negative, but they survived infection again. Except the industrial pig farms now PCV2 is widespread in back yards and among East Balkan pigs and wild boars (table 8) (Milev et al., 2009).



Table 8: Results from investigation according to categories and regions (Milev et al., 2009).

Category of pigs	Region	No investigated back yards, farms, hunting areas	No investigated sows	No PCV2 positive
Domestic in back yards	Blagoevgrad	2	20	100
	Kjustendil	1	12	100
	Vratza	1	5	100
	Montana	2	12	100
	Yambol	1	10	100
	Gabrovo	5	59	100
	Razgrad	2	32	90.62
	Pleven	1	12	100
	Russe	2	16	50
	<i>Total</i>	17	178	89.89
East Balkan pigs	Shoumen	6	107	83.17
	Varna	2	32	100
	Burgas	4	72	63.89
	<i>Total</i>	12	211	79.15
Wild boars	Kardzhaly	1	9	55.55
	Blagoevgrad	4	40	67.50
	<i>Total</i>	5	49	67.34

On all the investigated farms we observed symptoms of PMWS: progressive loss of weight, difficult breathing, obvious enlargement of inguinal lymph nodes, diarrhoea, paleness and jaundice. The sick animals didn't react to the treatment. Dead animals showed enlargement of the mesenteric, bronchial and inguinal lymph nodes, which often were reddened, and enlargement of lungs septa (interstitial pneumonia) was noticed. Pigs affected with PDNS had red to purple skin spots preliminary on back of the hams and perineum which tended to fuse. Such pigs showed anorexia and reluctance to move. The lesions after death was lymphadenopathy, enlarged kidneys with petechia and multi-coloured lungs, sometimes with purulent pneumonia.

Our experience shows that we can limit the losses of PCV2 by strict application of general prophylactic measures and maintain the herd immunity against the existing diseases by vaccination, on the first place against PRRS and *Mycoplasma hyopneumoniae* (M. hyo). In Bulgaria an inactivated vaccine for sows (Circovac, Merial) has been registered and also two live subunit vaccines for pigs Ingelvac Circoflex (Boehringer) and Porcilis PCV (Intervet). Some farms examined the inactivated vaccine for sows but were not satisfied with the results. The first results from a live vaccine for pigs are encouraging (Table 9).

Table 9: Results from vaccination against PCV2

Index	Group	Average	Difference
No of pigs	experimental	394	-
	control	394	
Injected pigs, %	experimental	30.21±13.11	- 15.49
	control	45.70±12.62	
Average daily gain, g	experimental	416	9
	control	407	
Mortality, %	experimental	0.49±0.03	-2.52
	control	3.01±0.04	

*The associated infections* are characteristic for Bulgarian pig industry as well. By complex investigations of 13 industrial farms we established that in all of them persist PCV2, porcine parvovirus (PPV), influenza virus (SIV), M. hyo and Actinobacillus pleuropneumoniae (APP), in 70% of them PRRS and in 60% - AD. On 3 pig farms all the 7 investigated infectious agents are present, on 2 they are 6, on 5 – 5 and on 3 – 4 agents (Table 10). In investigation of 177 pigs on 9 industrial pig farms we found that all of them were affected by AD, M. hyo and APP, but on 5 of them PRRS and SIV exist. The highest percent of seropositive and the most farms and animals with seroconversion was established in respect to APP and AD (Table 11).

Table 10: Associated infections of PCV2 with other pathogens

Pig farm	PCV2	PRRS	M..hyo	APP	SIV	ADV	PPV	Comon
1	+	-	+	ni*	+	-	+	4
2	+	ni*	ni*	+	+	+	+	5
3	+	+	+	+	ni*	+	+	6
4	+	ni*	+	+	+	ni*	+	5
5	+	-	+	+	+	ni*	+	5
6	+	+	+	ni*	ni*	ni*	+	4
7	+	ni*	+	+	+	+	+	4
8	+	+	+	+	+	+	+	7
9	+	+	+	+	+	-	+	6
10	+	+	+	+	+	+	+	7
11	+	+	+	+	+	+	+	7
12	+	+	+	+	ni*	-	+	5
13	+	-	+	+	+	-	+	5
Total	No	13	7	12	11	10	6	13
	%	100	70	100	100	100	60	100

ni\* - not investigated

Table 11: Results from serological investigation of 177 pigs in 9 farms.

