



# Near-infrared spectroscopy discriminates mass-reared sterile and wild tsetse flies



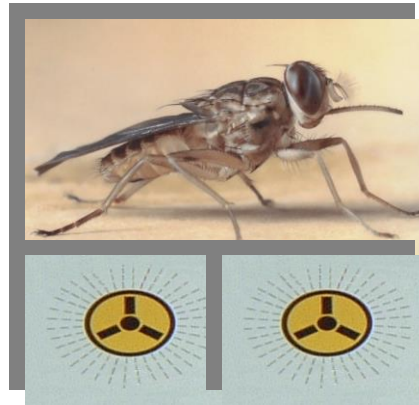
Pagabeleguem S, Da DF, Some BM, Avelessi MSP, Djègbè NDC, Yoda RL, Bagayogo A, Maïga H, Churcher TS, Dabire RK

**37<sup>th</sup> ISCTRC, Nairobi, Kenya, 15<sup>th</sup>–19<sup>th</sup> September 2025**

# Context

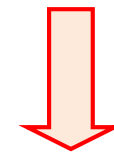
## Sterile Insect Technique (SIT)

- ✓ Key component of AW-IPM programs



Zanzibar, Burkina Faso, Nigeria and Senegal

(Politzar et Cuisance, 1984; Takken et al., 1986; Vreysen et al., 2000)



No offspring



2 regional insectariums:



**IBD** (Burkina Faso) for West africa

**STEP** (Ethiopia) for East Africa

## ➤ Constraints to the application of SIT

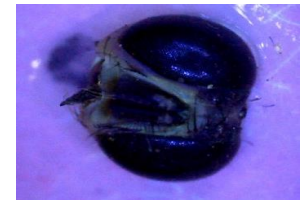
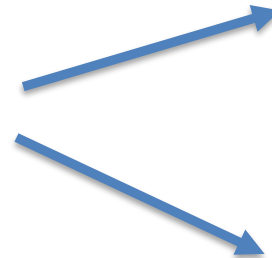
- ✓ Optimal conditions of transport of the mature pupae (Pagabeleguem et al, 2015)
- ✓ Evaluation of the quality of the sterile males released (Pagabeleguem et al, 2016)



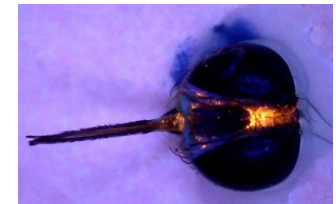
Fluorescent dye powder



Examination of heads with UV camera



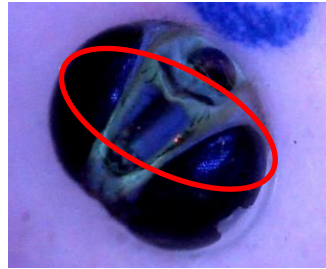
Wild male



Sterile male

# Current limitations

- ✓ Fluorescent dye marking: unreliable due to poor marking or contamination



Doubtful

RESEARCH ARTICLE

A Molecular Method to Discriminate between Mass-Reared Sterile and Wild Tsetse Flies during Eradication Programmes That Have a Sterile Insect Technique Component

**Accurate** (100%) but:

- Expensive : ~ 15 euro/fly
- Time-consuming: 2 weeks

# Current limitations

- ✓ The Near-infrared spectroscopy (NIRS) technique, a promising new-generation monitoring tool, appeared to be a reliable alternative for identifying tsetse flies
- ✓ NIRS has been applied:
  - Malaria research: predict mosquito age, identify *Anopheles* species and determine *Plasmodium* infection status (Da et al. 2021; Goh et al. 2021)
  - Tsetse: separate pupae by sex (Dowell et al 2005)

**Aim:** Evaluate the NIRS as a tool to discriminate: Mass-reared sterile **vs.** wild tsetse males

# Methods

- Study species: *G. palpalis gambiensis*
- 2 groups of flies:
  - **Insectary-reared** sub-groups: unmarked fertile, unmarked sterile, marked sterile.
  - **Wild flies** collected from Bama forest (Burkina Faso).
- Flies scanned using LabSpec4 spectrometer (350–2500 nm)

