

**SEASONAL PREVALENCE AND DISTRIBUTION OF TICKS
ON THE ACCRA PLAINS OF GHANA AND THEIR
ASSOCIATION WITH DERMATOPHILOSIS**

VOLUME II

by

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VOLUME II
CONTENTS

LIST OF PLATES

LIST OF TABLES

LIST OF FIGURES

APPENDICES

LIST OF PLATES

		Page No.
Plate 1.1	A bull infected with dermatophilosis. Note the thickness of scabs and how they have coalesced	1
Plate 1.2	<i>Dermatophilus congolensis</i> in an impression smear of the undersurface of a scab stained with Giemsa. Arrows are pointing at gram-positive rows of cocci which form the branching filaments of <i>D. congolensis</i>	2
Plate 2.1	<i>Amblyomma variegatum</i> ticks. Fully engorged female and a male. Note the relatively long and strong "mouth-parts" of the ticks	3
Plate 2.2(a)	<i>Amblyomma variegatum</i> ticks attached to the groin of a cow	4
Plate 2.2(b)	<i>Amblyomma variegatum</i> ticks attached to the brisket of the same cow in (a)	5
Plate 2.3	Animals of the experiment herd in their kraal. The white animals are zebu-type cattle and the rest are N'damas. In the background is the grazing area	6
Plate 2.4	Generalized dermatophilosis in a Friesian cow. Note lesions on all four feet, the axillae, brisket, body and face	41
Plate 2.5	Dermatophilosis lesions on the feet of a Friesian cow. Lesions normally start on the feet of Friesians	42

LIST OF TABLES

		Page No.
Table 2.1	Number of cattle at five selected local herds	7
Table 2.2	Tick attachment sites in ten untreated Zebu-type cattle in November 1989 and 1990	8
Table 2.3	Relative abundance of tick species counted on cattle at experiment herd over 26 months	9
Table 2.4	Significance of differences in the mean monthly counts of <i>Amblyomma variegatum</i> ticks on cattle	16
Table 2.5	Medians of the mean monthly counts of <i>Amblyomma variegatum</i> ticks on experiment groups of cattle	17
Table 2.6	Relative abundance of tick species counted on cattle at selected local herds over 26 months	19
Table 2.7	Correlation between numbers of <i>Amblyomma variegatum</i> and dermatophilosis	24
Table 2.8	Correlation between numbers of <i>Hyalomma rufipes</i> and dermatophilosis	25
Table 2.9	Correlation between numbers of <i>Rhipicephalus senegalensis</i> and dermatophilosis	26
Table 2.10	Correlation between numbers of <i>Boophilus</i> species and dermatophilosis	27
Table 2.11	Prevalence of dermatophilosis at local herd 1	31
Table 2.12	Prevalence of dermatophilosis at local herd 2	33
Table 2.13	Prevalence of dermatophilosis at local herd 3	34
Table 2.14	Prevalence of dermatophilosis at local herd 4	37
Table 2.15	Prevalence of dermatophilosis at local herd 5	39
Table 3.1	Monthly median values, using foetal calf serum (FCS), of the percentages of transformed cells per 200 lymphocytes cultured from five Zebu-type cows treated with acaricide	64
Table 3.2	Monthly median values, using foetal calf serum (FCS), of the percentages of transformed cells per 200 lymphocytes cultured from five Zebu-type cows in Group 1 infested with ticks	65

	Page No.	
Table 3.3	Monthly median values, using foetal calf serum (FCS), of the percentages of transformed cells per 200 lymphocytes cultured from five Zebu-type cows in Group 2 infested with ticks	66
Table 3.4	Monthly median values, using foetal calf serum (FCS), of the percentages of transformed cells per 200 lymphocytes cultured from five N'dama cows in Group 2 infested with ticks	67
Table 3.5	Summary of the medians of the percentages of lymphocytes transformed from cattle in the experiment groups comparing day-5 cultures without antigen and with Concanavalin A	68
Table 3.6	Summary of the medians of the percentages of lymphocytes transformed from cattle in the experiment groups comparing day-5 cultures without antigen and <i>D. congolensis</i>	69
Table 3.7	Comparison of the medians of the percentages of lymphocytes transformed from cattle in the experiment groups using day-5 cultures with Concanavalin A	70
Table 3.8	Significance of differences between the rates of transformation between lymphocytes from cows collected and cultured at monthly intervals in the absence of antigen	71
Table 3.9	Significance of differences between the rates of transformation between lymphocytes at monthly intervals from cows in the absence of antigen	72
Table 3.10	Day-5 blastogenesis results for Concanavalin A stimulated cultures	73
Table 3.11	Significance of differences in median numbers of blastogenic lymphocytes from untreated and acaricide-treated groups of cattle cultured in the presence of foetal calf serum and with Concanavalin A	74
Table 3.12	Significance of differences in median numbers of blastogenic lymphocytes from untreated and treated cattle cultured in the presence of autologous serum and with Concanavalin A	75
Table 3.13	Monthly median values, using foetal calf serum and autologous serum, of the percentages of transformed cells per 200 lymphocytes cultured from Friesian cattle treated with acaricides	76

	Page No.
Table 3.14	77
Acaricide-treated Friesian cattle. Comparison of day-5 culture medium containing no antigen with other treatment regimes using Mann-Whitney U Test	
Table 3.15	78
Monthly median values, using foetal calf serum and autologous serum, of the percentages of transformed cells per 200 lymphocytes cultured from Friesian cattle treated with acaricide	
Table 3.16	79
Monthly median values, using foetal calf serum of the percentages of transformed cells per 200 lymphocytes cultured from treated and untreated Friesian cattle	
Table 3.17	80
Lines of best fit calculated from arcsin transformation of the percentages of transformed lymphocytes in acaricide-treated and untreated Friesians	
Table 3.18	83
Monthly medians of the percentages of transformed cells per 200 lymphocytes derived from untreated Friesian cattle and cultured for five days with foetal calf serum	
Table 3.19	84
Monthly medians of the percentages of transformed cells per 200 lymphocytes derived from untreated Friesian cattle and cultured for five days with autologous serum	
Table 3.20	85
Paired Wilcoxon rank sign test of the percentages of transformed lymphocytes in Concanavalin A-treated cultures supplemented with foetal calf serum and autologous serum	
Table 3.21	87
Monthly counts of lymphocyte cultures supplemented with FCS and pulsed with [³ H]-thymidine: comparison between cultures from untreated Friesians without antigen, with Concanavalin A and with <i>D. congolensis</i>	
Table 3.22	88
Monthly counts of lymphocyte cultures supplemented with FCS and pulsed with [³ H]-thymidine: comparison between cultures from acaricide-treated Friesians without antigen, with Concanavalin A and with <i>D. congolensis</i>	
Table 3.23	89
Monthly counts of lymphocyte cultures supplemented with autologous serum and pulsed with [³ H]-thymidine: comparison between cultures from acaricide-treated Friesians without antigen, with Concanavalin A and with <i>D. congolensis</i>	

	Page No.	
Table 3.24	Monthly counts of lymphocyte cultures supplemented with autologous serum and pulsed with [³ H]-thymidine: comparison between cultures from acaricide-treated Friesians without antigen, with Concanavalin A and with <i>D. congolensis</i>	90
Table 4.1	Monthly median values, using foetal calf serum (FCS) of the percentages of transformed cells per 200 lymphocytes cultured from six clinically infected Zebu-type cattle	91
Table 4.2	Clinically infected cattle. Comparison of culture medium containing no antigen with other treatment regimes using Mann-Whitney U Test	92
Table 4.3	Monthly median values, of the percentages of transformed cells per 200 lymphocytes cultured from six clinically infected Zebu-type cattle using a mixture of foetal calf serum (FCS) and autologous serum	93
Table 4.4	Day 5 blastogenesis percentages for Concanavalin A-stimulated cultures from clinically infected animals cultured with FCS alone and with a mixture of FCS and autologous serum	94
Table 4.5	Median values, using foetal calf serum, autologous serum and sera from two clinically infected cows, of the percentages of transformed cells per 200 lymphocytes cultured from two acaricide-treated Zebu-type cows	95
Table 4.6	Percentage depression in relation to percentage proliferation of lymphocytes derived from acaricide-treated animals with FCS in Concanavalin A day-5 cultures	96
Table 4.7	Statistical analysis of differences between percentages of blastogenic activity in cultures of lymphocytes from cows 159 and 164 supplemented with different sera	97
Table 5.1	Skin reactivity of cattle to intradermal injections with pure protein derivative (PPD)	98
Table 5.2	Kruskal-Wallis analyses of skin measurements before and after intradermal inoculation of three groups of cattle with PPD	99

	Page No.	
Table 5.3	Median values using foetal calf serum (FCS) and pure protein derivative (PPD) antigen, of the percentages of transformed cells per 200 lymphocytes cultured from cattle on different treatments	100
Table 5.4	Slopes of lines of best fit	101
Table 5.5	Median values, using foetal calf serum, of the percentages of transformed cells per 200 lymphocytes from 15 cows sensitized with PPD cultured with Concanavalin A and <i>D. congolensis</i>	103
Table 5.6	Median values, using foetal calf serum (FCS) and tick saliva antigen, of the percentages of transformed cells per 200 lymphocytes cultured from cattle on different treatments	105
Table 5.7	Significance of differences in the percentages of lymphocytes from different treatment groups of cattle cultured without antigen and cultured with tick saliva	106
Table 5.8	Days to clear infection in cattle experimentally infected with <i>D. congolensis</i>	107
Table 5.9	Median days for experimental infection to complete resolution	108
Table 5.10	Comparison of days to complete resolution between first and subsequent infections	110
Table 5.11	Significance of differences attributable to number of infections and days to complete resolution in the different experimental groups of cattle	111
Table 5.12	Significance of differences attributable to cattle groups in days to complete resolution	112
Table 5.13	Skin reactivity of cattle to intradermal injections with <i>D. congolensis</i> antigen - antigen M - 24 hours post inoculation	113
Table 5.14	Skin reactivity of cattle to intradermal injections with <i>D. congolensis</i> antigen - antigen S - 24 hours post inoculation	114
Table 5.15	Skin reactivity of cattle to intradermal injections with <i>D. congolensis</i> antigen - antigen M - 72 hours post inoculation	115
Table 5.16	Skin reactivity of cattle to intradermal injections with <i>D. congolensis</i> antigen - antigen S - 72 hours post inoculation	116

LIST OF FIGURES

		Page No.
Figure 2.1	Seasonal distribution of ticks on the first group of untreated Zebu-type cattle (UTZ)	10
Figure 2.2	Seasonal distribution of ticks on the second group of UTZ	11
Figure 2.3	Seasonal distribution of ticks on the untreated N'damas	12
Figure 2.4	Seasonal distribution of ticks on the untreated Friesians (UTF)	13
Figure 2.5	Seasonal distribution of ticks on acaricide-treated Zebu-type cattle (A-TZ)	14
Figure 2.6	Seasonal distribution of ticks on the acaricide-treated Friesians (A-TF)	15
Figure 2.7	Seasonal distribution of ticks on cattle at local herd 1	18
Figure 2.8	Seasonal distribution of ticks on cattle in local herd 2	20
Figure 2.9	Seasonal distribution of ticks on cattle in local herd 3	21
Figure 2.10	Seasonal distribution of ticks on cattle in local herd 4	22
Figure 2.11	Seasonal distribution of ticks on cattle in local herd 5	23
Figure 2.12	Association between <i>Amblyomma variegatum</i> and dermatophilosis in local herd 1	28
Figure 2.13	Pearson's parametric correlation between <i>Amblyomma variegatum</i> and dermatophilosis at local herd 1	29
Figure 2.14	Pearson's parametric correlation between <i>Amblyomma variegatum</i> and dermatophilosis at local herd 1 with 2 month lag	30
Figure 2.15	Association between <i>Amblyomma variegatum</i> and dermatophilosis at local herd 2	32
Figure 2.16	Association between <i>Amblyomma variegatum</i> and dermatophilosis at local herd 3	35

Figure 2.17	Association between <i>Amblyomma variegatum</i> and dermatophilosis at local herd 4	36
Figure 2.18	Association between <i>Amblyomma variegatum</i> and dermatophilosis at local herd 5	38
Figure 2.19	Association between <i>Amblyomma variegatum</i> and dermatophilosis in the UTF	40
Figure 2.20	Association between <i>Amblyomma variegatum</i> and dermatophilosis in the A-TF	43
Figure 2.21	Association between <i>Amblyomma variegatum</i> and dermatophilosis in the A-TZ	44
Figure 2.22	Rainfall and temperature at Accra Airport 1989-1991	45
Figure 2.23	Relative humidity at Accra Airport 1989-1991	46
Figure 2.24	Association between rainfall and <i>Amblyomma variegatum</i> at local herd 1	47
Figure 2.25	Association between rainfall and dermatophilosis at local herd 1	48
Figure 2.26	Association between relative humidity and dermatophilosis at local herd 1	49
Figure 2.27	Association between relative humidity and <i>Amblyomma variegatum</i> at local herd 1	50
Figure 2.28	Association between temperature and <i>Amblyomma variegatum</i> at local herd 1	51
Figure 2.29	Rainfall and temperature at Legon 1989-1991	52
Figure 2.30	Relative humidity at Legon 1989-1991	53
Figure 2.31	Association between rainfall and <i>Amblyomma variegatum</i> at local herds 3, 4 and 5	54
Figure 2.32	Association between rainfall and dermatophilosis at local herds 3, 4 and 5	55
Figure 2.33	Association between relative humidity and dermatophilosis at local herds 3, 4 and 5	56
Figure 2.34	Association between relative humidity and <i>Amblyomma variegatum</i> at local herds 3, 4 and 5	57

	Page No.	
Figure 2.35	Association between temperature and <i>Amblyomma variegatum</i> at local herds 3, 4 and 5	58
Figure 2.36	Association between rainfall and dermatophilosis at experiment herd	59
Figure 2.37	Association between rainfall and <i>Amblyomma variegatum</i> at experiment herd	60
Figure 2.38	Association between relative humidity and <i>Amblyomma variegatum</i> at experiment herd	61
Figure 2.39	Association between relative humidity and dermatophilosis at experiment herd	62
Figure 2.40	Association between temperature and <i>Amblyomma variegatum</i> at experiment herd	63
Figure 3.1(a)	Percentage lymphocyte transformation in acaricide-treated and untreated Friesians	81
Figure 3.1(b)	Arcsin transformation of percentages of transformed lymphocytes derived from acaricide-treated and untreated Friesians	82
Figure 3.2	Arcsin transformation of percentages of [³ H]-thymidine uptake by lymphocytes derived from acaricide-treated and untreated Friesians	86
Figure 5.1	Regression of arcsin transformation of percentages of lymphocytes transformed on the number of injections of PPD	102
Figure 5.2	Relationship between arcsin transformation of percentages of lymphocytes transformed and the number of injections of <i>D. congolensis</i> antigen, Dc ₂	104
Figure 5.3	Relationship between ranks of days to resolution and the numbers of experimental infections with <i>D. congolensis</i>	109



Plate 1.1 A bull infected with dermatophilosis. Note the thickness of scabs and how they have coalesced

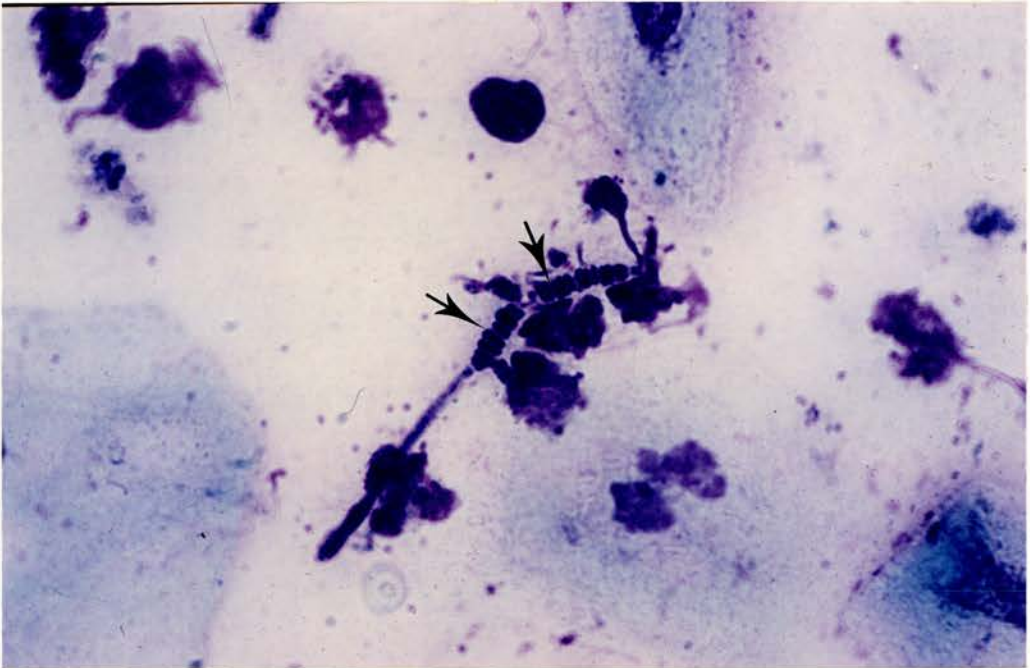


Plate 1.2 *Dermatophilus congolensis* in an impression smear of the undersurface of a scab stained with Giemsa. Arrows are pointing at gram-positive rows of cocci which form the branching filaments of *D. congolensis*



Plate 2.1 *Amblyomma variegatum* ticks. Fully engorged female and a male. Note the relatively long and strong "mouth-parts" of the ticks



Plate 2.2(a) *Amblyomma variegatum* ticks attached to the groin of a cow



Plate 2.2(b) *Amblyomma variegatum* ticks attached to the brisket of the same cow in (a)



Plate 2.3

Animals of the experiment herd in their kraal. The white animals are zebu-type cattle and the rest are N'damas. In the background is the grazing area

Table 2.1**Numbers of cattle at five selected local herds**

Kraal	Number of cattle
1	130
2	105
3	160
4	135
5	75

Table 2.2

Tick attachment sites in ten untreated Zebu-type cattle in November 1989 and 1990

Attachment site	Tick species			
	<i>A. variegatum</i>	<i>R. senegalensis</i>	<i>H. rufipes</i>	<i>Boophilus spp.</i>
Ears	0	31	0	1
Axillae	148	0	0	27
Groin	358	2	0	22
Ventral	37	0	0	5
Under tail/ Perineum	10	0	57	1
Dewlap	8	0	0	0
Limbs	13	0	0	8
Other	1	0	0	2
Total	575	33	57	66

Table 2.3**Relative abundance of tick species counted on cattle at experiment herd over 26 months**

Animals in exp. herd	Species of ticks				Total
	<i>A. variegatum</i>	<i>Boophilus</i>	<i>H. rufipes</i>	<i>R. senegalensis</i>	
1st group untreated Zebu-types	4745(76)	770(12)	420(7)	350(6)	6285
2nd group untreated Zebu-types	2390(74)	510(16)	190(6)	135(4)	3225
Untreated N'damas	935(67)	265(19)	65(5)	130(9)	1395
Untreated Friesians	1608*(70)	359(16)	103(4)	229(10)	2299
AT Zebu-type	35	20	7	2	64
Acaride- treated Friesians	61	3	0	1	65

() = percentage tick infestations are in brackets

* = Friesians were infested with ticks for eight months

FIRST GROUP UTZ

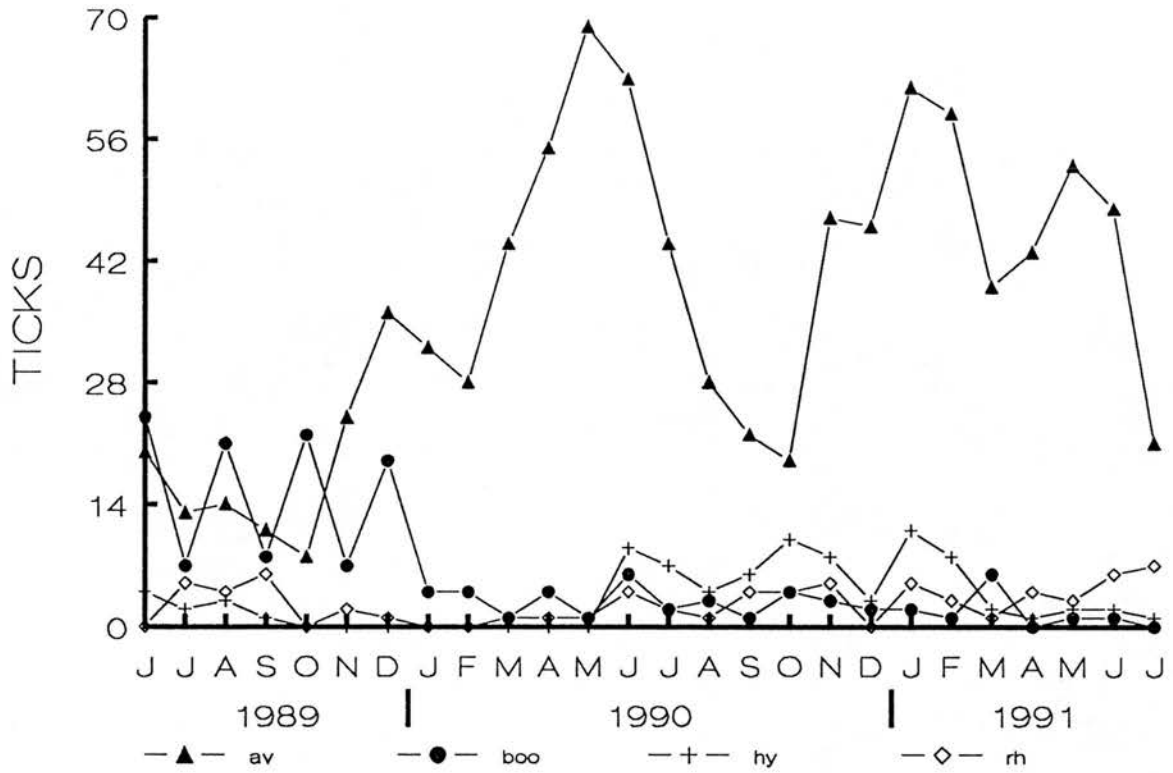


Figure 2.1

Seasonal distribution of ticks on the first group of untreated Zebu-type cattle (UTZ) covering the period June 1989 to August 1991. Tick counts are expressed as means of five animals

av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus</i> species
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>

SECOND GROUP UTZ

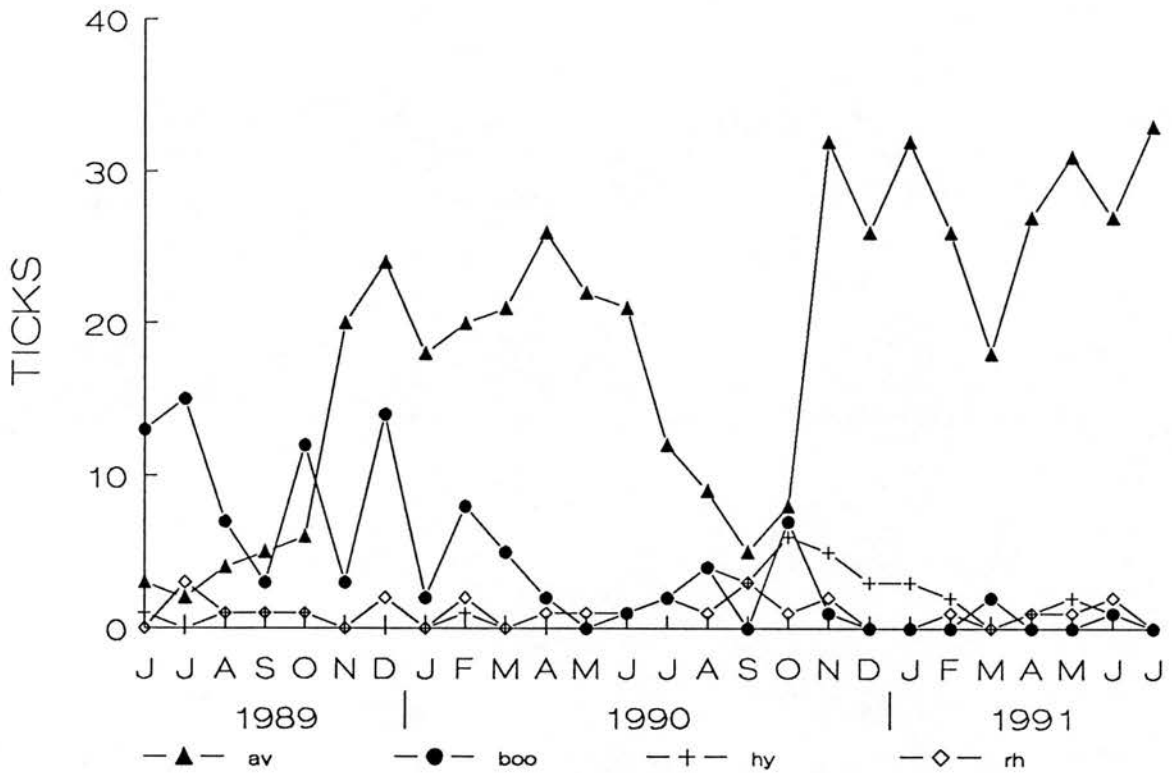


Figure 2.2

Seasonal distribution of ticks on the second group of UTZ covering the period June 1989 to June 1991). Tick counts are expressed as means of five animals

av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus</i> species
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>

UNTREATED NDAMAS

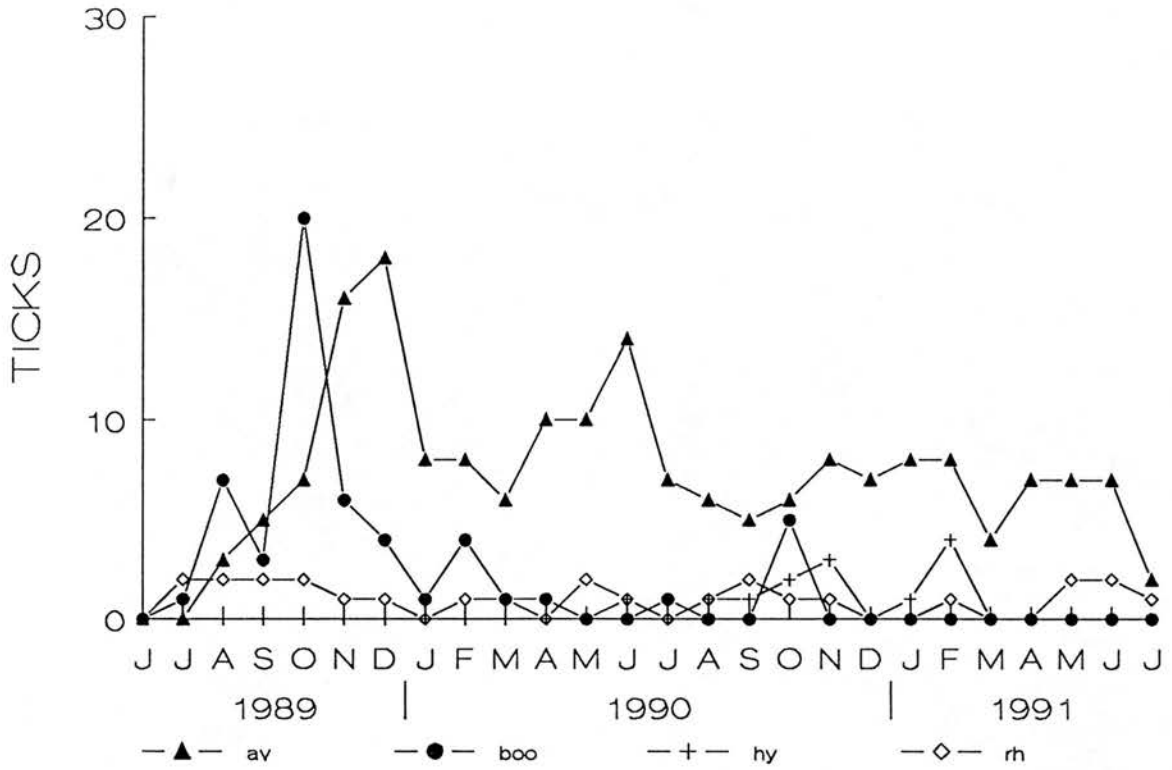


Figure 2.3

Seasonal distribution of ticks on the untreated N'damas covering the period June 1989 to July 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variegatum*
 boo = *Boophilus* species
 hy = *Hyalomma rufipes*
 rh = *Rhipicephalus senegalensis*

UNTREATED FRIESIANS

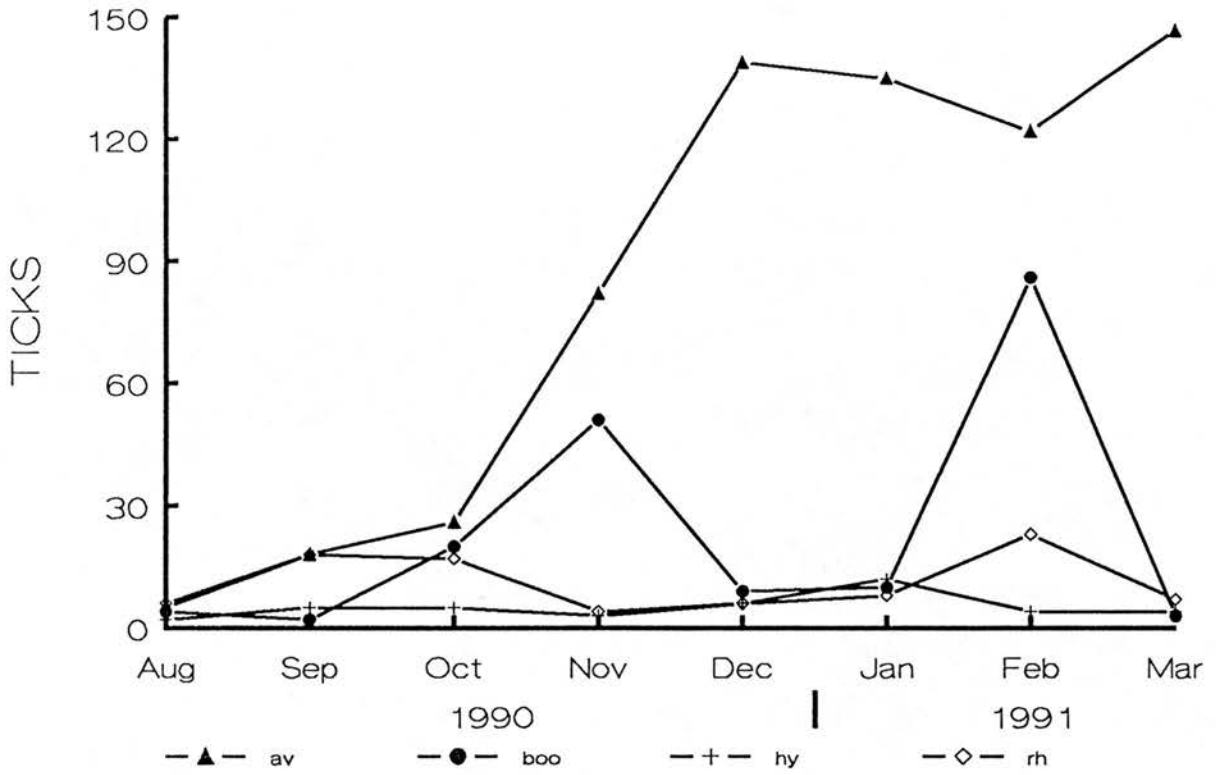


Figure 2.4

Seasonal distribution of ticks on the untreated Friesians (UTF) covering the period August 1990 to March 1991. Tick counts are expressed as means of three animals from August to December and thereafter, as the mean of two animals

av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus</i> species
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>

ACARICIDE-TREATED ZEBU-TYPES

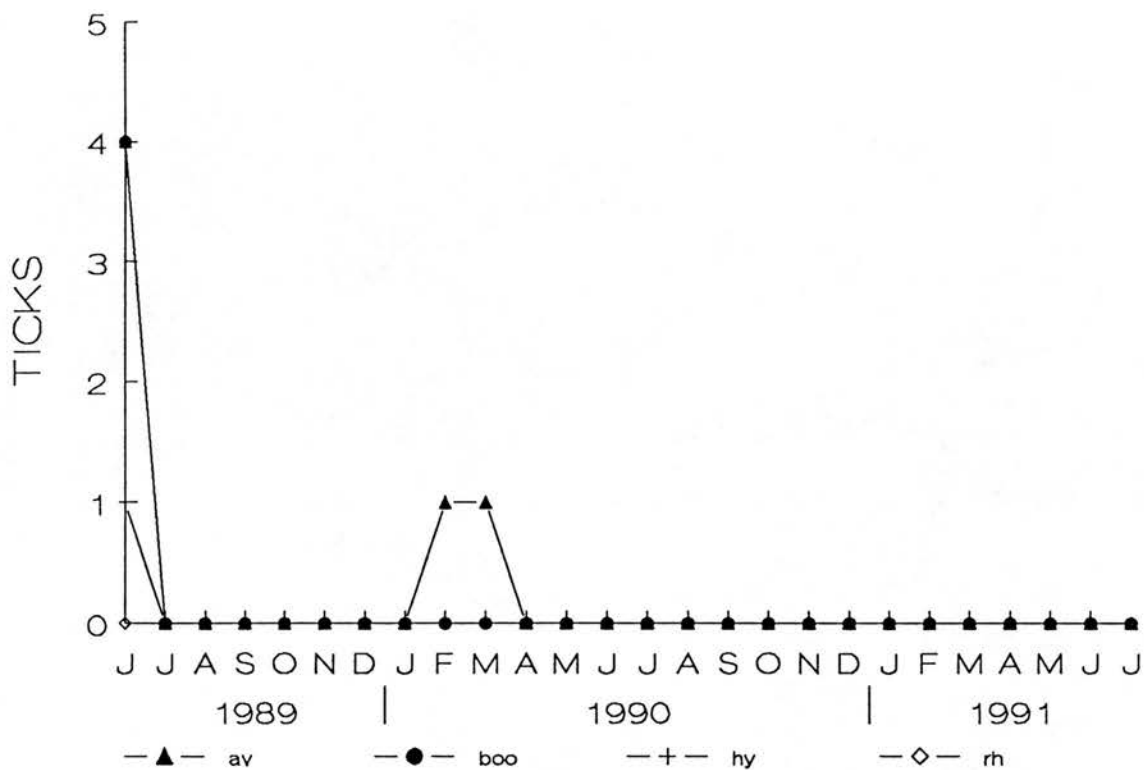


Figure 2.5

Seasonal distribution of ticks on the acaricide-treated Zebu-type (A-TZ) cattle covering the period June 1989 to June 1991. Tick counts are expressed as means of five animals

av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus</i> species
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>

ACARICIDE-TREATED FRIESIANS

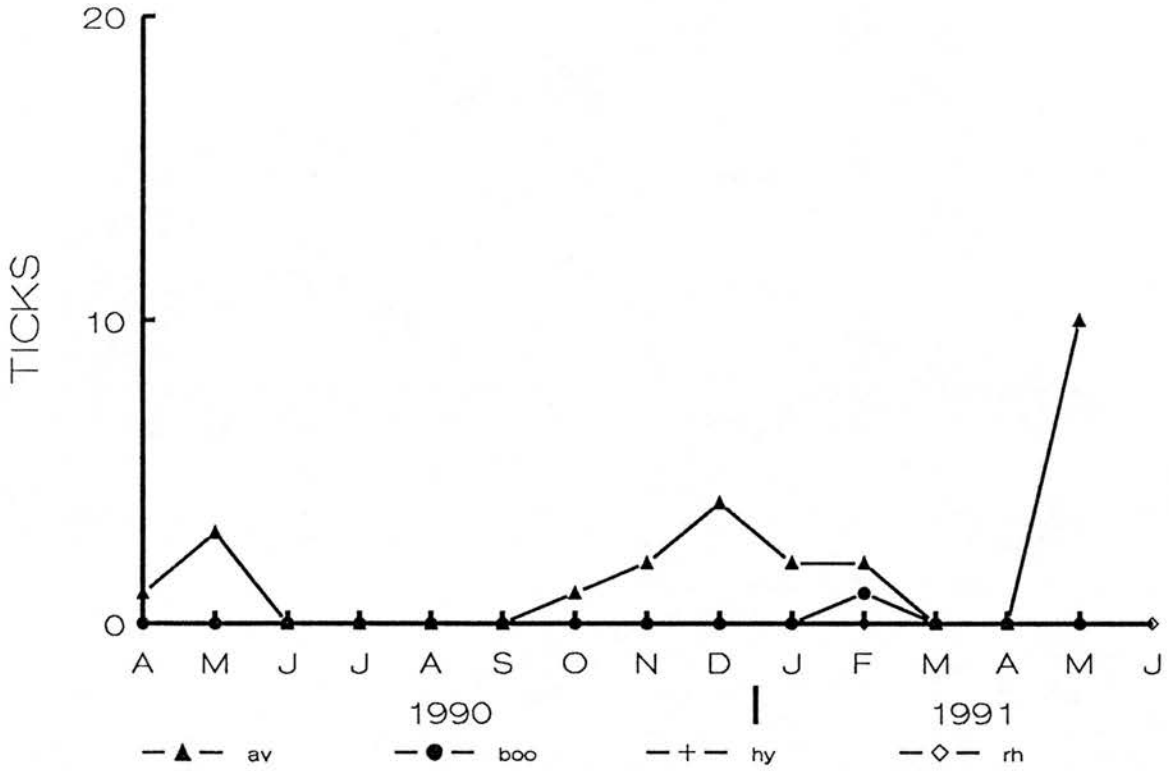


Figure 2.6

Seasonal distribution of ticks on the acaricide-treated Friesians (A-TF) covering the period April 1990 to May 1991. Tick counts are expressed as means of three animals from August to December and thereafter as the mean of two animals

av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus species</i>
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>