Index	AD	M. hyo	APP	PRRS	SIV H <sub>3</sub> N <sub>2</sub>
No of positive farms	9	9	9	5	5
% positive animals	60.90	24.86	100	12.43	15.25
No of farms with seroconversion	8	2	9	3	2
% animals with seroconversion	51.72	9.19	23,73	5.75	5.75

We detected associated infections in pigs in back yards, East Balkan breed and wild boars as well (Milev et al, 2009). In all the investigated regions we found animals in back yards with PCV2 antibodies. In Russe region positive were half of the investigated animals and in Razgrad region 90%, but in all the rest regions all the investigated animals were positive. In all of the four investigated regions we found positive on SIV antibodies and the difference between them was considerable. In 3 regions there were animals with AD antibodies with big difference between the regions. In each of the three investigated regions there were East Balkan pigs with antibodies against three viruses and the difference between the regions was small. A part of the wild boar population in both investigated regions had PCV2 antibodies and SIV antibodies, on one of them AD antibodies were present as well. In all three categories of pigs the percent of seropositive animals was the highest for PCV2 and the lowest for AD (Table 12).

Table 12: Results from investigation of different categories of pigs and different regions (Milev et al., 2009).

Category of Pigs	Region	No investing. back yards, farms, hunting areas	No Investigated Pigs	% positive for		
				PCV2	SIV	ADV
Domestic in back yards	Blagoevgrad	2	20	100	-	-
	Kjustendil	1	12	100	-	-
	Vratza	1	5	100	-	-
	Montana	2	12	100	-	-
	Yambol	1	10	100	-	-
	Gabrovo	5	59	100	28.81	20.33
	Razgrad	2	32	90.62	84.37	75
	Pleven	1	12	100	50	0
	Russe	2	16	50	87.5	6.25
East Balkan pigs	Shoumen	6	107	83.33	30.84	23.36
	Varna	2	32	100	50	31.25
	Burgas	4	72	63.89	43.05	16.67
Wild boars	Kardzhaly	1	9	55.55	11.11	0
Wild boar	Blagoevgrad	4	40	67.50	32.50	7.5

All the investigated sows and the majority of the pigs of all age groups in an industrial pig farm had antibodies against three viruses. The most positive animals for PCV2 and SIV antibodies were in finishers, but for AD antibodies – in sucklers (Table 13). The results from serologic investigations are confirmed by virologic investigations (Table 14) (Dimitrova et al., 2009).

Table: 13. Results from serological investigation (Dimitrova et al., 2009).

Category of pigs	Investigated for:					
	PCV2 ELISA antibodies		SIV HI - antibodies		AD ELISA antibodies	
	No. investi-gated	% positive	No. investi-gated	% positive	No. invest-tigated	% positive
Sucklers	20	80	30	93.33	30	93,33
Growers	50	74	40	75.00	40	47.50
Fatteners	40	92.5	30	96.67	30	46.67
Sows	10	100	10	100	10	100

Table 14. Results from virological investigation (Dimitrova et al., 2009).

Category of pigs	Investigated for:					
	ADV isolation in tissue culture		PCV2 PCR		PC V2 DIFM	
	No. investi-gated	% positive	No. investi-gated	% positive	No. investigated	% positive
Sucklers	3	66.67	-		2	100
Growers	13	30.77	3	100	4	50
Fatteners	26	42.31	ni	ni	24	58.33
Sows	ni*	ni*	ni*	ni*	Ni*	ni*

\*ni – not investigated

## CONCLUSIONS

1. The Bulgarian pig industry has some features, which affect the infectious diseases: sharply shrinking and constantly decreasing; rearing of pigs on large industrial and small family farms and in back yards; the existence of East Balkan breed on pastures and a population of wild boars.
2. There is a constant tendency of decrease of CSF outbreaks since 1990. The Program for Control and Eradication includes clinical, virulogical and serological monitoring of domestic pigs without vaccination and vaccination of wild boars along the western and northern border.
3. Aujeszky's disease is widespread on Bulgarian pig farms and the virus maintains itself as a latent infection. The Program for Eradication includes intensive vaccination by gE- vaccine and test and removal by gE ELISA.

