Table S1. Pathogens combination and frequency of co-infections detected in cattle in Malawi.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Double infections*** | Study site | | | | | | | | | | | Overall  *n* = 191 |
| Kasungu  *n* = 26 | | Nkhotakota  *n* = 37 | | Katete  *n* = 36 | | Likasi  *n* = 34 | | LUANAR  *n* =33 | | Mikolongwe  *n* = 28 |
| *Anaplasma marginale* + *Theileria mutans* | 0 | | 1 (3%) | | 1 (3%) | | 1 (3%) | | 0 | | 0 | 3 (1.6%) |
| *Anaplasma marginale* + *Theileria parva* | 0 | | 1 (3%) | | 1 (3%) | | 0 | | 0 | | 0 | 2 (1.0%) |
| *Anaplasma marginale* + *Theileria velifera* | 0 | | 0 | | 1 (3%) | | 0 | | 1 (3%) | | 0 | 2 (1.0%) |
| *Anaplasma platys* + *Theileria parva* | 0 | | 2 (5%) | | 2 (6%) | | 2 (6%) | | 1 (3%) | | 0 | 7 (1.6%) |
| *Anaplasma platys* + *Theileria velifera* | 0 | | 0 | | 0 | | 1 (3%) | | 0 | | 0 | 1 (0.5%) |
| *Anaplasma* sp.+ *Theileria mutans* | 1 (4%) | | 0 | | 0 | | 0 | | 0 | | 0 | 1 (0.5%) |
| *Ehrlichia* sp.+ *Theileria mutans* | 0 | | 1 (3%) | | 0 | | 1 (3%) | | 0 | | 1 (4%) | 3 (1.6%) |
| *Ehrlichia* sp.+ *Theileria parva* | 1 (4%) | | 1 (3%) | | 0 | | 0 | | 0 | | 0 | 2 (1.0%) |
| *Ehrlichia* sp. + *Theileria velifera* | 0 | | 1 (3%) | | 0 | | 0 | | 0 | | 0 | 1 (0.5%) |
| *Theileria mutans* + *Theileria parva* | 1 (4%) | | 3 (8%) | | 4 (11%) | | 1 (3%) | | 0 | | 0 | 9 (4.7%) |
| *Theileria mutans* + *Theileria velifera* | 4 (15%) | | 4 (11%) | | 1 (3%) | | 2 (6%) | | 11 (33%) | | 1 (4%) | 23 (12.0%) |
| Sub-total | 7 (27%) | | 14 (38%) | | 10 (28%) | | 8 (24%) | | 13 (39%) | | 2 (7%) | 54 (28.3%) |
| ***Triple infections*** | | | | | | | | | | | | |
| *Anaplasma bovis* + *Theileria mutans* + *Theileria velifera* | 0 | 0 | | 0 | | 0 | | 1 (3%) | | 1 (4%) | | 2 (1.0%) |
| *Anaplasma marginale* + *Theileria mutans* + *Theileria parva* | 1 (4%) | 0 | | 2 (6%) | | 0 | | 1 (3%) | | 0 | | 4 (2.1%) |
| *Anaplasma marginale* + *Theileria mutans* + *Theileriatautotragi* | 0 | 1 (3%) | | 0 | | 0 | | 0 | | 1 (4%) | | 2 (1.0%) |
| *Anaplasma marginale* + *Theileria mutans* + *Theileria velifera* | 1 (4%) | 1 (3%) | | 0 | | 0 | | 0 | | 1 (4%) | | 3 (1.6%) |
| *Anaplasma platys* + *Anaplasma* sp.+ *Theileria mutans* | 0 | 1 (3%) | | 0 | | 6 (18%) | | 3 (9%) | | 3 (11%) | | 13 (6.8%) |
| *Anaplasma platys* + *Anaplasma* sp.+ *Theileria velifera* | 1 (4%) | 0 | | 0 | | 0 | | 0 | | 0 | | 1 (0.5%) |
| *Anaplasma platys* + *Theileriamutans* + *Theileria parva* | 1 (4%) | 0 | | 0 | | 0 | | 0 | | 0 | | 1 (0.5%) |
| *Anaplasma platys* + *Theileria mutans* + *Theileria tautotragi* | 1 (4%) | 0 | | 1 (3%) | | 0 | | 0 | | 0 | | 2 (1.0%) |
| *Anaplasma platys* + *Theileria mutans* + *Theileria velifera* | 0 | 2 (5%) | | 0 | | 0 | | 0 | | 0 | | 2 (1.0%) |
| *Anaplasma* sp.+ *Theileria mutans* + *Theileria tautotragi* | 0 | 6 (16%) | | 0 | | 3 (9%) | | 0 | | 0 | | 9 (4.7%) |
| *Anaplasma* sp. + *Theileria mutans* + *Theileria velifera* | 1 (4%) | 0 | | 0 | | 2 (6%) | | 0 | | 0 | | 3 (1.6%) |
| *Ehrlichia* sp.+ *Theileria mutans* + *Theileria parva* | 2 (8%) | 0 | | 0 | | 1 (3%) | | 0 | | 0 | | 3 (1.6%) |
