Sugar sources that influence local mosquito movement patterns offer valuable insights for novel vector control: Attractive Toxic Sugar Baits (ATSB)

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Some interesting facts:

As a rule mosquitoes and sand flies feed first on sugar. Sugar is their main energy source, influences longevity & fecundity, host seeking behavior and ultimately blood feeding & disease transmission.

Measured attraction distances for female *An. sergentii*

• Non-flowering plants (+/-) honeydew	<2m
• annual flowers ranged from	<2-4m
• *Acacia raddiana*	22m
• *Ochradenus baccatus*	44m
• Chicken	32m
• Human	40m
• ATSB	8m

apart from many traditional pesticides also low risk toxins like:

- spinosad
- boric acid
- photo toxins
- detergents
- *some food preservatives*

are effective oral toxins for mosquitoes

With oral toxins a completely new array of pesticides is available

toxins can be easily combined to reduce resistance

How to find sugar in the gut of a fly?
Sugar feeding status of mosquitoes and sand flies In Central Mali

Flies are placed in a microtiter plate

Reaction agent is added

Microplate Reader 590nm

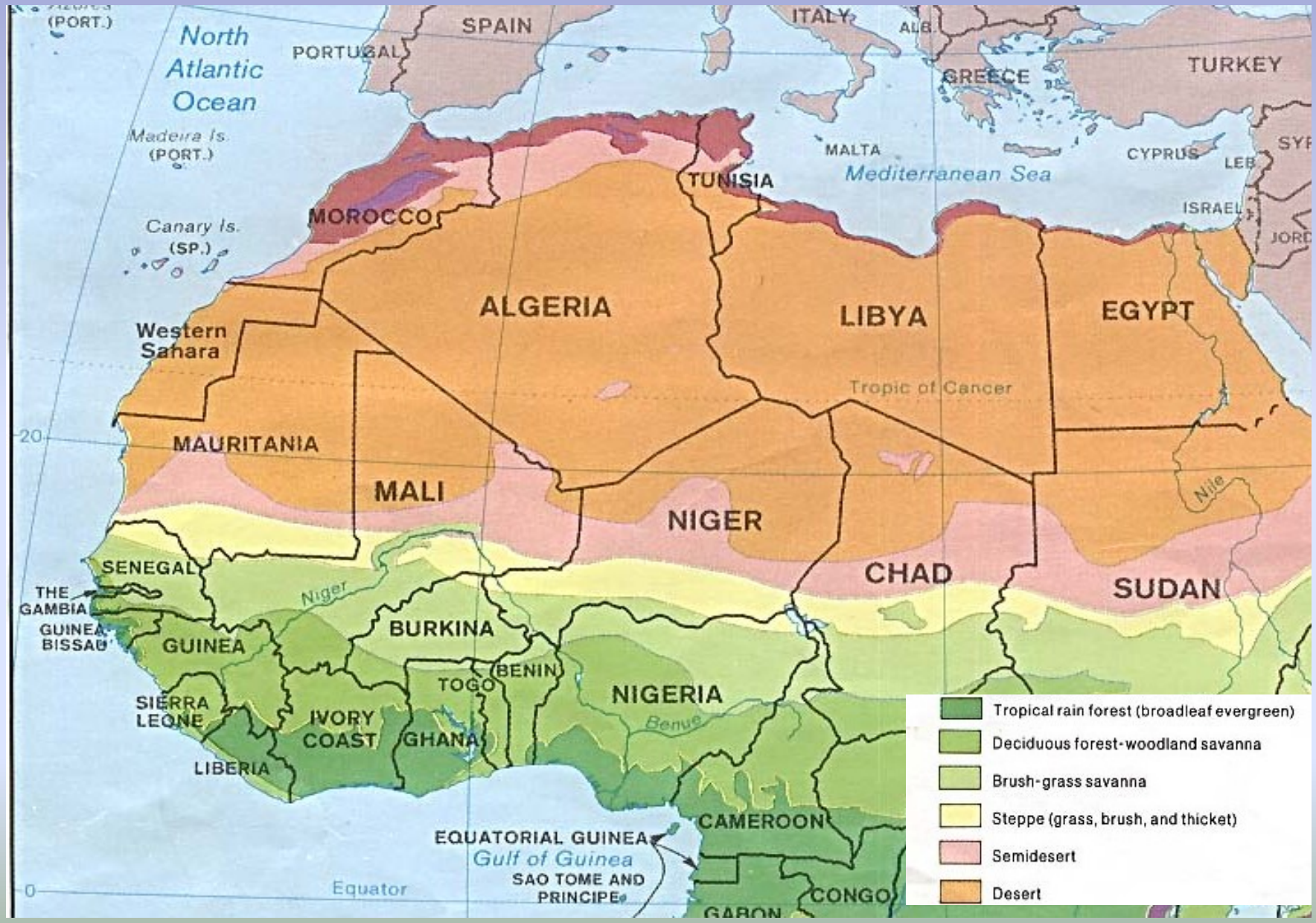
OD's are converted to sucrose equivalents with a calibration curve