Table 2.4

Significance of differences in the mean monthly counts of *Amblyomma variegatum* ticks on cattle

(i) Zebus and N'damas

Comparison	Treatment	Medians	n	Wilcoxon T	Probability
Group 1 Zebus	Untreated	34.0	26.0	8.5	<0.01
Group 2 Zebus	Untreated	32.5			
Group 1 Zebus	Untreated	34.0	26	0	<0.01
Zebus	Treated	0			
Group 1 Zebus	Untreated	34.0	26	0	<0.01
N'damas	Untreated	7.0			
Group 2 Zebus	Untreated	32.5	26	0	<0.01
N'damas	Untreated	7.0			
Group 2 Zebus	Untreated	32.5	26	0	<0.01
Zebus	Treated	0			

(ii) Zebus, N'damas and Friesians

Comparison	Treatment	Medians	n	Wilcoxon T	Probability
Group 1 Zebu	Untreated	42.5	8	4	<0.10 >0.05
Friesians	Untreated	110.5			
Group 2 Zebus	Untreated	22	8	1	<0.05
Friesians	Untreated	110.5			
N'damas	Untreated	6.5	8	0	<0.01
Friesians	Treated	1.5			
Zebus	Treated	0	5	15	>0.05
Friesians	Treated	1.5			

*Differences were shown to be normally distributed by Rankit test and paired t-test = 2.622, P<0.05

Table 2.5

Medians of the mean monthly counts of *Amblyomma variegatum* ticks on experiment groups of cattle

Experiment cow groups	Medians of means
Acaricide-treated Zebu-types	0
Acaricide-treated Friesians	1.5
Untreated N'damas	6.5 - 7.0
Untreated group 2 Zebu-types	22.0 - 32.5
Untreated group 1 Zebu-types	34.0 - 42.5
Untreated Friesians	110.5

LOCAL HERD 1

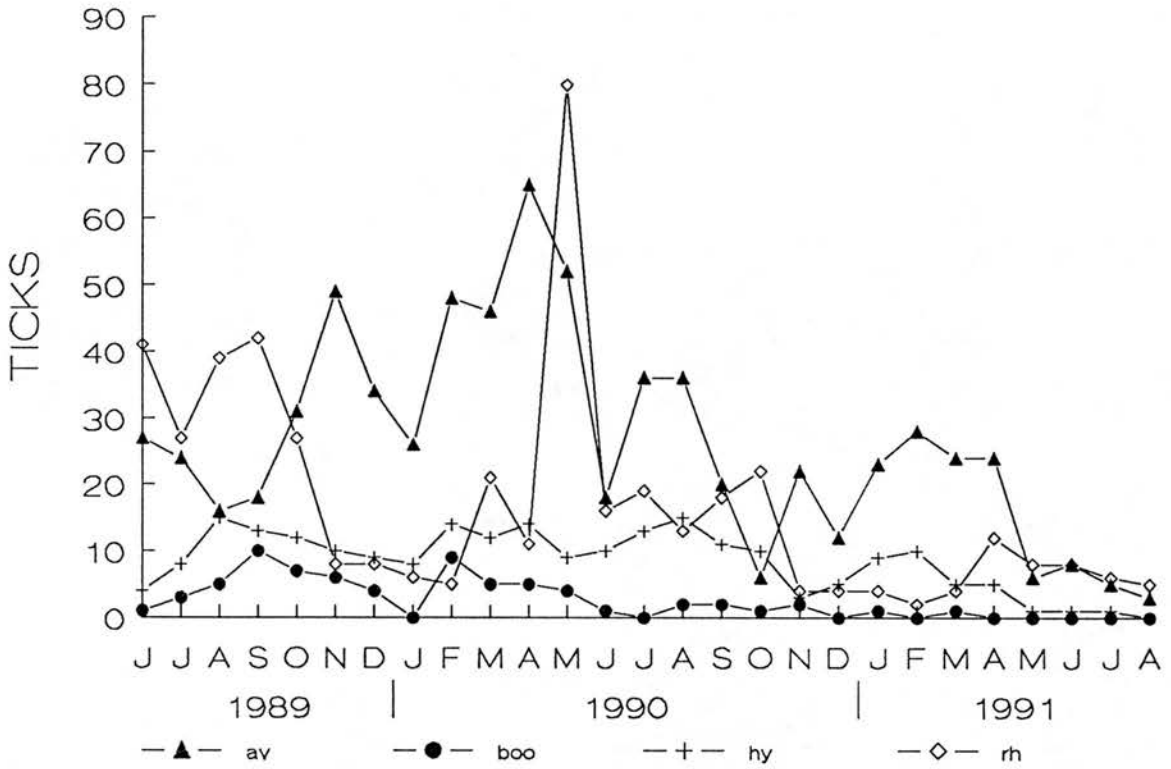


Figure 2.7

Seasonal distribution of ticks on cattle at local herd 1 covering the period June 1989 to August 1991. Tick counts are expressed as means of five animals

av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus</i> species
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>

Table 2.6**Relative abundance of tick species counted on cattle at selected local herds over 26 months**

Animals in local herd	Species of ticks				Total
	<i>A. variegatum</i>	<i>Boophilus</i>	<i>H. rufipes</i>	<i>R. senegalensis</i>	
1	3535(48)	345(5)	1135(16)	2300(31)	7315
2	3650(79)	355(8)	150(3)	475(10)	4630
3	2555(52)	345(7)	490(10)	1545(31)	4935
4	1780(47)	450(12)	385(10)	1135(30)	3750
5	1865(54)	150(4)	275(8)	1145(33)	3435
Total	13385	1645	2435	6600	24065

() = percentage tick infestations are in brackets

LOCAL HERD 2

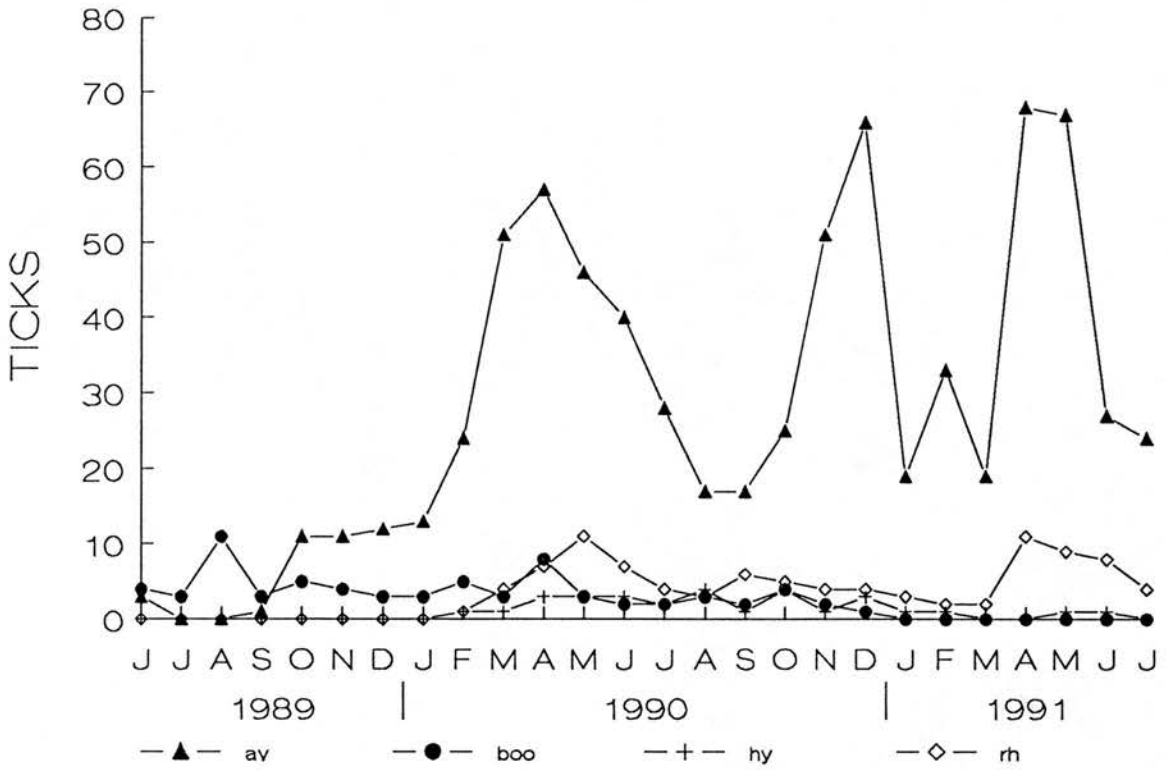


Figure 2.8

Seasonal distribution of ticks on cattle in local herd 2 covering the period June 1989 to July 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variegatum*
 boo = *Boophilus* species
 hy = *Hyalomma rufipes*
 rh = *Rhipicephalus senegalensis*

LOCAL HERD 3

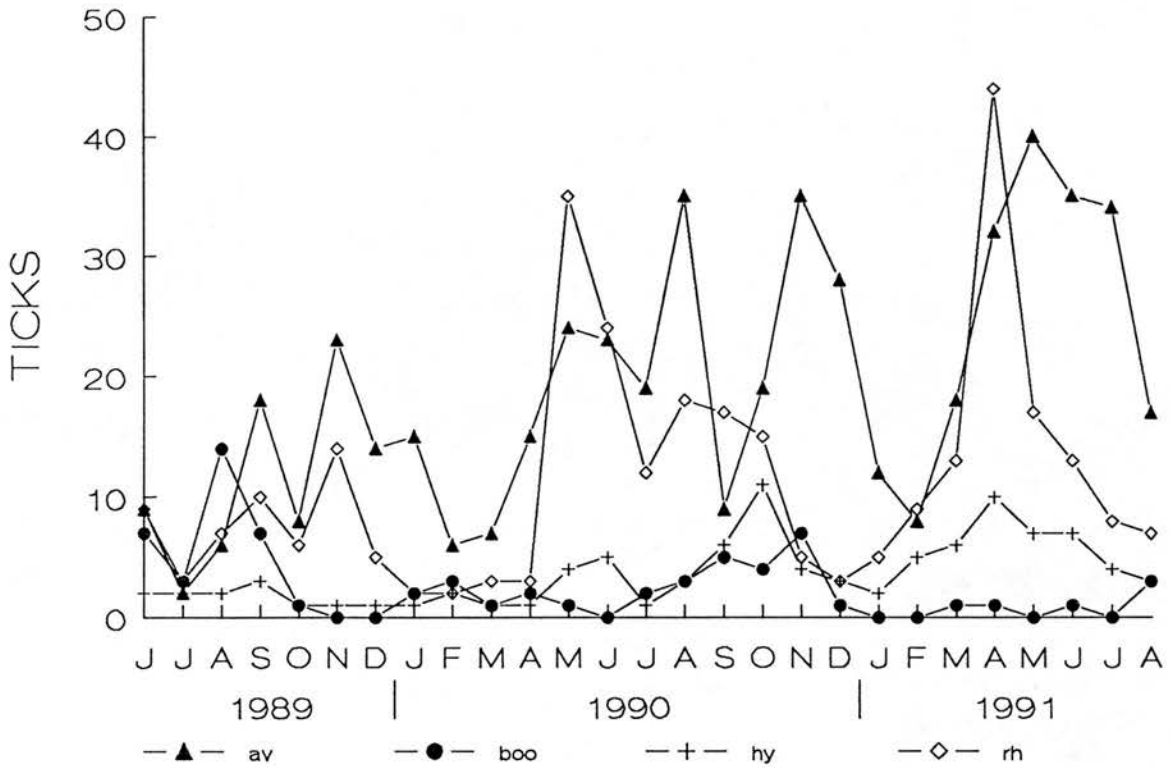


Figure 2.9

Seasonal distribution of ticks on cattle in local herd 3 covering the period June 1989 to August 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variegatum*
 boo = *Boophilus* species
 hy = *Hyalomma rufipes*
 rh = *Rhipicephalus senegalensis*

LOCAL HERD 4

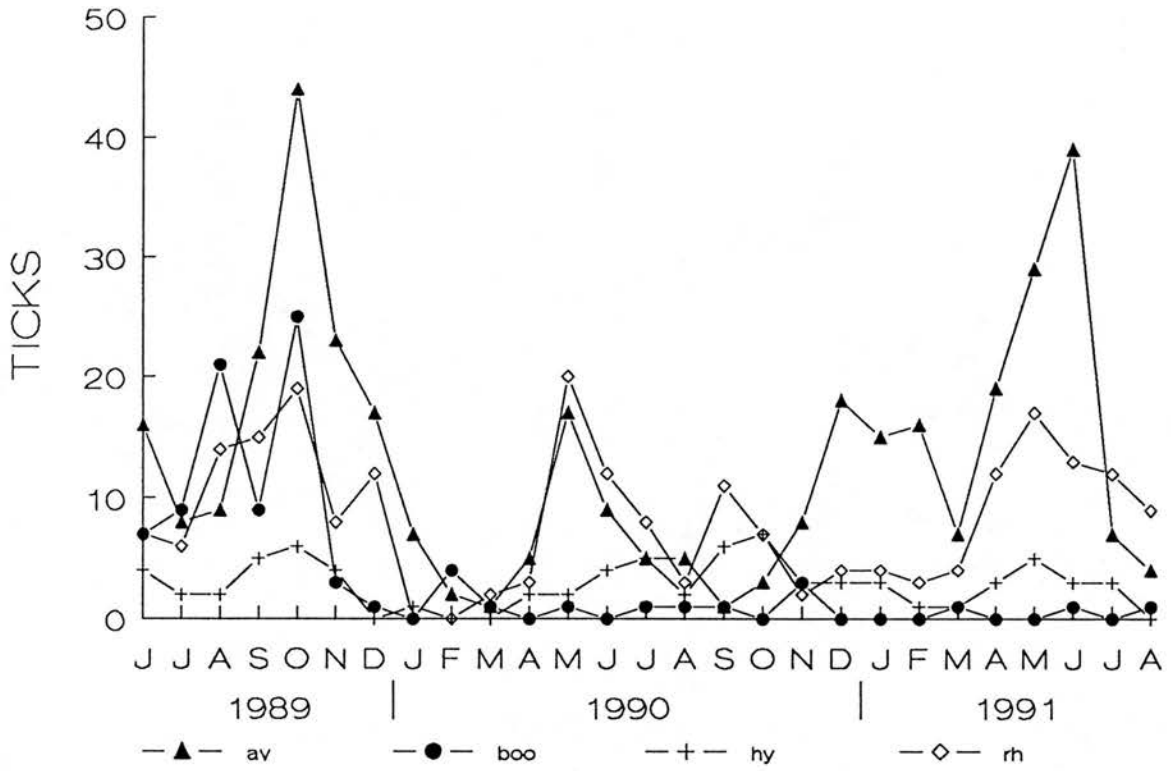


Figure 2.10

Seasonal distribution of ticks on cattle in local herd 4 covering the period June 1989 to August 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variegatum*
 boo = *Boophilus* species
 hy = *Hyalomma rufipes*
 rh = *Rhipicephalus senegalensis*

LOCAL HERD 5

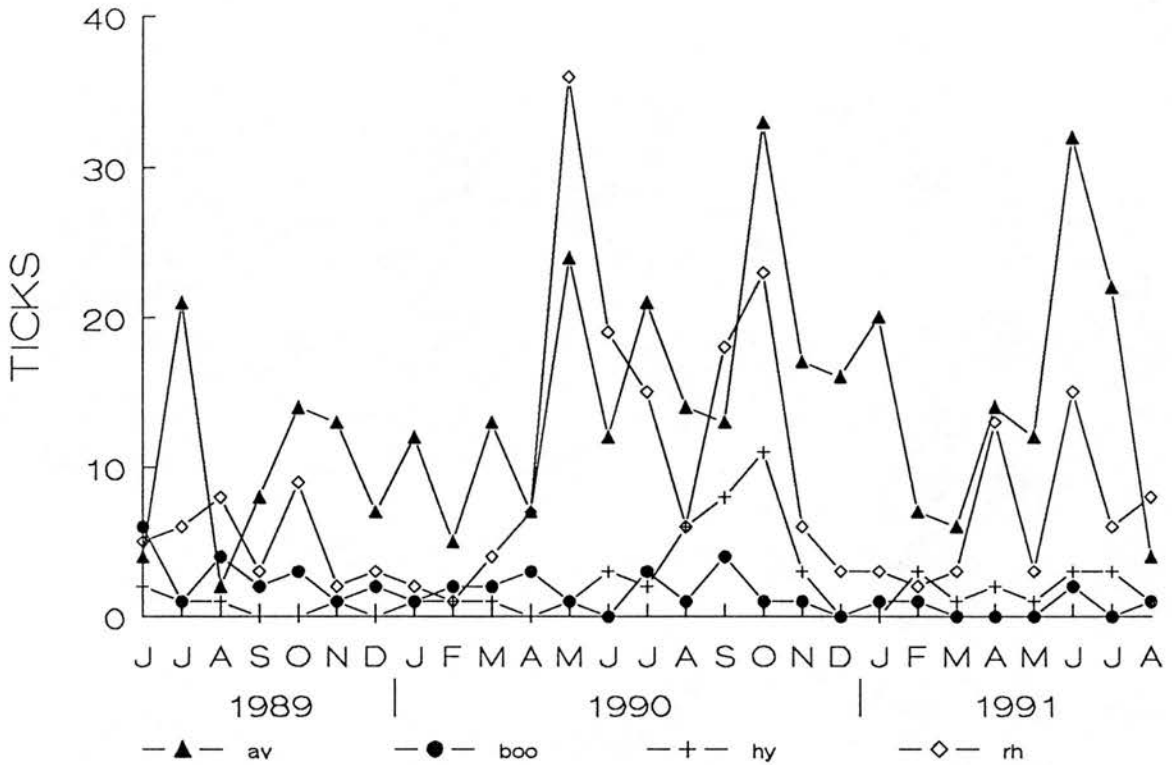


Figure 2.11

Seasonal distribution of ticks on cattle in local herd 5 covering the period June 1989 to August 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variegatum*
 boo = *Boophilus* species
 hy = *Hyalomma rufipes*
 rh = *Rhipicephalus senegalensis*

Table 2.7**Correlation between numbers of *Amblyomma variegatum* and dermatophilosis**

Local herd	Correlation coefficient (r)	v	t	Probability	Interpretation
1	+0.41	25	2.27	<0.05	s
2	+0.530	24	3.06	<0.01	vs
3	+0.500	25	2.90	<0.01	vs
4	-0.010	25	5.90	>0.05	ns
5	+0.003	25	1.36	>0.05	ns

ns = not significant
s = significant
vs = very significant

Table 2.8

Correlation between numbers of *Hyalomma rufipes* and dermatophilosis

Local herd	Correlation coefficient (r)	v	t	Probability	Interpretation
1	+0.44	25	2.48	<0.01	vs
2	+0.49	24	2.75	<0.01	vs
3	+0.31	25	1.62	>0.05	ns
4	-0.27	25	1.38	>0.05	ns
5	+0.02	25	0.11	>0.05	ns

ns = not significant
vs = very significant

Table 2.9

Correlation between numbers of *Rhipicephalus senegalensis* and dermatophilosis

Local herd	Correlation coefficient (r)	v	t	Probability	Interpretation
1	+0.15	25	0.76	>0.050	ns
2	+0.62	24	3.82	<0.001	vvs
3	+0.29	25	1.51	>0.050	ns
4	+0.08	25	0.38	>0.050	ns
5	+0.31	25	1.61	>0.050	ns

ns = not significant
vvs = very, very significant

Table 2.10**Correlation between numbers of *Boophilus* species and dermatophilosis**

Local herd	Correlation coefficient (r)	v	t	Probability	Interpretation
1	-0.07	25	0.37	>0.05	ns
2	-0.52	24	2.30	<0.01	vs
3	-0.39	25	2.14	<0.05	s
4	-0.14	25	0.71	>0.05	ns
5	-0.33	25	1.76	>0.05	s

ns = not significant
s = significant
vs = very significant

LOCAL HERD 1

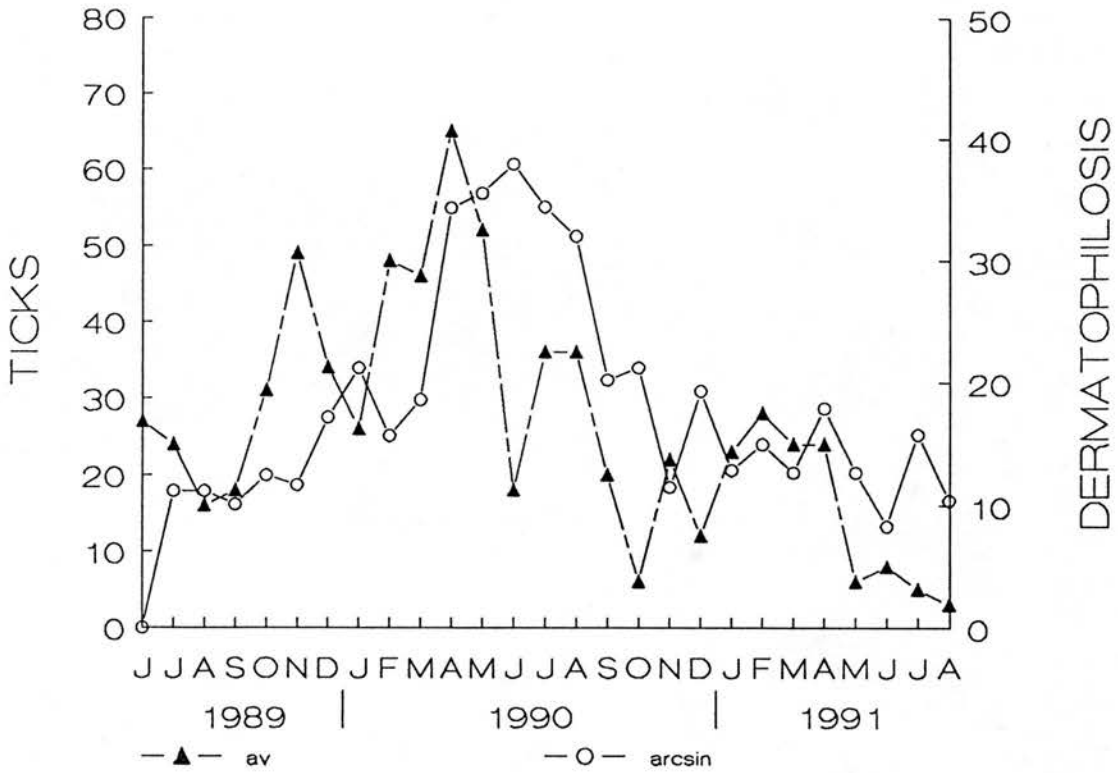


Figure 2.12

Association between *Amblyomma variegatum* and dermatophilosis in local herd 1 covering the period June 1989 to August 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variegatum*
 arcsin = Arcsin transformation of percentages of dermatophilosis cases

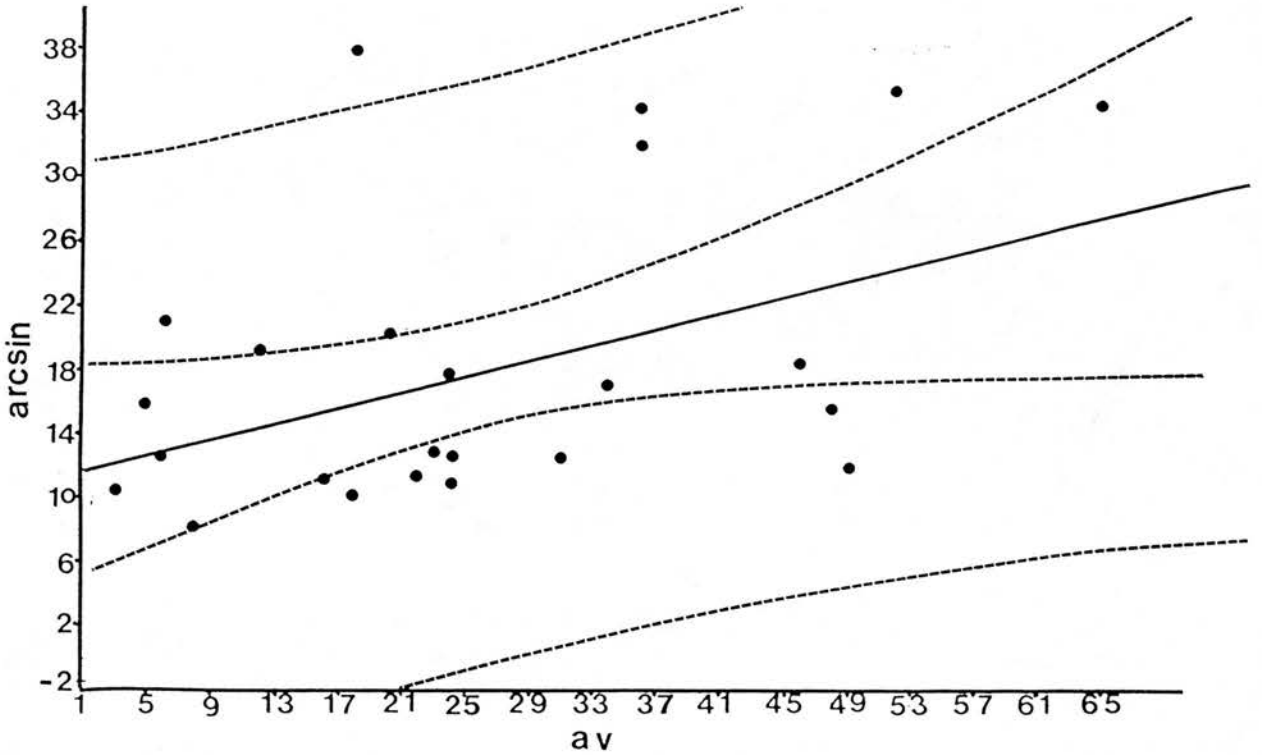


Figure 2.13

Pearson's parametric correlation between *Amblyomma variegatum* and dermatophilosis at local herd 1

av = *Amblyomma variegatum*
 arcsin = Arcsin transformation of percentages
 of dermatophilosis cases

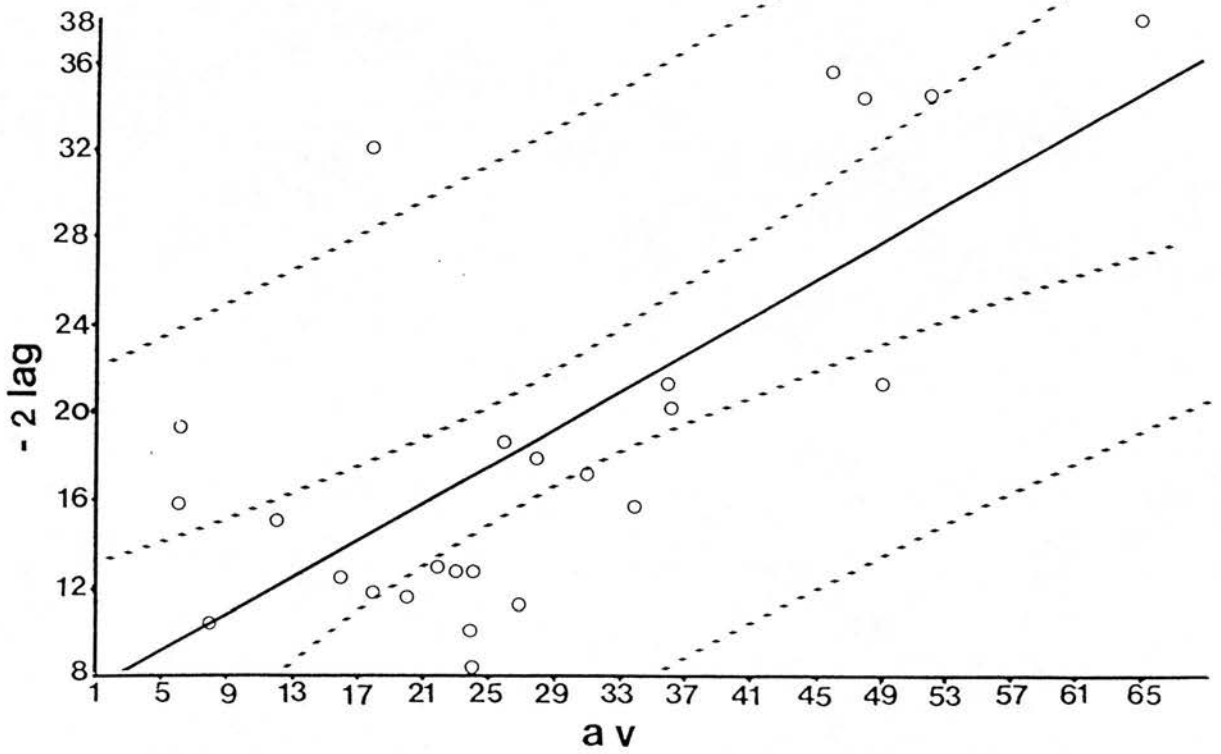


Figure 2.14

Pearson's parametric correlation between *Amblyomma variegatum* and dermatophilosis at local herd 1 with 2 month lag

av = *Amblyomma variegatum*
 - 2 lag = 2 months lag of arcsins transformation of percentages of dermatophilosis cases

Table 2.11**Prevalence of dermatophilosis at local herd 1**

Year	No. of animals	No. affected	Per cent
1989			
June	nc	nc	nc
July	130	5	3.8
August	130	5	3.8
September	130	4	3.1
October	124	6	4.8
November	142	6	4.2
December	157	14	8.9
1990			
January	136	18	13.0
February	136	10	7.4
March	136	14	10.3
April	119	38	31.9
May	119	40	33.6
June	104	39	37.5
July	104	33	31.7
August	118	33	28.0
September	118	14	11.8
October	99	13	13.1
November	99	4	4.0
December	101	11	10.9
1991			
January	101	5	5.0
February	105	7	6.6
March	105	5	4.8
April	106	10	9.4
May	106	5	4.7
June	134	3	2.2
July	134	10	7.4
August	120	4	3.3

nc = not counted

LOCAL HERD 2

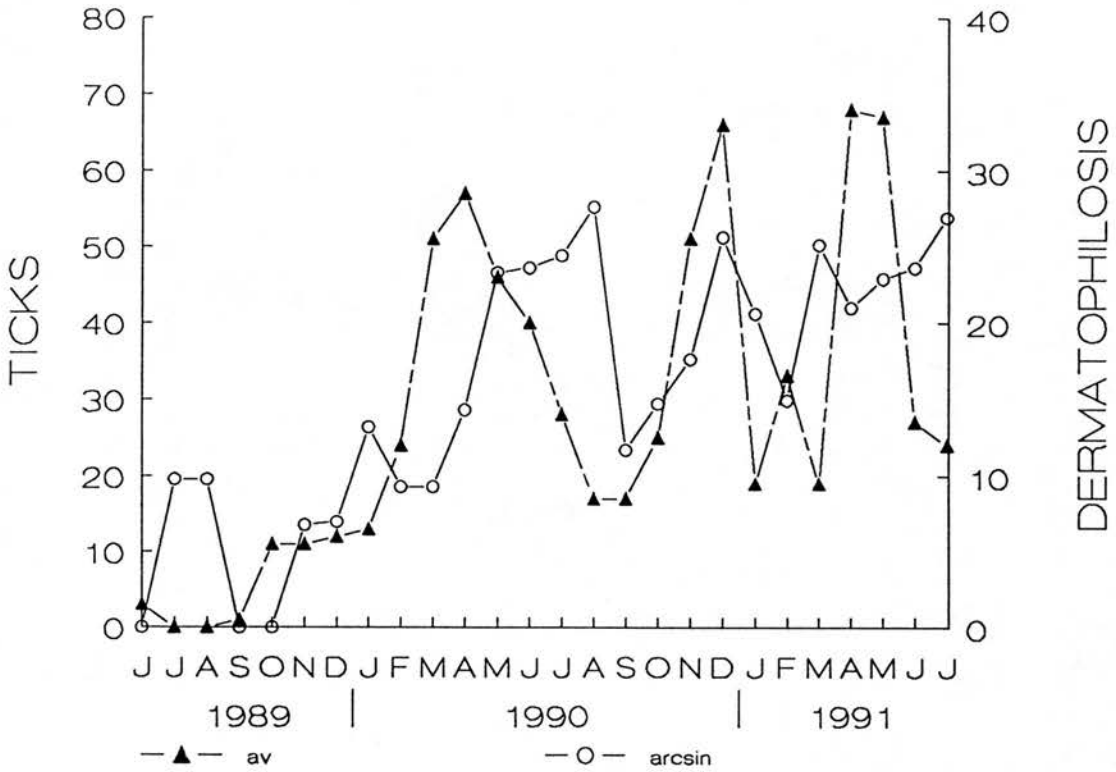


Figure 2.15

Association between *Amblyomma variegatum* and dermatophilosis at local herd 2 covering the period June 1989 to July 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variegatum*
 arcsin = Arcsin transformation of percentages of dermatophilosis cases

Table 2.12**Prevalence of dermatophilosis at local herd 2**

Year	No. of animals	No. affected	Per cent
1989			
June	nc	nc	nc
July	68	2	2.9
August	68	2	2.9
September	68	0	0.0
October	71	0	0.0
November	73	1	1.4
December	67	1	1.5
1990			
January	77	4	5.2
February	115	3	2.6
March	115	3	2.6
April	115	7	6.1
May	115	18	15.6
June	106	17	16.0
July	106	18	17.0
August	103	22	21.3
September	98	4	4.1
October	110	7	6.4
November	110	10	9.1
December	113	21	18.6
1991			
January	113	14	12.4
February	122	8	6.5
March	122	22	18.0
April	139	18	12.9
May	139	21	15.1
June	151	24	15.9
July	151	31	20.5

nc = not counted

Table 2.13**Prevalence of dermatophilosis at local herd 3**

Year	No. of animals	No. affected	Per cent
1989			
June	nc	nc	nc
July	nc	nc	nc
August	152	3	2
September	152	4	2.6
October	157	3	2
November	145	10	7
December	145	4	3
1990			
January	150	9	6
February	150	6	4
March	150	5	3
April	170	7	4
May	170	9	5
June	156	11	7
July	156	9	6
August	151	12	8
September	151	17	11
October	162	7	4
November	162	8	5
December	168	10	6
1991			
January	168	15	9
February	170	11	6
March	170	9	5
April	180	10	5.5
May	180	13	7
June	181	11	6
July	181	14	8
August	178	12	7

nc = not counted

LOCAL HERD 3

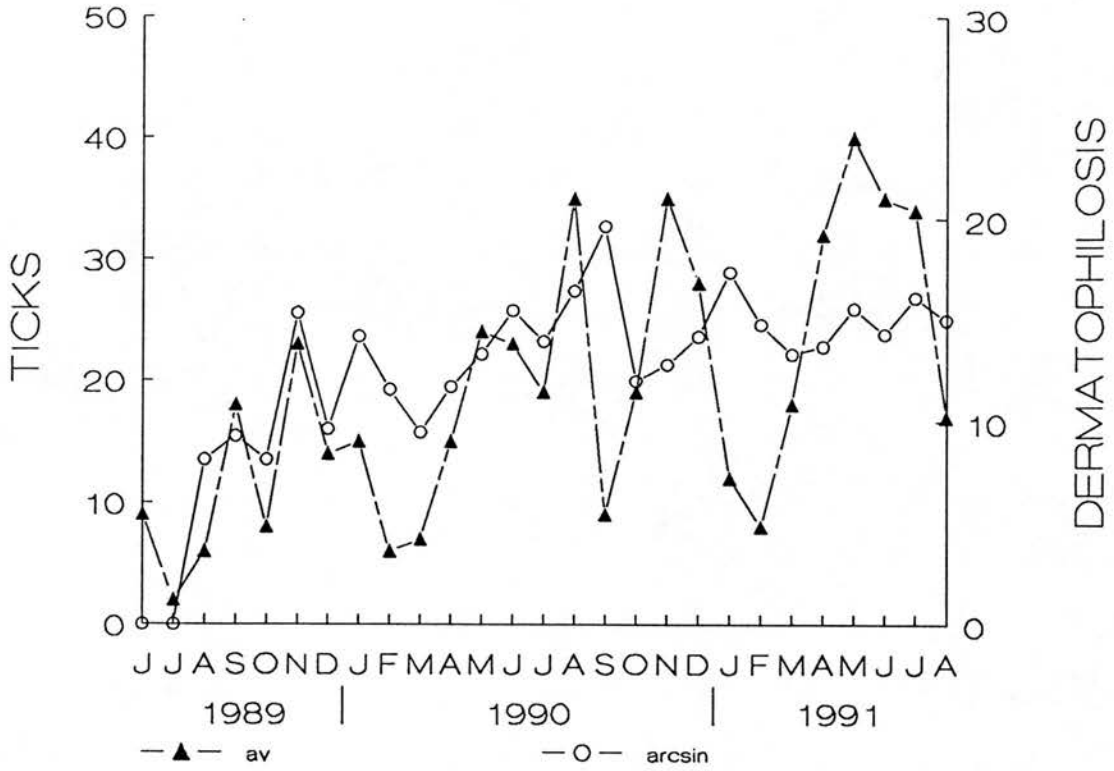


Figure 2.16

Association between *Amblyomma variegatum* and dermatophilosis at local herd 3 covering the period June 1989 to August 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variegatum*
 arcsin = Arcsin transformation of percentages of dermatophilosis cases