| *Ehrlichia* sp.+ *Theileria mutans* + *Theileria velifera* | 1 (4%) | 0 | | 0 | | 0 | | 0 | | 0 | | 1 (0.5%) |
| *Babesia bigemina* + *Theileria mutans* + *Theileria velifera* | 1 (4%) | 2 (5%) | | 0 | | 2 (6%) | | 2 (6%) | | 6 (22%) | | 13 (6.8%) |
| *Theileriamutans* + *Theileria parva* + *Theileria tautotragi* | 1 (4%) | 0 | | 0 | | 0 | | 0 | | 0 | | 1 (0.5%) |
| *Theileria mutans* + *Theileria parva* + *Theileria velifera* | 1 (4%) | 0 | | 4 (11%) | | 3 (9%) | | 6 (18%) | | 1 (4%) | | 15 (7.9%) |
| Sub-total | 12 (46%) | 13 (35%) | | 7 (19%) | | 17 (50%) | | 13 (39%) | | 13 (46%) | | 75 (39.3%) |
| ***Quadruple infection*** | | | | | | | | | | | | |
| *Anaplasma bovis* + *Anaplasma marginale* + *Theileria mutans* + *Theileria tautotragi* | 0 | 0 | | 0 | | 0 | | 0 | | 1(4%) | | 1 (0.5%) |
| *Anaplasma marginale* + *Babesia bigemina* + *Theileriamutans* + *Theileria velifera* | 0 | 0 | | 0 | | 1 (3%) | | 0 | | 0 | | 1 (0.5%) |
| *Anaplasma marginale* + *Theileria mutans* + *Theileria parva* + *Theileria tautotragi* | 0 | 0 | | 1 (3%) | | 0 | | 1 (3%) | | 2 (7%) | | 4 (2.1%) |
| *Anaplasma marginale* + *Theileria mutans* + *Theileria parva* + *Theileria velifera* | 0 | 0 | | 2 (6%) | | 3 (9%) | | 0 | | 0 | | 5 (2.6%) |
| *Anaplasma* *platys* + *Theileria mutans* + *Theileria parva* + *Theileria tautotragi* | 0 | 0 | | 1 (3%) | | 0 | | 0 | | 0 | | 1 (0.5%) |
| *Anaplasma platys* + *Theileria mutans* + *Theileria parva* + *Theileria velifera* | 0 | 1 (3%) | | 1 (3%) | | 0 | | 0 | | 0 | | 2 (1.0%) |
| *Anaplasma* sp.+ *Ehrlichia* sp.+ *Theileria mutans* + *Theileria velifera* | 0 | 0 | | 0 | | 0 | | 0 | | 1 (4%) | | 1 (0.5%) |
| *Anaplasma* sp.+ *Theileria mutans* + *Theileria parva* + *Theileria velifera* | 1 (4%) | 0 | | 0 | | 0 | | 0 | | 1 (4%) | | 2 (1.0%) |
| *Ehrlichia* sp. + *Theileria mutans* + *Theileria parva* + *Theileria velifera* | 0 | 0 | | 0 | | 0 | | 0 | | 1 (4%) | | 1 (0.5%) |
| Sub-total | 1 (4%) | 1 (3%) | | 5 (14%) | | 4 (12%) | | 1 (3%) | | 6 (21%) | | 18 (9.4%) |
| ***Quintuple infection*** | | | | | | | | | | | | |
| *Anaplasma Platys* + *B. bigemina* + *Theileria mutans* + *Theileria parva* + *Theileria velifera* | 0 | 1 (3%) | | 0 | | 0 | | 0 | | 0 | | 1 (0.5%) |
| *Anaplasma platys* + *Anaplasma* sp.+ *Theileria mutans* + *Theileria parva* + *Theileria velifera* | 0 | 0 | | 0 | | 0 | | 1 (3%) | | 0 | | 1 (0.5%) |
| *Anaplasma marginale* + *Anaplasma platys* + *Anaplasma* sp.+ *Theileria mutans* + *Theileria velifera* | 0 | 0 | | 0 | | 0 | | 1 (3%) | | 0 | | 1 (0.5%) |
| *Anaplasma bovis* + *Anaplasma platys* + *Anaplasma* sp.+ *Theileria mutans* + *Theileria velifera* | 0 | 0 | | 0 | | 0 | | 0 | | 1 (4%) | | 1 (0.5%) |
| Sub-total | 0 | 1 (3%) | | 0 | | 0 | | 2 (6%) | | 1 (4%) | | 4 (2.1%) |
| ***Sextuple infection*** | | | | | | | | | | | | |
| *Anaplasma bovis* + *Anaplasma platys* + *Anaplasma* sp.+ *Theileria mutans* + *Theileria parva* + *Theileria velifera* | 0 | 0 | | 0 | | 0 | | 1 (3%) | | 0 | | 1 (0.5%) |

n = number of samples, number of samples positive and percentage is provided in parenthesis.