If given the chance both mosquitoes and sand flies are feeding daily on sugar.

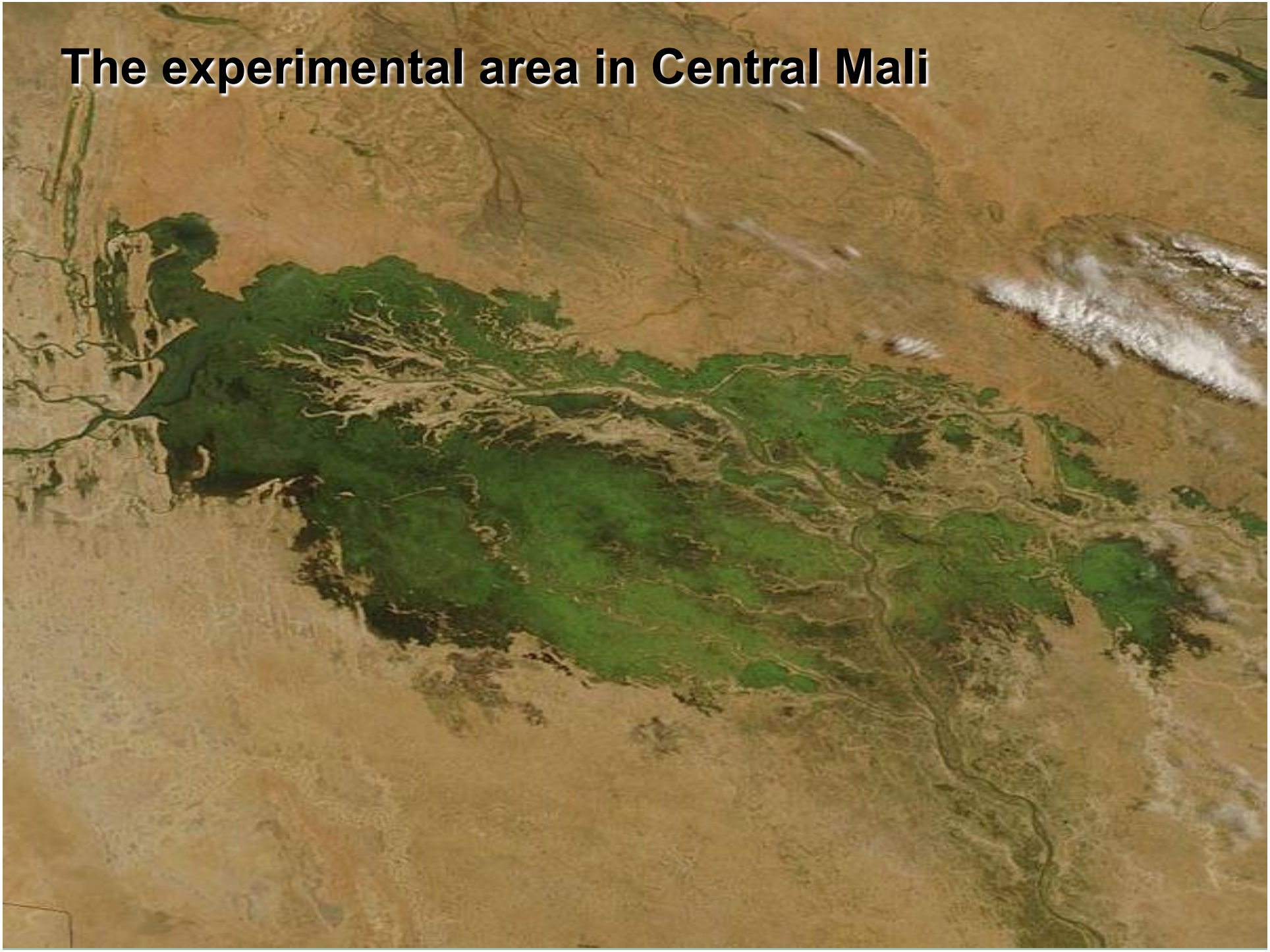
Low sugar feeding levels of field collected mosquitoes and sand flies are an indicator of sugar shortage.

