

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	iii
ABSTRACT IN ENGLISH	v
ABSTRACT IN THAI	vii
TABLE OF CONTENTS	ix
LIST OF TABLES	xiii
LIST OF ILLUSTRATION	xiv
LIST OF APPENDICES	xv
LIST OF ABBREVIATIONS AND SYMBOL	xvi
1. INTRODUCTION AND OBJECTIVES	1
1.1 General overview	1
1.2 Livestock production and pork demand in Cambodia	2
1.3 Porcine cysticercosis and trichinellosis	3
1.4 Objectives of the study	4
2. LITERATURE REVIEW	5
2.1 <i>Taenia solium</i> complex	5
2.1.1 General overview	5
2.1.2 Morphology	7
2.1.3 Life cycle	7
2.1.4 Pathogenicity and clinic	9
2.1.5 Epidemiology	10
2.1.6 Diagnosis	12
2.1.7 Therapy and prevention	14
2.2 <i>Taenia asiatica</i> complex	16
2.3 Differentiation of cysticercus species	17
2.4 <i>Trichinella</i> complex	19
2.4.1 General overview	19
2.4.2 Morphology	21

2.4.3 Life Cycle	21
2.4.4 Pathogenicity and clinic	22
2.4.5 Epidemiology	23
2.4.6 Diagnosis	26
2.4.7 Therapy and prevention	33
2.5 Global importances of porcine cysticercosis and trichinellosis	34
2.5.1 Porcine cysticercosis	34
2.5.2 Trichinellosis	36
3. MATERIALS AND METHODS	39
3.1 Justification for the selection of study locations	39
3.2 Slaughterhouses and slaughter pigs	39
3.3 Description of the study design	40
3.4 General description of study setting areas	42
3.5 Pig raisings and pig breed in Cambodia	42
3.6 Description of study population	43
3.7 Sampling procedure and biological sample collection	43
3.7.1 Sample size determination	43
3.7.2 Collection of biological samples	45
3.7.2.1 Cyst collection	45
3.7.2.2 Blood collection and preparation of sera	45
3.8 Ante- and post-mortem examination of porcine cysticercosis	45
3.8.1 Ante-mortem examination (Tongue palpation)	45
3.8.2 Post-mortem examination (Meat inspection) and predilection sites	46
3.9 Isolation, identification and characteristics of cysts of <i>T. solium</i>	47
3.9.1 Morphological examination of <i>T. solium</i> cysticerci	47

3.9.2 Indirect non-competitive enzyme linked immunosorbent assays (AB-ELISA)	47
3.9.3 Endpoint titration of serum samples positive by single dilution AB-ELISA	50
3.10 Questionnaire survey	51
3.10.1 Slaughterhouse and hospital questionnaires	51
3.10.2 Pig farm questionnaires.....	51
3.11 Data management and analysis	52
4. RESULT	53
4.1 Investigation on porcine cysticercosis	53
4.1.1 Slaughterhouse survey results	53
4.1.1.1 Distribution of prevalence for cysticercosis by breeds of slaughter pigs in Cambodia	53
4.1.1.2 Distribution of prevalence for porcine cysticercosis by slaughterhouses.....	54
4.1.1.3 Distribution of prevalence for porcine cysticercosis by farm types	55
4.1.1.4 Distribution of prevalence for porcine cysticercosis by districts.....	55
4.1.1.5 Distribution of prevalence for porcine cysticercosis by provinces.....	57
4.1.1.6 Predilection sites of cysts for porcine cysticercosis by meat inspection	58
4.1.2 Morphology of <i>T. solium</i> cysticerci hooks	59
4.2 Investigation on trichinellosis	60
4.2.1 Distribution of sero-positive samples for trichinellosis by breeds of slaughter pigs.....	60
4.2.2 Summary results of AB-ELISA reading of <i>Trichinella</i> of slaughter pigs.....	61
4.2.3 Endpoint titration of serum samples positive	

by single dilution AB-ELISA	61
4.2.4 Sero-prevalence of trichinellosis of slaughter pigs by husbandry and geographical distribution	61
4.3 Results from questionnaire surveys	65
4.3.1 Responses to slaughterhouse questionnaire survey..	65
4.3.2 Responses to pig farm questionnaire survey	66
4.3.3 Responses to hospital questionnaire survey	67
5. DISCUSSION AND CONCLUSION	68
5.1 Investigation on porcine cysticercosis	68
5.2 Investigation on trichinellosis	71
5.3 Conclusion and recommendation	72
6. REFERENCES	75
7. APPENDICES	92
CURRICULUM VITAE	105
DECLARATION	108