LOCAL HERD 4

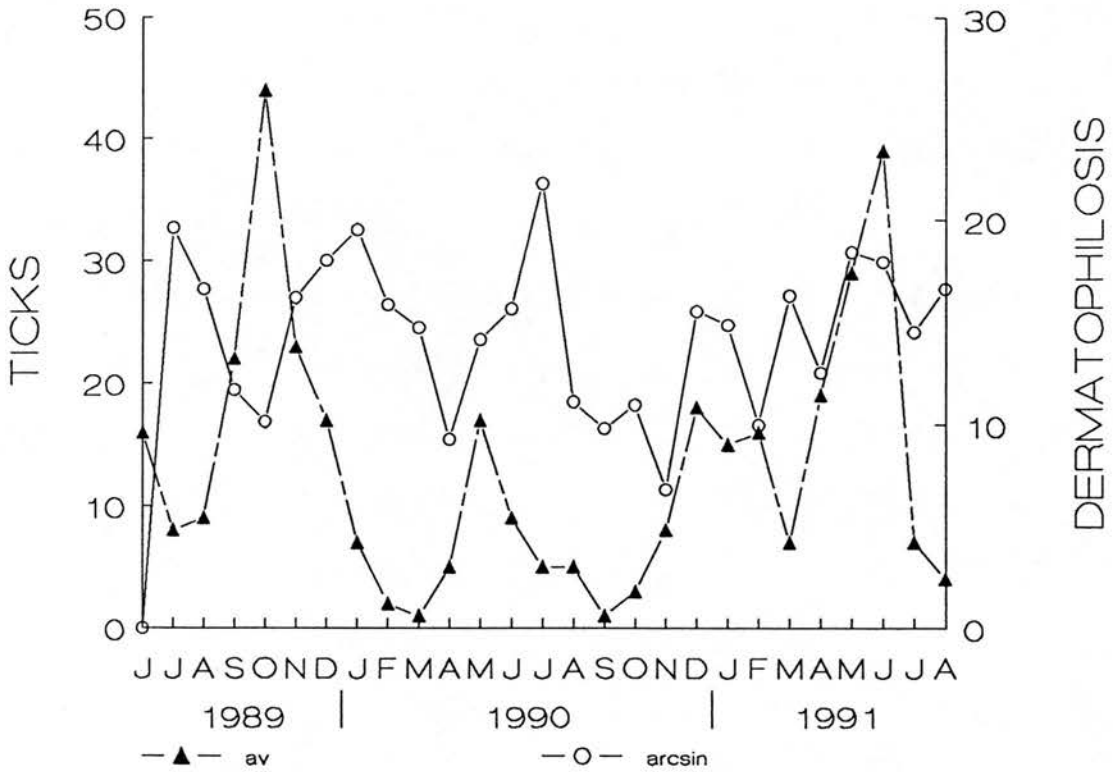


Figure 2.17

Association between *Amblyomma variegatum* and dermatophilosis at local herd 4 covering the period June 1989 to August 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variegatum*
 arcsin = Arcsin transformation of percentages
 of dermatophilosis cases

Table 2.14**Prevalence of dermatophilosis at local herd 4**

Year	No. of animals	No. affected	Per cent
1989			
June	nc	nc	nc
July	97	11	11
August	97	8	8
September	97	4	4
October	97	3	3
November	102	8	8
December	104	10	10
1990			
January	107	13	12
February	107	8	7
March	107	7	6.5
April	116	3	2.6
May	116	7	6
June	123	9	7
July	123	17	14
August	135	5	4
September	139	4	3
October	140	5	4
November	140	2	1
December	152	11	7
1991			
January	152	10	7
February	169	5	3
March	177	14	8
April	190	9	5
May	190	19	10
June	189	18	10
July	189	12	6
August	196	16	8

nc = not counted

LOCAL HERD 5

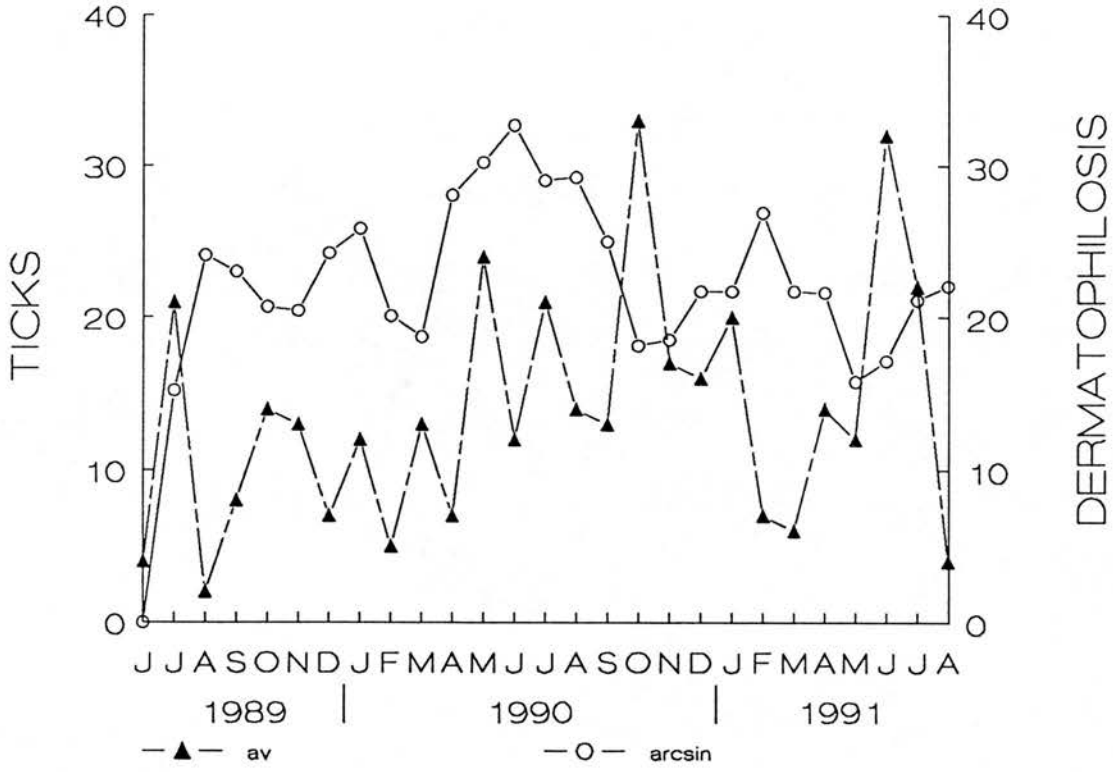


Figure 2.18

Association between *Amblyomma variegatum* and dermatophilosis at local herd 5 covering the period June 1989 to August 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variegatum*
 arcsin = Arcsin transformation of percentages of dermatophilosis cases

Table 2.15**Prevalence of dermatophilosis at local herd 5**

Year	No. of animals	No. affected	Per cent
1989			
June	nc	nc	nc
July	72	5	7
August	72	12	17
September	72	11	15
October	72	9	13
November	74	9	12
December	71	12	17
1990			
January	68	13	19
February	68	8	12
March	68	7	10
April	63	14	22
May	63	16	25
June	72	21	29
July	72	17	24
August	67	16	24
September	67	12	18
October	72	7	10
November	79	8	10
December	73	10	14
1991			
January	73	10	14
February	73	15	21
March	73	10	14
April	81	11	14
May	81	6	7
June	92	8	9
July	92	12	13
August	85	12	14

nc = not counted

UNTREATED FRIESIANS

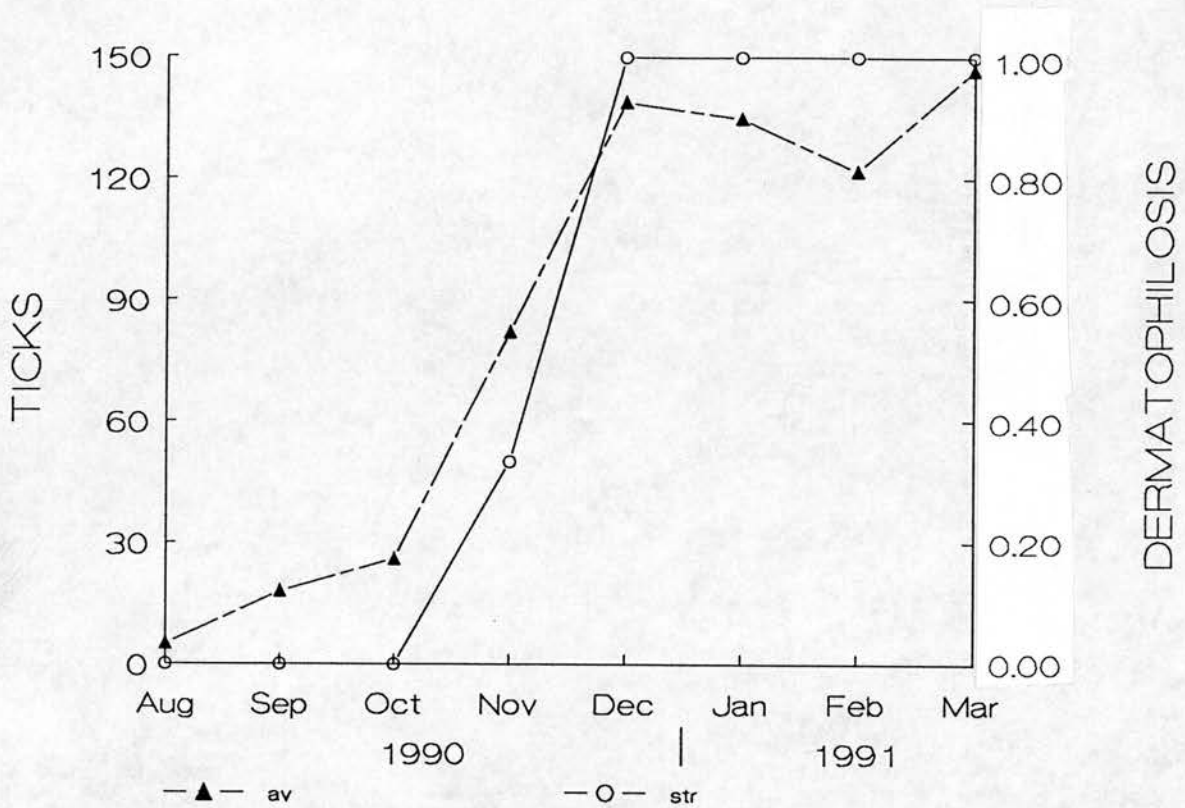


Figure 2.19

Association between *Amblyomma variegatum* and dermatophilosis in the UTF covering the period August 1989 to March 1991. Tick count means and proportion of cattle with dermatophilosis are for three animals from August to December and thereafter two animals.

av = *Amblyomma variegatum*
 str = Streptothricosis (dermatophilosis)

**Plate 2.4**

Generalized dermatophilosis in a Friesian cow. Note lesions on all four feet, the axillae, brisket, body and face



Plate 2.5 Dermatophilosis lesions on the feet of a Friesian cow. Lesions normally start on the feet of Friesians

ACARICIDE-TREATED FRIESIANS

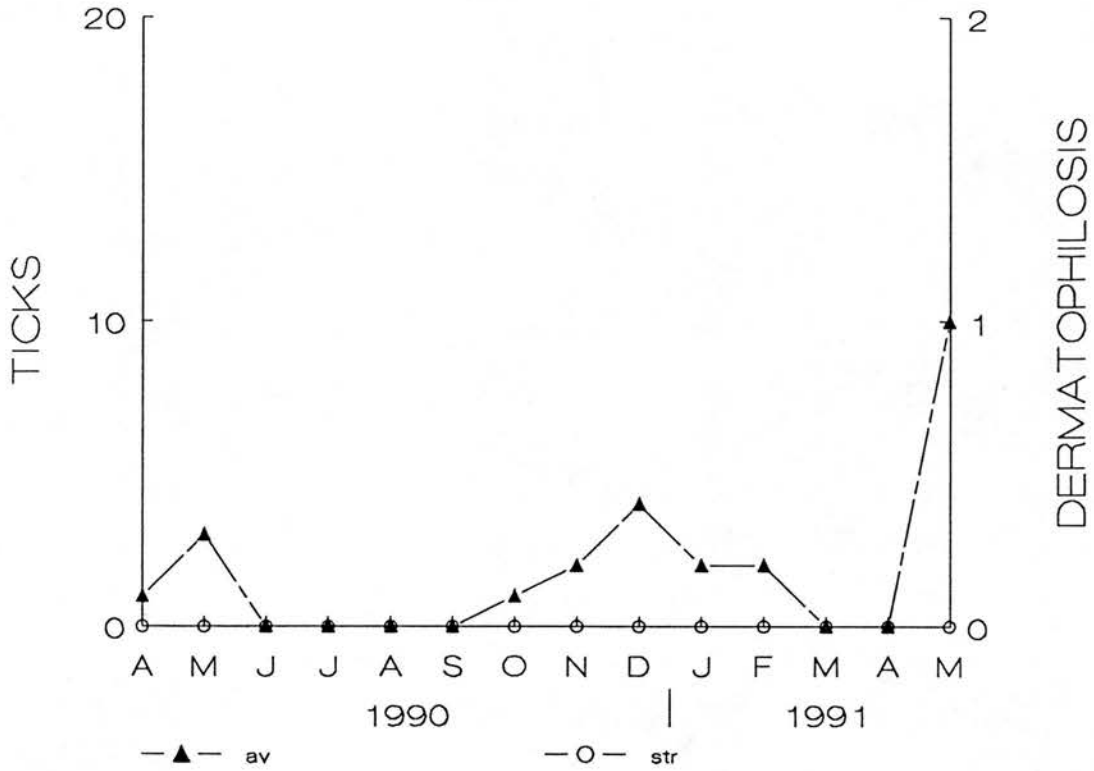


Figure 2.20

Association between *Amblyomma variegatum* and dermatophilosis in the A-TF covering the period April 1989 to May 1991. Tick counts are expressed as means of three animals from August to December and thereafter as means of two animals

av = *Amblyomma variegatum*
 str = Streptothricosis (dermatophilosis)

ACARICIDE-TREATED ZEBU-TYPES

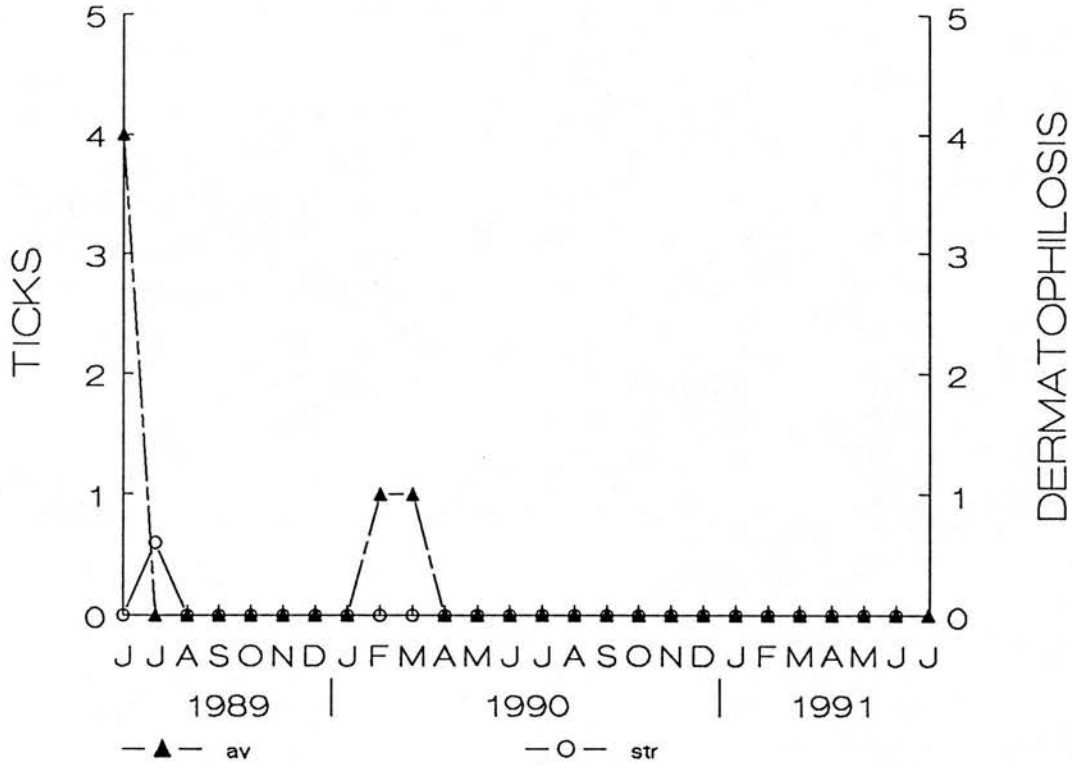


Figure 2.21

Association between *Amblyomma variegatum* and dermatophilosis in the A-TZ covering the period June 1989 to June 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variegatum*
 str = Streptothricosis (dermatophilosis)

RAINFALL AND TEMPERATURE

Accra Airport 1989-91

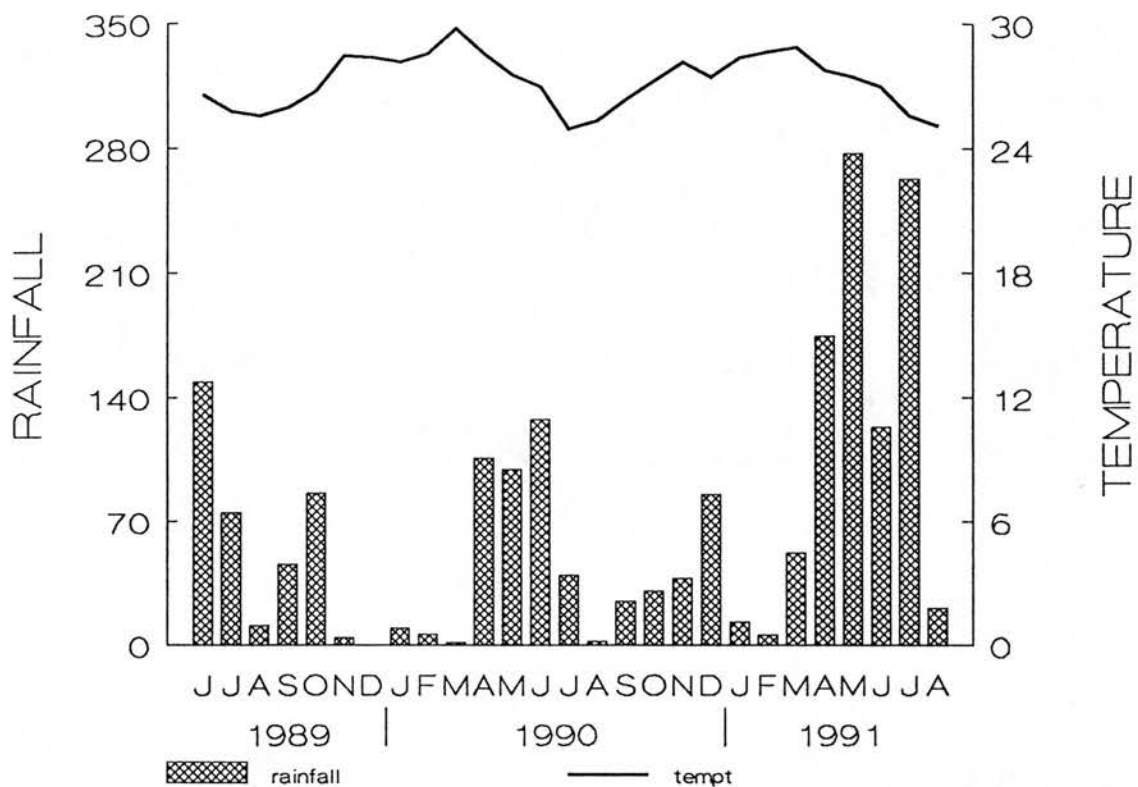


Figure 2.22

Rainfall and temperature at Accra Airport 1989-1991

Rainfall = mm
 Tempt. = Temperature °C

RELATIVE HUMIDITY

Accra Airport 1989-91

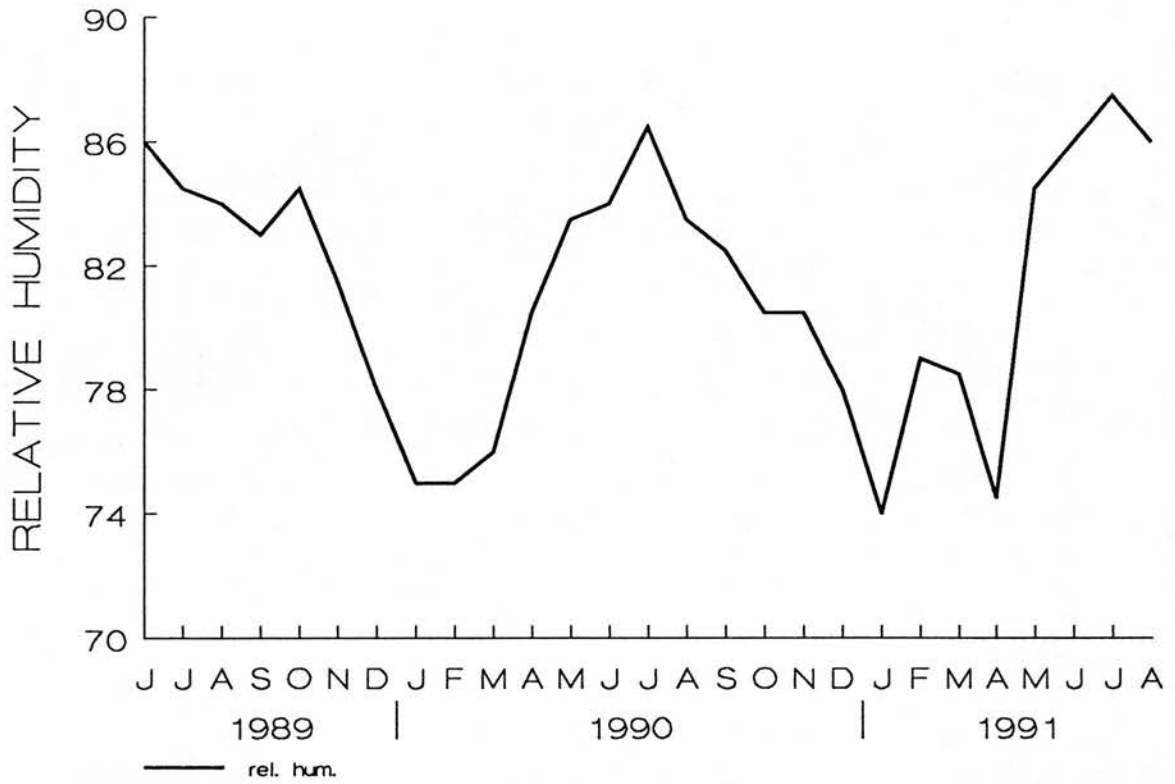


Figure 2.23

Relative humidity at Accra Airport 1989-1991

rel. hum. = Relative humidity %

LOCAL HERD 1

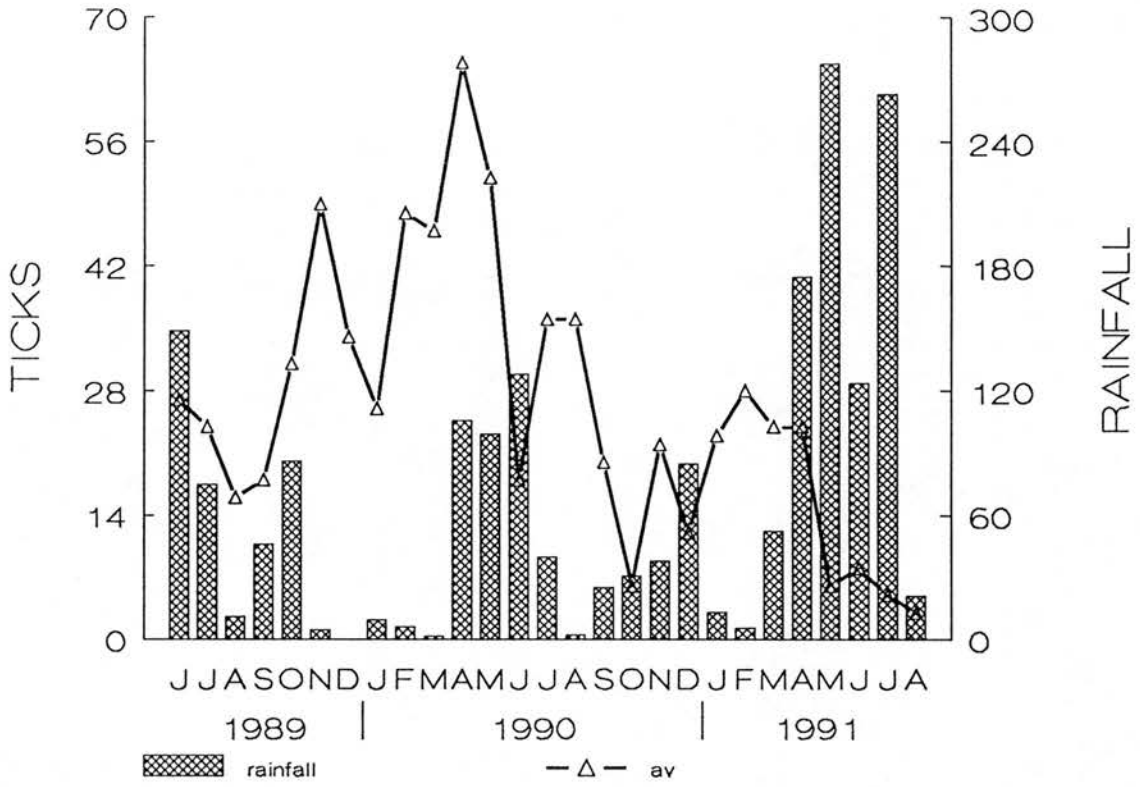


Figure 2.24

Association between rainfall and *Amblyomma variagatum* at local herd 1 covering the period June 1989 to August 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variagatum*
rainfall mm

LOCAL HERD 1

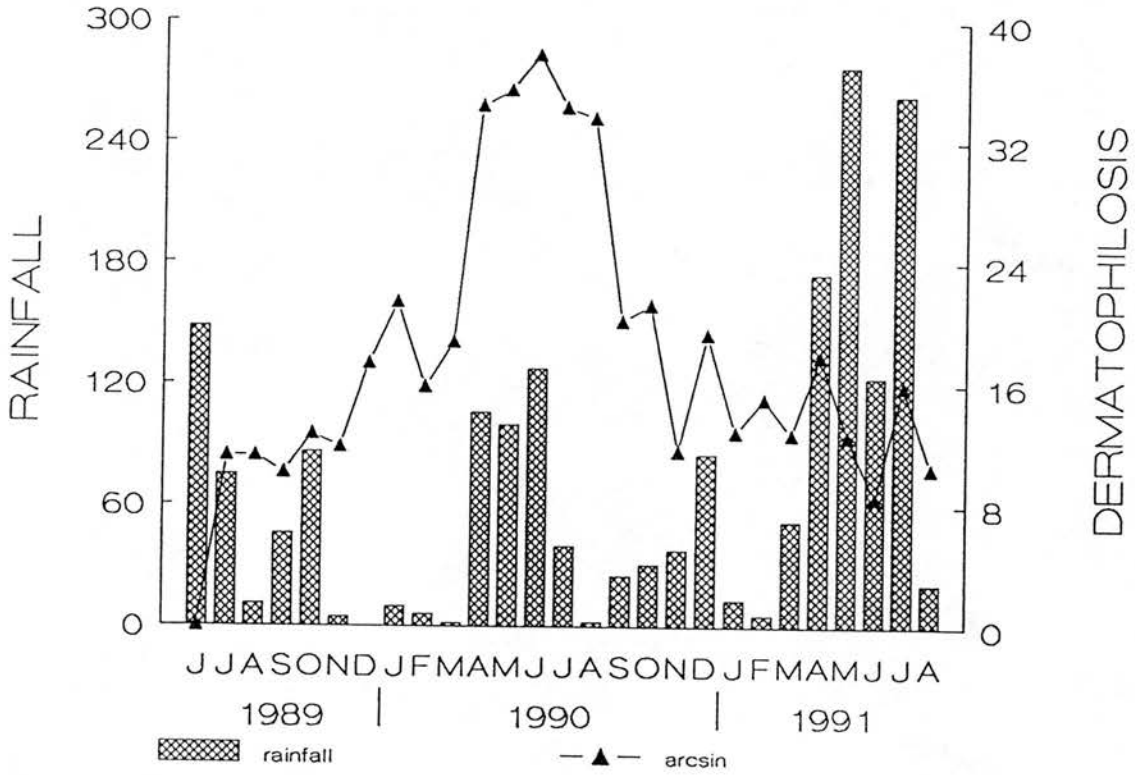


Figure 2.25

Association between rainfall and dermatophilosis at local herd 1 covering the period June 1989 to August 1991.

arcsin = Arcsin transformation of percentages of dermatophilosis cases
rainfall mm

LOCAL HERD 1

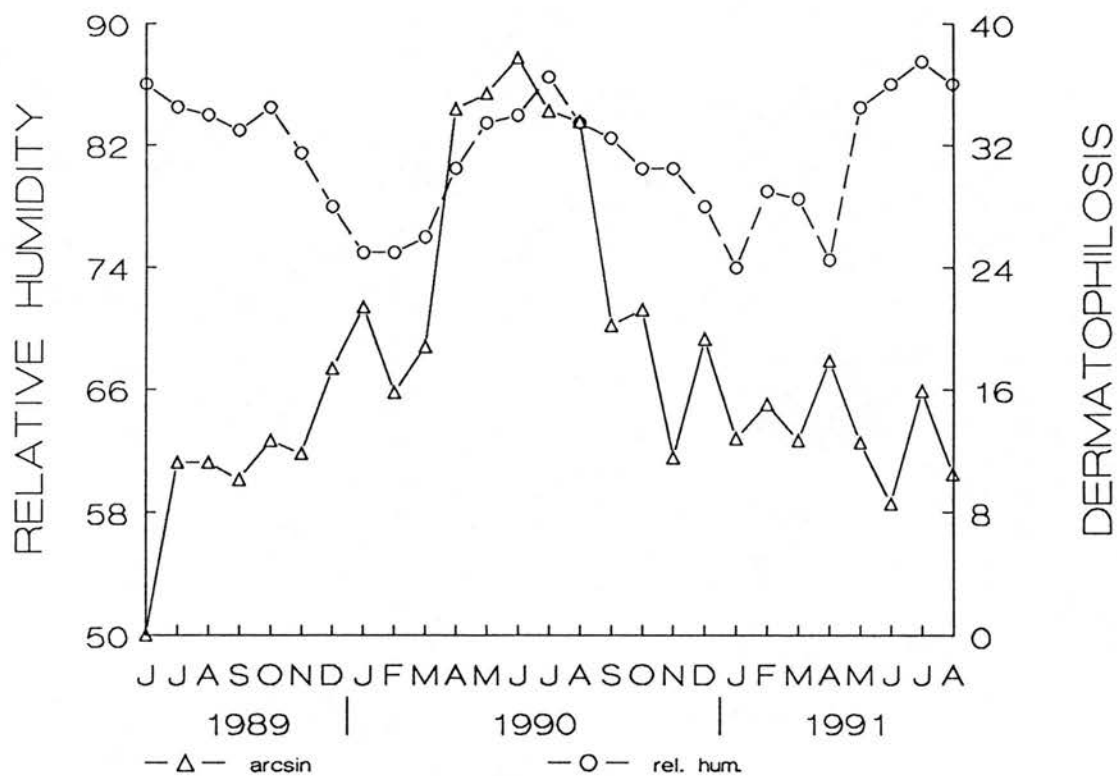


Figure 2.26

Association between relative humidity and dermatophilosis at local herd 1 covering the period June 1989 to August 1991

rel. hum. = Relative humidity %
 arcsin = Arcsin transformation of percentages of dermatophilosis cases

LOCAL HERD 1

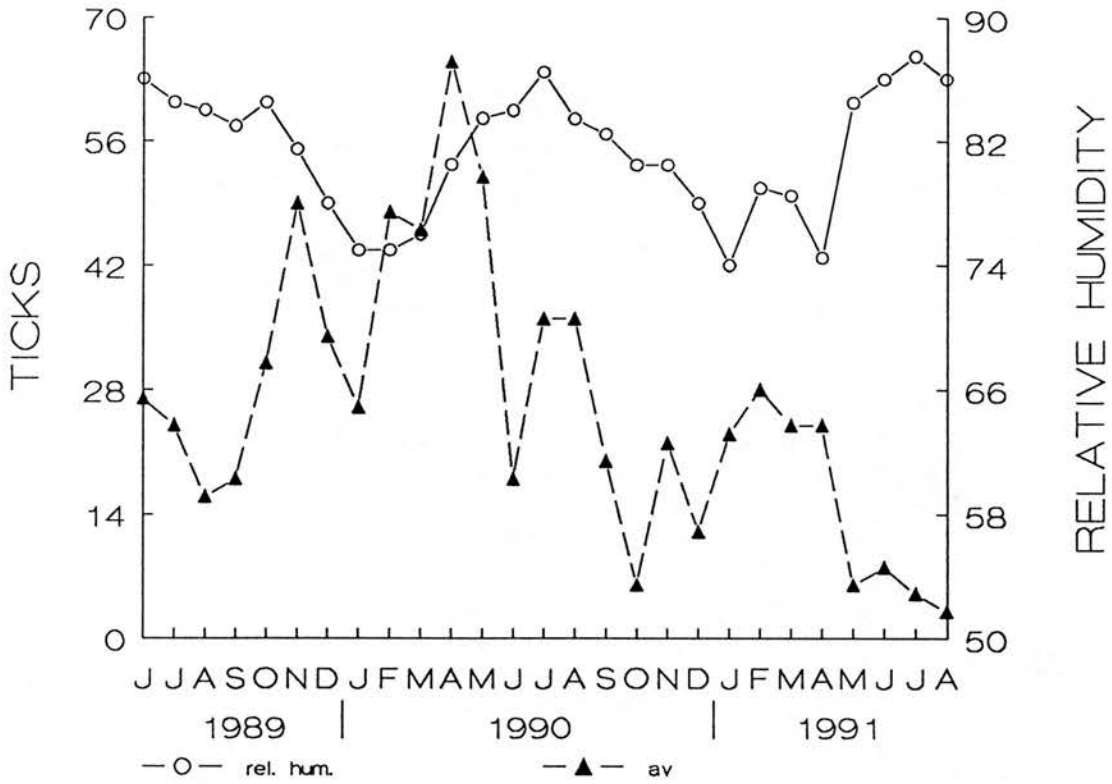


Figure 2.27

Association between relative humidity and *Amblyomma variegatum* at local herd 1 covering the period June 1989 to August 1991. Tick counts are expressed as means of five animals.

