ACARICIDE RESISTANCE: UGANDA EXPERIENCE

Regional workshop for OIE National Focal points for Veterinary Products, Swaziland, 6-8 December 2017
INTRODUCTION

Major ticks in Uganda (Big 3)

**Rhipicephalus appendiculatus**

**Rhipicephalus (Boophilus) decoloratus**

**Amblyomma variegatum**

Uganda’s weather
Temperature: 16-31°C
Rainfall: 1000 -1639 mm
UBOS: 2015)

**Ticks:** 85.6% disease control cost & 30% calf crop loss (Ocaido et al, 2009)
Impact in Africa is grossly under estimated (Jongejan and Uilenberg, 2004).
Control in Uganda

Native
Crosses 1
Crosses 2

Occasional 7 days 3 days

$26 million spent on importation of acaricides annually (Piper, 2011)

4 classes of acaricides
ACARICIDE RESISTANCE IN UGANDA: INITIAL CASE

Acaricide resistant *Rhipicephalus* (Boophilus) *decoloratus*

2012: First case

We followed the first case with further investigations.
TICK ACARICIDE RESISTANCE IN UGANDA:
DISTRIBUTION ACROSS THE COUNTRY

Acaricide resistant *R. decoloratus* (B.) ticks

TICK ACARICIDE RESISTANCE IN UGANDA: PRESS REPORTS & E-PRESCRIPTIONS

Drug-resistant ticks suck Ankole cattle farmers’ hope

“Ticks and TBD have hit new high levels with all innovations in modern medical sciences” Dr. Ssekanjakko

E-prescription of acaricides is becoming common
ACARICIDE RESISTANCE IN UGANDA:
MULTIPLE RESISTANCE IS A REAL THREAT THAT WILL BE COSTLY TO OVERCOME

Consequence of multiple resistance
1. Use of concentrated acaricide solution
2. Mixing 3 classes of acaricides
3. Spraying every 3 days
4. Illicit purchase of acaricides from other countries
5. Use of agro-pesticides
6. Irrational use of ivermectin

Farms with acaricide failure in southwest & central Uganda are likely to have resistance against 2 or molecules

NB: Data based on Vudriko et al, 2016 and on-going investigation
**Synthetic pyrethroid (SP) resistance**: Super-knock down resistance in voltage sensitive sodium channel, what is the implication on future of SP?

<table>
<thead>
<tr>
<th>Tick ID</th>
<th>Nucleotide sequence</th>
<th>Amino acid sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM08</td>
<td>CTCTATCATGGGAAAACC</td>
<td>PTLNLLISNGKTIGALG</td>
</tr>
<tr>
<td>AF134216</td>
<td>. . . . . . . . . .</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>TSR</td>
<td>. . . . . . . . . .</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>2SBL</td>
<td>. . . . . . . . . .</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>WKBC</td>
<td>. . . . . . . . . .</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>3BUS</td>
<td>. . . . . . . . . .</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>2BUS</td>
<td>. . . . . . . . . .</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>KKK</td>
<td>. . . . . . . . . .</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>KKN</td>
<td>. . . . . . . . . .</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>KD01</td>
<td>. . . . . . . . . .</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>MS22</td>
<td>. . . . . . . . . .</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>KM073928.T170C</td>
<td>. . . . . . . . . .</td>
<td>. . . . . . . . . .</td>
</tr>
</tbody>
</table>

- **T58C super kdr**
- **M19T substitution**

*Vudriko et al, 2017a*

**Rapid diagnostic tests**

How long will it take for the resistance gene to recede?

In progress: genetic makers for rapid detection of amitraz and organophosphate resistance

Reducing time for diagnosis of stable resistance from 4 weeks to 2 day
WHAT POSSIBLY WENT WRONG WITH TICK CONTROL IN UGANDA?

Farm malpractices
- Low prioritization of ticks & TBD control
- Low access to extension
- Poor knowledge on acaricide stewardship

Acaricide regulation & rotation
- Over dependence on chemicals
- Lack of Acaricide Efficacy monitoring
ACARICIDE RESISTANCE: A COMPLEX CHALLENGE THAT AFFECTS ANIMALS, HUMAN AND ENVIRONMENTAL HEALTH (ONE-HEALTH CONCERN)

Increased TBD

Livelihood & income loss

Excessive antibiotic use

Antimicrobial resistance??

