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AN OUTBREAK OF LEPTOSPIROSIS IN A SWINE BREEDING HERD : IT'S DIAGNOSIS, TREATMENT AND ECONOMIC EFFECT

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ปัญหาการระบาดของโรคเลปโตสไปโรซีสในฟาร์มพ่อแม่พันธุ์สุกร : การชันสูตร การรักษาและผลกระทบทางเศรษฐกิจ

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Abstract

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AN OUTBREAK OF LEPTOSPIROSIS IN A SWINE BREEDING HERD : IT'S DIAGNOSIS, TREATMENT AND ECONOMIC EFFECT

An outbreak of leptospirosis in a 2600 sow breeding herd, in which 5% of the sows aborted, was investigated. Serum samples from 11 aborted sows were examined for leptospira antibodies. Using a Microscopic Agglutination Test (MAT), containing only 12 serovars, no leptospira serovars were detected. However, after using a Microcapsule Agglutination Test (MCAT) kit, a further MAT using the additional three serovars *(sejroe, hardjo and bratislava)* revealed that the cause of abortion was *Leptospira interrogan* serovars *bratislava* and *sejroe.* After the final diagnosis, the animals were treated by using 800 ppm chlortetracycline in the feed for two weeks, followed by two weeks at 600 ppm. This was combined with systemic antibiotic treatment to all affected and at risk sows and fever, anorexia and abortions ceased. Rats were eradicated and the feeding boxes in all pens were covered, as a preventive measure to control the disease. The economic losses from the outbreak were substantial and including fewer piglets weaned, the value of sows that had to be culled, the cost of medication and the labour required to treat and control the disease. All of these factors have been reported in this study.

Keywords : Swine, leptospirosis, abortion, economic losses

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ปัญหาการระบาดของโรคเลปโตสไปโรซีสในฟาร์มพ่อแม่พันธุ์สุกร : การชันสูตร การรักษาและผลกระทบทางเศรษฐกิจ

การศึกษาการระบาดของโรคเลปโตสไปโรซีสเกิดขึ้นในฟาร์มพ่อแม่พันธุ์สุกรขนาด 2,600 แม่ ซึ่งมีปัญหาการแท้งลูก 5% ผลการตรวจสอบตัวอย่างซีรั่มของแม่สุกรที่แท้ง 11 ตัว โดยวิธี Microscopic Agglutination Test (MAT) ซึ่งมีความจำเพาะในการตรวจ serovar ของเชื้อเลปโตสไปร่า 12 ชนิด พบว่าเป็นผลลบ อย่างไรก็ตาม หลังจากที่ใช้วิธี Microcapsule Agglutination Test (MCAT) ซึ่งมีผลออกมาเป็นบวกทำให้มีการทดสอบโดยวิธี MAT อีกครั้งโดยเพิ่ม serovar ของเชื้ออีก 3 ชนิด คือ *sejroe hardjo* และ *bratislava* ผลปรากฏว่าการทดสอบชี้ว่าปัญหาการแท้งของฟาร์มนี้เกิดจากเชื้อเลปโตสไปร่า serovar *bratislava* และ *sejroe* การรักษา และแก้ปัญหาได้ดำเนินการโดยใช้ยาคลอเตตร้าไซคลินในอาหารแม่สุกร 800 ppm เป็นเวลา 2 สัปดาห์และตามด้วย 600 ppm อีก 2 สัปดาห์ ได้มีการฉีดยาปฏิชีวนะให้กับแม่สุกรที่มีปัญหาและสงสัยว่ามีปัญหาจนปัญหาสามารถควบคุมได้ ปัจจัยของความสำเร็จในการควบคุมโรคนี้รวมไปถึงการกำจัดหนูการปิดกล่องอาหารและถังอาหารสุกรอย่างมิดชิดด้วย ความสูญเสียทางเศรษฐกิจจากโรคนี้มีมหาศาลซึ่งรวมไปถึงจำนวนลูกสุกรหย่านมที่ลดจำนวนลง ความสูญเสียจากแม่ที่ต้องคัดทิ้ง ค่ายารักษาและค่าแรงงานในการรักษาและควบคุมโรคนี้ ซึ่งได้รายงานไว้ในการศึกษาครั้งนี้

