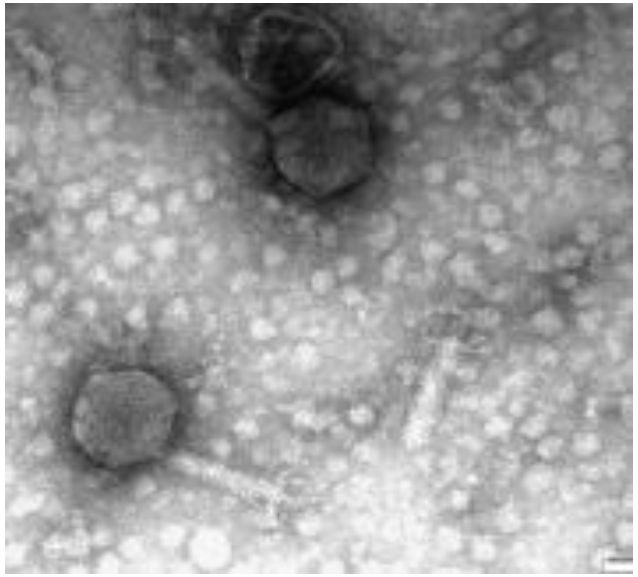
Exploring Use of bacteriophages as alternatives to antibiotic use in poultry and aquaculture production in Uganda



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2nd Global Network for Antimicrobial Resistance and Infection Prevention Symposium, Kampala, Uganda,

March 4-7, 2019

Presentation Outline

- Antibiotic use in animal production
- Antibiotic alternatives in fish and poultry farms
- Bacteriophage use as antibiotic alternatives
- Some approved phage products
- Phage research in Africa
  - ✓On-going research in Uganda
  - ✓Capacity building
- Acknowledgements

Why antibiotic use in animal production in Uganda?

- Growth performance and disease prophylaxis
- Limited access to diagnostic (quality) services – indiscriminate drug use
- Vaccine shortage
- No options to antibiotics use

Alternatives for drug use in fish & poultry farms

- Vaccines
- Probiotics
- Short Chain Fatty Acids
- Disinfectants
- Phytomedicines
- Bacteriophages

British Microbiology Research Journal
17(5): 1-8, 2016; Article no.BMRJ.29721
ISSN: 2231-0886, NLM ID: 101608140

SCIENCEDOMAIN *international*
www.sciencedomain.org

Isolation and Identification of Potential Probiotics Bacteria from the Gut of *Oreochromis niloticus* and *Clarias gariepinus* in Uganda

Charles Drago Kato[1,2*], Mark Benjamin Mugaanyi[1], Samuel Majalija[1], Andrew Tamale[1], Nathan Lubowa Musisi[1] and Asuman Sengooba[3]

Print ISSN 2319-2003 | Online ISSN 2279-0780

IJBCP International Journal of Basic & Clinical Pharmacology

doi: 10.5455/2319-2003.ijbcp20141023

Research Article

Comparative study of in-vitro antimicrobial activity and phytochemical composition of *Sida cuneifolia* fruits, leaves, and stem bark extracts

Rebecca Nalubega[1]*, Steven A. Nyanzi[2], Jesca L. Nakavuma[1]

Alternatives for drug use in fish and poultry farms

Vaccines

- Poultry vaccines
  (none for *E.coli* infections)

Review

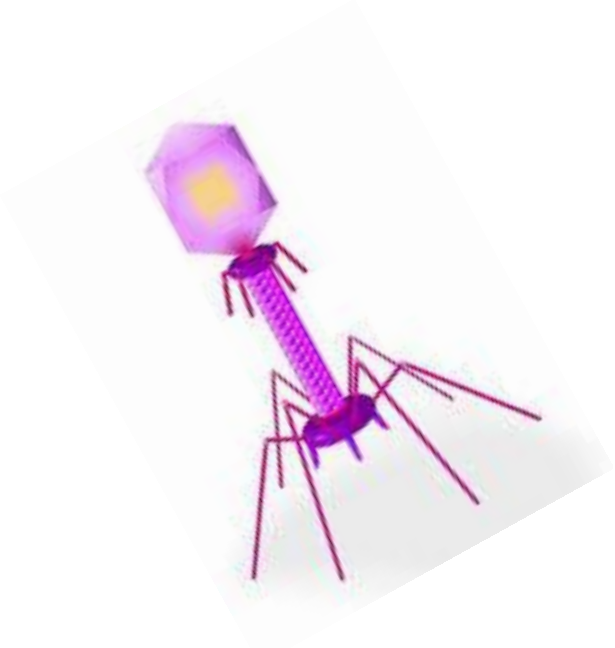
Adjuvant effects of medicinal herbs and probiotics for fish vaccines

Mehdi Soltani, Alan Lymbery, Seong Kyu Song, Pezhman Hosseini Shekarabi

First published: 17 October 2018
https://doi.org/10.1111/raq.12295

- Infectious diseases in aquaculture are often partly controlled by vaccination, herbs or probiotics - elsewhere
- However, some disease have no vaccines; short-lived immunity; not easy to administer in fish

Why bacteriophages?