Cattle mortality

Ineffective acaricides

Treatment cost

Psychological trauma

Acaricides?

Ivermectin?

Pesticides?

Antibiotics?

Increased mortality

Pollinators?

Natural enemies?

Aquatic life?

Chronic toxicity?

Acute toxicity?

Agro-pesticides?

31.8%

High drug burden

Food safety

Animal Welfare

Human safety

Animal poisoning 12.9%

Animal Welfare

Environmental

Livelihood & income loss

Food safety

Increased TBD

Animal poisoning 12.9%

High drug burden

Acaricides?

Ivermectin?

Pesticides?

Antibiotics?

ACARICIDE RESISTANCE: A COMPLEX CHALLENGE THAT AFFECTS ANIMALS, HUMAN AND ENVIRONMENTAL HEALTH (ONE-HEALTH CONCERN)

Increased TBD

Livelihood & income loss

Excessive antibiotic use

Antimicrobial resistance??

Cattle mortality

Ineffective acaricides

Treatment cost

Psychological trauma

Acaricides?

Ivermectin?

Pesticides?

Antibiotics?

Increased mortality

Pollinators?

Natural enemies?

Aquatic life?

Chronic toxicity?

Acute toxicity?

Agro-pesticides?

31.8%

High drug burden

Food safety

Animal Welfare

Human safety

Animal poisoning 12.9%

Acaricides?

Ivermectin?

Pesticides?

Antibiotics?
SOLUTION 1: BUILDING LABORATORY & HUMAN CAPACITY FOR RESISTANCE DIAGNOSIS & INTERVENTION (RTC LAB)

Established as part of the Evidence-Based Tick Acaricide Control (EBATIC: IT-IE) (Vudriko et al, 2017b) with support from JICA in 2015
SOLUTION II: TICK TESTING AND USING RESULT TO INTERVENE (EVIDENCE BASED)

RTC: Tick assay

RTC, NDA community sensitization

EBATIC stakeholders

RTC, NDA, MAAIF & NaLIRRI joint outreach

RTC Lab supports evidence-based acaricide prescription, intervention & community outreach
SOLUTION III: COLLABORATIVE PARTNERSHIP IN RESEARCH & CAPACITY BUILDING ON TICKS AND TBD RESEARCH AT NRCPD (JAPAN)

Directors of NRCPD and COVAB leaders signing MOU at EBATIC stakeholders workshop in Makerere University

Tayebwa D (OIE Babesia reference Lab, NRCPD)

Tumwebaze M (Host Defense Lab, NRCPD)

Byamukama B (Host defence Lab, NRCPD)

Vudriko P, Asst. R. Umemiya-Shirafuji & Assoc. Prof. T. Hatta in Genome Lab, NRCPD
LESSONS, MAJOR THREATS & CALL FOR REGIONAL ACTION

- Multiple acaricide resistance by multi-tick species-complex
- Acaricide resistance: Threat to public health & environment
- National institutional collaboration and private sector involvement
- National standards for tick control facilities & practices
- National acaricide rotation & resistance management strategy
- National ticks & TBD control policy (in-progress in Uganda)
- National acaricide resistance surveillance + EBATIC: IT-IE
- Regional strategy for acaricide licensing
- Regional strategy for acaricide resistance management
- Regional acaricide resistance action working committee
- Regional strategy for prioritization of ticks & TBD control
ACKNOWLEDGEMENT

Prof. Hiroshi Suzuki, Prof. Xuenan Xuan, Asst. Prof. Rika Umemiya-Shirafuji, Prof. Kozo Fujisaki, Assoc. Prof. James Acai, Dr. Dickson Tayebwa, Dr. Joseph Byaruhanga, Dr. Robert Omara, Dr. Jeanne B. Muhindo

MAAIF, NDA, COVAB, JICA

RTC Laboratory: Research for Solution and Information