av = *Amblyomma variegatum*
 rel. hum. = Relative humidity %

LOCAL HERD 1

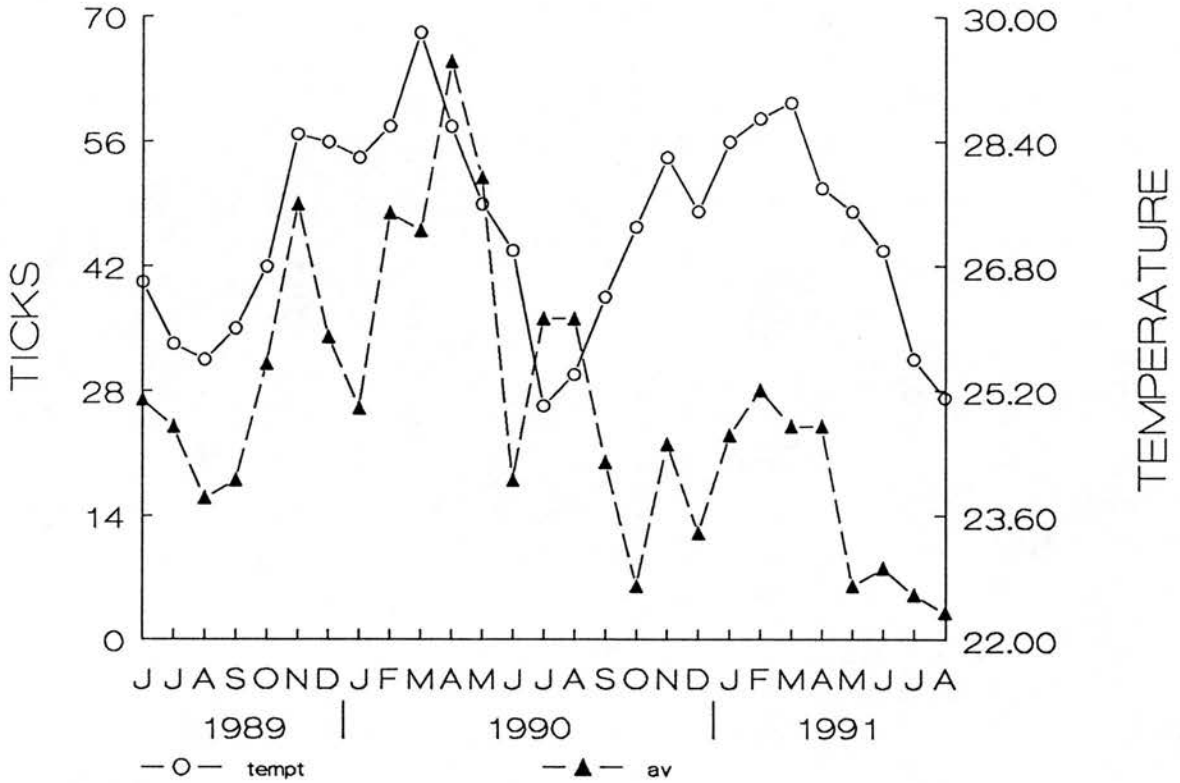


Figure 2.28

Association between temperature and *Amblyomma variegatum* at local herd 1 covering the period June 1989 to August 1991. Tick counts are expressed as means of five animals

av = *Amblyomma variegatum*
 tempt. = Temperature °C



RAINFALL AND TEMPERATURE LEGON 1989-1991

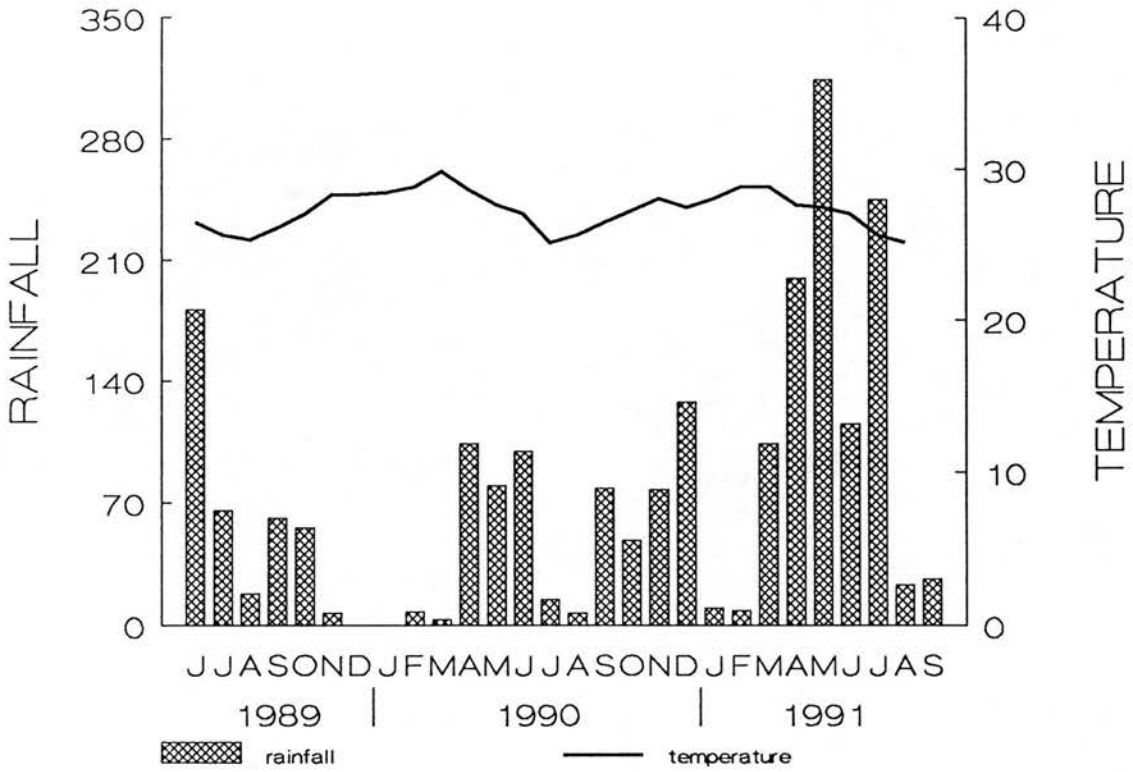


Figure 2.29

Rainfall and temperature at Legon 1989-1991

rain mm = rainfall mm
 tempt. C = Temperature °C

RELATIVE HUMIDITY LEGON 1989-1991

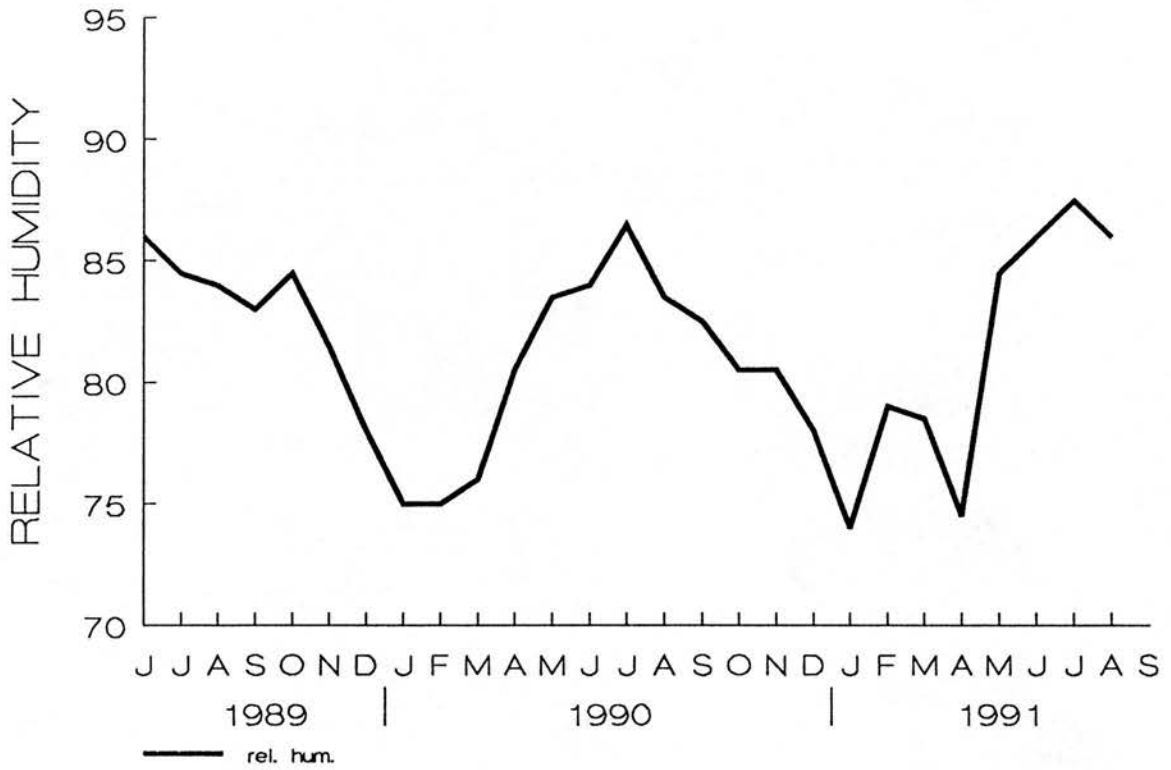


Figure 2.30

Relative humidity at Legon 1989-1991

rel. hum. = Relative humidity %

LOCAL HERDS 3,4 & 5

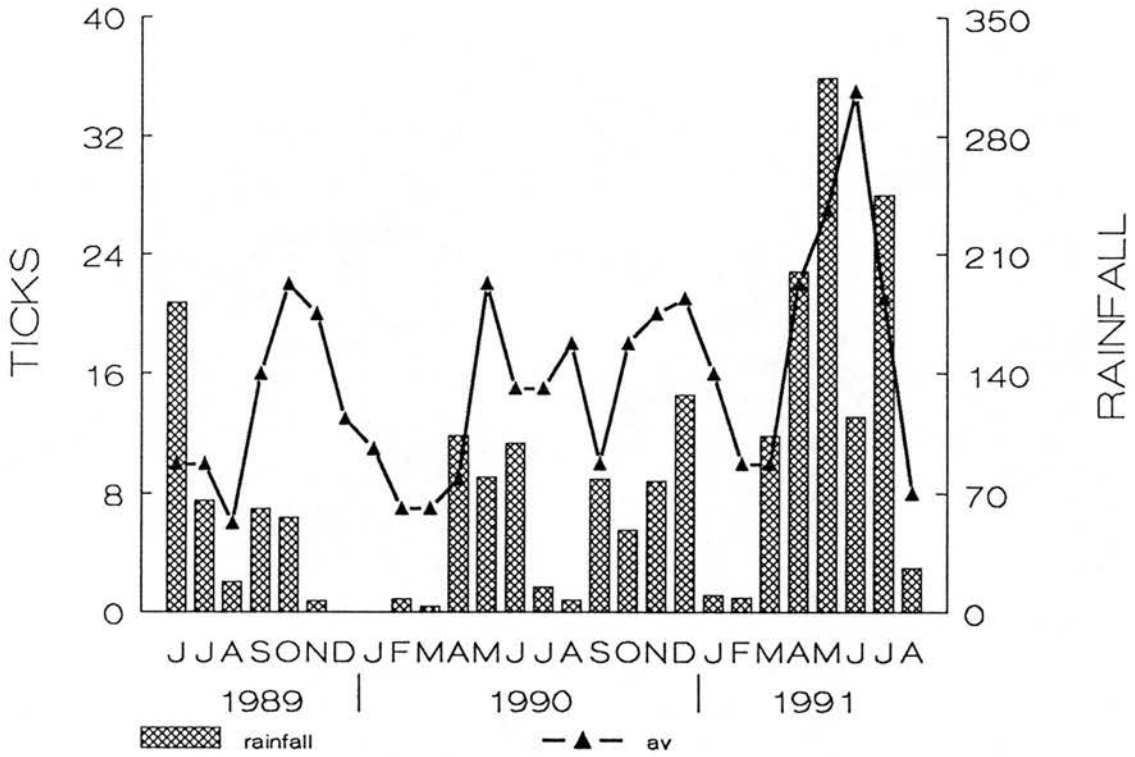


Figure 2.31

Association between rainfall and *Amblyomma variegatum* at local herds 3, 4 and 5 covering the period June 1989 to August 1991. Tick counts are expressed as means of 15 animals

av = *Amblyomma variegatum*
 rainfall = Rainfall in millimetres

LOCAL HERDS 3,4 & 5

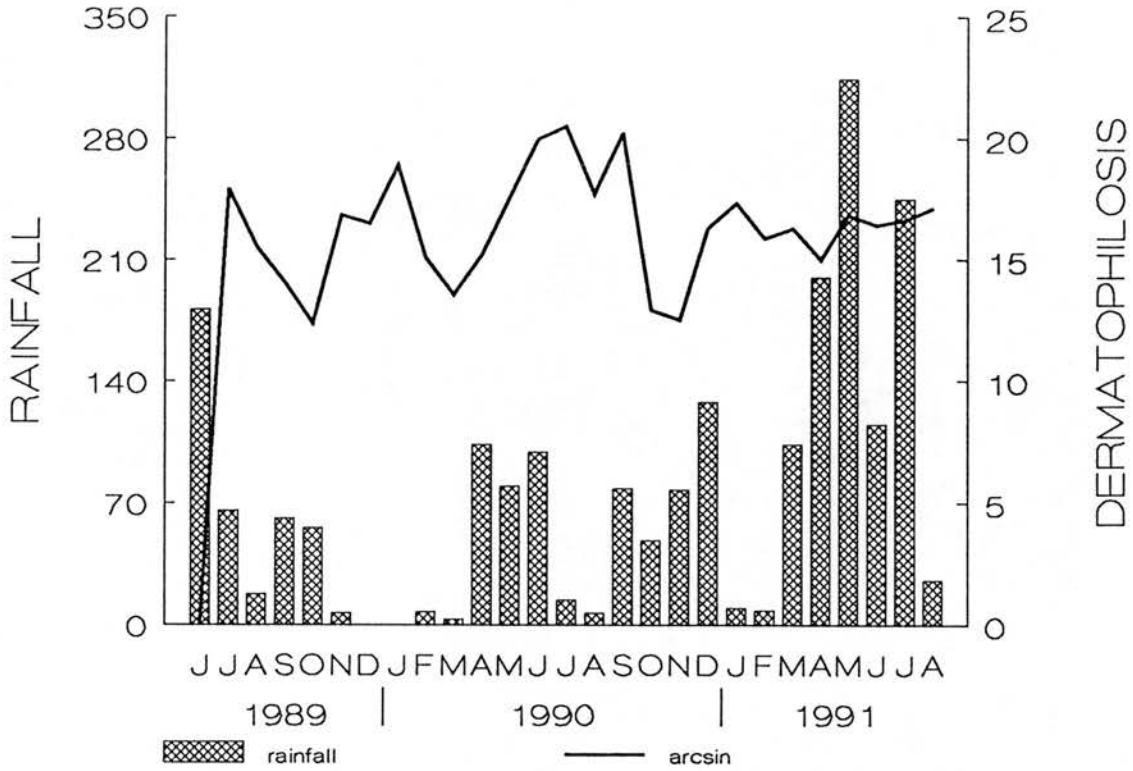


Figure 2.32

Association between rainfall and dermatophilosis at local herds 3, 4 and 5 covering the period June 1989 to August 1991

rainfall = Rainfall in millimetres
 arcsin = Arcsin transformation of percentages of dermatophilosis cases

LOCAL HERDS 3,4 & 5

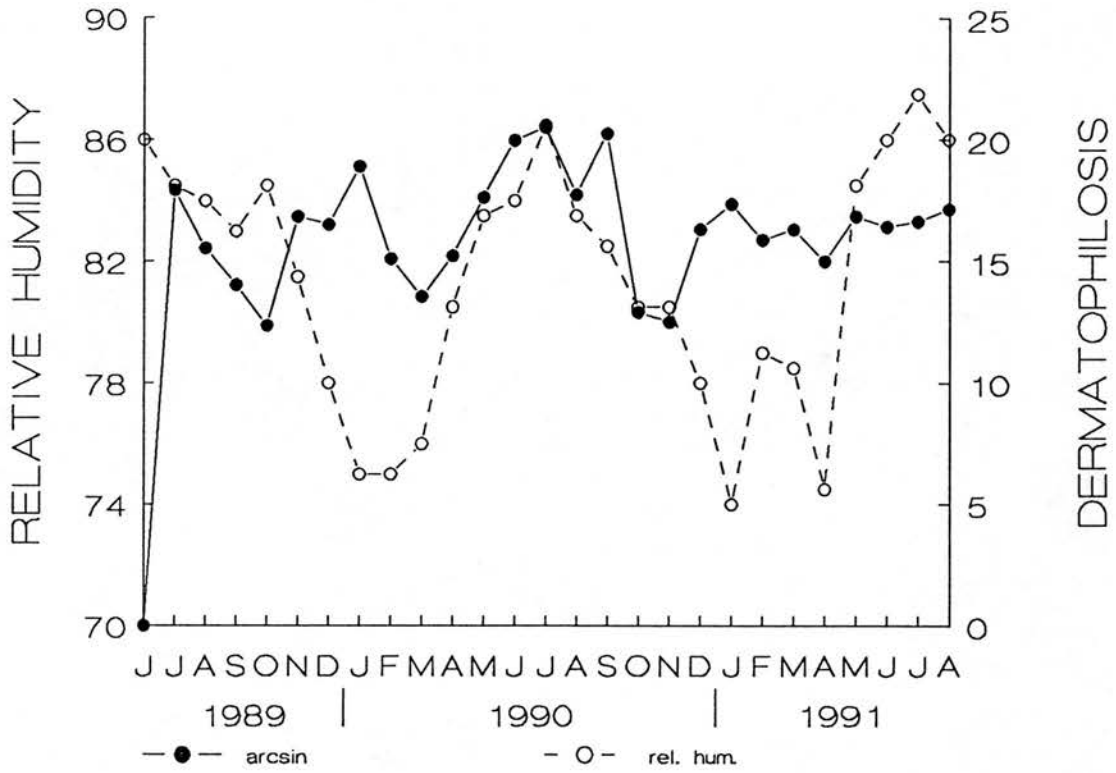


Figure 2.33

Association between relative humidity and dermatophilosis at local herds 3, 4 and 5 covering the period June 1989 to August 1991

rel. hum. = Relative humidity %
 arcsin = Arcsin transformation of percentages of dermatophilosis cases

LOCAL HERDS 3,4 & 5

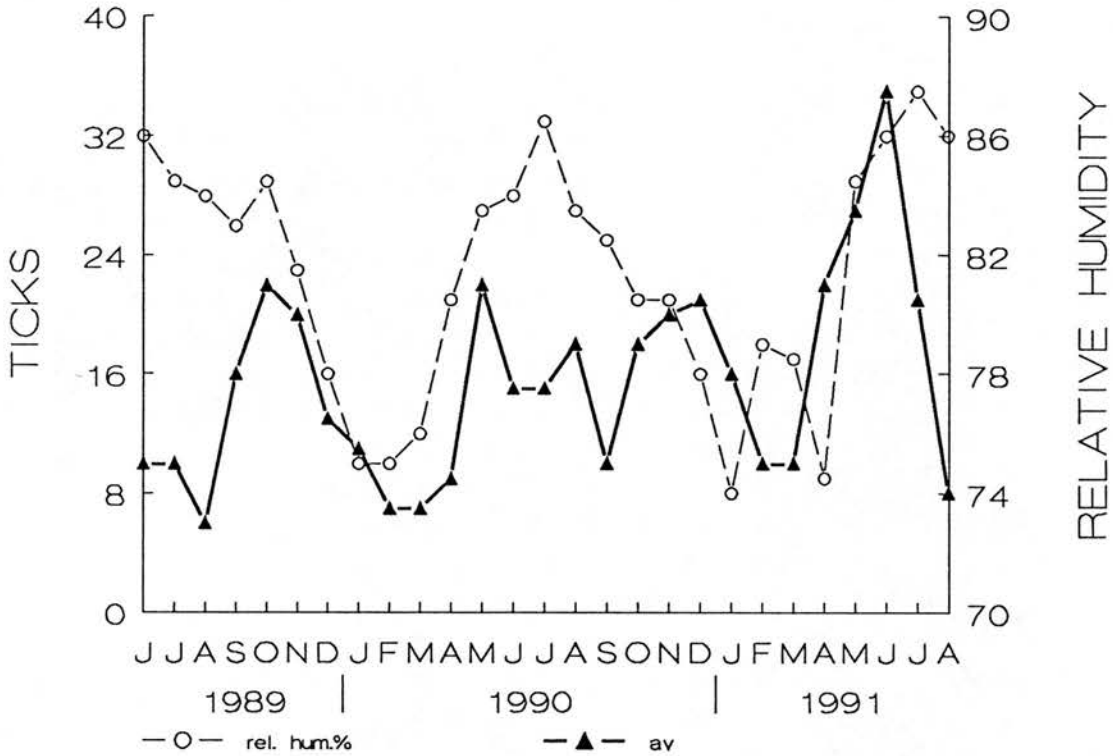


Figure 2.34

Association between relative humidity and *Amblyomma variegatum* at local herds 3, 4 and 5 covering the period June 1989 to August 1991. Tick counts are expressed as means of 15 animals

av = *Amblyomma variegatum*
 rel. hum. = Relative humidity %

LOCAL HERDS 3,4 & 5

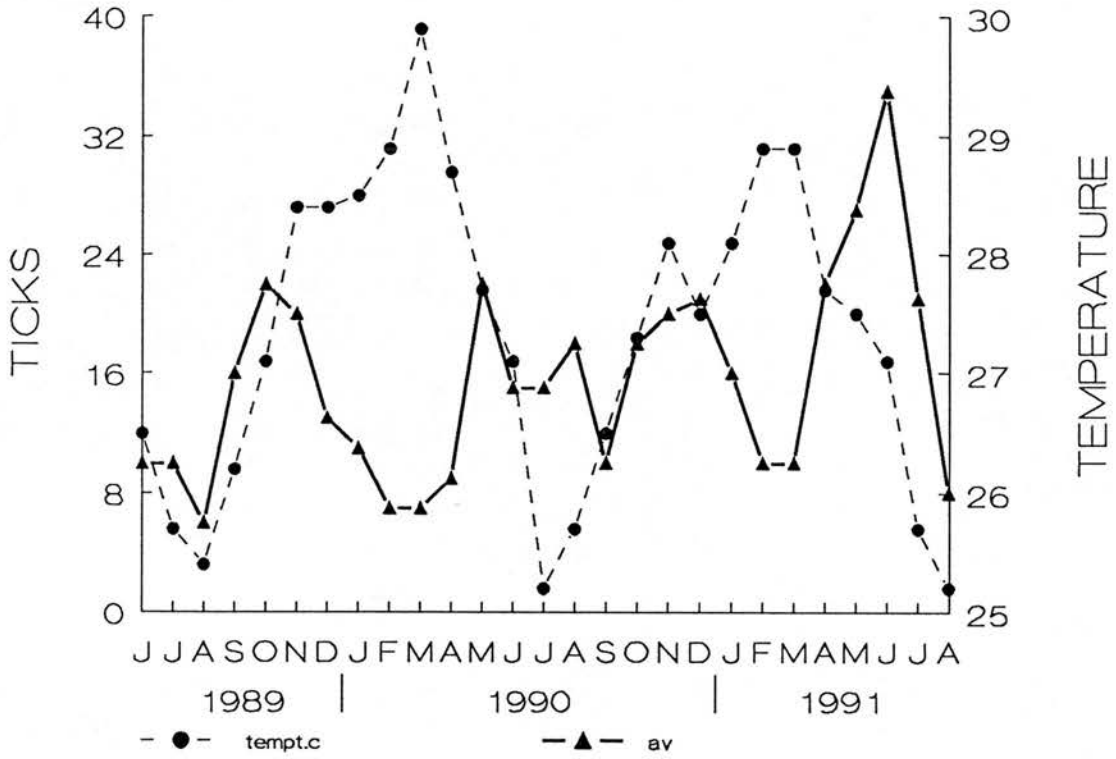


Figure 2.35

Association between temperature and *Amblyomma variegatum* at local herds 3, 4 and 5 covering the period June 1989 to August 1991. Tick counts are expressed as means of 15 animals

av = *Amblyomma variegatum*
 tempt. C = Temperature °C

EXPERIMENT HERD

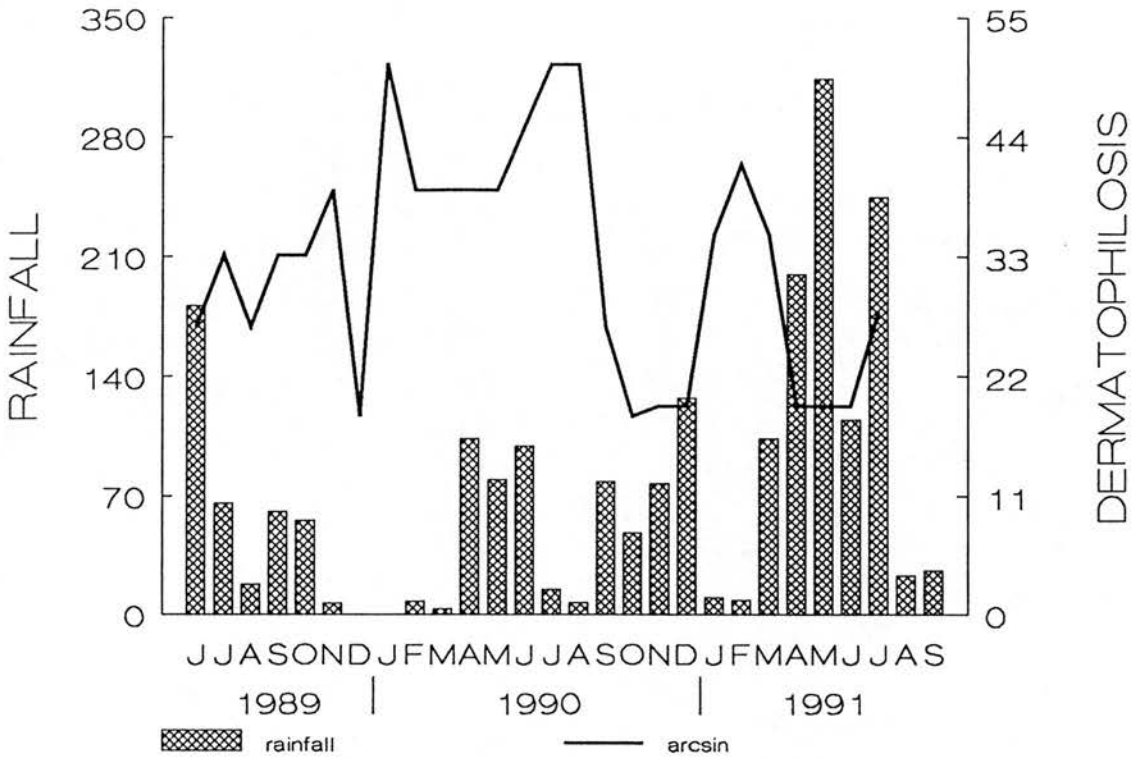


Figure 2.36

Association between rainfall and dermatophilosis at experiment herd covering the period June 1989 to July 1991

rainfall in millimetres

arcsin = Arcsin transformation of percentages of dermatophilosis cases

EXPERIMENT HERD

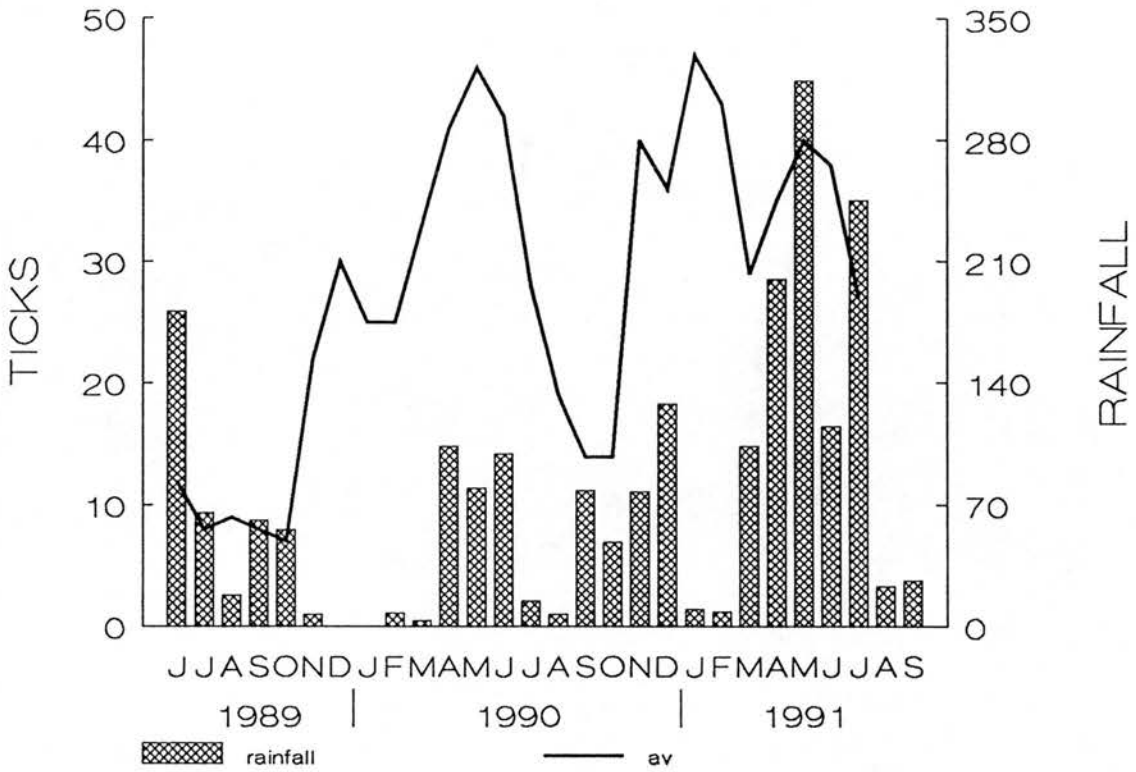


Figure 2.37

Association between rainfall and *Amblyomma variegatum* at experiment herd covering the period June 1989 to July 1991. Tick counts are expressed as means of ten animals

av = *Amblyomma variegatum*
rainfall in millimetres

EXPERIMENT HERD

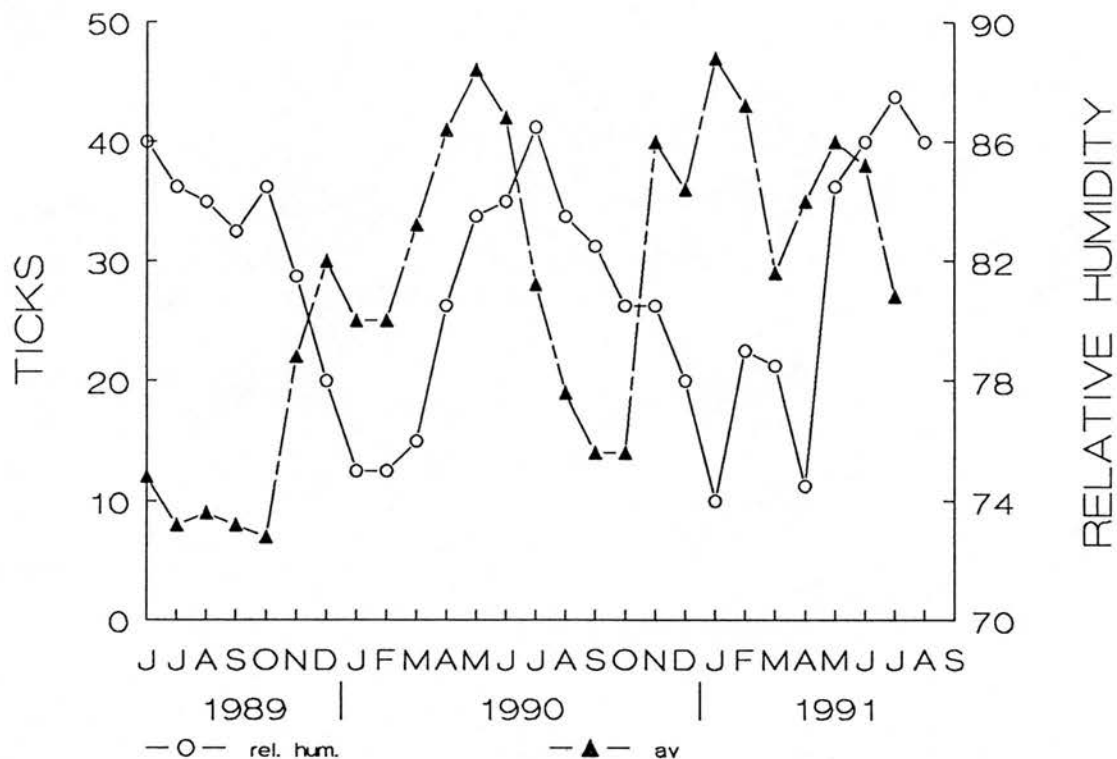


Figure 2.38

Association between relative humidity and *Amblyomma variegatum* at experiment herd covering the period June 1989 to July 1991. Tick counts are expressed as means of ten animals

av = *Amblyomma variegatum*
 rel. hum. = Relative humidity %

EXPERIMENT HERD

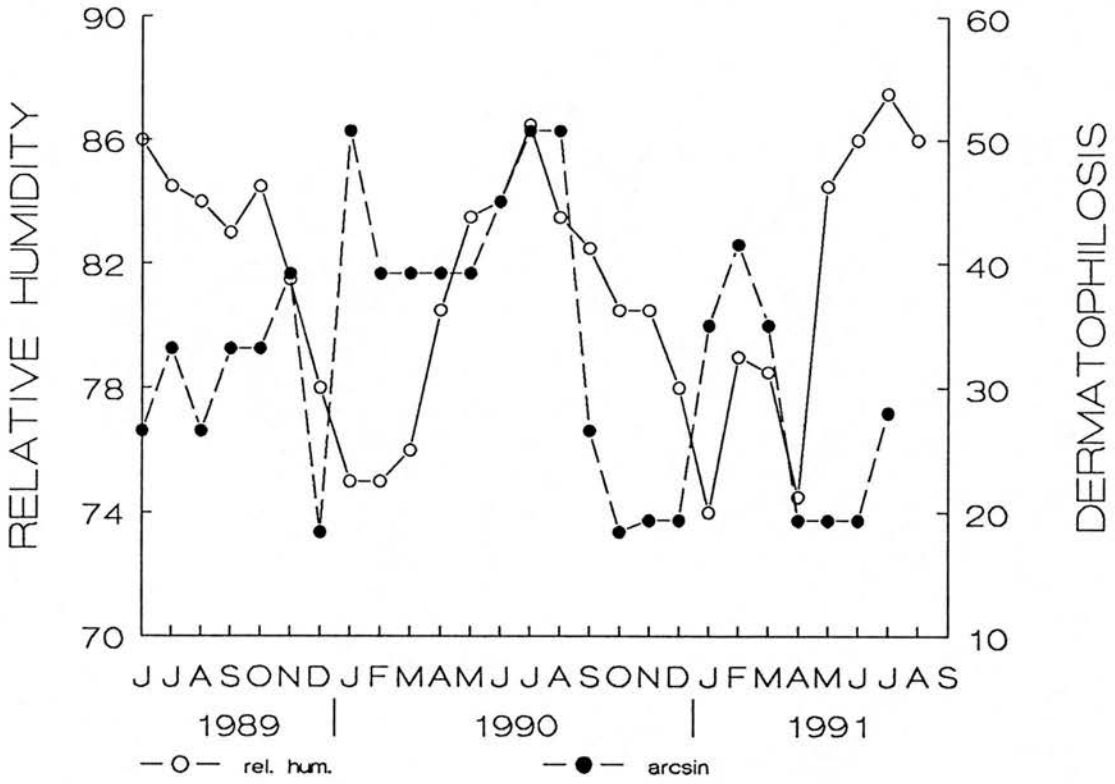


Figure 2.39

Association between relative humidity and dermatophilosis at experiment herd covering the period June 1989 to July 1991

rel. hum. = Relative humidity %
 arcsin = Arcsin transformation of percentages of dermatophilosis cases

EXPERIMENT HERD

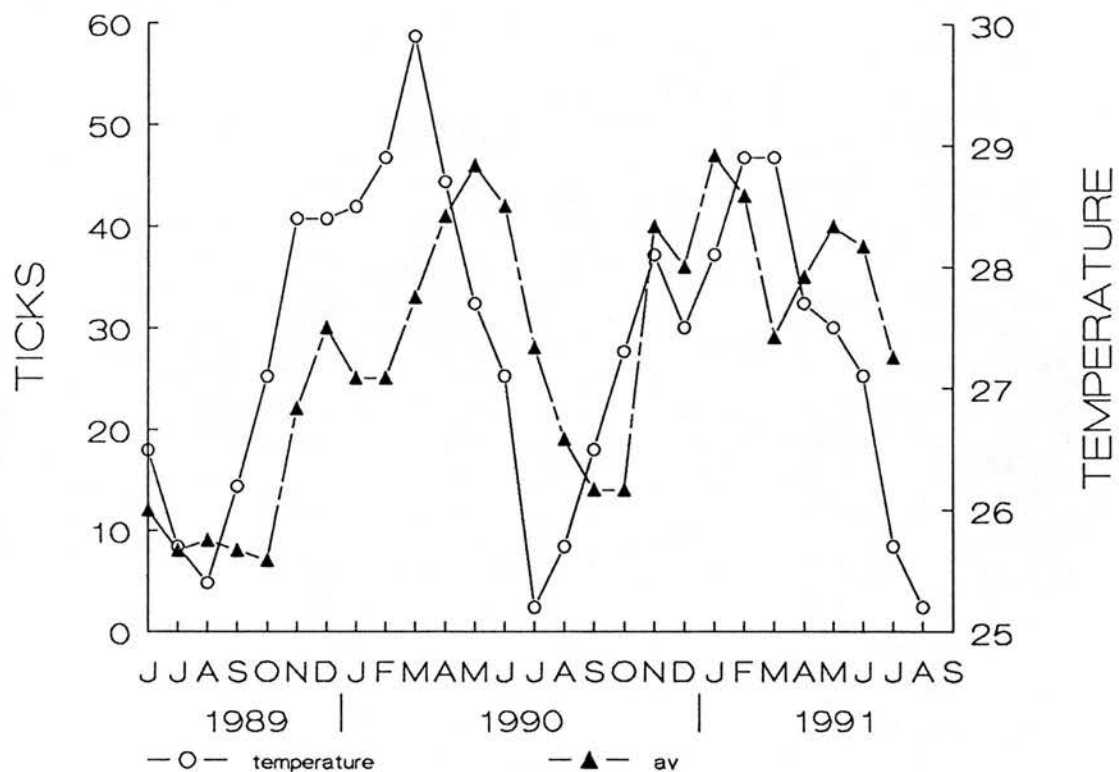


Figure 2.40

Association between temperature and *Amblyomma variegatum* at experiment herd covering the period June 1989 to July 1991. Tick counts are expressed as means of ten animals

av = *Amblyomma variegatum*
Temperature °C

Table 3.1

Monthly median values, using foetal calf serum (FCS) of the percentages of transformed cells per 200 lymphocytes cultured from five Zebu-type cows treated with acaricide