LIST OF TABLES

Table	Page
1. Morphological differentiation between <i>T. solium</i> , <i>T. saginata</i> and <i>T. asiatica</i>	18
2. Global prevalence data on porcine cysticercosis, taeniosis and human cysticercosis in some countries of the world.....	36
3. Global Prevalence data on trichinellosis in some countries of the world.....	38
4. Distribution of prevalence for porcine cysticercosis by breed of slaughter pigs in Phnom Penh/ Cambodia, 2004-2005.....	54
5. Prevalence of porcine cysticercosis by four slaughterhouses in Phnom Penh/ Cambodia, 2004-2005	54
6. Distribution of prevalence for porcine cysticercosis by farm types, Cambodia, 2004-200.....	55
7. Distribution of prevalence for porcine cysticercosis by districts/Cambodia, 2004-2005.....	56
8. Distribution of prevalence for porcine cysticercosis by provinces/ Cambodia	57
9. Organ and muscle involvement (%) of cysts in slaughter pigs in Phnom Penh / Cambodia, 2004-2005 (n= 47)	58
10. Morphology of <i>T. solium</i> cysticerci hooks obtained from pig carcasses.....	59
11. Distribution of sero-positive samples (by AB-ELISA) for trichinellosis by breeds of slaughter pigs in Cambodia, 2004-2005.....	60
12. Summary results of AB-ELISA reading of <i>Trichinella</i> of slaughter pigs (n=440)	63
13. Endpoint titration of <i>Trichinella</i> positives of slaughter pigs by single dilution AB-ELISA	64
14. Sero-prevalence of trichinellosis of slaughter pigs by husbandry and geographical distribution in Cambodia, 2004-2005.....	64

LIST OF ILLUSTRATIONS

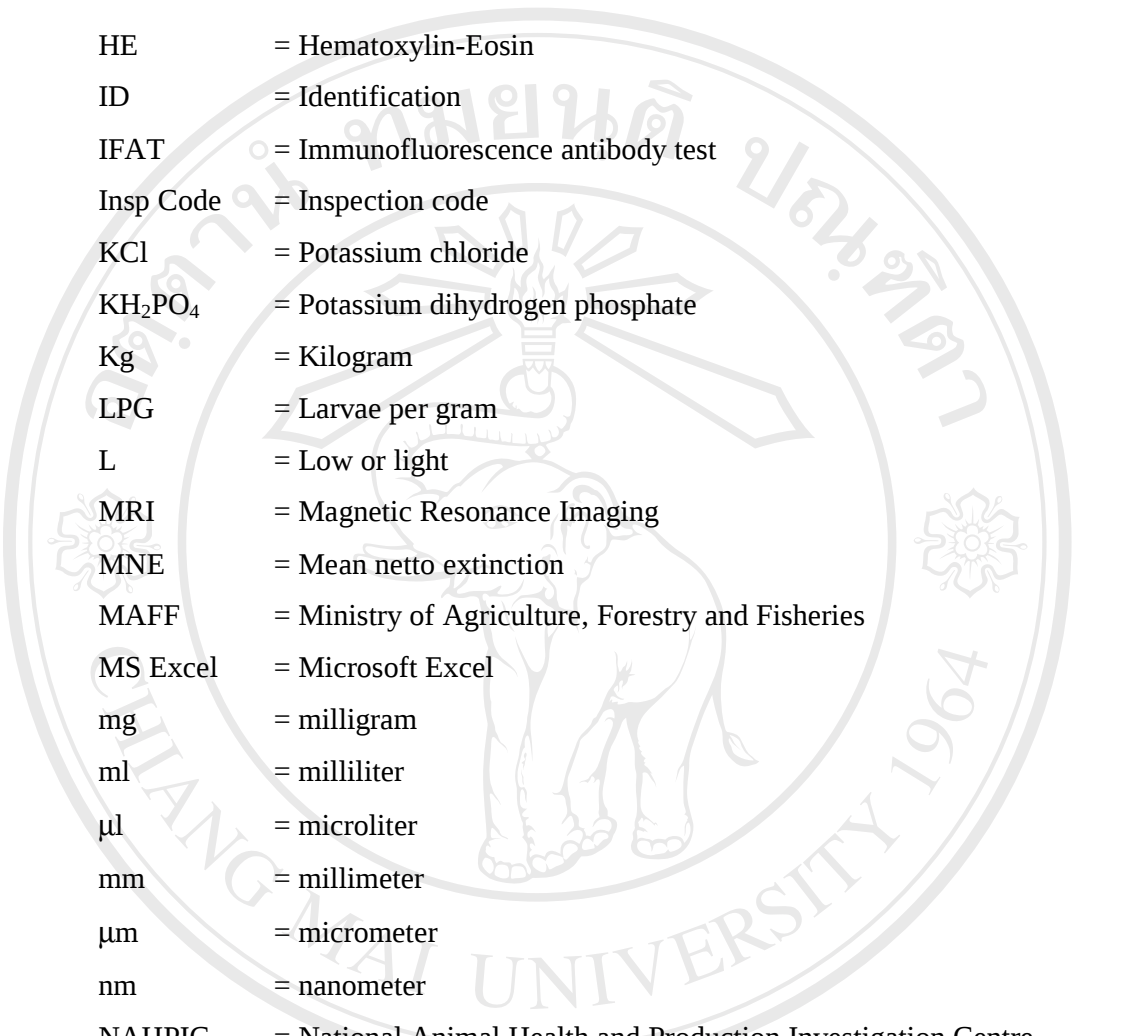
Figure	page
1. Phnom Penh Map showing slaughterhouses located in different districts around Phnom Penh Municipality	41
2. Map of Cambodia showing provinces where slaughter pigs were.....	44