คำสำคัญ : สุกร เลปโตสไปโรซีส แท้งลูก ความสูญเสียทางเศรษฐกิจ

Introduction

The aetiology of reproductive failure or SMEDI (Stillborn, Mummy, Embryonic Death, Infertility) syndrome in swine farms is often complex. It may involve infections and/or management failure. Leptospirosis is one of the causes of reproductive failure in swine breeding herds and has been reported in pig farms all over the world. It occurs whenever there is a risk of direct or indirect contact with the urine of infected animals and their infected conception products. (Faine, et al., 1999). When the disease starts in a susceptible breeding herd with low immunity, losses from abortions, stillbirths and weak piglets will be high, which has a negative effect on the economic performance of the herd. On the other hand, if the infection is endemic, little evidence of clinical disease may be seen (Ellis, 1992). Preventing economic losses due to leptospiral infection is highly dependent upon proper sanitation and the use of an immunizing agent that can prevent abortion, weak newborns, and uterine and renal infections (Bey and Johnson, 1983). Microscopic Agglutination Test (MAT) is the most widely used standard reference

test for the serodiagnosis of leptospirosis (Cacciapuoti et al., 1993). Due to high specificity of the MAT, the battery of serovars in the test should cover the infecting serovars in that particular area (Faine et al., 1999). In Thailand, Suputtamongol et al. (1998) investigated the Microcapsule Agglutination Test (MCAT) kit for leptospirosis and reported the efficacy of this method. Although the investigation method has been well studied (Arimitsu et al., 1994; Suputtamongol et al., 1998), the treatment of the problem and it's economic cost has not been evaluated before.

The purpose of this report is to present details of the disease investigation, the treatment, control measures and the evaluation of losses, following an outbreak of leptospirosis in a swine breeding herd in Thailand.

Materials and Method

1) History and Clinical findings

A 2600 sow, farrow-to-finisher, swine operation comprising of six breeding-farrowing, six nursery and 15 fattening units was the object of this study. All units were located in 100 acres site. Sows had been vaccinated against Hog Cholera, Foot and Mouth disease, Aujesky's disease and Parvovirus. Pregnant sows were fed with a farm mixed feed once a day. Body score condition was being regularily evaluated and was in the range of 2.5-3.5. All sows, when possible, received a natural service three times each oestrus, using an alternate mating system by experienced Duroc boars. Production data from this farm prior to the problem is shown in Table 1.

Table 1 Reproductive performance during January-June 1998

Performance	Average figure
Farrowing rate (%)	83.0
Non Productive Day (Days)	61.0
Average Born alive/litter	8.9
Average weaned/litter	8.3
Litters/Sow/Year	2.1
Piglets weaned/ Sow/ Year	16.8

Between June and November 1998, one hundred and seventy-six (5%) late abortions, in the last trimester of pregnancy, occurred, and many stillborn and weak piglets were born. Some sows were seen to be sick before abortion, showing fever, anorexia and producing a pinkish colored urine. Antibiotic treatment was given to sick sows but there was a poor response and most of the sows aborted. Losses due to abortion from June 1998 to June 1999 are presented in Table 2. Aborted sows were all culled.

Table 2 Distribution of abortions from June 1998 - June 1999

Year	Month	Number of abortions (Ave. no. of sows mated/month)	% aborting
1998	June	23* (556)	4.1
	July	24* (594)	4.0
	August	22* (594)	3.7
	September	28* (594)	4.7
	October	31* (583)	5.3
	November	48* (583)	8.2
	December	2 (583)	0.3
1999	January	9 (590)	1.5
	February	12 (590)	2.0
	March	6 (590)	1.0
	April	8 (603)	1.3
	May	4 (603)	0.7
	June	6 (603)	1.0