Date		Day 5 cultures		
		Without antigen	Concanavalin A	<i>D. congolensis</i>
1989	July	1	84	nd
	August	4	89	5
	September	6	84	8
	October	7	78	8
	November	9	68	20
1990	February	10	61	7
	April	11	58	13

nd = not done

Table 3.2

Monthly median values, using foetal calf serum (FCS), of the percentages of transformed cells per 200 lymphocytes cultured from five Zebu-type cows in Group 1 infested with ticks

Date		Day 5 cultures		
		Without antigen	Concanavalin A	<i>D. congolensis</i>
1989	July	4	84	nd
	August	7	90	32
	September	7	82	15
	October	13	90	4
	November	16	81	25
1990	February	6	67	10
	April	10	65	13

nd = not done

Table 3.3

Monthly median values, using foetal calf serum (FCS) of the percentages of transformed cells per 200 lymphocytes cultured from five Zebu-type cows in Group 2 infested with ticks

Date		Day 5 cultures		
		Without antigen	Concanavalin A	<i>D. congolensis</i>
1989	July	2	82	nd
	August	8	80	24
	October	11	83	20
	November	28	82	35
1990	March	14	62	15
	April	14	74	21

nd = not done

Table 3.4

Monthly median values, using foetal calf serum (FCS) of the percentages of transformed cells per 200 lymphocytes cultured from five N'dama cows in Group 2 infested with ticks

Date		Day 5 cultures		
		Without antigen	Concanavalin A	<i>D. congolensis</i>
1989	July	6	90	nd
	August	4	85	13
	October	5	84	9
	November	33	77	32
1990	March	12	61	20
	April	21	76	22

nd = not done

Table 3.5

Summary of the medians of the percentages of lymphocytes transformed from cattle in the experiment groups comparing day-5 cultures without antigen and with Concanavalin A

Experiment cow groups	Without antigen	Concanavalin A	Mann-Whitney U	Probability	Interpretation
Acaricide-treated Zebu-types	7.0	78.0	0	<0.01	vs
Untreated group 1 Zebu-types	7.0	82.0	0	<0.01	vs
Untreated group 2 Zebu-types	12.5	81.0	0	<0.01	vs
Untreated N'damas	9	80.5	0	<0.01	vs

vs = very significant difference

Table 3.6

Summary of the medians of the percentages of lymphocytes transformed from cattle in the experiment groups comparing day-5 cultures without antigen and with *D. congolensis*

Experiment cow groups	Without antigen	<i>D. congolensis</i>	Mann-Whitney U	Probability	Interpretation
Acaricide-treated Zebu-types	7.0	14	14.6	>0.05	ns
Untreated group 1 Zebu-types	7.0	14	11.5	>0.05	ns
Untreated group 2 Zebu-types	12.5	21	4	>0.05	ns
Untreated N'damas	9.0	20	9	>0.05	ns

ns = no significant difference

Table 3.7

Comparison of the medians of the percentages of lymphocytes transformed from cattle in the experiment groups using day-5 cultures with Concanavalin A

Comparison	Median	Mann-Whitney U	Probability	Interpretation
Acaricide-treated v Untreated group 1 Zebu-types	78.0 v 82.0	18.67	>0.05	ns
Acaricide-treated v Untreated group 2 Zebu-types	78.0 v 81.0	17.00	>0.05	ns
Acaricide-treated v Untreated N'damas	78.0 v 80.5	16.67	>0.05	ns

ns = no significant difference

Table 3.8

Significance of differences between the rates of transformation between lymphocytes from cows collected and cultured at monthly intervals in the absence of antigen

Differences attributable to cows (n=6, k=5)			
Experimental cow groups	Friedman M	Probability	Interpretation
Acaricide-treated Zebu-types	5.4	>0.05	ns
Untreated group 1 Zebu-types	1.0	>0.05	ns
Untreated group 2 Zebu-types	2.5	>0.05	ns
Untreated N'damas	5.0	>0.05	ns

ns = no significant difference

Table 3.9

Significance of differences between the rates of transformation between lymphocytes at monthly intervals from cows in the absence of antigen

Differences attributable to months of collection (n=5, k=7)			
Experimental cow groups	Friedman M	Probability	Interpretation
Acaricide-treated Zebu-types	28.38	<0.01	vs
Untreated group 1 Zebu-types	4.39	> 0.05	ns
Untreated group 2 Zebu-types	16.00	<0.01	vs
Untreated N'damas	19.00	<0.01	vs

ns = no significant difference
vs = very significant difference

Table 3.10**Day-5 blastogenesis results for Concanavalin A stimulated cultures**

Experimental cow groups	Normal cultures	Cultures to which auto- logous serum was added	Reduction %
Acaricide- treated group Zebu-types	78.0	68	13
Untreated group 1 Zebu-types	78.5	50	36
Untreated group 2 Zebu-types	68.0	41	40
N'damas	74.0	49	34

Except where stated all results give the median percentage of blast cells in culture from five animals

Table 3.11

Significance of differences in median percentages of blastogenic lymphocytes from untreated and acaricide-treated groups of cattle cultured in the presence of foetal calf serum and with Concanavalin A

Comparison	Concanavalin A blastogenic lympho- cytes/200 cells	Chi-square	Probability	Interpretation
Acaricide-treated v untreated group 1 Zebu-types	78.0 v 78.5	0.003	>0.90	ns
Acaricide-treated v untreated group 2 Zebu-types	78.0 v 68.0	1.079	>0.05	ns
Acaricide-treated v untreated N'damas	78.0 v 74.0	0.170	>0.50	ns

ns = no significant difference

Table 3.12

Significance of differences in median percentages of blastogenic lymphocytes from untreated and treated cattle cultured in the presence of autologous serum and with Concanavalin A

Comparison	Blastogenic lymphocytes/200	Chi-square	P	Interpretation
Acaricide-treated v untreated group 1 Zebu-types	68 v 50	3.895	<0.05	s
Acaricide-treated v untreated group 2 Zebu-types	68 v 41	9.193	<0.01	vs
Acaricide-treated v untreated N'damas	68 v 49	4.361	<0.05	s

s = significant difference
vs = very significant difference

Table 3.13

Monthly median values, using foetal calf serum and autologous serum, of the percentages of transformed cells per 200 lymphocytes cultured from Friesian cattle treated with acaricide

Month of collection	Day 5 cultures			
	n	Without antigen	Concanavalin A treated	<i>D. congolensis</i> treated
April	6	12.0	69.0	17.0
May	6	9.0	78.0	13.0
June	6	11.5	69.0	13.0
July	6	12.8	64.0	11.5
August	3	10.0	60.0	11.0
September	3	8.0	72.0	u
October	3	10.0	56.5	u
November	3	11.0	67.0	6.0
December	3	14.0	59.0	20.0
January	2	11.0	55.5	11.5
February	2	14.5	53.5	u

u = unreadable

Table 3.14

Acaricide-treated Friesian cattle. Comparison of day-5 culture medium containing no antigen with other treatment regimes using Mann-Whitney U Test

Serum cultures	Comparison	Median	Mann-Whitney U	Probability	Interpretation
FCS	Without antigen v Concanavalin A	11.75 v 66	0	<0.01	vs
	Without antigen v <i>D. congolensis</i>	11.75 v 13	2.5	>0.05	ns

ns = no significant difference
vs = very significant difference

Table 3.15

Monthly median values, using foetal calf serum and autologous serum, of the percentages of transformed cells per 200 lymphocytes cultured from Friesian cattle treated with acaricide

Day 5 cultures supplemented with Concanavalin A			
Months of collection	n	FCS	Autologous serum
April	6	69.0	u
May	6	78.0	52.0
June	6	69.0	52.0
July	6	64.0	44.5
August	3	60.0	42.0
September	3	72.0	57.5
October	3	56.5	34.0
November	3	67.0	32.0
December	3	59.0	39.0
January	2	55.5	35.5
February	2	53.5	u

u = unreadable

Table 3.16

Monthly median values, using foetal calf serum of the percentages of transformed cells per 200 lymphocytes cultured from treated and untreated Friesian cattle

Day 5 cultures containing Concanavalin A			
Months after exposure	Acaricide-treated Friesians	Untreated Friesians	Reduction %
2	57.0	38	33
3	67.0	33	51
4	59.0	37	37
5	55.5	34	38
6	55.0	24	56

Table 3.17

Lines of best fit calculated from arcsin transformation of the percentages of transformed lymphocytes in acaricide-treated and untreated Friesians

Group	n	line of best fit	F	P
Acaricide-treated cows	7	$\hat{y} = 54.7 - 1.1 x$	21.5	>0.05
Untreated cows	7	$\hat{y} = 53.5 - 4.2 x$	15.23	<0.05

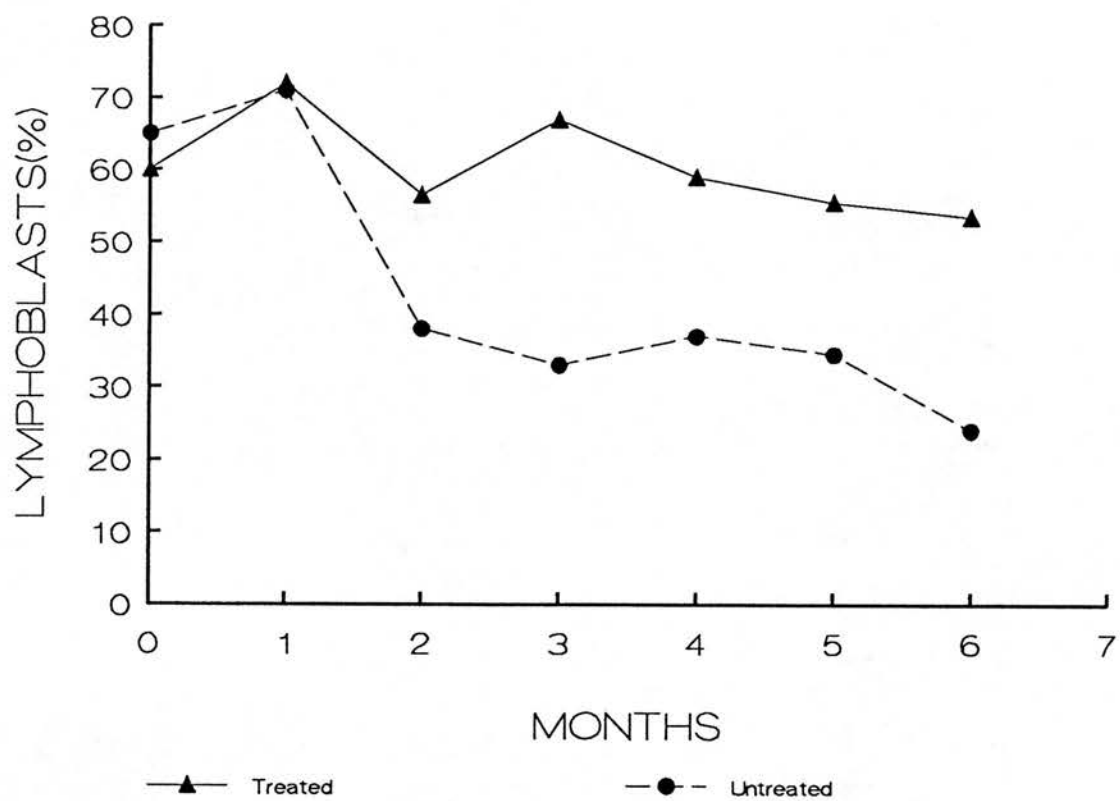


Figure 3.1(a) Percentage lymphocyte transformation in acaricide-treated and untreated Friesians

Treated - Acaricide-treated Friesians
Untreated - Untreated Friesians

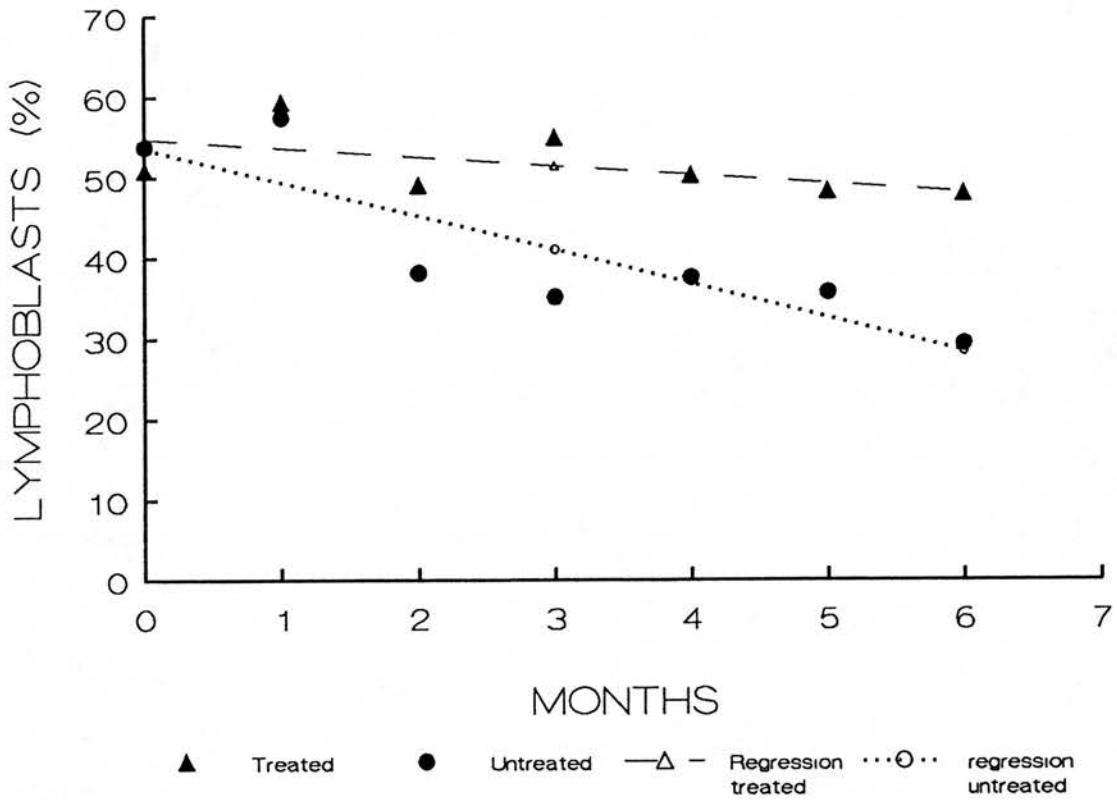


Figure 3.1(b) Arcsin transformation of percentages of transformed lymphocytes derived from acaricide-treated and untreated Friesians

Treated - Acaricide-treated Friesians
 Untreated - Untreated Friesians

Table 3.18

Monthly medians of the percentages of transformed cells per 200 lymphocytes derived from untreated Friesian cattle and cultured for five days with foetal calf serum

Month of collection	n	Without antigen	Concanavalin A treated	<i>D. congolensis</i> treated
August	3	11.0	65.0	11.0
September	3	9.0	71.0	u
October	3	8.0	38.0	u
November	3	11.0	33.0	12.0
December	3	12.0	37.0	19.0
January	2	11.5	34.5	15.5
February	2	9.0	24.0	u

u = unreadable

Table 3.19

Monthly medians of the percentages of transformed cells per 200 lymphocytes derived from untreated Friesian cattle and cultured for five days with autologous serum

Month of collection	n	Without antigen	Concanavalin A treated	<i>D. congolensis</i> treated
August	3	6.0	27.0	10.0
September	3	5.0	39.0	u
October	3	8.0	15.0	u
November	3	6.0	24.0	4.0
December	3	9.0	19.0	10.0
January	2	6.5	18.5	8.0
February	2	9.0	nd	u

nd = not done
u = unreadable

Table 3.20

Paired Wilcoxon rank sign test of the percentages of transformed lymphocytes in Concanavalin A-treated cultures supplemented with foetal calf serum and autologous serum

Month of collection	Foetal calf serum	Autologous serum	Difference	Rank
August	65.0	27.0	+38	6
September	71.0	39.0	+32	5
October	38.0	15.0	+23	4
November	33.0	24.0	+9	1
December	37.0	19.0	+18	3
January	34.5	18.5	+16	2

∴ Wilcoxon T = 0, P < 0.05

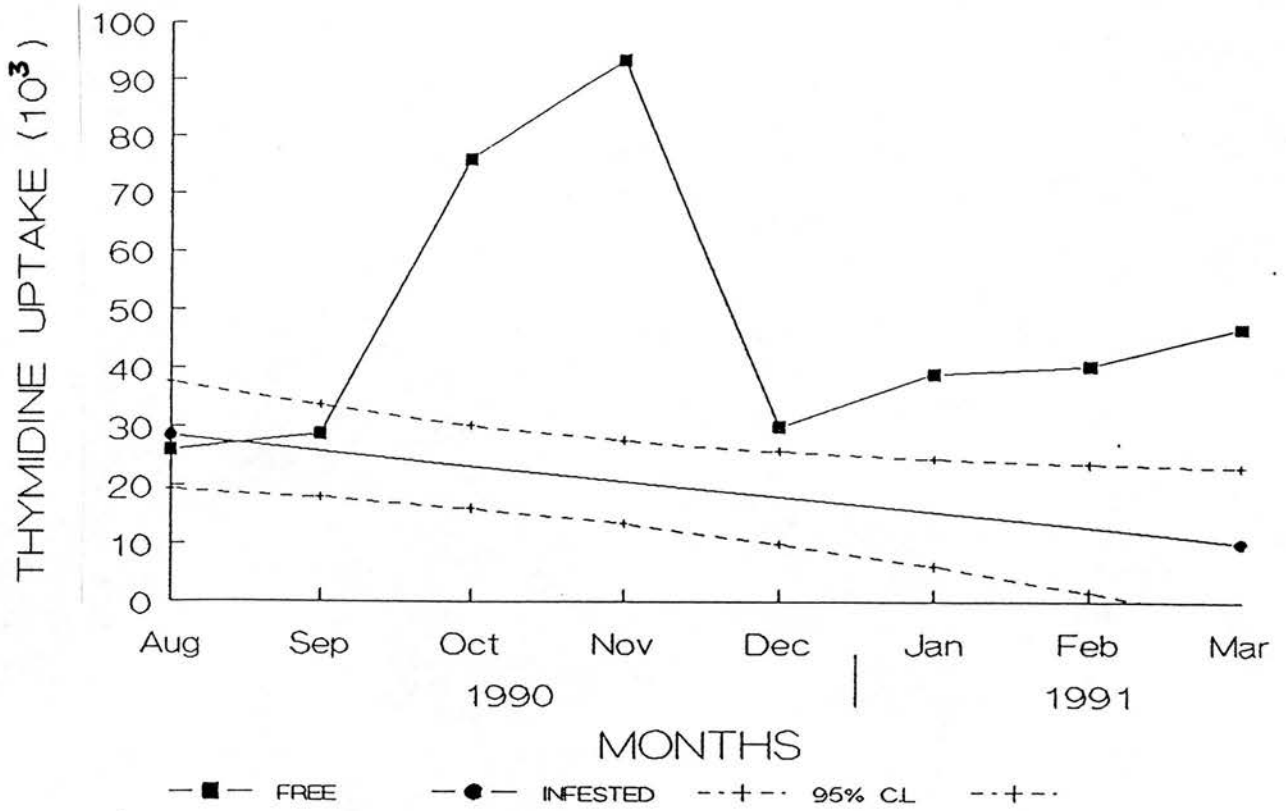


Figure 3.2 $[^3\text{H}]$ -thymidine uptake by lymphocytes derived from acaricide-treated and untreated Friesians

Free	-	Acaricide-treated Friesians
Infested	-	Untreated Friesians
C.L.	-	Confidence limits

Table 3.21

Monthly counts of lymphocyte cultures supplemented with FCS and pulsed with [³H]-thymidine: comparison between cultures from untreated Friesians without antigen, with Concanavalin A and with *D. congolensis*

Comparison	n ₁	n ₂	Mann-Whitney U	Probability	Interpretation
Without antigen v <i>D. congolensis</i>	8	9	10	>0.05	ns
Without antigen v Concanavalin A	9	10	0	<0.01	vs
Concanavalin A v <i>D. congolensis</i>	8	10	0	<0.01	vs

ns = not significant
vs = very significant

Table 3.22

Monthly counts of lymphocyte cultures supplemented with FCS and pulsed with [³H]-thymidine: comparison between cultures from acaricide-treated Friesians without antigen, with Concanavalin A and with *D. congolensis*

Comparison	n ₁	n ₂	Mann-Whitney U	Probability	Interpretation
Without antigen v <i>D. congolensis</i>	8	9	17	>0.05	ns
Without antigen v Concanavalin A	9	10	0	<0.01	vs
Concanavalin A v <i>D. congolensis</i>	8	10	0	<0.01	vs

ns = not significant

vs = very significant

Table 3.23

Monthly counts of lymphocyte cultures supplemented with autologous serum and pulsed with [³H]-thymidine: comparison between cultures from acaricide-treated Friesians without antigen, with Concanavalin A and with *D. congolensis*

Comparison	n ₁	n ₂	Mann-Whitney U	Probability	Interpretation
Without antigen v <i>D. congolensis</i>	7	8	10	>0.05	ns
Without antigen v Concanavalin A	8	9	0	<0.01	vs
Concanavalin A v <i>D. congolensis</i>	7	9	0	<0.01	vs

ns = not significant
vs = very significant

Table 3.24

Monthly counts of lymphocyte cultures supplemented with autologous serum and pulsed with [³H]-thymidine: comparison between cultures from acaricide-treated Friesians without antigen, with Concanavalin A and with *D. congolensis*

Comparison	n ₁	n ₂	Mann-Whitney U	Probability	Interpretation
Without antigen v <i>D. congolensis</i>	7	8	11	>0.05	ns
Without antigen v Concanavalin A	8	9	0	<0.01	vs
Concanavalin A v <i>D. congolensis</i>	7	9	0	<0.01	vs

ns = not significant
vs = very significant

Table 4.1

Monthly median values, using foetal calf serum (FCS) of the percentages of transformed cells per 200 lymphocytes cultured from six clinically infected Zebu-type cattle

Kraal	Cow	Without antigen	Day 5 cultures Concanavalin A	<i>D. congolensis</i>
1	1	18	70	u
	2	16	72	u
	3	14	70	17
	4	u	u	27
2	5	12	56	9
	6	17	48	14

u = unreadable

Table 4.2

Clinically infected cattle. Comparison of culture medium containing no antigen with other treatment regimes using Mann-Whitney U Test

Serum cultures	Comparison	Median	U	P	Interpretation
FCS	Without antigen	16.0	0	<0.05	s
	v Concanavalin A	70.0			
	Without antigen	16.0	10	>0.05	ns
	v <i>D. congolensis</i>	15.5			
Autologous serum	Without antigen	14.5	0	<0.05	s
	v Concanavalin A	35.5			
	Without antigen	14.5	8.5	>0.05	ns
	v <i>D. congolensis</i>	15.0			

s = significant difference
ns = no significant difference

Table 4.3

Monthly median values, of the percentages of transformed cells per 200 lymphocytes cultured from six clinically infected Zebu-type cattle using a mixture of foetal calf serum (FCS) and autologous serum

Kraal	Cow	Without antigen	Day 5 cultures Concanavalin A	<i>D. congolensis</i>
1	1	18	34	u
	2	16	37	u
	3	16	44	13
	4	5	41	19
2	5	10	22	12
	6	13	21	17

u = unreadable

Table 4.4

Day 5 blastogenesis percentages for Concanavalin A - stimulated cultures from clinical infected animals cultured with FCS alone and with a mixture of FCS and autologous serum

Infected animals	Cultures with FCS alone	Cultures with FCS and autologous serum	Reduction %
1	70	34	51
2	72	37	49
3	70	44	37
4	u	41	-
5	56	22	61
6	48	21	56

u = unreadable

Table 4.5

Median values, using foetal calf serum, autologous serum and sera from two clinically infected cows, of the percentages of transformed cells per 200 lymphocytes cultured from two acaricide-treated Zebu-type cows

Serum supplement	Donor cow 159		Donor cow 164	
	Without antigen	Concanavalin A day 5	Without antigen	Concanavalin A day 5
FCS	12	80	12	84
Autologous	10	66	16	56
Infected Cow 1	10	35	10	49
Infected Cow 2	5	42	13	49

Table 4.6**Percentage depression in relation to percentage proliferation of lymphocytes derived from acaricide-treated animals with FCS in Concanavalin day-5 cultures**

Serum supplement	Σx Cow 159	Σx Cow 164
Autologous	18	33
Infected Cow 1	56	42
Infected Cow 2	48	42

Table 4.7

Statistical analysis of differences between percentages of blastogenic activity in cultures of lymphocytes from cows 159 and 164 supplemented with different sera

Comparison	n ₁ ,n ₂	Mann-Whitney U	P	Interpretation
Without antigen v Concanavalin A 5	8	0	<0.01	vs
FCS v Autologous serum	8	24	>0.05	ns
Cow 1 serum v Cow 2 serum	4	6	>0.05	ns
FCS + Autologous serum ¹ v Cow 1 + Cow 2 serum ¹	4	0	<0.05	s

¹ Counts from Concanavalin A day-5 cultures only
 vs = very significant
 ns = not significant
 s = significant

Table 5.1

Skin reactivity of cattle to intradermal injections with Pure Protein Derivative (PPD)

Experiment cow groups	Cow number	Pre-inoculation	72 hours after inoculation	Increase	%
Acaricide-treated Zebu-types	152	5.2 mm	5.5 mm	0.2 mm	3.8
	154	5.4	7.8	1.8	33.3
	159	5.2	9.4	4.2	80.7
	163	5.1	9.3	4.2	82.3
	164	6.2	8.8	2.6	41.9
Median		5.2	8.8	2.6	41.9
Untreated Zebu-types	160	5.0	5.5	0.5	10.0
	161	5.0	7.5	2.7	54.0
	162	5.8	9.4	3.6	62.0
	165	5.7	6.3	0.6	10.5
	166	5.1	6.7	1.6	31.4
Median		5.1	6.7	1.6	31.4
Untreated N'damas	102	4.5	7.7	3.2	71.0
	146	4.7	5.5	0.8	17.0
	147	5.4	7.3	1.9	35.2
	148	5.8	7.0	1.2	20.6
	464	5.4	6.5	1.1	20.4
Median		5.4	7.0	1.2	20.6

Table 5.2**Kruskal-Wallis analyses of skin measurements before and after intradermal inoculation of three groups of cattle with PPD**

Comparison	Kruskal-Wallis H	P	Interpretation
Pre-inoculation	0.54	>0.05	ns
Post-inoculation	2.44	>0.05	ns
Increases	0.96	>0.05	ns

ns = not significant

Table 5.3

Median values using foetal calf serum (FCS) and Pure Protein Derivative (PPD) antigen, of the percentages of transformed cells per 200 lymphocytes cultured from cattle on different treatments

Day 5 cultures					
Treatment groups	Number of injections	Without Antigen	Concanavalin A	Pure protein derivative $5 \mu\text{g}^{-1}$	$10 \mu\text{g}^{-1}$
Acaricide-treated Zebu-types	1	10	66	9	8
	2	9	62	19	15
	3	8	60	11	14
Q ₂		9	62	11	14
Untreated Zebu-types	1	12	62.5	10	9
	2	10	47.0	10	9
	3	12	46.0	13	13
Q ₂		10	47.0	10	9
Untreated N'damas	1	13	64	8	12
	2	9	56	10	11
	3	13	66	13	17
Q ₂		9	64	10	12
Overall Q ₂		10	62	10	12

Table 5.4**Slopes of lines of best fit**

Treatment	Slope
$5 \mu\text{g}^{-1}$	+1.55
$10 \mu\text{g}^{-1}$	+2.22
Without antigen	-0.33
Concanavalin A	-1.98

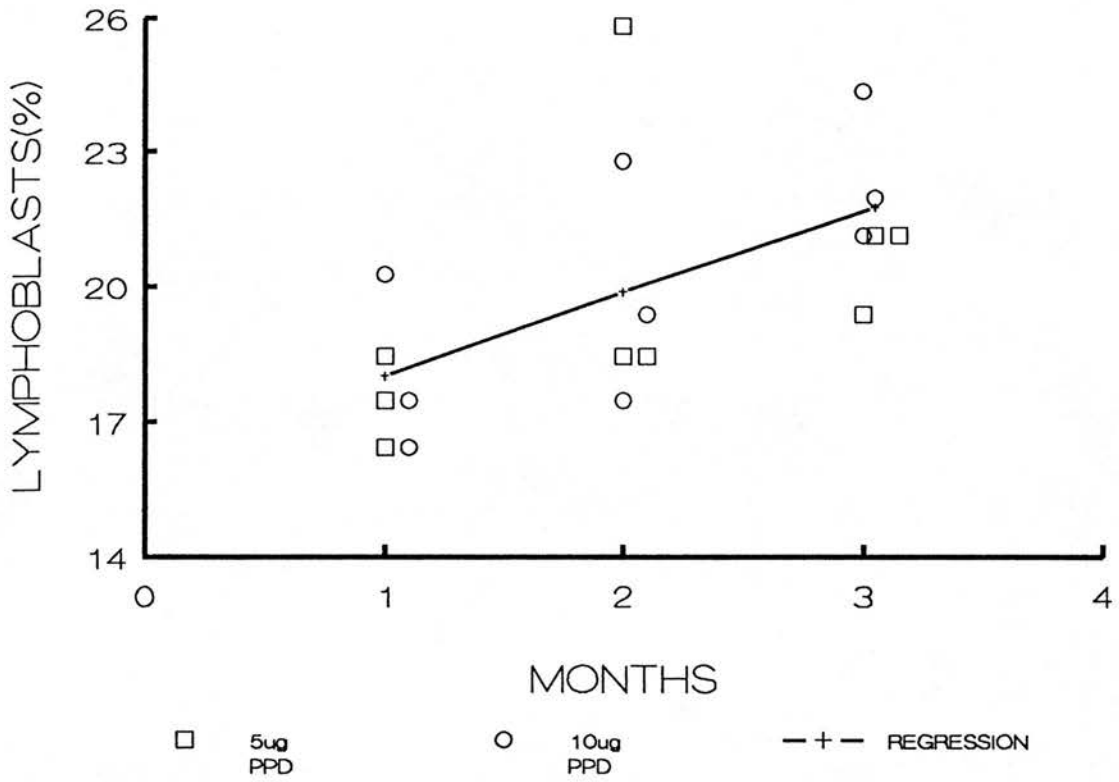


Figure 5.1 Regression of arcsin transformation of percentages of lymphocytes transformed on the number of injections of PPD

Table 5.5

Median values, using foetal calf serum, of the percentages of transformed cells per 200 lymphocytes from 15 cows sensitized with PPD cultured with Concanavalin A and *D. congolensis*

Experiment cow groups	Sample number	Day 5 cultures			
		Without antigen	Concanavalin A	<i>D. congolensis</i> Dc ₁ Dc ₂	
Acaricide-treated Zebu-types	1	9	62	15	9
	2	12	64	17	11
	3	10	65	16	18
Q ₂		9	64	16	11
Untreated Zebu-types	1	7	40.5	12	10.0
	2	9	56.0	15	9.5
	3	10	54.0	18	18.0
Q ₂		9	54	15	10
Untreated N'damas	1	13	63	14	12
	2	15	63	23	14
	3	11	60	13	14
Q ₂		13	63	14	14
Overall medians		10	62	15	12

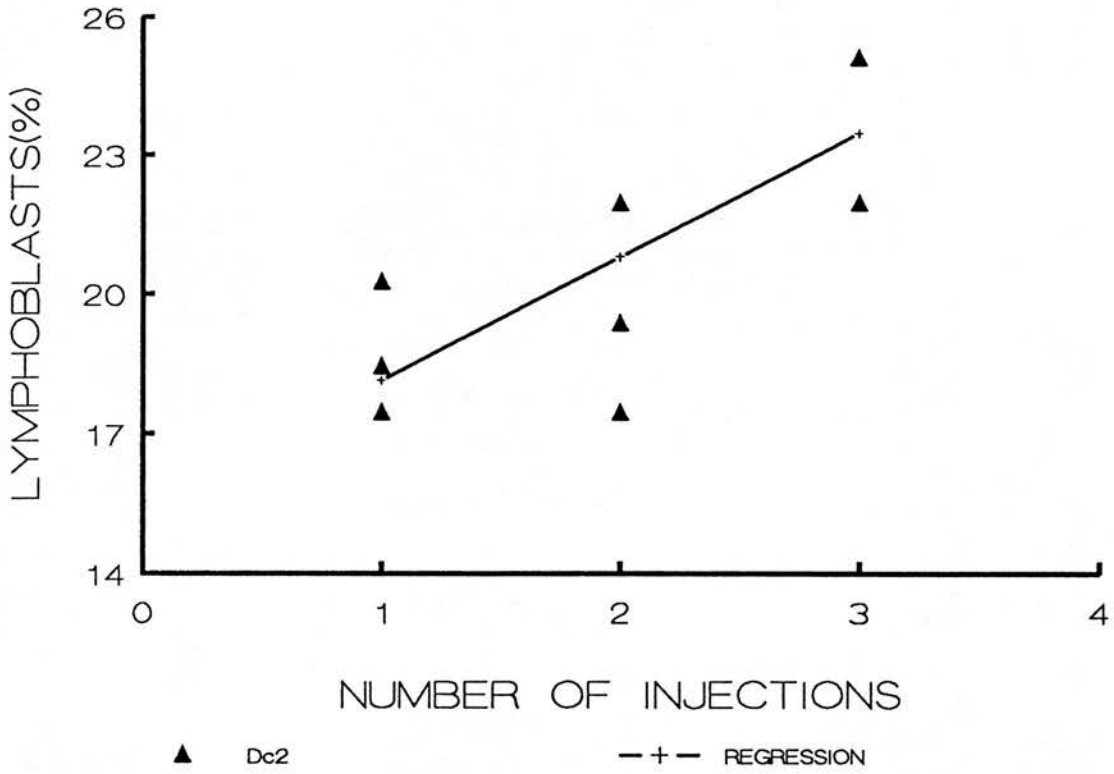


Figure 5.2 Relationship between arcsin transformation of percentages of lymphocytes transformed and the numbers of injections of *D. congolensis* antigen, Dc₂

Table 5.6

Median values, using foetal calf serum (FCS) and tick saliva antigen, of the percentages of transformed cells per 200 lymphocytes cultured from cattle on different treatments

Treatment groups	Day 5 cultures			
	Without antigen	Concanavalin A	Concanavalin A + saliva $5 \mu\text{g}^{-1}$	Tick saliva antigen $5 \mu\text{g}^{-1}$
Acaricide-treated Zebu-types	7.5	72.5	60.5	7.5
Untreated Zebu-types	5.8	58.5	61.5	18.0
Untreated N'damas	9.0	66.0	49.0	10.5
Acaricide-treated Friesians	15.5	58.0	53.5	18.0
Untreated Friesians	10.0	33.5	40.5	10.5

Overall Kruskal-Wallis $H = 15.019$, $k = 4$, $n = 5$; $P < 0.001$

Table 5.7

Significance of differences in the percentages of lymphocytes from different treatment groups of cattle cultured without antigen and cultured with tick saliva

Cattle groups	Chi-square	P	Interpretation
Acaricide-treated Zebu-types	0	>0.05	ns
Untreated Zebu-types	13.636	<0.001	vvs
Untreated N'damas	0.256	>0.05	ns
Acaricide-treated Friesians	0.448	>0.05	ns
Untreated Friesians	0.027	>0.05	ns

ns = not significant
vvs = very, very significant

Table 5.8**Days to clear infection in cattle experimentally infected with *D. congolensis***

Treatment groups	Cow number	Number of infections			
		1	2	3	4
Acaricide-treated Zebu-types	152	17	16	14	14
	154	12	5	5	11
	159	18	9	11	11
	163	17	9	11	14
	164	14	9	7	21
Untreated Zebu-types	160	17	16	15	16
	161	17	9	11	11
	162	12	9	11	11
	165	12	9	11	11
	166	17	9	15	21
Untreated N'damas	464	12	9	7	14
	102	12	9	11	11
	146	12	9	7	11
	148	12	9	7	11
	147	12	5	7	16

Table 5.9**Median days for experimental infection to complete resolution**

Treatment groups	Number of infections				Overall
	1	2	3	4	
Acaracide-treated Zebu-types	17	9	11	14	11.5
Untreated Zebu-types	17	9	11	11	11.5
Untreated N'damas	12	9	7	11	11.0
Overall	12	9	11	11	11.0