4. PRRS became widespread after 2000 and induced big losses due to reproductive disorders and respiratory diseases. The vaccination decreases economical losses and the live vaccine with European strain is safe and more effective.
5. PCV2 infected Bulgarian pig industry in the recent years and spread among domestic pigs in the industrial farms and back yards, East Balkan pigs and wild boars. It induces PMWS and PDNS and immunosuppression as well. The vaccination of pigs is better than the vaccination of sows.
6. The associated infections are characteristic for Bulgarian pig industry as well and include association of two or more pathogens: PCV2, PRRS, AD, SIV, M. hyo, APP and PPV. The associated infections affect not only the industrial farms, but also back yards, East Balkan pigs and wild boars.

## LITERATURE

1. Benfield, D.A., Collins J.E., Lenny A.L., Loula T.J.: Porcine reproductive and respiratory syndrome. In: Diseases of swine. Ames, Iowa, Iowa State University Press, USA, 1992,
2. Benfield, D.A., Christopher-Hennings J., Nelson E.A., Rowland R.R., Nelson J.K., Rossow C. C., Collins J.E.: Persistent fetal infection of porcine reproductive and respiratory syndrome (PRRS) virus. In: Proceedings of American Association of swine Practitioners. Quebec, Canada, 1997, 455-458.
3. Dimitrova, A., Milev D., Faldgijska G., Atanasova D., Christova V.: A case of Porcine respiratory disease complex in an industrial pig farm. In: Scientific – practical conference on occasion of 108 anniversary of NDNIVMI, May 21, Sofia, 2009, Under print.
4. Kamenov, P.: Classical swine fever. Epizootiological state, control and profilactics in Republic of Bulgaria. In: Conference "One health", June 23-24, Plovdiv, 2009,
5. Milev, D., Faldgijska G., Ivanova E., Motovski A., Nikolov D., Chervenkov M.: Incidence of PCV2, SIV and ADV in wild boars, east Balkan pigs and the pigs in back yards. In: Scientific–practical conference on occasion of 108 anniversary of NDNIVMI, May 21, Sofia, 2009, Under print.
6. Motovski, A., Uostoglou P., Paul G.: Investigation on participation of four actual virus infections in pigs. *Veterinarna sbirka*, 9-10, 1999, 20-24.
7. Motovski, A.: Porcine reproductive and respiratory syndrome. *Veterinary medicine*, VII, 1-2, 68-77, 2001.
8. Motovski, A.: Peculiarities in manifestation of PRRS in Bulgaria. *Veterinarna sbirka*, 3-4, 17-20, 2004.
9. Motovski, A., Segales J., Manov V., Motovski D., Milev D.: First description of circovirus infections in Bulgaria. *Veterinary medicine*, IX, 1-2, 7-11, 2005.

10. Segales, J.: Update on postweaning multisystemic wasting syndrome and porcine dermatitis and nephropathy syndrome diagnostics, *J Swine Health Prod* 10, 277-281, 2002.
11. Thacker, E.L., Halbur P.G., Ross R.F., Thanawongnuwech R., Thacker B.J.: *Mycoplasma hyopneumoniae* potentiation of porcine reproductive and respiratory syndrome virus induced pneumonia. *J Clinical Microbiology*, 37, 620-627, 1999.
12. Yordanov, S., I.Chenchev. First dates for the existence of Porcine reproductive and respiratory syndrome (PRRS) in Bulgaria. In: Proceedings of the 5<sup>th</sup> International Congress of the European Society for Veterinary Virology, Brescia, Italy, 27-30 August, 2000.

Primljeno: 17.11.2009.

Odobreno: 23.11.2009.