* Only late abortions are noted

2) Investigation and diagnosis

Foetal tissues, blood samples and urine samples were collected from eleven aborted sows and were sent to the diagnostic laboratory of the Faculty of Veterinary Science, Chulalongkorn University. Foetal tissues and urine samples were sent for bacteriological and Fluoresent Antibody test for hog cholera . Blood samples were tested for virus antibodies, blood parasites and bacterial infections. One sample of sow feed was collected to determine the amount of mycotoxin present. Based-on the clinical symptoms, leptospirosis was suspected and serum samples from eleven aborted sows, were submitted to the National Institute of Animal Health Laboratory, Department of Livestock Development. Serum samples were tested using the Microscopic Agglutination Test (MAT) according to the method of Faine et al. (1999) and later by the Microcapsule Agglutination Test (MCAT) kit. On the first test twelve leptospiral serovars used for the MAT, : *australis, autumnalis, bataviae, canicola, grippotyphosa, hebdomadis, tarrasovi, icterohae-morrhagiae, javanica, pomona, pyrogenes and wolffi* and later on after the MCAT kit was used, three additional serovars : *bratislava, hardjo* and *sejroe* were added to the MAT battery of serovars.

Results

1) Laboratory results

Laboratory tests could not find any evidence of viral or blood parasite infections or mycotoxicosis. The response to the medicated feed, suggested that the problem might be bacterial infection. The first MAT results for all the 11 serum samples were negative for the 12 specific serovars. However, 2 out of 11 samples were positive for *autumnalis*, with a titre of 1:40. The MCAT kit was used to confirm the first MAT and the results showed that 9 serum samples were positive, one was negative and one sample was suspected to be *Leptospira* genus. As a result a second MAT was performed using an additional 3 serovars. The results are shown in Table 3. All 11 samples were positive (determined at 1:80) for serovars *bratislava*, 6 out of 10 for serovars *sejroe* and 2 out of 3 for serovars *hardjo*. The serological testing indicated that the outbreak was due to a *Leptospira* infection caused by a combination of the serovars *bratislava* and *sejroe*.

Table 3 The MAT results of additional serovar testing and titres to the specific serovars

Sample	*hardjo*	*sejroe*	*bratislava*
E 0801	-	1 : 40	1 : 640
E 0994	-	-	1 : 320
E 1022	-	1 : 40	1 : 320
E 1023	1 : 160	1 : 640	1 : 80
G 0632	-	1 : 160	1 : 640
G 0866	-	1 : 320	1 : 80
G 0956	1 : 80	1 : 640	1 : 160
G 0958	-	1 : 20	1 : 160
G 0960	-	1 : 320	1 : 160
G 1025	-	1 : 40	1 : 80
G 1102	1 : 40	1 : 160	1 : 320

2) Problem solving, Treatment and Control

After leptospirosis had been diagnosed as the cause of the abortions, all sows and boars were treated with chlortetracycline (CTC) at 400 ppm in the feed for 1 month (July 1998). Despite of this medication the abortions continued and in August 1998 the medication was increased to 800 ppm for a period of two weeks and then reduced to 400 ppm for a further 2 weeks. There was no reduction in the number of abortion.

A revised feed medication programme using 800 ppm CTC in the feed for two weeks followed by 600 ppm CTC for two weeks, was implemented in November 1998. At the same time all sows were

given either amoxycillin LA or penicillin-streptomycin injections and vaccinated with a leptospirosis vaccine.

The treatment regime was combined with an intensive programme to eradicate all the rats on the farm. Thousands of rats were killed and all feeding boxes in the pens were covered with a proper lid.

In December 1998, the abortion rate had fallen to 0.3% which is within the normal range. During 1999, the abortion rate continued to be normal and it was concluded that the disease had been controlled.

3) Economic losses

The leptospira abortion problem caused substaintial economic losses for this farm, which can be judged from the reproductive performance of the sows in 1998 compared to 1999, as shown in Table 4.

Table 4 Reproductive performance of sow herd in 1998 and 1999 by quarter (Q) and all year (Total)

Performance	1998					1999				
	Q1	**Q2**	**Q3**	**Q4**	**Total**	**Q1**	**Q2**	**Q3**	**Q4**	**Total**
Farrowing rate (%)	84	82	79	76	**80**	81	85	83	83	**83**
NPD (Days)	59	63	74	60	**64**	47	42	38	28	**39**
Litters/Sow/Year	2.0	2.2	2.1	2.2	**2.1**	2.3	2.3	2.3	2.4	**2.4**
Born alive/litter	9.0	8.7	8.1	8.2	**8.5**	8.7	8.2	9.3	9.4	**9.2**
Weaned/litter	8.1	8.4	7.6	7.6	**8.0**	8.2	8.7	8.5	8.7	**8.5**
Piglets weaned/ Sow/ Year	16.2	17.4	15.0	15.6	**16.4**	17.6	19.5	19.8	20.6	**19.7**
Total Piglets weaned			**41,380**					**49,290**		