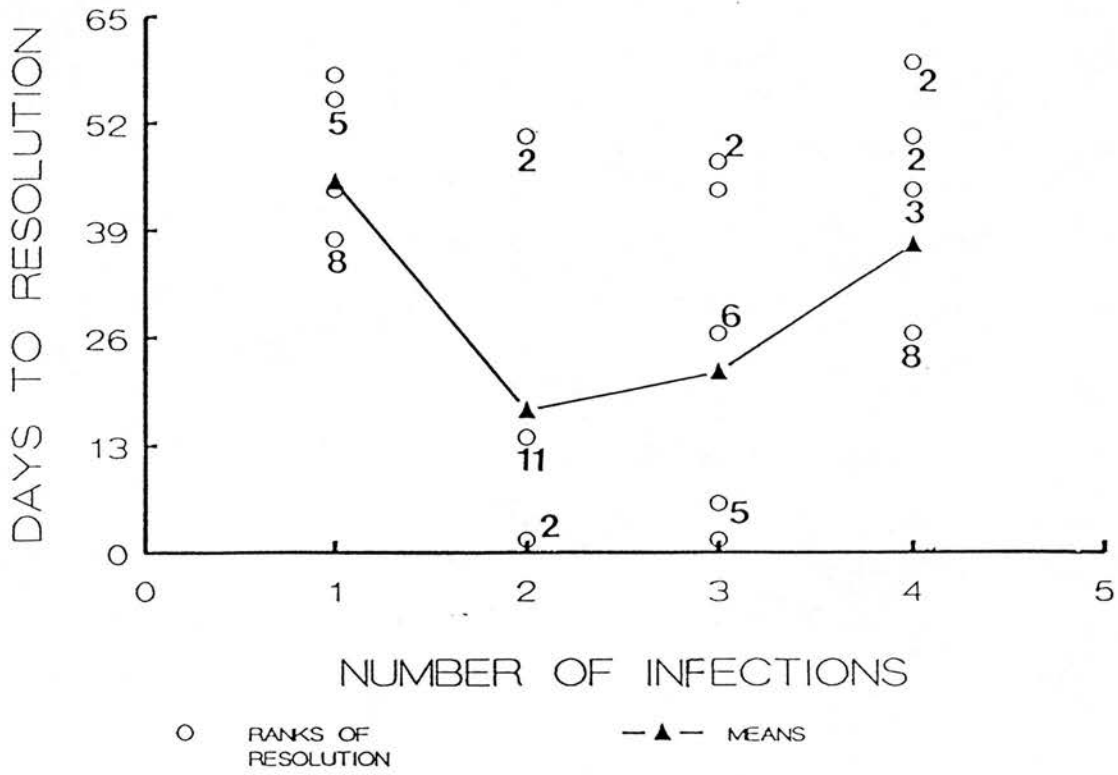


Figure 5.3 Relationship between ranks of days to resolution and the numbers of experimental infections with *D. congolensis*

Table 5.10

Comparison of days to complete resolution between first and subsequent infections

Comparison between infections	Mann-Whitney U	n ₁	n ₂	P	Interpretation
Infection 1 v infection 2	18.0	15	15	<0.01	vs
Infection 1 v infection 3	29.0	15	15	<0.01	vs
Infection 1 v infection 4	73.5	15	15	>0.05	ns

ns = not significant
vs = very significant

Table 5.11

Significance of differences attributable to number of infections and days to complete resolution in the differing experimental groups of cattle

Comparison	Kruskal-Wallis H	k	n	P	Interpretation
Acaricide-treated Zebu-types	8.82	4	5	<0.050	s
Untreated Zebu-types	8.14	4	5	<0.050	s
Untreated N'damas	15.75	4	5	<0.010	vs
Overall	26.50	4	15	<0.001	vvs

s = significant
vs = very significant
vvs = very, very significant

Table 5.12

Significance of differences attributable to cattle groups in days to complete resolution

Comparison	Kruskal-Wallis H	k	n	P	Interpretation
1st infection	4.89	3	5	>0.05	ns
2nd infection	0.84	3	5	>0.05	ns
3rd infection	5.39	3	5	>0.05	ns
4th infection	0.28	3	5	>0.05	ns
Overall	3.89	3	20	>0.05	ns

ns = not significant

Table 5.13

Skin reactivity of cattle to intradermal injections with *D. congolensis* antigen - antigen M

Experiment cow groups	Skin thickness in mm			
	Cow number	Pre- inoculation	24 hours post- inoculation	Increase
Acaricide- treated Zebu-types	152	5.2	5.4	0.2
	154	5.3	6.3	1.0
	159	4.5	6.2	1.7
	163	4.5	5.3	0.8
	164	6.5	6.3	-0.2
Median		5.2	6.2	0.8
Untreated Zebu-types	160	4.1	5.4	1.3
	161	5.6	7.1	1.5
	162	6.7	6.6	-0.1
	165	6.1	6.7	0.6
	166	5.3	6.3	1.0
Median		5.6	6.6	1.0
Untreated N'damas	102	4.9	6.3	1.4
	146	4.3	5.4	1.1
	147	5.6	5.0	-0.6
	148	5.0	6.5	1.5
	464	5.2	5.5	0.3
Median		5.0	5.5	1.1

Table 5.14

Skin reactivity of cattle to intradermal injections with *D. congolensis* antigens

Experiment cow groups	Antigen S			
	Cow number	Skin thickness in mm		
		Pre- inoculation	24 hours after/inoc.	Increase
Acaricide- treated Zebu-types	152	4.9	5.2	0.3
	154	5.2	6.4	1.2
	159	5.0	6.4	1.4
	163	4.9	6.4	1.5
	164	7.0	8.0	1.0
Median		5.0	6.4	1.2
Untreated Zebu-types	160	4.5	5.8	1.3
	161	5.2	6.2	1.0
	162	6.0	6.6	0.6
	165	5.5	6.2	0.7
	166	4.7	6.6	1.9
Median		5.2	6.2	1.0
Untreated N'damas	102	5.0	5.1	0.1
	146	5.2	5.1	-0.1
	147	4.4	4.4	0.0
	148	6.1	6.2	0.1
	464	4.7	5.2	0.5
Median		5.0	5.1	0.1

Table 5.15

Skin reactivity of cattle to intradermal injections with *D. congolensis* antigen - antigen M

Experiment cow groups	Cow number	Skin thickness in mm		
		Pre-inoculation	72 hours post-inoculation	Increase
Acaricide-treated Zebu-types	152	5.2	4.9	-0.3
	154	5.3	5.1	-0.2
	159	4.5	4.9	0.4
	163	4.5	5.3	0.8
	164	6.5	6.5	0.0
Median		5.2	5.1	0
Untreated Zebu-types	160	4.1	4.5	0.4
	161	5.6	6.5	0.9
	162	6.7	6.1	-0.6
	165	6.1	6.7	0.6
	166	5.3	6.0	0.7
Median		5.6	6.1	0.6
Untreated N'damas	102	4.9	4.6	-0.3
	146	4.3	4.8	0.5
	147	5.6	4.9	-0.7
	148	5.0	5.9	0.9
	464	5.2	5.3	0.1
Median		5.0	4.9	0.1

Table 5.16

Skin reactivity of cattle to intradermal injections with *D. congolensis* antigen - antigen S

Experiment cow groups	Cow number	Skin thickness in mm		
		Pre-inoculation	72 hours post-inoculation	Increase
Acaricide-treated Zebu-types	152	4.9	4.8	-0.1
	154	5.2	4.8	-0.4
	159	5.0	5.3	0.3
	163	4.9	5.7	0.8
	164	7.0	7.0	0.0
Median		5.0	5.3	0.0
Untreated Zebu-types	160	4.5	5.2	0.7
	161	5.2	5.5	0.3
	162	6.0	5.3	-0.3
	165	5.5	5.8	0.3
	166	4.7	5.1	0.4
Median		5.2	5.3	0.3
Untreated N'damas	102	5.0	4.8	-0.2
	146	5.2	4.8	0.4
	147	4.4	4.7	-0.3
	148	6.1	6.1	0.0
	464	4.7	5.3	0.6
Median		5.0	4.8	0.0

Appendix Table 1

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 1, 17.7.89

Treatment groups	Cow no.	Without antigen	Concanavalin A
Acaricide-treated Zebu-types (A-TZ)	152	0	93
		1	95
		7	95
	154	0	69
		5	72
		25	76
	159	4	79
		7	80
		8	83
	163	0	97
		1	97
		2	98
	164	0	76
		1	84
		2	87
Untreated group 1	156	1	69
		2	70
		4	86
	161	1	66
		4	84
		4	87
	162	4	70
		5	75
		5	79
	165	0	84
		1	84
		1	86
	166	7	74
		8	84
		10	85

Appendix Table 2

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 2, 24.7.89

Treatment groups	Cow no.	Without antigen	Concanavalin A
Untreated group 2 Zebu-types (UTZ)	151	1	u
		2	u
		4	u
	153	0	u
		2	u
		2	u
	155	2	79
		6	82
		8	84
	157	3	u
		4	u
		7	u
	160	2	u
		2	u
		4	u
Untreated N'damas	102	4	89
		6	90
		10	94
	146	11	86
		14	90
		18	94
	147	11	94
		12	u
		16	96
	148	5	85
		6	89
		8	91
	464	1	91
		3	94
		8	97

u = unreadable

Appendix Table 3

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 3, 31.7.89

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TZ	152	1	91	6
		4	92	6
		5	94	10
	154	2	66	47
		2	71	51
		4	74	76
	159	2	89	5
		2	91	5
		4	94	7
	163	4	85	0
		4	85	1
		8	91	4
	164	7	86	2
		7	89	4
		10	91	10
UTZ group 1	161	2	87	8
		2	87	12
		3	93	14
	162	u	u	34
		u	u	47
		u	u	u
	165	5	88	31
		7	94	41
		8	94	44
	166	8	86	19
		8	90	24
		10	91	27

u = unreadable

cow 156: contaminated

Appendix Table 4

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 4, 7.8.89

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
UTZ group 2	151	15	78	22
		18	80	24
		20	82	30
	153	11	79	11
		13	80	13
		14	84	14
	157	6	88	11
		7	89	15
		7	90	16
	155	6	80	23
		8	80	24
		10	84	28
	160	1	87	20
		3	87	27
		9	89	29
Untreated N'damas	102	7	65	8
		8	72	13
		13	74	15
	146	3	83	22
		3	89	23
		4	89	32
	147	4	67	1
		4	71	3
		7	74	13
	148	0	86	4
		1	90	5
		1	91	10
	464	6	81	17
		7	85	18
		10	87	27

Appendix Table 5

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 5, 25.9.89

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TZ	152	0	78	4
		1	81	5
		2	84	7
	154	4	79	4
		4	84	7
		9	84	7
	159	4	82	6
		6	83	9
		7	86	9
	163	6	87	11
		9	90	12
		11	92	u
	164	8	83	7
		10	84	8
		12	88	10
UTZ group 1	156	2	84	8
		5	84	10
		6	86	u
	161	6	55	17
		7	65	19
		9	77	24
	162	4	79	18
		6	82	15
		11	89	21
	165	9	80	12
		11	83	15
		12	84	15
	166	7	65	4
		11	66	6
		11	68	8

u = unreadable

Appendix Table 6

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 6, 2.10.89

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
UTZ group 2	151	10	67	30
		11	67	32
		14	68	34
	153	8	88	6
		11	90	9
		13	94	9
	155	12	83	19
		13	83	20
		27	84	25
	157	12	78	14
		13	79	20
		16	87	27
	160	9	80	16
		11	90	24
		u	90	25
Untreated N'damas	102	6	78	13
		9	82	14
		11	90	16
	146	1	82	7
		2	84	11
		4	86	12
	147	4	83	8
		5	85	8
		7	86	8
	148	3	90	4
		4	92	5
		7	94	8
	464	10	79	11
		10	80	12
		11	92	16

u = unreadable

Appendix Table 7

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 7, 9.10.89

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATZ	152	7	73	16
		10	75	17
		12	76	19
	154	5	76	8
		7	78	8
		8	82	9
	159	6	81	4
		6	85	6
		11	94	8
	163	2	91	8
		3	93	7
		6	95	u
	164	7	73	12
		9	78	13
		10	83	16
UTZ group 1	156	6	81	6
		9	83	8
		13	84	14
	161	10	79	12
		13	84	13
		15	85	14
	162	22	90	4
		26	92	4
		30	95	7
	165	14	84	3
		15	92	3
		17	95	4
	166	6	87	3
		u	90	4
		u	94	6

u = unreadable

Appendix Table 8**Trial 8, 13.11.89**

Experiment groups: untreated zebu-type cattle in group 2, and untreated N'damas

Slides were discarded because cytopins were unreadable

Appendix Table 9

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 9, 20.11.89

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATZ	152	6	75	15
		8	77	16
		10	77	17
	154	1	53	20
		4	54	26
		5	56	28
	159	11	66	13
		12	69	20
		13	70	22
	163	6	63	18
		9	64	21
		10	67	25
	164	14	65	13
		19	68	15
		20	69	17
UTZ group 1	156	15	63	22
		15	66	25
		16	68	u
	161	18	80	24
		20	88	28
		22	90	32
	162	27	74	24
		29	74	28
		30	77	30
	165	15	80	18
		16	88	25
		17	90	28
	166	4	80	18
		5	81	22
		5	82	25

u = unreadable

Appendix Table 10

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 10, 27.11.89

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>	
UTZ group 2	151	c	c	c	
		153	30	78	32
			33	80	34
	34		83	36	
	155	31	80	30	
		33	85	32	
		45	85	46	
	157	22	86	34	
		23	87	37	
		25	88	38	
	160	23	76	37	
		24	77	38	
		27	87	38	
	Untreated N'damas	102	32	77	38
			37	77	38
38			78	40	
146		26	71	25	
		28	76	26	
		30	79	29	
147		36	82	34	
		40	85	36	
		42	86	38	
148		26	82	25	
		33	84	32	
		33	85	u	
464		8	70	c	
		11	75	c	
		12	78	c	

u = unreadable
c = contaminated

Appendix Table 11

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 11, 19.2.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATZ	152	15	67	10
		18	69	11
		19	73	11
	154	4	57	3
		7	61	4
		7	64	8
	159	9	58	5
		9	60	7
		11	67	9
	163	5	55	4
		10	56	12
		10	59	13
	164	15	65	4
		17	66	6
		18	73	7
UTZ group 1	156	10	60	7
		12	63	8
		13	66	13
	161	2	55	8
		6	64	9
		7	66	10
	162	3	65	17
		3	69	23
		4	72	u
	165	6	68	11
		9	69	12
		10	71	13
	166	4	60	8
		6	67	10
		7	70	12

u = unreadable

--Appendix Table 12

Trial 12, 26.2.90

Treatment groups: untreated group 2 zebu-types and untreated N'damas

Cultures contaminated

Appendix Table 13

Trial 13, 19.3.90

Treatment groups: acaricide-treated zebu-types and untreated group 1 zebu-types

Cultures contaminated

Appendix Table 14

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 14, 27.3.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
UTZ group 2	151	7	56	17
		9	58	18
		10	60	21
	153	10	58	13
		10	59	15
		12	60	16
	155	8	62	12
		14	65	16
		15	65	16
	157	7	56	12
		14	62	14
		14	65	15
	160	12	67	10
		15	70	15
		17	72	16
Untreated N'damas	102	16	55	16
		17	55	18
		18	62	18
	146	12	57	19
		12	61	20
		15	65	23
	147	11	71	23
		14	72	25
		14	75	27
	148	12	60	17
		12	61	21
		14	64	24
	464	11	54	15
		11	66	16
		13	67	17

u = unreadable

Appendix Table 15

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 15, 16.4.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATZ	152	6	48	9
		11	53	10
		12	53	12
	154	11	53	12
		13	54	13
		15	58	16
	159	10	57	5
		10	60	9
		13	64	10
	163	7	55	12
		7	57	13
		10	60	14
	164	6	62	6
		12	68	14
		14	73	14
UTZ group 1	156	11	47	9
		13	48	11
		15	53	15
	161	7	56	12
		10	59	13
		11	64	15
	162	5	65	17
		10	73	21
		u	75	u
	165	6	72	9
		13	72	13
		17	78	16
	166	5	57	8
		6	65	9
		13	78	10

u = unreadable

Appendix Table 16

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 16, 23.4.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
UTZ group 2	151	12	67	21
		13	73	21
		19	76	24
	153	14	62	14
		17	74	26
		21	76	29
	155	12	75	13
		12	75	13
		18	78	15
	157	15	70	20
		17	75	22
		20	75	27
	160	12	62	13
		14	67	13
		14	70	17
Untreated N'damas	102	21	73	22
		21	75	25
		23	79	25
	146	17	71	26
		22	71	27
		27	74	31
	147	18	72	18
		20	79	21
		22	80	26
	148	16	73	12
		16	80	20
		17	82	26
	464	19	75	19
		22	76	22
		24	79	26

Appendix Table 17

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 17, 30.4.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
Acaricide-treated Friesians (A-TF)	210	10	65	13
		10	67	17
		15	73	18
	211	11	67	14
		12	72	14
		16	73	15
	218	10	70	14
		10	70	15
		10	70	15
Untreated Friesians (UTF)	212	12	65	11
		17	70	24
		18	73	27
	216	8	61	u
		12	65	u
		12	73	u
	229	12	67	17
		u	68	u
		14	69	u

u = unreadable

Appendix Table 18

Monthly triplicate values, using FCS alone in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from clinically infected zebu-type cattle: Trial 18, 17.5.90

Clinically infected cows	Without antigen	Concanavalin A	<i>D. congolensis</i>
1	12	64	u
	18	70	u
	18	74	u
2	12	65	u
	16	72	u
	18	75	u
3	14	66	13
	14	70	17
	24	75	19
4	u	u	21
	u	u	27
	u	75	31
5	10	47	7
	12	56	9
	14	57	11
6	14	44	14
	17	48	14
	21	50	16

u = unreadable

Appendix Table 19

Monthly triplicate values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from clinically infected zebu-type cattle: Trial 18, 17.5.90

Clinically infected cows	Without antigen	Concanavalin A	<i>D. congolensis</i>
1	18	33	u
	18	34	u
	21	35	u
2	14	35	u
	16	37	u
	17	41	u
3	9	28	9
	16	44	13
	17	49	14
4	4	25	15
	5	41	19
	8	56	21
5	9	20	11
	10	22	12
	10	29	16
6	11	16	15
	13	21	17
	13	26	18

u = unreadable

Appendix Table 20

Triplicate values, using FCS, autologous serum and sera from two clinically infected cattle, of the percentages of transformed cells per 200 lymphocytes derived from two acaricide-treated zebu-type cattle (159, 164): Trial 19, 22.5.90

Treatment	Cow 159		Cow 164	
	Without antigen	Concanavalin A	Without antigen	Concanavalin A
Foetal calf serum	11	79	11	82
	12	80	12	84
	13	84	12	84
Autologous serum	9	64	12	48
	10	66	16	56
	11	68	22	61
Infected cow 1	10	33	10	44
	10	35	10	49
	11	42	16	53
Infected cow 2	4	42	11	40
	5	42	13	49
	9	46	15	53

Appendix Table 21

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from acaricide-treated Friesians (A-TF) and untreated Friesians (UTF): Trial 20, 29.5.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TF	210	9	73	14
		10	u	u
		13	u	14
	211	8	77	9
		u	u	13
		u	u	17
	218	6	78	5
		7	80	u
		9	84	6
UTF	212	14	77	17
		14	79	20
		16	84	20
	216	10	76	12
		u	u	13
		14	84	14
	229	6	72	7
		8	75	8
		9	80	8

u = unreadable

Appendix Table 22

Monthly triplicate values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from ATF and UTF: Trial 20, 29.5.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATF	210	12	36	8
		u	37	10
		14	42	12
	211	10	50	2
		14	65	9
		14	66	10
	218	9	40	8
		11	48	10
		11	66	11
UTF	212	12	41	4
		u	41	10
		16	48	12
	216	10	55	5
		11	56	7
		12	64	9
	229	u	51	6
		u	66	9
		u	66	10

u = unreadable

Appendix Table 23

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis* of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 21, 18.6.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
UTZ group 2	151	14	69	11
		15	74	12
		20	76	12
	153	6	68	16
		6	77	19
		7	77	22
	155	15	74	9
		16	76	9
		16	80	9
	157	4	66	10
		6	76	14
		8	81	14
	160	10	62	8
		16	80	16
		25	86	22
Untreated N'damas	102	11	67	20
		17	69	21
		20	74	26
	146	9	72	16
		10	75	19
		10	82	21
	147	12	78	10
		17	78	18
		18	u	u
	148	12	76	6
		13	80	7
		17	84	12
	464	12	u	14
		u	71	18
		14	u	19

u = unreadable

Appendix Table 24

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from ATF and UTF: Trial 22, 25.6.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATF	210	5	67	13
		12	67	15
		13	73	18
	211	5	60	9
		5	65	11
		7	76	12
	218	10	70	9
		11	72	10
		13	73	13
UTF	212	12	74	17
		14	u	18
		15	80	20
	216	14	53	10
		14	62	15
		16	73	15
	229	7	66	6
		8	71	8
		9	71	9

u = unreadable

Appendix Table 25

Monthly triplicate values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 22, 25.6.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TF	210	12	50	10
		13	58	14
		21	64	16
	211	4	40	2
		13	45	8
		13	54	10
	218	9	48	6
		11	50	7
		15	60	9
UTF	212	5	53	11
		12	58	12
		13	59	15
	216	7	49	7
		7	u	12
		9	50	13
	229	8	45	7
		8	54	8
		9	58	8

u = unreadable

Appendix Table 26

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 23, 9.7.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATZ	152	7	74	8
		7	76	10
		9	82	16
	154	11	71	12
		12	75	12
		13	79	14
	159	12	74	6
		12	78	8
		13	79	11
	163	9	79	7
		12	u	12
		12	81	13
	164	12	80	9
		13	80	12
		14	81	14
UTZ group 1	156	10	78	15
		10	u	17
		14	79	19
	161	10	64	11
		12	76	12
		15	78	19
	162	13	69	18
		13	70	19
		16	73	20
	165	17	82	19
		19	84	20
		22	85	23
	166	16	79	14
		16	u	14
		18	81	16

u = unreadable

Appendix Table 27

Monthly triplicate values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 23, 9.7.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATZ	152	17	73	8
		20	78	10
		21	82	12
	154	12	67	8
		13	68	10
		15	75	10
	159	8	69	14
		9	70	16
		12	71	20
	163	12	58	14
		12	68	15
		16	70	17
	164	16	61	14
		17	62	16
		17	67	20
UTZ group 1	156	11	46	7
		12	46	8
		20	47	10
	161	14	49	21
		14	50	24
		19	51	27
	162	24	55	20
		25	58	21
		28	60	22
	165	23	53	15
		u	53	17
		25	55	19
	166	12	40	10
		13	45	12
		13	46	14

u = unreadable

Appendix Table 28

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial, 24 23.7.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TF	210	7	60	9
		9	65	10
		12	67	11
	211	9	63	10
		12	66	13
		15	69	15
	218	9	60	8
		14	63	11
		14	69	13
UTF	212	13	64	9
		u	65	10
		14	69	12
	216	12	56	11
		u	59	12
		13	66	13
	229	10	58	9
		13	60	12
		15	71	13

u = unreadable

Appendix Table 29

Monthly triplicate values, using FCS and autologous serum in day-5 culture containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 24, 23.7.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TF	210	7	33	9
		8	40	12
		12	45	12
	211	13	36	11
		13	37	14
		13	44	16
	218	11	54	11
		13	56	12
		13	59	12
UTF	212	10	36	10
		11	50	11
		12	52	14
	216	7	43	10
		11	44	13
		12	46	13
	229	12	41	9
		14	45	10
		19	49	12

— Appendix Table 30

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 25, 20.8.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
UTZ group 2	151	7	68	12
		8	71	13
		10	76	14
	153	5	70	9
		5	71	12
		8	77	12
	155	4	53	5
		6	54	6
		7	62	7
	157	10	56	8
		11	63	11
		11	65	13
	160	5	67	12
		6	u	15
		9	69	18
Untreated N'damas	102	13	68	13
		15	74	15
		15	78	16
	146	16	69	20
		19	71	21
		22	78	26
	147	7	73	11
		9	74	12
		13	74	12
	148	4	75	6
		5	75	10
		7	75	13
	464	8	71	14
		8	74	17
		12	76	24

u = unreadable

Appendix Table 31

Monthly triplicate values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 25, 20.8.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
UTZ group 2	151	11	40	11
		13	42	15
		14	45	15
	153	7	37	11
		7	41	13
		10	45	14
	155	7	40	5
		8	41	6
		9	50	7
	157	13	28	9
		15	31	11
		15	38	13
	160	13	32	26
		18	33	28
		20	42	30
Untreated N'damas	102	10	45	10
		10	49	11
		13	50	12
	146	10	50	4
		11	u	10
		12	55	13
	147	14	50	8
		16	51	8
		17	56	11
	148	7	43	4
		11	45	7
		13	46	8
	464	7	31	17
		10	34	17
		13	35	18

u = unreadable

Appendix Table 32

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 26, 27.8.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TF	210	9	40	11
		10	55	11
		12	57	15
	211	9	54	8
		11	60	9
		12	64	12
	218	7	61	10
		7	65	11
		8	70	12
UTF	212	10	62	10
		11	65	11
		13	66	11
	216	14	56	16
		15	60	18
		16	63	19
	229	3	56	5
		4	65	5
		5	68	11

Appendix Table 33

Monthly triplicate values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 26, 27.8.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TF	210	10	29	9
		11	34	13
		16	44	13
	211	8	44	10
		9	44	11
		10	47	12
	218	5	38	6
		7	42	6
		10	43	8
UTF	212	5	23	8
		6	25	9
		8	27	10
	216	7	40	10
		11	40	11
		11	41	14
	229	3	14	u
		3	27	u
		5	28	u

u = unreadable

Appendix Table 34

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 27, 17.9.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATZ	152	8	68	12
		12	69	12
		12	69	12
	154	10	71	11
		14	75	12
		15	76	16
	159	8	69	9
		12	70	12
		15	70	16
	163	10	72	11
		10	75	u
		12	78	12
	164	8	63	10
		16	66	12
		16	70	15
UTZ group 1	156	15	59	14
		16	60	15
		16	63	25
	161	11	65	9
		18	67	13
		20	69	16
	162	14	82	20
		18	82	21
		20	86	21
	165	12	74	14
		13	75	16
		13	78	20
	166	10	60	12
		11	62	u
		12	65	13

u = unreadable

Appendix Table 35

Monthly triplicate values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 27, 17.9.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TZ	152	9	56	10
		10	59	11
		10	61	12
	154	4	36	6
		10	42	11
		12	43	13
	159	9	40	9
		11	42	12
		12	44	13
	163	5	17	4
		5	21	5
		8	22	6
	164	8	50	6
		9	54	8
		10	58	10
UTZ group 1	156	14	29	9
		14	31	16
		16	34	16
	161	10	17	14
		10	19	15
		11	23	15
	162	15	52	6
		16	u	6
		22	53	14
	165	15	41	11
		17	42	13
		22	43	15
	166	9	25	10
		9	26	11
		11	26	14

u = unreadable

Appendix Table 36

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from ATF and UTF: Trial 28, 24.9.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATF	210	13	68	c
		15	69	c
		16	74	c
	211	4	70	c
		8	u	c
		9	78	c
	218	6	69	c
		7	72	c
		12	76	c
UTF	212	8	69	c
		9	75	c
		10	76	c
	216	12	65	c
		14	71	c
		15	78	c
	229	4	56	c
		6	58	c
		7	62	c

u = unreadable

c = contaminated

Appendix Table 37

Monthly triplicate values, using and autologous serum FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 28, 24.9.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TF	210	12	u	c
		15	u	c
		16	u	c
	211	10	51	c
		10	60	c
		13	64	c
	218	10	50	c
		13	55	c
		15	56	c
UTF	212	5	33	c
		5	39	c
		6	46	c
	216	8	47	c
		9	47	c
		10	50	c
	229	2	31	c
		u	u	c
		4	44	c

u = unreadable

c = contaminated

Appendix Table 38

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A, of the percentages of transferred cells per 200 lymphocytes derived from ATF and UTF: Trial 29, 22.10.90

Treatment groups	Cow no.	Without antigen	Concanavalin A
ATF	210	10	40
		13	42
		13	54
	211	3	45
		6	u
		7	68
	218	7	63
		10	65
		11	67
UTF	212	7	36
		8	38
		10	44
	216	7	32
		11	40
		11	40
	229	7	19
		8	26
		10	52

u = unreadable

Appendix Table 39

Monthly triplicate values, using FCS and autologous serum in day-5 cultures containing Concanavalin A, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 29, 22.10.90

Treatment groups	Cow no.	Without antigen	Concanavalin A
A-TF	210	13	30
		13	31
		16	31
	211	8	33
		14	34
		18	38
	218	11	36
		16	38
		18	42
UTF	212	10	14
		u	15
		13	15
	216	8	14
		9	18
		9	20
	229	3	14
		7	15
		9	16

u = unreadable

Appendix Table 40

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and tick saliva antigen, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 30, 9.11.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	Concanavalin A + saliva antigen	Tick saliva antigen
ATZ	152	7	72	64	8
		9	78	67	10
		14	81	72	10
	164	4	77	70	4
		7	78	70	7
		9	82	71	7
UTZ	153	3	76	70	17
		10	78	70	20
		12	81	71	21
	160	1	34	57	18
		2	35	66	18
		4	46	69	21

Appendix Table 41

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from ATF and UTF: Trial 31, 27.11.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATF	210	6	57	7
		11	59	11
		11	69	12
	211	2	70	3
		2	73	3
		6	76	8
	218	11	63	4
		11	67	u
		13	68	8
UTF	212	1	19	2
		4	23	3
		9	27	4
	216	7	31	11
		15	45	12
		18	50	18
	229	7	30	11
		11	33	14
		13	41	15

u = unreadable

Appendix Table 42

Monthly triplicate values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 31, 27.11.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TF	210	8	29	7
		8	35	8
		11	36	8
	211	5	30	3
		12	32	6
		17	32	8
	218	5	30	4
		5	32	9
		4	37	11
UTF	212	5	18	2
		6	20	2
		6	24	3
	216	1	17	3
		3	24	4
		5	28	5
	229	11	21	3
		12	25	4
		12	27	5

Appendix Table 43

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and tick saliva antigen, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 32 28.11.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	Concanavalin A + saliva antigen	Tick saliva antigen
A-TZ	159	6	65	53	5
		7	67	54	8
		10	67	57	9
	154	6	63	40	5
		8	64	50	5
		8	68	51	8
UTZ	161	5	57	52	14
		u	60	56	16
		6	67	60	25
	165	6	55	57	18
		6	57	57	18
		9	61	63	21
Untreated N'damas	147	5	73	56	9
		7	81	62	9
		11	82	63	10
	464	6	68	47	7
		9	70	48	8
		9	72	49	14

u = unreadable

Appendix Table 44

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and PPD, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 33, 4.12.90

Treatment groups	Cow no.	Without antigen	Concanavalin A	PPD $5 \mu\text{g}^{-1}$	PPD $10 \mu\text{g}^{-1}$
A-TZ	152	6	64	5	8
		10	66	9	10
		11	68	10	11
	154	8	63	9	11
		12	66	13	12
		13	67	14	14
	159	7	55	5	8
		12	58	9	8
		14	59	13	11
	163	7	62	5	8
		8	62	7	u
		10	65	10	8
UTZ	160	8	49	6	9
		9	63	7	13
		13	64	12	18
	161	10	40	5	2
		12	44	5	7
		12	45	7	8
	162	16	60	14	6
		20	66	14	9
		30	67	17	10
	165	20	61	21	18
		21	u	u	19
		22	63	22	22
	166	8	46	10	4
		10	58	10	5
		11	65	16	6

Appendix Table 44 (contd.)

Treatment groups	Cow no.	Without antigen	Concanavalin A	PPD $5 \mu\text{g}^{-1}$	PPD $10 \mu\text{g}^{-1}$
Untreated N'damas	102	12	62	11	12
		16	64	13	14
		16	71	22	16
	146	12	58	3	6
		12	60	6	12
		25	66	14	16
	147	7	58	4	4
		8	63	5	5
		13	66	9	10
	148	10	68	6	4
		14	68	8	8
		15	71	10	17
	464	11	66	12	11
		13	67	12	13
		14	70	18	13

u = unreadable

Appendix Table 45

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from ATF and UTF: Trial 34, 2.1.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATF	210	10	57	10
		14	59	11
		16	61	14
	211	28	61	21
		28	62	30
		31	70	31
	218	9	58	10
		12	59	20
		18	65	21
UTF	212	12	36	17
		12	37	19
		15	38	20
	216	12	24	22
		12	37	u
		14	44	26
	229	12	19	10
		13	29	15
		17	31	18

u = unreadable

Appendix Table 46

Monthly triplicate values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 34 2.1.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TF	210	16	38	8
		17	39	U
		18	43	10
	211	23	39	25
		23	39	26
		31	45	30
	218	16	39	13
		17	42	18
		19	44	26
UTF	212	10	13	8
		11	16	10
		15	24	12
	216	8	26	3
		9	28	12
		12	30	14
	229	7	17	4
		8	19	5
		12	22	10

u = unreadable

Appendix Table 47

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and PPD, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 35 7.1.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	PPD $5 \mu\text{g}^{-1}$	PPD $10 \mu\text{g}^{-1}$
A-TZ	152	6	50	4	13
		7	60	11	14
		10	62	14	15
	159	10	56	10	13
		12	63	13	17
		12	68	24	19
	154	7	69	16	16
		10	70	18	20
		10	71	21	21
	163	8	51	6	5
		8	54	8	7
		10	58	8	9
	164	8	56	10	6
		8	60	10	8
		11	63	10	13
UTZ	160	12	40	9	12
		12	45	10	15
		13	50	11	16
	161	12	42	10	8
		12	46	13	8
		18	48	14	9
	162	12	50	18	19
		16	53	18	22
		20	57	20	24
	165	10	48	14	9
		13	50	14	13
		14	54	15	16
	166	6	33	5	2
		8	u	5	10
		10	44	9	10

Appendix Table 47 (contd.)

Treatment groups	Cow no.	Without antigen	Concanavalin A	PPD $5 \mu\text{g}^{-1}$	PPD $10 \mu\text{g}^{-1}$
Untreated N'damas	102	13	68	9	19
		13	68	10	20
		18	70	11	23
	146	20	65	11	17
		33	66	u	18
		33	66	18	20
	147	3	56	2	6
		8	67	4	10
		10	71	15	11
	148	5	49	12	17
		11	56	13	17
		15	69	21	25
	464	10	56	10	14
		13	58	13	17
		15	63	15	18

u = unreadable

Appendix Table 48

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 36, 28.1.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TF	210	10	51	11
		11	53	u
		16	57	12
	211	8	54	10
		11	58	12
		14	58	14
UTF	212	9	28	14
		9	32	17
		12	38	17
	216	5	31	14
		14	37	14
		14	47	15

u = unreadable

Appendix Table 49

Monthly triplicate values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 36, 28.1.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
A-TF	210	19	34	19
		26	36	20
		28	44	24
	211	18	34	12
		23	35	u
		24	37	17
UTF	212	5	17	6
		8	19	7
		12	20	8
	216	3	17	7
		5	18	9
		6	20	9

u = unreadable

Appendix Table 50

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and tick saliva antigen, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 37, 3.2.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	Concanavalin A + tick saliva antigen	Tick saliva antigen
Untreated N'damas	102	11	48	47	16
		16	52	47	16
		20	54	50	20
	148	8	55	46	9
		9	62	50	12
		14	65	55	13
A-TF	210	14	55	54	16
		16	59	58	19
		21	59	58	26
	211	15	53	49	16
		15	57	49	17
		18	58	52	21
UTF	212	9	31	40	8
		12	32	41	8
		12	35	44	12
	216	8	34	31	13
		8	35	40	13
		9	39	42	15

Appendix Table 51

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from ATF and UTF: Trial 38, 25.2.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>
ATF	210	12	53	c
		14	56	c
		16	61	c
	211	7	51	c
		15	54	c
		16	54	c
UTF	212	4	24	c
		4	26	c
		5	26	c
	216	11	20	c
		14	22	c
		14	25	c

c = contaminated

Appendix Table 52

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and PPD, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 39, 11.3.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	PPD 5 μg^{-1}	PPD 10 μg^{-1}
A-TZ	152	6	58	15	12
		9	62	19	13
		10	63	19	19
	154	9	60	15	15
		9	63	16	15
		11	65	19	20
	159	8	55	17	14
		9	62	19	16
		9	65	20	20
	163	7	58	4	4
		10	62	7	7
		11	65	10	9
	164	8	58	14	18
		12	60	21	u
		22	63	22	22
UTZ	160	9	41	9	4
		10	44	10	8
		11	46	10	11
	161	9	35	8	7
		9	40	9	8
		12	45	11	11
	162	18	57	10	13
		22	63	u	14
		25	68	12	17
	165	7	46	10	11
		9	47	11	13
		10	50	18	15
	166	11	38	8	6
		13	47	9	9
		14	49	11	10

Appendix Table 52 (contd.)

Treatment groups	Cow no.	Without antigen	Concanavalin A	PPD $5 \mu\text{g}^{-1}$	PPD $10 \mu\text{g}^{-1}$
Untreated N'damas	102	7	52	9	12
		11	54	12	14
		12	57	12	14
	146	3	53	7	6
		5	55	7	8
		8	55	9	9
	147	7	62	11	8
		9	65	11	11
		10	65	12	12
	148	8	52	6	3
		8	56	10	4
		10	56	10	9
	464	6	54	10	11
		13	56	10	12
		13	56	13	12

u = unreadable

Appendix Table 53

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 40, 18.3.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>	
				Dc ₁	Dc ₂
A-TF	210	13	52	10	16
		18	59	14	17
		19	62	16	17
	211	22	50	18	18
		23	56	22	u
		25	56	23	21
UTF	212	6	37	10	6
		7	39	11	9
		11	41	12	9
	216	9	37	7	11
		13	37	11	12
		14	50	13	12

u = unreadable

Appendix Table 54

Monthly triplicate values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 40, 18.3.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>	
				Dc ₁	Dc ₂
A-TF	210	9	37	11	12
		u	44	14	u
		20	44	21	19
	211	21	40	22	25
		u	u	u	28
		u	41	25	30
UTF	212	7	15	4	13
		8	24	11	16
		8	25	12	17
	216	4	19	6	7
		u	25	u	u
		7	25	8	10

u = unreadable

Appendix Table 55

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 41, 22.4.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>	
				Dc ₁	Dc ₂
A-TF	210	9	54	8	8
		10	56	12	12
		12	59	12	15
	211	13	57	12	22
		14	60	16	23
		16	64	17	25
UTF	212	6	46	7	6
		7	46	8	6
		9	48	9	7
	216	8	49	7	10
		12	50	11	12
		12	52	11	12

Appendix Table 56

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 42, 20.5.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>		
				Dc ₁	Dc ₂	
A-TZ	152	6	67	13	8	
		10	68	15	9	
		11	69	16	10	
	154	9	62	18	9	
		9	62	u	9	
		18	64	18	10	
	159	7	60	8	8	
		8	u	12	8	
		11	61	13	13	
	163	5	66	9	12	
		6	67	10	15	
		7	69	14	15	
	164	8	59	14	12	
		16	59	15	13	
		18	61	17	17	
	UTZ	160	5	44	10	6
			7	49	12	10
			13	50	13	11
161		5	40	5	5	
		7	u	5	5	
		11	41	8	12	
162		10	61	13	9	
		15	62	15	12	
		17	65	21	16	
165		6	38	4	5	
		7	40	6	6	
		8	42	6	6	
166		8	37	10	7	
		11	40	13	11	
		12	42	13	12	

Appendix Table 56 (contd.)