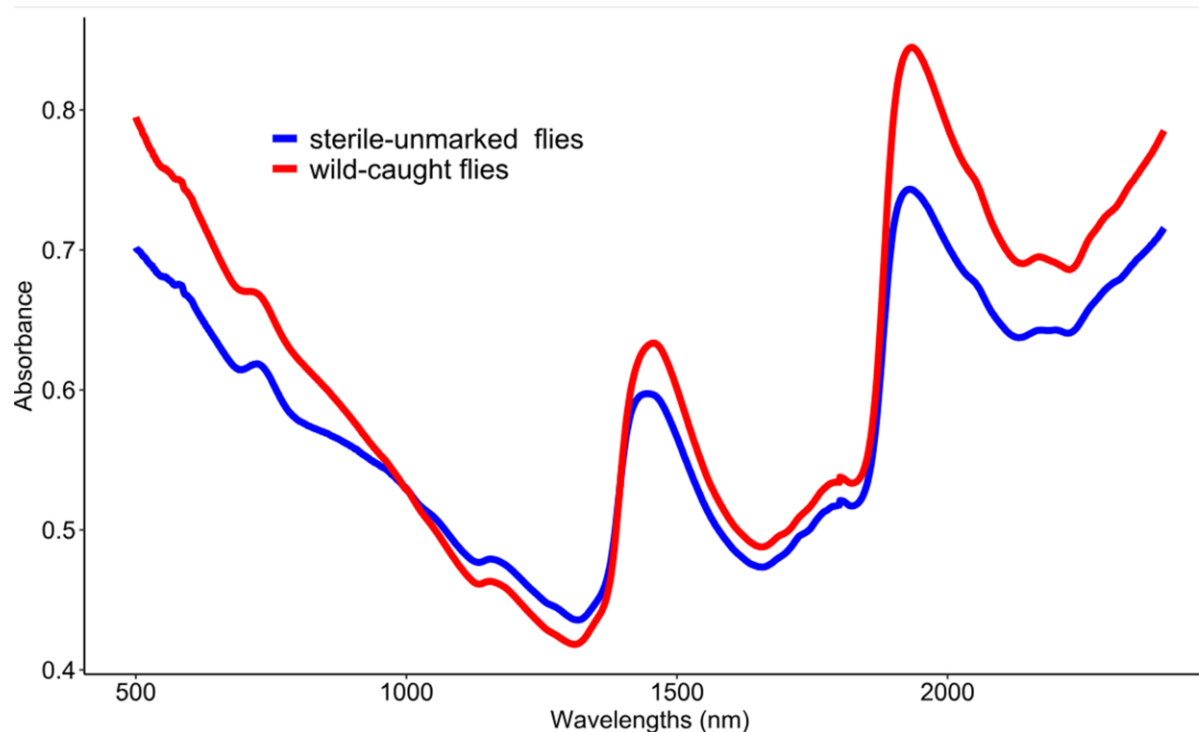


- Data analyzed using machine learning (PLS regression, logistic regression)