Although, the outbreak continued for only six months (June-November), the economic losses were of considerable significance. As the farm always maintained a constant inventory of 2600 sows, a comparison of the total number of piglets weaned in 1998 and 1999 can be considered relevant and was found to be in the year after infection was 7910 piglets. The controlled and extra value of 7910 piglets, using only the cost of production as a measure is around 500 baht/weaned piglet which means that the farm lost at least 3,955,000 baht during 1998 as a result of the problem. This evaluation does not include the opportunity value lost from culled sows (176 sows), the cost of medication and the labour input while treating and controlling the problem. If everything was included it is estimated that the total losses were not less than 5 million baht.

Discussion and Conclusion

The investigation indicated that *Leptospira interrogan* serovar *bratislava* and *sejroe* were common infections in this farm. The diagnosis of leptospirosis is not an easy task, complicated by many serogroups and serovars, some of which cannot be tested for in Thailand. At the beginning of the outbreak the laboratory was mislead by getting negative results when using an MAT with only 12 specific serovars. However, when the MCAT kit was applied, it could be concluded that the problem might be caused by the *Leptospira* genus. The reason has been explained by Arimitsu et al. (1994) who reported that the MCAT kit detected antibodies in 35/54 (64.8%) serum samples compared with the 20/54 (32%) detected by MAT and 21/54 (38.9%) by IgM ELISA. These results indicated that the sensitivity of the MCAT kit is better than the MAT and the IgM ELISA. In Thailand, Suputtamongol et al. (1998) reported that the sensitivity and accuracy of MCAT was 90.2 and 93.7%, respectively. Therefore, the MCAT can be used for the screening of the *Leptospira* genus (Cacciapouti, et al. 1993) but can not identify specific serovars which is better performed by the MAT (Faine, et al. 1999). When the laboratory added additional serovars for the MAT, it was found that serovars *bratislava* and *sejroe* were specific for the serum antibodies that were present in this problem herd.

In making a diagnosis, it is helpful to know what are the most likely infecting serovars otherwise a battery of serovars for the MAT must ensure that there is a high possibility of detecting any antileptospiral antibodies present. This is a good example for field practitioners who, when needing to solve the problem quickly, must be aware of such test results.

Although the diagnosis was correct, the treatment and control measures seemed to be unsuccessful at the beginning. This might have been due to the short periods of medication or the low doses used. In the UK., it has been suggested that either chlor-or oxy-tetracycline at 600 ppm in the feed is required. This ration is fed either continuously or on a one-month-on and one-month-off basis. At the same time streptomycin at 25 mg/kg can be given to both affected and at risk animals (Ellis, 1992).

In this case, we used 400 ppm in the first month (July, 1998) although later on (August 1998) it was increased to 800 ppm for a period of two weeks. After using 800 ppm for two weeks, followed by 600 ppm for two weeks, in November 1998 together with a systemic antibiotic treatment, the problem was controlled. Nevertheless, it is worth mentioning that rat eradication and covering the feeding boxes were major contributions to the control of this disease.

Economic losses were demonstrated by comparing the total number of piglets weaned in 1998 and 1999. It appeared that during 1999, the overall performance also improved when compared to the figures recorded before the problem started (piglets weaned/sow/year 19.7 VS 16.8). This could be due to farm personel working harder after the crisis, for if we compared the figures for the first six months of 1998 with the last six months, we saw a difference of only 0.8 piglets weaned per sow

per year. Using this figure, the lost production during the problem period, was only 1040 weaned piglets. This was similar to what we would loose from 176 aborted sows (1400 weaned piglets). We could calculate either one way or the other but both ways showed that the economic losses due to this disease were considerable and that they could be controlled.

It can be concluded that leptospirosis is a disease causing severe reproductive failure and substantial economic losses. Diagnosis, treatment and control of the disease are not an easy task and one has to consider all measures to reach the ultimate goal, including the eradication of rats, covering the feeding boxes, antibiotic injections to affected and at risk animals, as well as high doses of in feed antibiotics.

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