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>	
				Dc ₁	Dc ₂
Untreated N'damas	102	7	59	17	17
		13	60	20	17
		14	63	22	18
	146	14	60	13	10
		17	63	14	12
		19	66	16	12
	147	11	65	14	12
		13	66	15	13
		14	69	16	15
	148	4	66	8	7
		10	66	9	7
		12	68	10	10
	464	12	56	12	7
		13	60	12	9
		13	64	18	17

u = unreadable

Appendix Table 57

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from A-TF and UTF: Trial 43, June 91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>	
				Dc ₁	Dc ₂
A-TF	210	7	43	20	9
		12	u	22	13
		17	44	23	16
	211	12	50	18	5
		14	51	20	7
		15	54	22	13
UTF	212	5	46	8	2
		5	47	12	6
		8	49	17	8
	216	5	38	13	11
		7	40	14	14
		11	42	17	16

u = unreadable

Appendix Table 58

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 44, 25.6.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>	
				Dc ₁	Dc ₂
A-TZ	152	5	62	15	10
		7	64	17	11
		8	70	18	17
	154	8	62	26	18
		12	64	27	20
		19	70	31	22
	159	12	58	10	8
		16	65	11	10
		17	67	17	11
	163	3	59	25	7
		10	63	u	9
		11	69	27	12
	164	8	59	12	9
		14	63	15	10
		18	72	15	13
UTZ	160	9	51	21	7
		9	56	22	u
		10	56	22	10
	161	7	43	8	3
		9	44	15	4
		9	48	15	10
	162	14	60	22	12
		15	62	u	u
		17	72	28	22
	165	2	52	13	10
		7	57	13	12
		9	62	15	12
	166	12	45	9	5
		12	u	10	7
		13	50	13	8

Appendix 58 (contd.)

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>	
				Dc ₁	Dc ₂
Untreated N'damas	102	15	64	15	15
		u	65	23	15
		15	67	25	18
	146	11	69	16	17
		16	u	23	19
		16	70	30	20
	147	14	62	20	9
		19	63	22	10
		19	70	23	13
	148	10	59	15	10
		10	63	17	14
		16	70	19	17
	464	7	59	18	15
		u	61	19	15
		13	67	21	18

u = unreadable

Appendix Table 59

Monthly triplicate values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of the percentages of transformed cells per 200 lymphocytes derived from cattle on different treatments: Trial 45, 12.8.91

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>		
				Dc ₁	Dc ₂	
A-TZ	152	6	69	13	13	
		7	u	15	14	
		10	71	18	15	
	154	7	59	18	15	
		u	61	19	15	
		13	67	21	18	
	159	8	63	16	17	
		12	66	16	18	
		13	74	17	19	
	163	10	63	19	17	
		10	65	u	23	
		14	66	25	24	
	164	6	61	9	20	
		7	64	10	24	
		9	65	13	25	
	UTZ	160	6	48	15	16
			6	52	17	18
			10	55	19	19
161		5	41	9	13	
		6	44	9	17	
		7	49	10	17	
162		11	63	16	11	
		14	72	22	17	
		19	72	24	17	
165		10	51	22	22	
		u	59	24	24	
		12	61	25	28	
166		7	52	17	16	
		10	54	18	21	
		11	61	21	26	

Appendix 59 (contd.)

Treatment groups	Cow no.	Without antigen	Concanavalin A	<i>D. congolensis</i>	
				Dc ₁	Dc ₂
Untreated N'damas	102	14	57	15	17
		15	57	17	18
		16	59	20	20
	146	5	63	12	12
		6	u	13	14
		6	65	20	16
	147	8	60	16	8
		9	63	16	9
		16	66	16	18
	148	7	52	12	11
		11	56	13	12
		12	60	16	16
	464	7	54	10	17
		8	60	13	21
		9	63	19	23

u = unreadable

Appendix Table 60

Monthly values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 46, June 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>	
A-TF	210	126	15.6	97	
		162	16.3	154	
		163	16.5	199	
		225	18.0	231	
		684	18.4	254	
	211	78	22.6	296	
		183	25.9	312	
		191	38.0	347	
		244	39.0	366	
		845	41.5	367	
	218	134	33.0	195	
		162	34.0	206	
		166	34.5	230	
		188	34.9	240	
		215	35.7	242	
	UTF	212	146	24.9	129
			154	26.0	203
			158	30.7	231
217			39.4	233	
236			45.5	324	
216		56	10.0	104	
		67	12.3	127	
		69	12.5	136	
		117	13.0	143	
		132	14.4	171	
229		82	19.3	163	
		88	20.3	182	
		103	20.6	213	
		110	21.8	245	
		128	22.1	253	

Appendix Table 61

Monthly values, using FCS in and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 46, June 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>	
A-TF	210	242	6.2	35	
		272	7.2	55	
		294	7.2	78	
		491	7.4	87	
		703	7.5	126	
	211	118	7.0	59	
		130	9.1	77	
		151	9.7	87	
		190	10.0	104	
		447	10.6	121	
	218	76	9.3	46	
		123	9.5	50	
		156	10.2	61	
		194	10.5	67	
		213	11.8	181	
	UTF	212	58	1.3	57
			64	2.3	69
			83	2.3	91
			90	3.2	100
			2163	3.3	133
		216	68	3.8	97
70			4.7	115	
75			5.2	129	
98			7.4	129	
116			9.5	159	
229		54	1.7	35	
		69	4.7	39	
		69	5.2	43	
		77	6.3	44	
		86	6.7	57	

Appendix Table 62

Monthly values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from ATF and UTF: Trial 47, July 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>	
ATF	210	134	24.6	216	
		174	24.8	290	
		179	25.6	309	
		254	25.7	323	
		266	26.1	325	
	211	198	29.5	291	
		259	32.2	406	
		267	32.2	462	
		274	32.3	543	
		281	33.4	601	
	218	162	47.5	297	
		174	48.4	298	
		197	49.8	331	
		198	52.8	382	
		216	56.2	419	
	UTF	212	124	41.0	259
			136	42.1	281
			137	42.3	290
172			42.9	359	
205			43.6	396	
216		184	40.7	339	
		208	42.6	351	
		211	43.2	377	
		242	43.7	439	
		305	43.9	488	
229		103	16.3	167	
		140	16.7	201	
		164	17.1	212	
		181	17.9	222	
		183	18.5	225	

Appendix Table 63

Monthly values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from ATF and UTF: Trial 47, July 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>	
ATF	210	95	3.6	89	
		104	3.6	114	
		115	3.8	148	
		117	4.0	161	
		163	4.0	169	
	211	85	3.9	88	
		101	4.0	132	
		122	4.0	149	
		125	4.5	158	
		131	4.8	166	
	218	121	13.6	76	
		134	13.7	195	
		169	14.4	260	
		234	14.5	382	
		237	14.7	532	
	UTF	212	66	1.6	98
			67	1.6	101
			71	1.8	102
78			2.1	154	
80			2.1	195	
216		65	6.5	83	
		68	7.1	116	
		110	7.2	122	
		111	7.2	166	
		152	7.2	182	
229		84	1.9	73	
		87	2.0	89	
		88	2.2	87	
		94	2.3	97	
		94	3.0	102	

Appendix Table 64

Monthly values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 48, August 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>	
A-TF	210	335	23.2	131	
		386	25.0	374	
		441	26.1	377	
		798	26.4	422	
		1855	27.9	506	
	211	259	26.0	295	
		273	43.9	326	
		338	44.1	381	
		346	46.3	391	
		360	48.1	419	
	218	127	16.3	103	
		146	20.0	108	
		165	20.9	155	
		199	21.5	221	
		228	21.7	293	
	UTF	212	118	17.8	104
			207	21.1	170
			245	22.4	307
259			25.7	325	
2309			29.4	358	
216		156	24.4	204	
		175	34.4	233	
		198	34.9	262	
		208	35.9	316	
		228	38.7	376	
229		104	29.3	351	
		115	36.5	778	
		130	37.1	784	
		138	38.8	907	
		138	44.6	1002	

Appendix Table 65

Monthly values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 49, August 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>	
A-TF	210	157	2.0	67	
		214	2.4	150	
		248	2.8	174	
		248	3.6	216	
		1915	4.4	530	
	211	137	4.1	97	
		145	5.6	106	
		151	5.7	141	
		179	6.0	142	
		231	6.5	176	
	218	78	3.7	81	
		95	3.8	100	
		110	4.2	114	
		121	4.7	186	
		135	5.0	226	
	UTF	212	73	0.5	121
			76	0.5	141
			98	0.5	193
100			0.7	195	
107			2.0	341	
216		61.0	1.2	72	
		110.0	1.7	81	
		111.0	1.7	84	
		123.0	2.0	94	
		137.0	2.6	100	
229		73.0	0.4	99	
		96.0	0.5	121	
		114.0	0.5	121	
		119.0	0.6	162	
		161.0	0.9	199	

Appendix Table 66

Monthly values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 50, September 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>
A-TF	210	c	11.5	c
			11.6	
			12.0	
			12.2	
			12.3	
	211	c	41.6	c
			42.5	
			42.8	
			43.2	
			45.6	
	218	c	27.5	c
			28.5	
			29.0	
			29.5	
			29.8	
UTF	212	c	24.9	c
			26.5	
			26.9	
			27.2	
			28.2	
	216	c	51.0	c
			67.0	
			68.0	
			72.0	
			111.0	
	229	c	22.8	c
			24.4	
			24.9	
			26.2	
			27.6	

c = contaminated

Appendix Table 67

Monthly values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from ATF and UTF: Trial 50, September 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>
ATF	210	c	1.7	c
			2.1	
			2.1	
			2.3	
			2.3	
	211	c	5.5	c
			5.9	
			6.1	
			6.1	
			6.5	
	218	c	6.5	c
			6.6	
			6.8	
			7.1	
			7.2	
UTF	212	c	3.1	c
			3.4	
			3.4	
			3.6	
			3.7	
	216	c	4.2	c
			4.2	
			4.5	
			4.6	
			4.7	
	229	c	3.6	c
			3.8	
			4.1	
			4.3	
			4.4	

c = contaminated

Appendix Table 68

Monthly values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 51, October 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>
A-TF	210	268	25.3	c
		325	25.6	
		332	25.6	
		1311	27.1	
		2253	28.2	
	211	377	70.3	c
		403	71.2	
		450	73.2	
		504	76.1	
		795	77.9	
	218	334	79.7	c
		337	84.7	
		365	85.7	
		433	86.2	
		444	87.1	
UTF	212	247	30.8	c
		259	31.5	
		270	31.7	
		271	31.7	
		280	34.9	
	216	199	22.2	c
		236	22.8	
		276	23.2	
		282	23.3	
		311	25.7	
	229	246	37.5	c
		249	39.9	
		253	40.4	
		268	41.6	
		275	42.6	

c = contaminated

Appendix Table 69

Monthly values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from ATF and UTF: Trial 51, October 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>
ATF	210	124.0	1.1	c
		164.0	1.2	
		229.0	1.3	
		258.0	1.4	
		542.0	1.5	
	211	108.0	3.0	c
		134.0	3.2	
		138.0	3.5	
		145.0	4.6	
		173.0	5.7	
	218	105.0	12.9	c
		109.0	14.4	
		123.0	14.9	
		136.0	15.8	
		147.0	19.0	
UTF	212	221.0	0.7	c
		241.0	0.9	
		258.0	1.1	
		275.0	1.2	
		362.0	1.3	
	216	82.0	0.7	c
		96.0	0.7	
		105.0	0.7	
		105.0	0.8	
		141.0	0.9	
	229	87.0	1.9	c
		107.0	2.0	
		114.0	2.1	
		116.0	2.3	
		136.0	3.6	

c = contaminated

Appendix Table 70

Monthly values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from ATF and UTF: Trial 52, November 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>
ATF	210	473.0	79.9	335.0
		515.0	82.1	372.0
		525.0	86.6	396.0
		643.0	89.1	529.0
		1251.0	94.4	968.0
	211	259.0	100.4	254.0
		261.0	108.7	267.0
		268.0	115.9	281.0
		270.0	120.6	289.0
		347.0	122.2	333.0
	218	157.0	70.4	180
		199.0	93.7	183
		215.0	95.3	210
		233.0	95.3	212
		255.0	777.8	237
UTF	212	121.0	19.6	144
		149.0	21.6	150
		154.0	21.6	157
		192.0	29.0	165
		194.0	34.9	210
	216	240.0	42.5	277
		292.0	43.4	298
		355.0	44.2	362
		361.0	45.1	425
		691.0	49.1	444
	229	540.0	11.9	486
		563.0	13.0	544
		612.0	14.0	713
		623.0	15.5	803
		630.0	18.7	1171

Appendix Table 71

Monthly values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 52, November 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>
A-TF	210	208.0	2.3	32.0
		394.0	3.5	34.0
		397.0	4.4	35.0
		559.0	5.1	50.0
		690.0	5.3	68.0
	211	104.0	3.8	39.0
		116.0	4.0	43.0
		132.0	4.3	45.0
		140.0	4.6	45.0
		151.0	6.4	49.0
	218	116.0	4.0	31.0
		124.0	4.1	33.0
		131.0	4.2	36.0
		143.0	4.5	40.0
		154.0	4.8	52.0
UTF	212	122.0	2.5	13.0
		134.0	2.8	41.0
		225.0	3.1	41.0
		228.0	3.2	52.0
		236.0	3.3	63.0
	216	61.0	1.4	34.0
		77.0	2.5	41.0
		79.0	2.8	42.0
		81.0	3.0	42.0
		82.0	4.3	51.0
	229	133.0	0.8	57.0
		154.0	1.1	70.0
		158.0	1.5	71.0
		179.0	1.8	93.0
		184.0	1.9	317.0

Appendix Table 72

Monthly values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 53, December 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>
A-TF	210	57.0	21.8	69.0
		78.0	23.3	83.0
		86.0	24.3	84.0
		139.0	24.4	101.0
		5227.0	26.7	107.0
	211	108.0	57.8	165.0
		130.0	60.1	198.0
		146.0	60.6	219.0
		151.0	61.0	238.0
		152.0	66.1	268.0
	218	88.0	28.6	115.0
		99.0	29.4	124.0
		106.0	30.1	141.0
		118.0	31.7	142.0
		158.0	40.0	185.0
UTF	212	70.0	8.4	83.0
		78.0	8.4	89.0
		85.0	8.5	94.0
		92.0	8.8	107.0
		348.0	10.7	111.0
	216	102.0	1.4	197.0
		144.0	2.2	223.0
		145.0	2.5	226.0
		149.0	2.6	438.0
		166.0	4.7	761.0
	229	72.0	1.8	68.0
		75.0	2.1	69.0
		78.0	2.2	90.0
		80.0	3.0	100.0
		81.0	3.2	127.0

Appendix Table 73

Monthly values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 53, December 90

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>
A-TF	210	63.0	0.7	40.0
		69.0	1.6	42.0
		73.0	1.9	43.0
		86.0	2.3	44.0
		213.0	2.6	48.0
	211	106.0	3.0	49.0
		111.0	3.1	49.0
		119.0	3.3	60.0
		124.0	3.3	63.0
		129.0	3.8	63.0
	218	88.0	2.0	38.0
		99.0	2.7	38.0
		106.0	2.9	39.0
		118.0	3.3	43.0
		158.0	3.4	52.0
UTF	212	62.0	0.4	30.0
		85.0	0.5	30.0
		87.0	0.5	38.0
		111.0	0.5	38.0
		119.0	0.6	40.0
	216	100.0	0.6	48.0
		104.0	0.6	48.0
		105.0	0.6	53.0
		116.0	0.8	57.0
		118.0	0.9	58.0
	229	51.0	0.3	33.0
		51.0	0.3	35.0
		56.0	0.4	42.0
		71.0	0.5	43.0
		103.0	0.5	47.0

Appendix Table 74

Monthly values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 54, January 91

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>	
A-TF	210	65.0	30.0	1468.0	
		80.0	34.8	1778.0	
		123.0	39.2	2366.0	
		168.0	40.6	1778.0	
		603.0	43.1	6556.0	
	211	90.0	47.1	132.0	
		92.0	49.8	151.0	
		95.0	51.3	172.0	
		95.0	51.4	230.0	
		110.0	57.2	644.0	
	UTF	212	75.0	8.0	99.0
			76.0	8.1	112.0
			105.0	9.3	123.0
			130.0	9.5	132.0
1240.0			15.1	171.0	
216		92.0	8.2	143.0	
		98.0	9.0	143.0	
		102.0	9.9	155.0	
		103.0	10.0	161.0	
		175.0	13.2	168.0	

Appendix Table 75

Monthly values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 54, January 91

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>	
A-TF	210	163.0	1.0	50.0	
		271.0	1.1	56.0	
		282.0	1.2	64.0	
		307.0	1.7	74.0	
		443.0	2.0	195.0	
	211	81.0	0.3	34.0	
		81.0	0.3	36.0	
		84.0	0.4	45.0	
		87.0	0.5	56.0	
		113.0	0.9	123.0	
	UTF	212	44.0	0.3	28.0
			66.0	0.4	33.0
			67.0	0.5	35.0
			71.0	0.5	47.0
105.0			0.5	67.0	
216		72.0	0.8	30.0	
		85.0	0.8	37.0	
		92.0	0.9	48.0	
		103.0	1.0	52.0	
		135.0	1.2	104.0	

Appendix Table 76

Monthly values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 55, February 91

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>
A-TF	210	92.0	35.7	270.0
		109.0	39.6	369.0
		109.0	40.3	446.0
		129.0	40.3	469.0
		167.0	41.8	662.0
	211	102.0	55.5	330.0
		110.0	55.6	503.0
		114.0	58.3	552.0
		119.0	58.4	558.0
		122.0	60.8	1074.0
UTF	212	67.0	11.1	205.0
		70.0	11.4	253.0
		83.0	12.6	278.0
		89.0	13.1	295.0
		129.0	16.2	360.0
	216	71.0	13.0	405.0
		86.0	13.7	444.0
		92.0	13.8	511.0
		116.0	14.2	539.0
		128.0	15.9	544.0

Appendix Table 77

Monthly values, using FCS in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 56, March 91

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>
A-TF	210	116.0	40.0	356.0
		125.0	46.8	408.0
		148.0	47.4	426.0
		149.0	51.0	590.0
		179.0	55.1	2188.6
	211	116.0	16.1	123.0
		135.0	17.6	132.0
		141.0	18.6	133.0
		144.0	19.6	139.0
		156.0	22.2	198.0
UTF	212	97.0	15.1	182.0
		101.0	16.1	199.0
		104.0	17.9	212.0
		119.0	18.5	215.0
		130.0	20.1	236.0
	216	155.0	nd	297.0
		167.0	nd	326.0
		169.0	nd	337.0
		179.0	nd	403.0
		247.0	nd	584.0

nd = not done

Appendix Table 78

Monthly values, using FCS and autologous serum in day-5 cultures containing Concanavalin A and *D. congolensis*, of [³H]-thymidine uptake by lymphocytes derived from A-TF and UTF: Trial 56, March 91

Treatment groups	Cow no.	Without antigen	Concanavalin A x 10 ³	<i>D. congolensis</i>	
A-TF	210	145.0	5.8	75.0	
		175.0	5.9	105.0	
		178.0	6.0	128.0	
		229.0	6.7	177.0	
		293.0	7.0	232.0	
	211	39.0	0.2	40.0	
		53.0	0.3	41.0	
		55.0	0.3	44.0	
		59.0	0.4	50.0	
		75.0	0.5	61.0	
	UTF	212	75.0	1.2	56.0
			92.0	1.3	88.0
			106.0	1.5	103.0
			107.0	1.5	108.0
130.0			1.6	109.0	
216		121.0	7.8	90.0	
		126.0	7.8	113.0	
		128.0	9.3	113.0	
		149.0	9.3	142.0	
		152.0	9.9	220.0	

Appendix Table 79

Tick data on first group of untreated zebu-type (UTZ) cattle covering the period June 1989 to July 1991

Label	=	Date
av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus</i> species
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>
str	=	Streptothricosis (dermatophilosis)

Label	C1	C2	C3	C4
	av	boo	hy	rh
1 6.89	20	24	4	0
2 7.89	13	7	2	5
3 8.89	14	21	3	4
4 9.89	11	8	1	6
5 10.89	8	22	0	0
6 11.89	24	7	0	2
7 12.89	36	19	0	1
8 1.90	32	4	0	0
9 2.90	28	4	0	0
10 3.90	44	1	0	1
11 4.90	55	4	0	1
12 5.90	69	1	0	1
13 6.90	63	6	9	4
14 7.90	44	2	7	2
15 8.90	28	3	4	1
16 9.90	22	1	6	4
17 10.90	19	4	10	4
18 11.90	47	3	8	5
19 12.90	46	2	3	0
20 1.91	62	2	11	5
21 2.91	59	1	8	3
22 3.91	39	6	2	1
23 4.91	43	0	1	4
24 5.91	53	1	2	3
25 6.91	48	1	2	6
26 7.91	21	0	1	7

Label	C5	C6
	str	MONTH
1 6.89	.4	1
2 7.89	.6	2
3 8.89	.4	3
4 9.89	.6	4
5 10.89	.4	5
6 11.89	.8	6
7 12.89	.2	7
8 1.90	.8	8
9 2.90	.6	9
10 3.90	.6	10
11 4.90	.8	11
12 5.90	.6	12
13 6.90	.8	13
14 7.90	1	14
15 8.90	1	15
16 9.90	.4	16
17 10.90	.2	17
18 11.90	.25	18
19 12.90	0	19
20 1.91	.5	20
21 2.91	.75	21
22 3.91	.75	22
23 4.91	.25	23
24 5.91	.25	24
25 6.91	0	25
26 7.91	0	26

Appendix Table 80

Tick data on second group of UTZ covering the period June 1989 to July 1991

Label = Date
 av = *Amblyomma variegatum*
 boo = *Boophilus* species
 hy = *Hyalomma rufipes*
 rh = *Rhipicephalus senegalensis*
 str = Streptothricosis (dermatophilosis)

Label	C1 av	C2 boo	C3 hy	C4 rh
1 6.89	3	13	1	0
2 8.89	2	15	0	3
3 9.89	4	7	1	1
4 10.89	5	3	1	1
5 10.89	6	12	1	1
6 11.89	20	3	0	0
7 12.89	24	14	0	2
8 1.90	18	2	0	0
9 2.90	20	8	1	2
10 3.90	21	5	0	0
11 4.90	26	2	0	1
12 5.90	22	0	0	1
13 6.90	21	1	1	1
14 7.90	12	2	2	2
15 8.90	9	4	4	1
16 9.90	5	0	3	3
17 10.90	8	7	6	1
18 11.90	32	1	5	2
19 12.90	26	0	3	0
20 1.91	32	0	3	0
21 2.91	26	0	2	1
22 3.91	18	2	0	0
23 4.91	27	0	1	1
24 5.91	31	0	2	1
25 6.91	27	1	1	2
26	33	0	0	0

Label	C5 str	C6 MONTHS
1 6.89	0	1
2 8.89	0	2
3 9.89	0	3
4 10.89	0	4
5 10.89	.2	5
6 11.89	0	6
7 12.89	0	7
8 1.90	.4	8
9 2.90	.2	9
10 3.90	.2	10
11 4.90	0	11
12 5.90	.2	12
13 6.90	.2	13
14 7.90	.2	14
15 8.90	.2	15
16 9.90	0	16
17 10.90	0	17
18 11.90	0	18
19 12.90	.2	19
20 1.91	.2	20
21 2.91	.2	21
22 3.91	0	22
23 4.91	.2	23
24 5.91	0	24
25 6.91	.2	25
26		

Appendix Table 81

Tick data on acaricide-treated zebu-type cattle covering the period June 1989 to July 1991

Label = Date
 av = *Amblyomma variegatum*
 boo = *Boophilus* species
 hy = *Hyalomma rufipes*
 rh = *Rhipicephalus senegalensis*
 str = Streptothricosis (dermatophilosis)

Label	C1 av	C2 boo	C3 hy	C4 rh
1 6.89	4	4	1	0
2 7.89	0	0	0	0
3 8.89	0	0	0	0
4 9.89	0	0	0	0
5 10.89	0	0	0	0
6 11.89	0	0	0	0
7 12.89	0	0	0	0
8 1.90	0	0	0	0
9 2.90	1	0	0	0
10 3.90	1	0	0	0
11 4.90	0	0	0	0
12 5.90	0	0	0	0
13 6.90	0	0	0	0
14 7.90	0	0	0	0
15 8.90	0	0	0	0
16 9.90	0	0	0	0
17 10.90	0	0	0	0
18 11.90	0	0	0	0
19 12.90	0	0	0	0
20 1.91	0	0	0	0
21 2.91	0	0	0	0
22 3.91	0	0	0	0
23 4.91	0	0	0	0
24 5.91	0	0	0	0
25 6.91	0	0	0	0

Label	C5 str	C6 MONTHS
1 6.89	0	1
2 7.89	.6	2
3 8.89	0	3
4 9.89	0	4
5 10.89	0	5
6 11.89	0	6
7 12.89	0	7
8 1.90	0	8
9 2.90	0	9
10 3.90	0	10
11 4.90	0	11
12 5.90	0	12
13 6.90	0	13
14 7.90	0	14
15 8.90	0	15
16 9.90	0	16
17 10.90	0	17
18 11.90	0	18
19 12.90	0	19
20 1.91	0	20
21 2.91	0	21
22 3.91	0	22
23 4.91	0	23
24 5.91	0	24
25 6.91	0	25

Appendix Table 82

Tick data on untreated N'damas in experiment herd covering the period June 1989 to July 1991

Label = Date
 av = *Amblyomma variegatum*
 boo = *Boophilus* species
 hy = *Hyalomma rufipes*
 rh = *Rhipicephalus senegalensis*
 str = Streptothricosis (dermatophilosis)

Label	C1 av	C2 boo	C3 hy	C4 rh
1 6.89	0	0	0	0
2 7.89	0	1	0	0
3 9.89	3	7	0	2
4 10.89	5	3	0	2
5 10.89	7	20	0	2
6 11.89	16	6	0	2
7 12.89	18	4	0	1
8 1.90	8	1	0	1
9 2.90	8	4	0	0
10 3.90	6	1	0	1
11 4.90	10	1	0	1
12 5.90	10	0	0	0
13 6.90	14	0	0	2
14 7.90	7	1	1	1
15 8.90	6	0	0	0
16 9.90	5	0	1	1
17 10.90	6	5	1	2
18 11.90	8	0	2	1
19 12.90	7	0	3	1
20 1.91	8	0	0	0
21 2.91	8	0	1	0
22 3.91	4	0	4	1
23 4.91	7	0	0	0
24 5.91	7	0	0	0
25 6.91	7	0	0	2
26 7.91	2	0	0	2

Label	C5 str	C6 MONTHS
1 6.89	0	1
2 7.89	0	2
3 9.89	0	3
4 10.89	.4	4
5 10.89	.2	5
6 11.89	.4	6
7 12.89	.2	7
8 1.90	.4	8
9 2.90	.4	9
10 3.90	.2	10
11 4.90	0	11
12 5.90	.2	12
13 6.90	.2	13
14 7.90	.4	14
15 8.90	.4	15
16 9.90	.4	16
17 10.90	0	17
18 11.90	.2	18
19 12.90	0	19
20 1.91	0	20
21 2.91	0	21
22 3.91	0	22
23 4.91	0	23
24 5.91	0	24
25 6.91	0	25
26 7.91	0	26

Appendix Table 83

Tick data on acaricide-treated Friesians (A-TF) in experiment herd covering the period April 1990 to May 1991

Label = Date
 av = *Amblyomma variegatum*
 boo = *Boophilus* species
 hy = *Hyalomma rufipes*
 rh = *Rhipicephalus senegalensis*
 str = Streptothricosis (dermatophilosis)

Label	C1 av	C2 boo	C3 hy	C4 rh
1 4.90	1	0	0	0
2 5.90	3	0	0	0
3 6.90	0	0	0	0
4 7.90	0	0	0	0
5 8.90	0	0	0	0
6 9.90	0	0	0	0
7 10.90	1	0	0	0
8 11.90	2	0	0	0
9 12.90	4	0	0	0
10 1.91	2	0	0	0
11 2.91	2	1	0	0
12 3.91	0	0	0	0
13 4.91	0	0	0	0
14 5.91	10	0	0	0

Label	C5 str	C6 MONTHS
1 4.90	0	1
2 5.90	0	2
3 6.90	0	3
4 7.90	0	4
5 8.90	0	5
6 9.90	0	6
7 10.90	0	7
8 11.90	0	8
9 12.90	0	9
10 1.91	0	10
11 2.91	0	11
12 3.91	0	12
13 4.91	0	13
14 5.91	0	14

Appendix Table 84

Tick data on untreated Friesians (U-TF) in experiment herd covering the period August 1990 to March 1991

Label	=	Date
av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus</i> species
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>
str	=	Streptothricosis (dermatophilosis)

Label	C1	C2	C3	C4
1 8.90	av	boo	hy	rh
2 9.90	5	4	2	6
3 10.90	18	2	5	18
4 11.90	26	20	5	17
5 12.90	82	51	3	4
6 1.91	139	9	6	6
7 2.91	135	10	12	8
8 3.91	122	86	4	23
	147	3	4	7

Label	C5	C6
1 8.90	str	MONTHS
2 9.90	0	1
3 10.90	0	2
4 11.90	0	3
5 12.90	.333	4
6 1.91	1	5
7 2.91	1	6
8 3.91	1	7
	1	8

Appendix Table 85

Meteorological and tick data on the two groups of UTZ in the experiment herd covering the period June 1989 to July 1991

Label = Date
 rainfall in millimetres
 temperature °C
 rel. hum. = Relative humidity %
 av = *Amblyomma variegatum*
 str = Streptothricosis (dermatophilosis)
 arcsin = Arcsin transformation of percentages
 of dermatophilosis cases

Label	C1 rainfall	C2 temperature	C3 rel. hum.	C4 a.v
1 jun.89	181.5	26.5	86	12
2 jul.89	65.7	25.7	84.5	8
3 aug.89	17.9	25.4	84	9
4 sept.89	61.1	26.2	83	8
5 oct.89	55.6	27.1	84.5	7
6 nov.89	6.8	28.4	81.5	22
7 dec.89	0	28.4	78	30
8 jan.90	0	28.5	75	25
9 feb.90	7.8	28.9	75	25
10 mar.90	3.2	29.9	76	33
11 apr.90	103.6	28.7	80.5	41
12 may.90	79.6	27.7	83.5	46
13 jun.90	99.4	27.1	84	42
14 jul.90	14.7	25.2	86.5	28
15 aug.90	.7	25.7	83.5	19
16 sept.90	78.4	26.5	82.5	14
17 oct.90	48.3	27.3	80.5	14
18 nov.90	77.4	28.1	80.5	40
19 dec.90	127.7	27.5	78	36
20 jan.91	9.9	28.1	74	47
21 feb.91	8.5	28.9	79	43
22 mar.91	103.7	28.9	78.5	29
23 apr.91	199.6	27.7	74.5	35
24 may.91	314.4	27.5	84.5	40
25 jun.91	115.1	27.1	86	38
26 jul.91	245.1	25.7	87.5	27
27 aug.91	23	25.2	86	
28	26			

Label	C5 months	C6 strep.	C7 c6 arcsin
1 jun.89	1	.2	26.57
2 jul.89	2	.3	33.21
3 aug.89	3	.2	26.57
4 sept.89	4	.3	33.21
5 oct.89	5	.3	33.21
6 nov.89	6	.4	39.23
7 dec.89	7	.1	18.43
8 jan.90	8	.6	50.77
9 feb.90	9	.4	39.23
10 mar.90	10	.4	39.23
11 apr.90	11	.4	39.23
12 may.90	12	.4	39.23
13 jun.90	13	.5	45
14 jul.90	14	.6	50.77
15 aug.90	15	.6	50.77
16 sept.90	16	.2	26.57
17 oct.90	17	.1	18.43
18 nov.90	18	.11	19.37
19 dec.90	19	.11	19.37
20 jan.91	20	.33	35.06
21 feb.91	21	.44	41.55
22 mar.91	22	.33	35.06
23 apr.91	23	.11	19.37
24 may.91	24	.11	19.37
25 jun.91	25	.11	19.37
26 jul.91	26	.22	27.97
27 aug.91			
28			

Appendix Table 86

Tick data on cattle at local herd 1 covering the period June 1989 to August 1991

Label	=	Date
av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus</i> species
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>
str	=	Streptothricosis (dermatophilosis)
arcsin	=	Arcsin transformation of percentages of dermatophilosis cases
C ₅ - 2 lag	=	2 month lag of dermatophilosis
C ₁ - 2 lag	=	2 month lag of <i>A. variegatum</i>
rain	=	Rainfall in millimetres
C ₁ - 3 lag	=	3 month lag of <i>A. variegatum</i>
C ₁₀ - 3 lag	=	3 month lag of rainfall
C ₂ - 2 lag	=	2 month lag of <i>R. senegalensis</i>

	Label	C1 a.v	C2 r.h	C3 boo	C4 hy
1	6.89	27	41	1	4
2	7.89	24	27	3	8
3	8.89	16	39	5	15
4	9.89	18	42	10	13
5	10.89	31	27	7	12
6	11.89	49	8	6	10
7	12.89	34	8	4	9
8	1.90	26	6	0	8
9	2.90	48	5	9	14
10	3.90	46	21	5	12
11	4.90	65	11	5	14
12	5.90	52	80	4	9
13	6.90	18	16	1	10
14	7.90	36	19	0	13
15	8.90	36	13	2	15
16	9.90	20	18	2	11
17	10.90	6	22	1	10
18	11.90	22	4	2	3
19	12.90	12	4	0	5
20	1.91	23	4	1	9
21	2.91	28	2	0	10
22	3.91	24	4	1	5
23	4.91	24	12	0	5
24	5.91	6	8	0	1
25	6.91	8	8	0	1
26	7.91	5	6	0	1
27	8.91	3	5	0	0
	Label	C5 str	C6 month	C7 C5arcsin	C8 C5 -2lag
1	6.89	0	1	0	11.2
2	7.89	.038	2	11.2	10.1
3	8.89	.038	3	11.2	12.5
4	9.89	.031	4	10.1	11.7
5	10.89	.048	5	12.5	17.2
6	11.89	.042	6	11.7	21.2
7	12.89	.089	7	17.2	15.7
8	1.90	.132	8	21.2	18.6
9	2.90	.074	9	15.7	34.3
10	3.90	.103	10	18.6	35.5
11	4.90	.319	11	34.3	37.9
12	5.90	.336	12	35.5	34.4
13	6.90	.375	13	37.9	32
14	7.90	.317	14	34.4	20.2
15	8.90	.28	15	32	21.2
16	9.90	.119	16	20.2	11.5
17	10.90	.131	17	21.2	19.3
18	11.90	.04	18	11.5	12.9
19	12.90	.109	19	19.3	15
20	1.91	.05	20	12.9	12.7
21	2.91	.067	21	15	17.9
22	3.91	.048	22	12.7	12.7
23	4.91	.094	23	17.9	8.3
24	5.91	.047	24	12.7	15.8
25	6.91	.022	25	8.3	10.4
26	7.91	.075	26	15.8	
27	8.91	.033	27	10.4	
	Label	C9 C1 -2lag	C10 rain	C11 C1 -3lag	C12 C10 -3lag
1	6.89	27	181.5	18	181.5
2	7.89	24	65.7	31	65.7
3	8.89	16	17.9	49	17.9
4	9.89	18	61.1	34	61.1
5	10.89	31	55.6	26	55.6
6	11.89	49	6.8	48	6.8
7	12.89	34	0	46	0
8	1.90	26	0	65	0
9	2.90	48	7.8	52	7.8
10	3.90	46	3.2	18	3.2
11	4.90	65	103.6	36	103.6
12	5.90	52	79.6	36	79.6
13	6.90	18	99.4	20	99.4
14	7.90	36	14.7	6	14.7
15	8.90	36	.7	22	.7
16	9.90	20	78.4	12	78.4
17	10.90	6	48.3	23	48.3
18	11.90	22	77.4	28	77.4
19	12.90	12	127.7	24	127.7