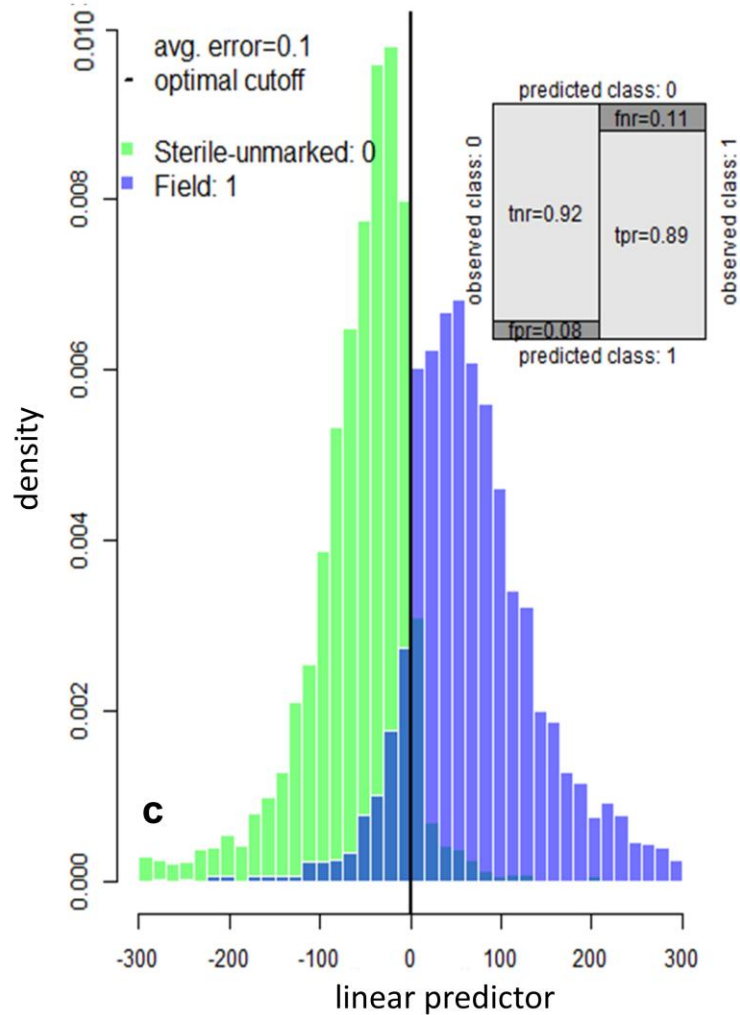
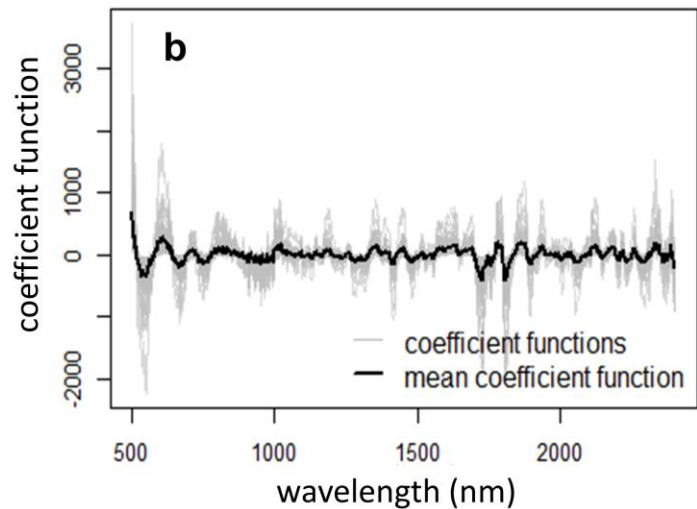
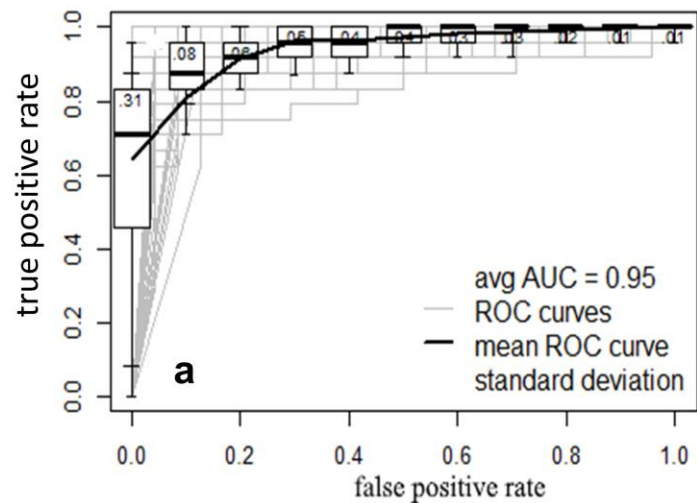
# Results/discussion

- ✓ 627 laboratory-reared males and 143 wild-caught males of *G. p. gambiensis* were used to determine the predictive discrimination ability of the model
- ✓ The spectra profile revealed noticeable differences between certain experimental groups.

