UNIVERSITI PUTRA MALAYSIA

EPIDEMIOLOGY AND MORPHOLOGY OF LUNGWORM (*DICTYOCAULUS VIVIPARUS*), AND ITS ASSOCIATED LUNG PATHOLOGY IN CATTLE AND BUFFALOES IN PENINSULAR MALAYSIA

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By

LAT LAT HTUN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

July 2007

DEDICATION

Dedicated with love and gratitude to my parents, U Thein Tun Oo and Daw Maing Saw Waing and gratitude to Dr. Saw Bawm and Moe Zaw Tun

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

EPIDEMIOLOGY AND MORPHOLOGY OF LUNGWORM (*DICTYOCAULUS VIVIPARUS*), AND ITS ASSOCIATED LUNG PATHOLOGY IN CATTLE AND BUFFALOES IN PENINSULAR MALAYSIA

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July 2007

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Bovine dictyocaulosis is an important parasitic disease of cattle and buffaloes and is caused by the lungworm, *Dictyocaulus viviparus*. The parasite is an important cause of lung infection especially in the temperate regions of the world. While the documentation on bovine lungworm is vast in the temperate, it is very sporadic and limited in the tropics. In Malaysia, a tropical country, the occurrence of lungworm infections in cattle and buffaloes has been anecdotal. The present study was carried out to detect the presence of lungworm infections in cattle and buffaloes, to determine the prevalence of lungworm infection in cattle and buffaloes, to identify the risk factors associated with bovine lungworm infection, to compare the morphology of egg, first stage larvae (L1) and adult stage of Malaysian bovine lungworm with those of *D. viviparus* from published reports and Sweden and to compare the histopathological lesions of lungs infected with Malaysian bovine lungworm and those of lungs infected with *D. viviparus.*

A retrospective examination of available records and data was carried out to investigate the presence of lungworm infections in Peninsular Malaysia. Two studies were carried out to address the objective. In the first study, an investigation on lungworm disease outbreak in a beef breeding farm was conducted. It was found that the yearly lungworm-infection mortality rate within the seven-year period was 0.31%. Among the cases, more than half (67%) were male and 33% were females. Seventy-five percent of lungworm infection deaths occurred in calves between the ages of six and 12 months, and 25% occurred in cattle aged 12 to 19 months. Most of the deaths occurred in November (19%) and May (17%). In the second study, data of condemnation of lungs and reasons of condemnation between 1998 and 2004 was collected at the Department of Veterinary Services Headquarters in Kuala Lumpur. Parasitic lung condemnation from all slaughtered animals was 0.11%. The prevalence of parasitic infection in the lungs was found much higher in buffaloes than in cattle ($t = -3.906$, $p = 0.002$).

A cross-sectional study was carried out in four large scale farms (Farms A, B, C and D) and three dairy smallholdings (Farm E) to detect and determine the prevalence of lungworm infection and to identify the risk factors. Blood and faecal sampling on each farm, except Farm E, was performed every two months for a period of seven months. Farm E was sampled only once. Questionnaires on individual animals, farm management and disease occurrence were developed and the data were collected at the time of blood and faecal sampling. Meteorological data was collected from the Climate Division, Malaysian Meteorological Service. The total blood and faecal samples collected from the farms were 602. Baermannisation was performed for parasitological diagnosis and enzyme-link-immunosorbent assay was conducted for

serodiagnosis. The prevalence of lungworm infection based on baermannisation was 4.7%. The highest prevalence was found in Farm E. Using binary logistic regression analysis, gender and the interaction between monthly temperature and monthly rainfall were identified as the statistically significant risk factors for bovine lungworm infection. The likelihood of lungworm infection was about four times greater when the monthly rainfall was >100 mm and the monthly temperature was >27˚C to 29.1˚C than when the monthly rainfall was <100 mm and when the temperature was <27˚C ($p = 0.002$). Female animals were about 2.9 times less likely to be infected than male animals ($p = 0.01$).

Another cross-sectional study was carried out where 11 out of 25 abattoirs in Peninsular Malaysia were visited and slaughtered animals were examined. Animals slaughtered at Universiti Putra Malaysia (UPM) mosque during festivals were also examined. Among the total of 283 lungs from 260 cattle and 23 buffaloes sampled, lungworm was found in three Kedah-Kelantan (KK) cattle (1.1%). The morphological evaluation of egg, L1 and adult worm of the Malaysian bovine lungworm were conducted by comparing with those of *D. viviparus* from published reports and Sweden. Histopathological lesions of infected lungs were also examined. Based on the morphology of the lungworm and the histopathological changes of the affected lungs, the Malaysian bovine lungworm is believed to be most likely *D. viviparus*.

In conclusion, bovine lungworm infection in the Malaysian cattle and buffaloes can be detected and the prevalence is low. The disease occurrence was associated with the gender of the animals, and the climatic conditions. Based on the morphology of

the lungworm and the histopathological changes of the affected lungs, the Malaysian bovine lungworm is believed to be *D. viviparus*.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

EPIDEMIOLOGI DAN MORFOLOGI CACING PEPARU (*DICTYOCAULUS VIVIPARUS*), DAN PATOLOGI PEPARU YANG BERKAITAN PADA TERNAKAN LEMBU DAN KERBAU DI SEMENANJUNG MALAYSIA

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Bovine dictyocaulosis ialah penyakit parasit yang penting pada ternakan lembu dan kerbau dan penyakit ini disebabkan oleh cacing peparu, *Dictyocaulus viviparus*. Parasit ini adalah penyebab utama jangkitan cacing peparu terutama kawasan dunia yang beriklim sederhana. Menurut laporan, cacing peparu lembu amat banyak terdapat di kawasan iklim sederhana tetapi hanya sekali sekala dan terhad di kawasan tropik. Di Malaysia negara beriklim tropika, kejadian jangkitan cacing peparu pada lembu dan kerbau merupakan anekdot. Kajian ini telah di jalankan untuk mengesan kehadiran jangkitan cacing peparu, menentukan kadar prevalens kejadian jangkitan cacing peparu pada lembu dan kerbau, memahami faktor risiko berkaitan dengan jangkitan cacing peparu, membuat bandingan morfometri dan morfologi peringkat larva dan peringkat dewasa cacing peparu lembu Malaysia dengan cacing *D. viviparus* dan membuat bandingan histopatologi pada lesion peparu yang di jangkiti cacing peparu lembu Malaysia dengan yang di jangkiti cacing peparu, *D. viviparus*.