20	1.91	23	9.9	24	9.9
21	2.91	28	8.5	6	8.5
22	3.91	24	103.7	8	103.7
23	4.91	24	199.6	5	199.6
24	5.91	6	314.4	3	314.4
25	6.91	8	115.1		
26	7.91		245.1		
27	8.91		25.9		

	Label	C13
		c2 -2lag
1	6.89	41
2	7.89	27
3	8.89	39
4	9.89	42
5	10.89	27
6	11.89	8
7	12.89	8
8	1.90	6
9	2.90	5
10	3.90	21
11	4.90	11
12	5.90	80
13	6.90	16
14	7.90	19
15	8.90	13
16	9.90	18
17	10.90	22
18	11.90	4
19	12.90	4
20	1.91	4
21	2.91	2
22	3.91	4
23	4.91	12
24	5.91	8
25	6.91	8
26	7.91	
27	8.91	

Appendix Table 87**Tick data on cattle at local herd 2 covering the period June 1989 to July 1991**

Label	=	Date
av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus</i> species
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>
str	=	Streptothricosis (dermatophilosis)
arcsin	=	Arcsin transformation of percentages of dermatophilosis cases
C ₁ - 2 lag	=	2 month lag of <i>A. variegatum</i>
C ₇ - 2 lag	=	2 month lag of arcsin transformed dermatophilosis data
C ₄ - 2 lag	=	2 month lag of <i>R. senegalensis</i>

	Label	C1 av	C2 boo	C3 hy	C4 rh
1	6.89	3	4	0	0
2	7.89	0	3	0	0
3	8.89	0	11	0	0
4	9.89	1	3	0	0
5	10.89	11	5	0	0
6	11.89	11	4	0	0
7	12.89	12	3	0	0
8	1.90	13	3	0	0
9	2.90	24	5	1	1
10	3.90	51	3	1	4
11	4.90	57	8	3	7
12	5.90	46	3	3	11
13	6.90	40	2	3	7
14	7.90	28	2	2	4
15	8.90	17	3	4	3
16	9.90	17	2	1	6
17	10.90	25	4	4	5
18	11.90	51	2	1	4
19	12.90	66	1	3	4
20	1.91	19	0	1	3
21	2.91	33	0	1	2
22	3.91	19	0	0	2
23	4.91	68	0	0	2
24	5.91	67	0	1	11
25	6.91	27	0	1	9
26	7.91	24	0	0	8
					4
	Label	C5 str	C6 MONTH	C7 C5 arcsin	C8 C1 -2lag
1	6.89	0	1	0	3
2	7.89	.029	2	9.8	0
3	8.89	.029	3	9.8	0
4	9.89	0	4	0	1
5	10.89	0	5	0	11
6	11.89	.014	6	6.8	11
7	12.89	.015	7	7	12
8	1.90	.052	8	13.2	13
9	2.90	.026	9	9.3	24
10	3.90	.026	10	9.3	51
11	4.90	.061	11	14.3	57
12	5.90	.157	12	23.3	46
13	6.90	.16	13	23.6	40
14	7.90	.17	14	24.4	28
15	8.90	.214	15	27.6	17
16	9.90	.041	16	11.7	17
17	10.90	.064	17	14.7	25
18	11.90	.091	18	17.6	51
19	12.90	.186	19	25.6	66
20	1.91	.124	20	20.6	19
21	2.91	.066	21	14.9	33
22	3.91	.18	22	25.1	19
23	4.91	.129	23	21	68
24	5.91	.151	24	22.9	67
25	6.91	.16	25	23.6	
26	7.91	.205	26	26.9	
	Label	C9 C7 -2lag	C10 c4 -2lag		
1	6.89	9.8	0		
2	7.89	0	0		
3	8.89	0	0		
4	9.89	6.8	0		
5	10.89	7	0		
6	11.89	13.2	0		
7	12.89	9.3	0		
8	1.90	9.3	0		
9	2.90	14.3	1		
10	3.90	23.3	4		
11	4.90	23.6	7		
12	5.90	24.4	11		
13	6.90	27.6	7		
14	7.90	11.7	4		
15	8.90	14.7	3		
16	9.90	17.6	6		
17	10.90	25.6	5		
18	11.90	20.6	4		

19	12.90	14.9	4
20	1.91	25.1	3
21	2.91	21	2
22	3.91	22.9	2
23	4.91	23.6	11
24	5.91	26.9	9
25	6.91		
26	7.91		

Appendix Table 88

Tick data on cattle at local herd 3 covering the period June 1989 to August 1991

Label	=	Date
av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus</i> species
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>
str	=	Streptothricosis (dermatophilosis)
arcsin	=	Arcsin transformation of percentages of dermatophilosis cases
$C_1 - 2 \text{ lag}$	=	2 month lag of <i>A. variegatum</i>
$C_7 - 2 \text{ lag}$	=	2 month lag of arcsin transformed dermatophilosis data
$C_4 - 2 \text{ lag}$	=	2 month lag of <i>R. senegalensis</i>

Label	C1 av	C2 boo	C3 hy	C4 rh
1 6.89	9	7	2	9
2 7.89	2	3	2	3
3 8.89	6	14	2	7
4 9.89	18	7	3	10
5 10.89	8	1	1	6
6 11.89	23	0	1	14
7 12.89	14	0	1	5
8 1.90	15	2	1	2
9 2.90	6	3	2	2
10 3.90	7	1	1	3
11 4.90	15	2	1	3
12 5.90	24	1	4	35
13 6.90	23	0	5	24
14 7.90	19	2	1	12
15 8.90	35	3	3	18
16 9.90	9	5	6	17
17 10.90	19	4	11	15
18 11.90	35	7	4	5
19 12.90	28	1	3	3
20 1.91	12	0	2	5
21 2.91	8	0	5	9
22 3.91	18	1	6	13
23 4.91	32	1	10	44
24 5.91	40	0	7	17
25 6.91	35	1	7	13
26 7.91	34	0	4	8
27 8.91	17	3	3	7

Label	C5 str	C6 MONYH	C7 c5 arcsin	C8 c1 -2lag
1 6.89	0	1	0	9
2 7.89	0	2	0	2
3 8.89	.02	3	8.13	6
4 9.89	.026	4	9.28	18
5 10.89	.02	5	8.13	8
6 11.89	.07	6	15.34	23
7 12.89	.028	7	9.63	14
8 1.90	.06	8	14.18	15
9 2.90	.04	9	11.54	6
10 3.90	.027	10	9.46	7
11 4.90	.041	11	11.68	15
12 5.90	.053	12	13.31	24
13 6.90	.071	13	15.45	23
14 7.90	.058	14	13.94	19
15 8.90	.08	15	16.43	35
16 9.90	.113	16	19.64	9
17 10.90	.043	17	11.97	19
18 11.90	.049	18	12.79	35
19 12.90	.06	19	14.18	28
20 1.91	.089	20	17.36	12
21 2.91	.065	21	14.77	8
22 3.91	.053	22	13.31	18
23 4.91	.056	23	13.69	32
24 5.91	.072	24	15.56	40
25 6.91	.061	25	14.3	35
26 7.91	.077	26	16.11	
27 8.91	.067	27	15	

Label	C9 c7 -2lag	C10 c4 -2lag
1 6.89	8.13	9
2 7.89	9.28	3
3 8.89	8.13	7
4 9.89	15.34	10
5 10.89	9.63	6
6 11.89	14.18	14
7 12.89	11.54	5
8 1.90	9.46	2
9 2.90	11.68	2
10 3.90	13.31	3
11 4.90	15.45	3
12 5.90	13.94	35
13 6.90	16.43	24
14 7.90	19.64	12
15 8.90	11.97	18
16 9.90	12.79	17
17 10.90	14.18	15
18 11.90	17.36	5
19 12.90	14.77	3

20	1.91	13.31	5
21	2.91	13.69	9
22	3.91	15.56	13
23	4.91	14.3	44
24	5.91	16.11	17
25	6.91	15	13
26	7.91		
27	8.91		

Appendix Table 89

Tick data on cattle at local herd 4 covering the period June 1989 to August 1991

Label	=	Date
av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus</i> species
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>
str	=	Streptothricosis (dermatophilosis)
arcsin	=	Arcsin transformation of percentages of dermatophilosis cases
C ₁ - 2 lag	=	2 month lag of <i>A. variegatum</i>
C ₇ - 2 lag	=	2 month lag of arcsin transformed dermatophilosis data
C ₄ - 2 lag	=	2 month lag of <i>R. senegalensis</i>

Label	C1 av	C2 boo	C3 hy	C4 rh
1 6.89	16	7	4	7
2 7.89	8	9	2	6
3 8.89	9	21	2	14
4 9.89	22	9	5	15
5 10.89	44	25	6	19
6 11.89	23	3	4	8
7 12.89	17	1	0	12
8 1.90	7	0	1	0
9 2.90	2	4	0	0
10 3.90	1	1	0	0
11 4.90	5	0	2	2
12 5.90	17	1	2	3
13 6.90	9	0	4	20
14 7.90	5	1	5	12
15 8.90	5	1	2	8
16 9.90	1	1	6	3
17 10.90	3	0	7	11
18 11.90	8	3	3	7
19 12.90	18	0	3	2
20 1.91	15	0	3	4
21 2.91	16	0	3	4
22 3.91	7	1	1	3
23 4.91	19	0	3	4
24 5.91	29	0	5	12
25 6.91	39	1	3	17
26 7.91	7	0	3	13
27 8.91	4	1	0	12
				9

Label	C5 str	C6 MONTH	C7 c5 arcsin	C8 c1 -2lag
1 6.89	0	1	0	16
2 7.89	.113	2	19.64	8
3 8.89	.082	3	16.64	9
4 9.89	.041	4	11.68	22
5 10.89	.031	5	10.14	44
6 11.89	.078	6	16.22	23
7 12.89	.096	7	18.04	17
8 1.90	.112	8	19.55	7
9 2.90	.075	9	15.89	2
10 3.90	.065	10	14.77	1
11 4.90	.026	11	9.28	5
12 5.90	.06	12	14.18	17
13 6.90	.073	13	15.68	9
14 7.90	.138	14	21.81	5
15 8.90	.037	15	11.09	5
16 9.90	.029	16	9.8	1
17 10.90	.036	17	10.94	3
18 11.90	.014	18	6.8	8
19 12.90	.072	19	15.56	18
20 1.91	.066	20	14.89	15
21 2.91	.03	21	9.97	16
22 3.91	.079	22	16.32	7
23 4.91	.047	23	12.52	19
24 5.91	.1	24	18.43	29
25 6.91	.095	25	17.95	39
26 7.91	.063	26	14.54	
27 8.91	.082	27	16.64	

Label	C9 c7 -2lag	C10 c4 -2lag
1 6.89	16.64	7
2 7.89	11.68	6
3 8.89	10.14	14
4 9.89	16.22	15
5 10.89	18.04	19
6 11.89	19.55	8
7 12.89	15.89	12
8 1.90	14.77	0
9 2.90	9.28	0
10 3.90	14.18	2
11 4.90	15.68	3
12 5.90	21.81	20
13 6.90	11.09	12
14 7.90	9.8	8
15 8.90	10.94	3
16 9.90	6.8	11

17	10.90	15.56	7
18	11.90	14.89	2
19	12.90	9.97	4
20	1.91	16.32	4
21	2.91	12.52	3
22	3.91	18.43	4
23	4.91	17.95	12
24	5.91	14.54	17
25	6.91	16.64	13
26	7.91		
27	8.91		

Appendix Table 90

Tick data on cattle at local herd 5 covering the period June 1989 to August 1991

Label	=	Date
av	=	<i>Amblyomma variegatum</i>
boo	=	<i>Boophilus</i> species
hy	=	<i>Hyalomma rufipes</i>
rh	=	<i>Rhipicephalus senegalensis</i>
str	=	Streptothricosis (dermatophilosis)
arcsin	=	Arcsin transformation of percentages of dermatophilosis cases
C ₁ - 2 lag	=	2 month lag of <i>A. variegatum</i>
c ₇ - 2 lag	=	2 month lag of arcsin transformed dermatophilosis data
C ₄ - 2 lag	=	2 month lag of <i>R. senegalensis</i>

	Label	C1	C2	C3	C4
		av	boo	hy	rh
1	6.89	4	6	2	5
2	7.89	21	1	1	6
3	8.89	2	4	1	8
4	9.89	8	2	0	3
5	10.89	14	3	0	9
6	11.89	13	1	1	2
7	12.89	7	2	0	3
8	1.90	12	1	1	2
9	2.90	5	2	1	1
10	3.90	13	2	1	4
11	4.90	7	3	0	7
12	5.90	24	1	1	36
13	6.90	12	0	3	19
14	7.90	21	3	2	15
15	8.90	14	1	6	6
16	9.90	13	4	8	18
17	10.90	33	1	11	23
18	11.90	17	1	3	6
19	12.90	16	0	0	3
20	1.91	20	1	0	3
21	2.91	7	1	3	2
22	3.91	6	0	1	3
23	4.91	14	0	2	13
24	5.91	12	0	1	3
25	6.91	32	2	3	15
26	7.91	22	0	3	6
27	8.91	4	1	1	8
	Label	C5	C6	C7	C8
		str	MONTH	c5 arcsin	c1 -2lag
1	6.89	0	1	0	4
2	7.89	.069	2	15.23	21
3	8.89	.167	3	24.12	2
4	9.89	.153	4	23.03	8
5	10.89	.125	5	20.7	14
6	11.89	.122	6	20.44	13
7	12.89	.169	7	24.27	7
8	1.90	.191	8	25.91	12
9	2.90	.118	9	20.09	5
10	3.90	.103	10	18.72	13
11	4.90	.222	11	28.11	7
12	5.90	.254	12	30.26	24
13	6.90	.292	13	32.71	12
14	7.90	.236	14	29.06	21
15	8.90	.239	15	29.27	14
16	9.90	.179	16	25.03	13
17	10.90	.097	17	18.15	33
18	11.90	.101	18	18.53	17
19	12.90	.137	19	21.72	16
20	1.91	.137	20	21.72	20
21	2.91	.205	21	26.92	7
22	3.91	.137	22	21.72	6
23	4.91	.136	23	21.64	14
24	5.91	.074	24	15.79	12
25	6.91	.087	25	17.15	32
26	7.91	.13	26	21.13	
27	8.91	.141	27	22.06	
	Label	C9	C10		
		c7 -2lag	c4 -2lag		
1	6.89	24.12	5		
2	7.89	23.03	6		
3	8.89	20.7	8		
4	9.89	20.44	3		
5	10.89	24.27	9		
6	11.89	25.91	2		
7	12.89	20.09	3		
8	1.90	18.72	2		
9	2.90	28.11	1		
10	3.90	30.26	4		
11	4.90	32.71	7		
12	5.90	29.06	36		
13	6.90	29.27	19		
14	7.90	25.03	15		
15	8.90	18.15	6		
16	9.90	18.53	18		

17	10.90	21.72	23
18	11.90	21.72	6
19	12.90	26.92	3
20	1.91	21.72	3
21	2.91	21.64	2
22	3.91	15.79	3
23	4.91	17.15	13
24	5.91	21.13	3
25	6.91	22.06	15
26	7.91		
27	8.91		

Appendix Table 91

Meteorological and tick data on cattle at local herds 3, 4 and 5 covering the period June 1989 to August 1991

Label	=	Date
rain mm	=	Rainfall in millimetres
tempt. C	=	Temperature °C
rel. hum.	=	Relative Humidity %
av	=	<i>Amblyomma variegatum</i>
str	=	Streptothricosis (dermatophilosis)
arcsin	=	Arcsin transformation of percentages of dermatophilosis cases
Month 1	=	June 1989
Month 27	=	August 1991

Label	C1 rain mm	C2 tempt. c	C3 rel. hum.%	C4 a.v
1 jun.89	181.5	26.5	86	10
2 jul.89	65.7	25.7	84.5	10
3 aug.89	17.9	25.4	84	6
4 sept.89	61.1	26.2	83	16
5 oct.89	55.6	27.1	84.5	22
6 nov.89	6.8	28.4	81.5	20
7 dec.89	0	28.4	78	13
8 jan.90	0	28.5	75	11
9 feb.90	7.8	28.9	75	7
10 mar.90	3.2	29.9	76	7
11 apr.90	103.6	28.7	80.5	9
12 may.90	79.6	27.7	83.5	22
13 jun.90	99.4	27.1	84	15
14 jul.90	14.7	25.2	86.5	15
15 aug.90	.7	25.7	83.5	18
16 sept.90	78.4	26.5	82.5	10
17 oct.90	48.3	27.3	80.5	18
18 nov.90	77.4	28.1	80.5	20
19 dec.90	127.7	27.5	78	21
20 jan.91	9.9	28.1	74	16
21 feb.91	8.5	28.9	79	10
22 mar.91	103.7	28.9	78.5	10
23 apr.91	199.6	27.7	74.5	22
24 may.91	314.4	27.5	84.5	27
25 jun.91	115.1	27.1	86	35
26 jul.91	245.1	25.7	87.5	21
27 aug.91	25.9	25.2	86	8
28				

Label	C5 months	C6 strep.	C7 c6 arscin
1 jun.89	1	0	0
2 jul.89	2	.095	17.95
3 aug.89	3	.072	15.56
4 sept.89	4	.059	14.06
5 oct.89	5	.046	12.38
6 nov.89	6	.084	16.85
7 dec.89	7	.081	16.53
8 jan.90	8	.105	18.91
9 feb.90	9	.068	15.11
10 mar.90	10	.055	13.56
11 apr.90	11	.069	15.23
12 may.90	12	.092	17.65
13 jun.90	13	.117	20
14 jul.90	14	.123	20.53
15 aug.90	15	.093	17.75
16 sept.90	16	.12	20.27
17 oct.90	17	.05	12.92
18 nov.90	18	.047	12.52
19 dec.90	19	.079	16.32
20 jan.91	20	.089	17.36
21 feb.91	21	.075	15.89
22 mar.91	22	.079	16.32
23 apr.91	23	.067	15
24 may.91	24	.084	16.85
25 jun.91	25	.08	16.43
26 jul.91	26	.082	16.64
27 aug.91	27	.087	17.15
28			

Appendix Table 92

Meteorological and tick data on cattle at local herd 1 covering the period June 1989 to August 1991

Rainfall in millimetres

tempt. C	=	Temperature °C
rel. hum.	=	Relative Humidity %
Month 1	=	June 1989
Month 27	=	August 1991
str	=	Streptothricosis (dermatophilosis)
arcsin	=	Arcsin transformation of percentages of dermatophilosis cases
av	=	<i>Amblyomma variegatum</i>

Label	C1 rainfall	C2 tempt.	C3 rel. hum.	C4 months
1	148.72	26.6	86	1
2	74.9	25.8	84.5	2
3	11	25.6	84	3
4	45.7	26	83	4
5	86.1	26.8	84.5	5
6	4.4	28.5	81.5	6
7	0	28.4	78	7
8	9.6	28.2	75	8
9	6	28.6	75	9
10	1.5	29.8	76	10
11	105.9	28.6	80.5	11
12	99.5	27.6	83.5	12
13	127.8	27	84	13
14	39.6	25	86.5	14
15	.2	25.4	83.5	15
16	24.9	26.4	82.5	16
17	30.7	27.3	80.5	17
18	37.8	28.2	80.5	18
19	85.1	27.5	78	19
20	13.1	28.4	74	20
21	5.5	28.7	79	21
22	52.2	28.9	78.5	22
23	174.6	27.8	74.5	23
24	277.7	27.5	84.5	24
25	123.5	27	86	25
26	263.1	25.6	87.5	26
27	21.1	25.1	86	27
28				

Label	C5 strep.	C6 c5 arcsin	C7 a.v
1	0	0	27
2	.038	11.24	24
3	.038	11.24	16
4	.031	10.14	18
5	.048	12.66	31
6	.042	11.82	49
7	.089	17.36	34
8	.133	21.39	26
9	.074	15.79	48
10	.103	18.79	46
11	.319	34.39	65
12	.336	35.42	52
13	.375	37.76	18
14	.317	34.27	36
15	.306	33.58	36
16	.119	20.18	20
17	.131	21.22	6
18	.04	11.54	22
19	.109	19.28	12
20	.049	12.79	23
21	.067	15	28
22	.048	12.66	24
23	.094	17.85	24
24	.047	12.52	6
25	.022	8.53	8
26	.075	15.89	5
27	.033	10.47	3
28			

Appendix Table 93

Data for Figure 3.1 (a)

X-axis - Months

Y-axis - Percentage lymphocyte transformation (lymphoblasts %)

X-axis	Y-axis	
0	60	65
1	72	71
2	56.5	38
3	67	33
4	59	37
5	55.5	34.5
6	53.5	24.0

Appendix Table 94

Data for Figure 3.1 (b)

X-axis - Months

Y-axis - Arcsin transformation of percentages of transformed lymphocytes (lymphoblasts %)

X-axis	Y-axis	
	Treated	Untreated
0	50.8 (54.7)	53.7 (53.5)
1	59.3	57.4
2	49.0	38.1
3	54.9 (51.5)	35.1 (40.9)
4	50.2	37.5
5	48.2	35.7
6	47.9 (48.3)	29.3 (28.4)

Treated $\hat{y} = 54.7 - 1.07x$

Untreated $\hat{y} = 53.5 - 4.19x$

Appendix Table 95

Data for Figure 3.2

X-axis - Months

Y-axis - Arcsin transformation of percentages of thymidine uptake (lymphoblasts %)

X-axis

	Treated	Untreated	Upper 99.9%	Lower 99.9%
1	30.7	34.5	45.5	23.5
2	32.6	31.8	41.9	21.7
3	60.7	29.2	38.6	19.8
4	75.5	26.5	35.7	17.3
5	33.3	23.9	33.3	14.5
6	38.8	21.2	31.2	11.2
7	39.6	18.6	29.5	7.7
8	43.5	16.0	28.1	3.9

Appendix Table 96

Data for Figure 5.1

X-axis - Number of injections

Y-axis - Arcsin transformation of percentages of transformed lymphocytes (lymphoblasts %)

X-axis	Y-axis		Regression
	5 $\mu\text{g ml}^{-1}$	10 $\mu\text{g ml}^{-1}$	
1	16.43	16.43	18.0
1	17.46	17.46	
1	18.44	20.27	
2	18.44	17.46	
2	18.44	19.37	19.88
2	25.84	22.79	
3	19.37	21.13	
3	21.13	21.97	
3	21.13	24.35	21.76

$$\hat{y} = 16.12 + 1.88x$$

$$F^1_{16} = 8.64$$

Appendix Table 97

Data for Figure 5.2

X-axis - Number of injections

Y-axis - Arcsin transformation of percentages of transformed lymphocytes (lymphoblasts %)

X-axis	Y-axis	Regression
1	17.46	18.13
1	18.44	
1	20.27	
2	17.46	
2	19.37	20.8
2	21.97	
3	21.97	
3	25.10	
3	25.10	23.47

$$\hat{y} = 15.46 + 2.67x$$

Appendix Table 98

Data for Figure 5.3

X-axis - Number of infections

Y-axis - Ranks of days to resolution

1st infection	2nd infection
38 x 8	1.5 x 2
44	14 x 11
55 x 5	50.5 x 2
58	
3rd infection	4th infection
1.5	26.5 x 8
6 x 5	44 x 3
26.5 x 6	50.5 x 2
44	59.5 x 2
47.5 x 2	

APPENDICES

Appendix 1

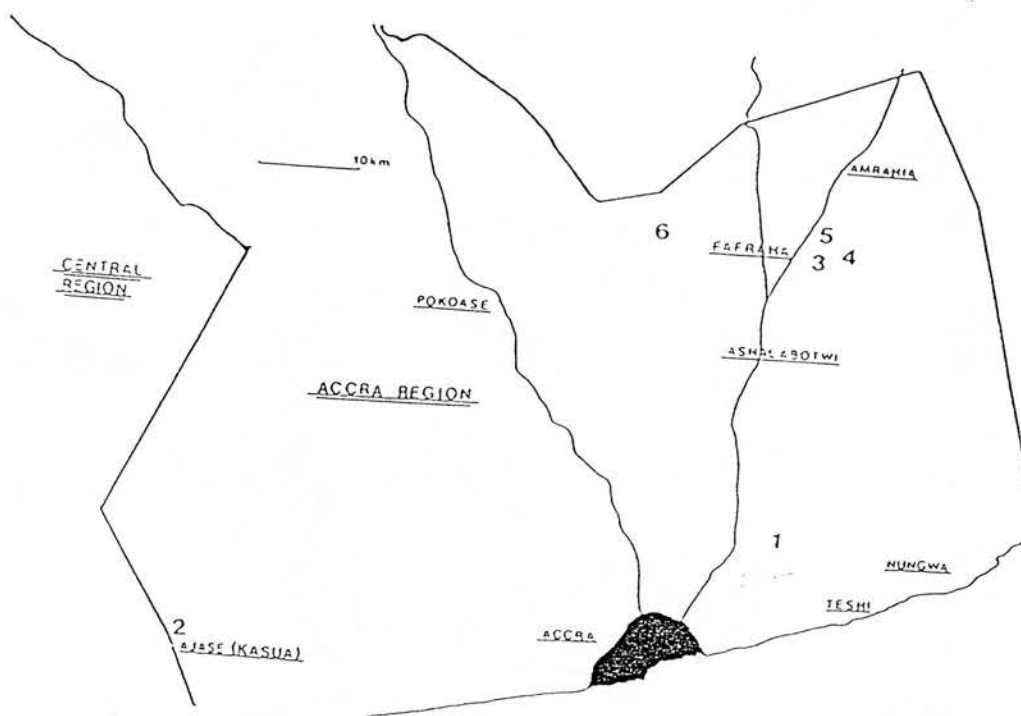
Map of Ghana showing the shaded area in which the study of the seasonal prevalence of ticks and dermatophilosis was carried out on the Coastal Plains of Ghana



Appendix 2

Map showing the location of farms in which the study of seasonal prevalence of ticks and dermatophilosis was carried out on the Coastal Plains of Ghana

Farm	Location
1 Local herd 1	Airport Area, Accra
2 Local herd 2	Kasua
3 Local herd 3	Fafraha
4 Local herd 4	Fafraha
5 Local herd 5	Fafraha
6 Experiment herd	Abladzei



Appendix 3

PURIFIED WATER

The water used for preparing media and other solutions for tissue culture was purified by the Milli Ro 60 system. It was then given a final polishing with the milli Q system (Millipore), such that the resultant resistivity was 18 mega ohm cm^{-2} indicating an extremely high purity.

STERILIZATION OF MATERIALS FOR USE IN CELL CULTURE

Purified water was sterilized by heating to 121°C, under a pressure of 15 psi (1.1. kg cm^{-2}) for 15-20 minutes. Phosphate buffered saline (PBS) was also sterilized by this method. All other solutions were sterilized by passing through a 0.22 μm , low protein absorption, disposable filter (Millex GV, Millipore). Pipettes were sterilized in a dry heat oven at 170°C for 90 minutes; other glassware was sterilized by heating under a pressure of 15 psi for 15 minutes.

WASHING OF GLASSWARE FOR USE IN CELL CULTURE

All glassware used for tissue culture was washed by soaking in 0.5 - 1 per cent Decon 75 (Decon Laboratories), rinsing thoroughly in tap water and then in purified water. Glass pipettes were washed as above except for extra washes in tap water.

PHOSPHATE-BUFFERED SALINE (PBS)

The Dulbecco A, calcium and magnesium-free formulation was used (Oxoid manual 1988).

Sodium chloride	8.00 g
Potassium chloride	0.20 g
Disodium hydrogen phosphate	1.15 g
Potassium dihydrogen phosphate	0.20 g

Made up to 1 L with purified water

All chemicals were anhydrous preparations of Analar grade material (BDH).

Final pH = 7.3 - 7.4.

PENICILLIN STOCK SOLUTION

To a sterile 1 x 10⁶ unit vial of sodium benzyl penicillin (Glaxovet), 1.6 ml sterile, purified water was added, making a total volume of 2 ml. This was diluted by a factor of ten with 18 ml water, giving a stock solution of 50,000 units ml^{-1} . The stock solution was stored in 5 ml aliquots at -20°C and, once thawed, at 4°C. For use, depending on the type of culture, either 100 or 200 μl was added per 100 ml culture medium, giving a final concentration of 50 or 100 units ml^{-1} respectively.

STREPTOMYCIN STOCK SOLUTION

To a sterile one gramme vial of streptomycin sulphate (Evans) 1.2 ml sterile, purified water was added, making a total volume of 2 ml. This was diluted by a factor of ten with 18 ml water, giving a stock solution of 50 mg ml^{-1} . The stock solution was stored at -20°C, in 5 ml aliquots and, once thawed, at 4°C. For use, as with the penicillin stock, either 100 or 200 μl per 100 ml medium was added, giving a final concentration of 50 or 100 $\mu\text{g ml}^{-1}$ respectively.

HEPARIN

Preservative-free heparin (Grade I, from porcine intestinal mucosa, Sigma) was dissolved in PBS to give a concentration of 1,000 units ml⁻¹ (e.g. 141 mg of a 177 units mg⁻¹ preparation made up to 25 ml with PBS). The solution was passed through a 0.22 µm filter and stored at 4°C.

RPMI 1640 MEDIUM CONTAINING HEPARIN

To make 100 ml medium:

RPMI 1640 (Gibco)	97.0 ml
Heparin, 1,000 units ml ⁻¹ stock solution	0.2 ml
Foetal calf serum (Gibco)	2.0 ml
Penicillin, 50,000 units ml ⁻¹ stock solution	0.4 ml
Streptomycin sulphate, 50 mg ml ⁻¹ stock solution	0.4 ml

2-MERCAPTOETHANOL STOCK SOLUTION

2-Mercaptoethanol, with a molecular weight of 78, supplied as a solution in which 1 ml weighs 1.12 mg (Sigma) was diluted 1,000 x with PBS (1 ml made up to 1 L) to give a 14 mM solution. This was further diluted 2.8 x (1 ml to 1.8 ml PBS). This stock 5 mM solution was passed through a 0.22 µm filter and stored, in 5 ml aliquots at -20°C and, once thawed, at 4°C. For use, 1 ml of the stock solution was added to a total of 100 ml medium, giving a final culture concentration of 5 x 10⁻⁵ M.

COMPLETE RPMI 1640 MEDIUM

Media was stored at 4°C and used within three days of preparation. For 100 ml complete medium:

RPMI 1640, (containing 25 mM Hepes and 2 mM L-glutamine, Gibco)	89.6 ml
Myoclone foetal calf serum (Gibco)	8.0 ml
2-mercaptoethanol, 5 mM stock	1.0 ml
L-glutamine, 200 mM (Flow)	1.0 ml
Benzyl-penicillin, 50,000 units ml ⁻¹ stock	0.2 ml
Streptomycin sulphate, 50 mg ml ⁻¹ stock	0.2 ml

GIEMSA'S STAIN

Ten grams of Giemsa powder (Azur-eosin-methylene blue, Merck) was ground into 540 ml glycerol (Analar, BDH); the mixture was heated to 60°C for one hour with occasional shaking. Once cooled to room temperature, 840 ml methanol (Analar solvent methanol, BDH) was added and the mixture shaken vigorously, then stirred overnight, 2.75 g Azur II (Merck) was then added and the mixture stirred overnight again. This stock solution was filtered (Whatman No. 4) and stored in a dark bottle. For use, a 5 per cent solution was made up in phosphate buffer (Gurr 6550, BDH) pH 7.2.

PURIFIED PROTEIN DERIVATIVE OF MYCOBACTERIUM TUBERCULOSIS (PPD)

Preservative-free PPD was dissolved in PBS to give a concentration of 3 mg ml⁻¹. The solution was filter-sterilized and stored for up to a month at 4°C. For sensitization of cattle 3 mg ml⁻¹, PPD was emulsified with an equal volume of Freund's incomplete adjuvant (Difco). The emulsion was checked by ensuring that when a drop was placed on ice-cold water, it remained intact and did not disperse. For skin tests the solvent was sterile PBS and for use in MC culture the solvent was complete RPMI medium.

BLOOD AGAR FOR GROWTH OF *D. CONGOLENSIS*

Blood agar (B/A) plates were prepared by dissolving 15.4 g Columbia agar base (Gibco) in 350 ml purified water, with boiling and frequent mixing. The solution was sterilized by heating under a pressure of 15 psi for 15 minutes. Once cooled to a temperature of 56°C, 25 ml of whole defibrinated sheep blood (Gibco) was added and gently shaken to mix. The blood agar was quickly poured into sterile petri dishes (Sterilin) and allowed to set. The plates were incubated for 24 hours at 37°C and checked for sterility, then stored at 4°C.

BROTH FOR GROWTH OF *D. CONGOLENSIS*

A 50/50 mixture of brain heart infusion and neutralized soya peptone (BHI/NSP, Oxoid) was prepared. Nineteen grams of each was dissolved in a total of one litre of purified water, by gentle heating. Aliquots of 15 ml were transferred to Universal bottles and sterilized by heating under a pressure of 15 psi for 15 minutes. For preparation of antigen, 400 ml volume were made and autoclaved for an extra five minutes

COCCI ANTIGEN

A suitable quantity of PBS was added to 48 hour B/A plate cultures of *D. congolensis* and the cocci harvested by gentle rubbing with a bent pasteur pipette. The suspension was left for one hour at 37°C to allow any filaments to settle out. After this time, the supernatant was collected and the antigen prepared from it in the same way as for the filament antigen.

VIABLE COUNTS FOR DETERMINATION OF *D. CONGOLENSIS* CELL NUMBERS

Serial, ten-fold dilutions of the bacterial suspension were made up in sterile PBS, from 10⁻¹ to 10⁻⁷. Nine 25 µl aliquots of each dilution were dropped onto B/A plates, which were then incubated for 48 hours at 37°C. The mean colony count for each dilution was calculated and the initial cell concentration derived.

Appendix 4**MANUFACTURERS' AND SUPPLIERS' NAMES AND ADDRESSES**

Alpha Laboratories
40 Parham Drive,
Eastleigh
HAMPSHIRE
England

Amersham International plc
Lincoln Place
Green End
Aylesbury
READING
England

Arnold Veterinary Products Ltd
14 Tessa Road
Richfield Avenue
READING
England

Bantin & Kingman Ltd
The Field Station
Grimston
Aldbrough
HULL
England

BDH Ltd
Broom Road
Poole
DORSET
England

Becton Dickinson UK Ltd
York House
Empire Way
Wembley
MIDDLESEX
England

Belco
Suppliers:
Horwell Ltd

Boehringer Mannheim (BCL)
Bell Lane
Lewes
EAST SUSSEX
England

Costar
Suppliers:
Northumbria Biologicals Ltd

Coulter Electronics Ltd
Northwell Drive
Luton
BEDFORDSHIRE
England

Decon Laboratories Ltd
Ellen Street
Portslade
BRIGHTON
England

Difco Laboratories Ltd
P.O. Box 149
Central Avenue
West Moseley
SURREY
England

Dynatech Laboratories Ltd
Daux Road
Billingshurst
SUSSEX
England

Flow Laboratories Ltd
Woodcock Hill Industrial
Estate
Harefield Road
Rickmansworth
HERTFORDSHIRE
England

Gibco Ltd
 P.O. Box 35
 Washington Road
 Abbotsinch Industrial Estate
 PAISLEY
 Scotland

Gurr
 Suppliers:
 BDH Ltd

Horwell Ltd
 73 Maygrove Road
 WEST HAMPSTEAD
 London
 England

Life Science Laboratories Ltd
 Sedgewick Road
 LUTON
 England

Merck
 Suppliers:
 BDH Ltd

Millipore S.A.
 67120 Molsheim
 FRANCE

Northumbria Biologicals Ltd
 South Nelson Industrial Estate
 CRAMLINGTON
 England

Oster
 Suppliers:
 Arnold Veterinary Products Ltd

Packard Instruments Ltd
 Manulife House
 13-17 Church Road
 Caversham
 BERKSHIRE
 England

Glaxovet Ltd
 Greenford
 MIDDLESEX
 England

Hawksley (Gelman Hawsley & Sons)
 10 Harrowden Road
 Breckmills
 NORTHAMPTON
 England

Leitz Instruments Ltd
 48 Park Street
 LUTON
 England

LKB
 Suppliers:
 Pharmacia

Millipore (UK) Ltd
 The Boulevard
 Ascot Road
 Croxley Green
 WATFORD
 England

MSE Scientific Instruments
 Manor Royal
 Crawley
 SUSSEX
 England

Nunclon
 Suppliers:
 Gibco Ltd

Oxoid Ltd
 Wade Road
 BASINGSTOKE
 England

Pharmacia Ltd
 Pharmacia House
 Midsummer Boulevard
 MILTON KENYES
 England

Pierce Chemicals
Suppliers:
Life Science Laboratories Ltd

Seralab
Crawley Down
SUSSEX
England

Shandon Southern Products Ltd
93 Chadwick Road
Astmoor
Runcorn
CHESHIRE
England

Sterilin Ltd
Sterilin House
Clockhouse Lane
Fettham
MIDDLESEX
England

Virtis
Suppliers:
Techmation Ltd
England

Primaria
Suppliers:
Becton Dickinson UK Ltd

Serotect
22 Bankside Station Approach
Kidlington
OXFORD
England

Sigma Chemical Company Ltd
Fancy Road
Poole
DORSET
England

Techmation Ltd
58 Edgeware Way
Edgeware
MIDDLESEX
England

Whatman Labsales Ltd
Unit 1
Coldred Road
Parkwood
Maidstone
KENT