**Ex:** absorbance levels of wild-caught flies > laboratory-reared, sterile-unmarked

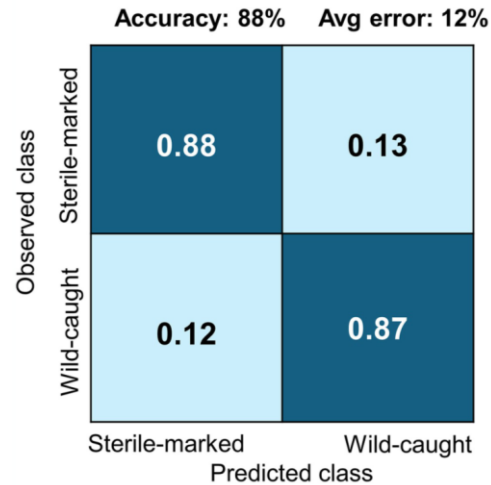


# Results/discussion

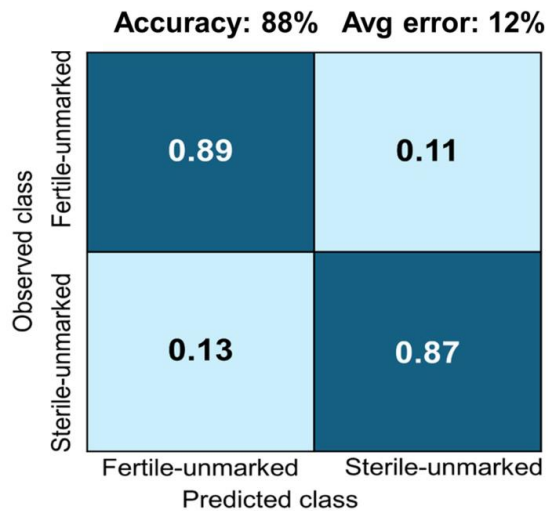


**Sterile (unmarked) vs Wild: 90%**

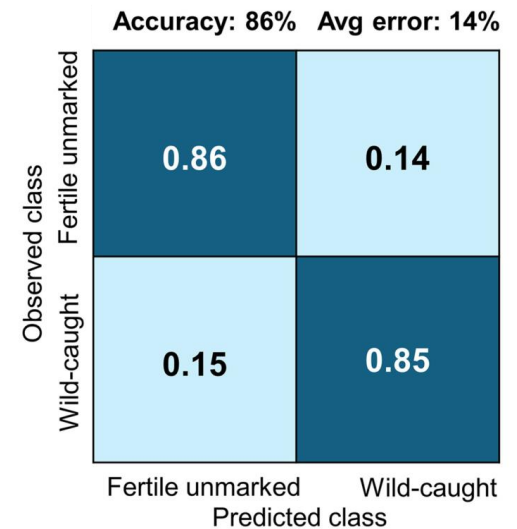
# Results/discussion



**Marked sterile vs Wild: 88%**



**Fertile vs Sterile: 88%**



**Fertile (lab) vs Wild: 86%**

# Results/discussion

- These findings suggest that NIRS can successfully identify tsetse flies even when UV camera identification is inconclusive
- **Advantages:** non-destructive, rapid, cost-effective once instrument acquired
- **Limitation:** ~10% error rate not yet acceptable for SIT decision-making

# Conclusion

- NIRS shows strong potential as complementary tool in SIT monitoring
- Further validation needed with larger datasets and field conditions
- Promising step toward improving accuracy of vector control programs

RESEARCH ARTICLE

## Near-infrared spectroscopy discriminates mass-reared sterile and wild tsetse flies

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