LIST OF APPENDICES

Appendix	Page
1. Reagents and solutions.....	92
2. Questionnaire survey	93
3. Degree of infection by cysticerci in organs and muscles (n=47).....	99
4. Summary results of questionnaire surveys in pig slaughterhouses around Phnom Penh / Cambodia (n=70).....	101
5. Summary results of questionnaire surveys of pig farms in 3 provinces / Cambodia, (n=132)	103

LIST OF ABBREVIATIONS

AB-ELISA	= Antibody enzyme linked immunosorbent assay
ABTS	= 2,2'azino-di-(3 ethylbenzthiazoline sulfonic acid)
Ag-ELISA	= Antigen-capture enzyme linked immunosorbent assay
BfR	= Federal Institute for Risk Assessment Berlin, Germany
CNS	= Central nervous system
CMU	= Chiang Mai University
CAC	= Codex Alimentarius Commission
CFT	= Complement fixation test
CI	= Confidence intervals
CT	= Computerized Tomography Scan
°C	= Degree Celsius
DAAD	= Deutscher Akademischer Austausch-Dienst (German Academic Exchange Services)
DAHP	= Department of Animal Health and Production
DNA	= Deoxyribonucleic Acid
EEC/ EC	= European Communities
EITB	= Enzyme Linked Immunoelctrotransfer Blot
E/S antigen	= Excretory/ secretory antigen
Format.	= Formation
FAO	= Food and Agriculture Organization of United Nations
FUB	= Freie Universität Berlin
°F	= Degree Fahrenheit
GDP	= Gross Domestic Products
HCl	= Hydrochloric acid
HAT	= Haemogglutination test
KW	= Kruskal-Wallis
H	= High or Heavy



HE	= Hematoxylin-Eosin
ID	= Identification
IFAT	= Immunofluorescence antibody test
Insp Code	= Inspection code
KCl	= Potassium chloride
KH_2PO_4	= Potassium dihydrogen phosphate
Kg	= Kilogram
LPG	= Larvae per gram
L	= Low or light
MRI	= Magnetic Resonance Imaging
MNE	= Mean netto extinction
MAFF	= Ministry of Agriculture, Forestry and Fisheries
MS Excel	= Microsoft Excel
mg	= milligram
ml	= milliliter
μl	= microliter
mm	= millimeter
μm	= micrometer
nm	= nanometer
NAHPIC	= National Animal Health and Production Investigation Centre
NCC	= Neurocysticercosis
NF	= National Formulary (United States)
NGOs	= Non-Government Organizations
NIS	= National Institute of Statistics of Cambodia
N	= Negative
NE	= Netto extinction
Na_2HPO_4	= Disodium hydrogen phosphate
NaCl	= Sodium chloride
No.	= Number

OIE	= Office International des Epizooties (World Organization for Animal Health)
OD	= Optical density
PCR	= Polymerase Chain Reaction
PCR-REA	= Polymerase Chain Reaction Restriction Enzyme Analysis
PBS	= Phosphate buffered saline
PBS-T	= Phosphate buffered saline, containing 0.05% Tween 20
P, P- value	= Probability value
Preval.	= Prevalence
QAS	= Quality assurance system
RCP	= Recommended International Code for ante and post mortem of slaughter animals
R., Rostel.	= Rostellum
Rudiment.	= Rudimentary
Sl.	= Slaughterhouse
T.	= <i>Taenia</i>
USA	= United States of American
UVMA	= University of Veterinary Medicine, Austria
VPH	= Veterinary Public Health
WHO	= World Health Organization
WBA	= Western blot analysis
χ^2	= Chi- square
+/-	= Questionable (doubtful)
+++	= Positive