Clinical and Laboratory Diagnosis of Some Blood Parasites in Dairy Cattle in Qena Governorate

PH.D. Thesis

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LIST OF ABBREVIATIONS

Abbreviations	Explanation
ALT	Alanine transaminase
A/G ratio	Albumin/Globulin ratio
ALP	Alkaline Phosphatase
A. cohaerens	*Ambylomma cohaerens*
A. haebraeum	*Ambylomma haebraeum,*
A. haebreum	*Ambylomma haebreum*
A. lepidu	*Ambylomma lepidu*
A.	*Anaplasma*
AST	Aspartate aminotransferase
AST	Aspartate transaminase
B.	*Babesia*
bp	Base pair
BUN	Blood urea nitrogen
B. indicus	Bos indicus
B. taurus	Bos taurus
CAT	Card agglutination test
˚C	Celsius
CFSPH	Center for Food Security and Public Health
cm	Centimeter
CSESP	Committee on Systematic and Evolution of the Society of Protozoologists
cELISA	competitive Enzyme-linked immunosorbent assay
cyt b	cytochrome b
dl	Deciliter
DNA	Deoxyribonucleic acid
D.B	Direct bilirubin

DDW	Double distilled water
ECF	East coast fever
EGP	Egyptian Pound
ELISA	Enzyme-linked immunosorbent assay
EDTA	Ethylenediaminetetraacetic acid
e.g.	Exempli gratia
fl	Femtoliter
FAO	Food and Agriculture Organization
GGT	Gamma-Glutamyl Transferase
GSTBS	Giemsa stained thin blood smear
gp	Glycoprotein
g	Gram
Hb	Haemoglobin
H.	*Hyalomma*
ICT	Immunochromatographic test
IgG	Immunoglobulin G
IgM	Immunoglobulin M
iELISA	Indirect Enzyme-linked immunosorbent assay
IFAT	Indirect fluorescent antibody test
ITM	Infection and treatment method
INF-γ	interferon-γ
kb	Kilobase
kDa	Kilodalton
Kg	Kilogram
kg	Kilogram
L	Liter
LAMP	Loop-mediated isothermal amplification
MSP	Major surface protein
MCH	Mean corpuscular haemoglobin

MCHC	Mean corpuscular haemoglobin concentration
MCV	Mean corpuscular volume
MPSA	merozoite / piroplasm surface antigen
MSAs	Merozoite surface antigens
µg	Microgram
µl	Microliter
µm	Micrometer
mg	Milligram
ml	Milliliter
mm	Millimeter
MALR	Ministry of Agriculture and Land Reclamation
min	Minute
NK	Natural killer
NO	Nitric oxide
NS	Non Significant
N	North
No.	Number
n	Number
OIE	Office of International Des Epizooties
PCV	Packed cell volume
pg	Picograms
PCR	Polymerase chain reaction
P value	Probability value
RT-PCR	Real-time Polymerase chain reaction
RDW	Red blood cell distribution width
RBCs	Red blood cells
R.	*Rhipicephalus*
RAPs	Rhoptry-associated proteins
RNA	Ribonucleic acid

rpm	Round per minute
sec.	Second
S	South
spp.	species
SBPs	Spherical body proteins
T.	*Theileria*
TBDs	Tick-borne diseases
TBE	Tris borate EDTA
TNF-α	Tumor necrosis factor alpha
UV	Ultra Violet
VMSA	variable merozoite surface antigens
WBCs	White blood cells
WHO	World Health organization

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Summary

Bovine theileriosis, babesiosis and anaplasmosis are a tick-borne hemoparasitic diseases and are responsible for huge economic losses in livestock sector in Egypt. *Theileria annulata* is a protozoan parasite that causes bovine theileriosis, *Babesia bigemina* and *Babesia bovis* are protozoan parasites that cause bovine babesiosis while *Anaplasma marginalis* is a rickettsial pathogen that causes bovine anaplasmosis.

In the current study, a total number of 110 dairy cattle from different zones of Qena governorate, Egypt were clinically and laboratory investigated for diagnosis of theileriosis, babesiosis and anaplasmosis using two methods: direct microscopy (stained blood smears) and polymerase chain reaction (PCR) during the period from January 2019 to December 2019.

PCR technique is the most sensitive and specific test used for diagnosis of the disease in either acute or chronic cases and also in carrier animals of theileriosis, babesiosis and anaplasmosis.

It is not accurate enough to determine the blood parasitic organisms by Giemsa staining as blood parasitic structures recognized in erythrocytes are often difficult to be differentiated from Heinz bodies, Howell-Jolly bodies or staining artifacts.

Hemato-biochemical alternations in theileriosis, babesiosis and anaplasmosis infected cattle were also detected in this study and can be considered one of the most important procedure that may confirm the infection.

In bovine piroplasmosis and anaplasmosis, there were changes in leucogram which might be attributed to persistent harmful effects of toxic metabolites of blood parasites on the haemopiotic organs especially bone marrow and their interference with the process of leucogenesis.

There were changes in hemogram could be due to destructive parasite's influence on RBCs, or because of lytic effect of intra erythrocyte parasite, immune-mediated mechanism such as erythrophagocytosis might be responsible for RBCs count reduction eventually. Anemia proposed to be resulted from removal of piroplasm from infected erythrocytes by macrophages.

In bovine piroplasmosis and anaplasmosis, there were changes in liver enzymes activities which explained as a result of the harmful effect of toxic metabolites of blood parasites on liver cells.

There were also changes in the protein picture in infected animals which could be due to decrease protein production as a result of harmful effect of toxic metabolites of blood parasites on liver cells, deprivation of diet protein resulting from anorexia and fever accompanied infection also, disturbed hepatic functions and destructed RBCs and its excretion in urine can play a role. Also immune response against blood parasites may have a role in these changes.

Due to the economic losses of livestock sector caused by hemoparasitic diseases, high costs of treatment and the high prevalence of carrier state infections, prevention is the best mean to control the infections; it consists of two types of actions which are control of the vector ticks and vaccination.