- Natural enemies of bacteria
- Lyse even the AMR strains
- Self-replicating, self limiting, selective due to high specificity
- Cheaper to develop compared to antibiotics
- Drug use in animal production – driver for AMR dev’t
- Consumers’ demand for chemical and drug-free foods

Considerations for Phage selection

- Lytic activity against pathogen of interest
- Biology of the pathogen - growth requirements; supportive to phage viability
- Should not carry undesirable genes
- Combination of phages into cocktail to avoid resistance

Aim: Food safety, improved animal productivity and antimicrobial resistance mitigation

Phage Applications for food safety

‘*farm-to-fork’* intervention points

- **Pre harvest**: Preventative and therapeutic application (phage therapy) ⟵ current focus
  - ✓Reduce shedding and colonization
  - ✓Applied as sprays, in animal feeds; in water
- **Post-harvest**
  - ✓Decontamination – as sprays
  - ✓Ready-to-Eat foods – incorporation in foods or packaging material

Pre- slaughter / pre-harvest phage use

Significance:

- Entry of contaminated raw materials and dissemination of the pathogen in the facility production is avoided
- Prevents animal-to-animal spread of pathogenic bacteria due to reduced shedding
- Poultry manure - main source of *E. coli* and *Salmonella* in the environment and consequently in food products; especially where applied as fertilizers

Challenge: Appropriate route of administration of the bacteriophage preparations for pre- slaughter biocontrol for systemic infections

Some approved phage products

LISTEX P100

OMNILYTICS™
THE PHAGE COMPANY

SALMONELLEX

AgriPhage™

**Phages highly species or even strain specific- what works in elsewhere may not suffice in Uganda!*

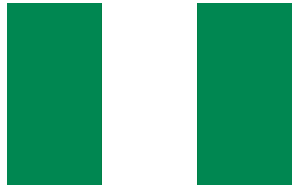
Some Phage research in Africa

El-Shibiny *et al 2017* Phage applications for improving food safety and infection control in Egypt**.** *Appl. Microbiol* doi: 10.1111/jam.13500

Investigation of the lytic ability of South African bacteriophages specific for *Staphylococcus aureus*, associated with bovine mastitis. *Biocontrol Science and Technology* https://doi.org/10.1080/09583157.2014.983458

Vibrio cholerae phages (PhD research), University of Nairobi

Phages for *Campylobacter* spp in chicken, KEMRI



Nigerian phages: The first bacteriophages from Tropical Africa (*Bacillus* spp., *E. coli*, *K. pneumoniae*, *P. aeruginosa*, *S. aureus* and *Xanthomonas* sp.)

On-going research at COVAB, Mak

1. **AU funded Project**: '*Development of bacteriophage cocktails as disease biocontrol agents for improved aquaculture productivity, food and nutrition safety in Ghana and Uganda*' (3 yr)

   ✓Expected Output – Phage cocktail products for fish farm application

1. **SIDA – Mak SCG**: '*Isolation of bacteriophages for management of colibacillosis and antimicrobial use in poultry production*' (½ yr)

   ✓Establishing stock of APEC lytic bacteriophages, for future development

Capacity building (Training and research)

- *PhagesforGlobalHealth* - Tobi Nagel Build critical mass of phage scientists
- Trainers: Ben Chan (Yale); Martha Clokie (Leicester)
  - ✓Two training workshops in East Africa, about 50 scientists participated
  - ✓June 2019 for West Africa (Nigeria); others planned in Southern Africa, TZ
- Several students' final year special project research (COVAB)
  - Clinical isolates (*E. coli, P. aeruginosa, MTB*); *E. coli*, *Salmonella*, *Staph aureus* from poultry, piggery, mastitis cases, mountain Gorilla habitat

1st East African Regional Phage Training Workshop (July 2017 at Makerere)

2nd East African Regional Phage Training Workshop at Pwani Univ, Mombasa Kenya July 2018

Acknowledgement

NAMRIP

University of Southampton

University of Leicester

Phages for Global Health

Yale University

THANK YOU