Pemeriksaan retrospektif pada rekod dan data yang telah dijalankan untuk mengesan kejadian jangkitan cacing peparu lembu di Semenanjung Malaysia. Dua kajian telah di jalankan untuk mencapai objektif. Kajian awal telah dijalankan dipusat pembiakan lembu pedaging untuk menyiasat wabak jangkitan cacing peparu. Di dapati kadar kematian jangkitan cacing peparu tahunan bagi tujuh tahun di ladang tersebut adalah bersamaan 0.31%. Lebih banyak kes di kesan berlaku pada lembu jantan (67%) berbanding lembu betina (33%). Tujuh puluh lima peratus dari kematian akibat cacing peparu berlaku pada lembu yang berumur kurang daripada 12 bulan berbanding lembu berumur 12 hingga 19 bulan. Kebanyakan kematian ternakan lembu berlaku pada bulan November (19%) dan Mei (17%).

Pada kajian kedua, data penghapusan peparu serta penyebab penghapusan diantara tahun 1998 dan tahun 2004 telah di ambil daripada Ibu Pejabat Jabatan Perkhidmatan Haiwan di Kuala Lumpur. Peratusan penghapusan peparu berparasit yang diperolehi daripada semua sembelihan haiwan adalah bersamaan 0.11%. Kadar kelaziman jangkitan parasit peparu lebih tinggi pada kerbau berbanding pada lembu ($t = -3.906$, $p = 0.002$).

Satu kajian keratan rentas telah dijalankan pada empat buah ladang (ladang A, B, C, D) bersama tiga ladang tenusu kecil (ladang E) untuk mengenalpasti dan menentukan kadar prevalens jangkitan cacing peparu serta untuk mengenali faktor risiko. Sampel darah dan tinja najis telah diambil daripada setiap ladang setiap dua bulan selama tempoh lapan bulan. Hanya ladang E, sampel diambil sekali sahaja. Soal-selidik untuk setiap ekor haiwan, pengurusan ladang dan kejadian jangkitan dijalankan pada masa sampel darah dan najis diambil. Maklumat suhu dan hujan di perolehi daripada

Bahagian Kajicuaca, Jabatan Kajicuaca Malaysia. Sejumlah 602 sampel darah dan najis diambil daripada ladang tersebut. Teknik Baermann's digunakan untuk pemeriksaan parasitologi dan *enzyme-link-immunosorbent assa*y untuk pemeriksaan serologi. Hasil pemeriksaan menggunakan teknik Baermann's mendapati, kadar prevalens jangkitan cacing peparu adalah bersamaan 4.7%. Ladang E menunjukkan kadar prevalens jangkitan yang paling tinggi. Dengan menggunakan analisis binari logistik regresi, jantina dan interaksi antara suhu bulanan dan taburan hujan bulanan telah menunjukkan keertian statistik sebagai faktor risiko jangkitan cacing peparu pada lembu. Kebarangkalian jangkitan cacing peparu bertambah empat kali ganda pada masa taburan hujan bulanan >100 mm dan suhu bulanan >27˚C – 29.1˚C berbanding dengan pada masa taburan hujan bulanan adalah <100 mm dan suhu bulanan <27˚C. Haiwan betina didapati kurang 2.9 kali ganda peluang jangkitan berbanding haiwan jantan.

Satu lagi kajian rentas telah dijalankan keatas 11 dari pada 25 rumah sembelih dan haiwan disembelih telah diperiksa. Haiwan yang disembelih di masjid Universiti Putra Malaysia semesa perayaan juga diperiksa. Cacing peparu telah dijumpai pada tiga lembu Kedah-Kelantan (1.1%), hasil pemeriksaan 283 peparu daripada 260 ekor lembu dan 23 ekor kerbau. Pemerhatian morfometri dan morfologi cacing peparu peringkat awal larva dan peringkat dewasa pada lembu Malaysia telah dibandingkan dengan cacing peparu *D. viviparus* di Sweden dan pada maklumat literasi. Pemeriksaan histopatologi juga dijalankan pada peparu yang dijangkiti. Berdasarkan pemerhatian morfometri dan morfologi cacing peparu dan hasil pemeriksaan histopatologi pada peparu yang dijangkiti adalah di percayai bahawa cacing peparu lembu Malaysia ialah *D. viviparus*.

Kesimpulannya, cacing peparu lembu dan jangkitannya boleh dikesan dan kadar prevalens adalah sangat rendah. Berlakunya jangkitan dihubungkaitkan dengan kejantinaan haiwan dan keadaan cuaca. Berdasarkan morfologi cacing dan histopatologi peparu, cacing peparu Malaysia dipercayai adalah *D. viviparus.*

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I certify that an Examination Committee has met on 6th July 2007 to conduct the final examination of Lat Lat Htun on her Doctor of Philosophy thesis entitled "Epidemiology and Morphology of Lungworm (*Dictyocaulus viviparus*), and its Associated Lung Pathology in Cattle and Buffaloes in Peninsular Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

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LAT LAT HTUN

Date: 23 JULY 2007

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