In Mali depending on the habitat sugar feeding ranged from 15 to 85% with large meal sizes at sugar rich sites and small meals at sugar poor sites.

Mayor Vegetation Zones in Africa



The experimental area in Central Mali



- Identification of local attractive sugar sources

The attraction experiments showed that both mosquitoes and sand flies have clear preferences

Some flowers and fruit were up to 20 times more attractive than others

Some of the identified attractive sugar sources were:

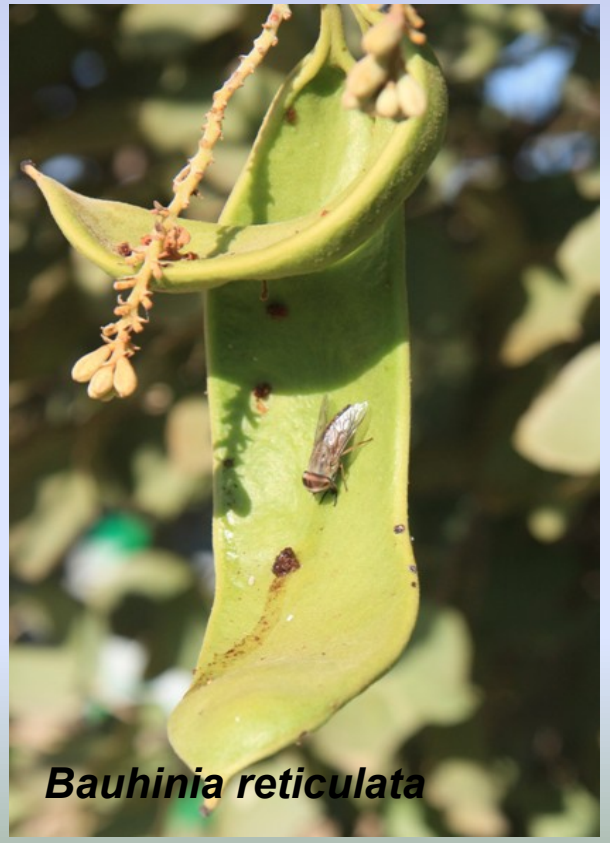

Ziziphus mauritiana L


Acacia albida


Acacia macrostachya


Boscia angustifolia


Honey melon
Cucumis melo


Bauhinia reticulata


Balanitis aegyptiaca


Citrillus lanatus


Diospyros mespiliformis

II ATSB:

Components
Preparation
Application methods

Attractive Toxic Sugar Bait (ATSB) the components:

30% Guava
30% Honey Melon
25% Water
10% Brown Sugar
1% mille beer
4% Bait Stab®
1% low risk toxin

Attractive Toxic Sugar Bait (ATSB) the preparation:

The fruits were crushed, mixed with the sugar, and left for two days for fermentation in the sun in plastic buckets. Later the liquid was separated from the pulp by a mesh sieve and a cloth.

Attractive Toxic Sugar Bait (ATSB) the preparation:

After fermentation the liquid was filled in tanks for storage. A concentrate of Bait Stab was added for preservation and bait stabilization. We used 1% Boric acid as an oral toxin. It is easily available, cheap and as toxic as table salt.

The leftovers (pulp) was used for chicken and goat feed.

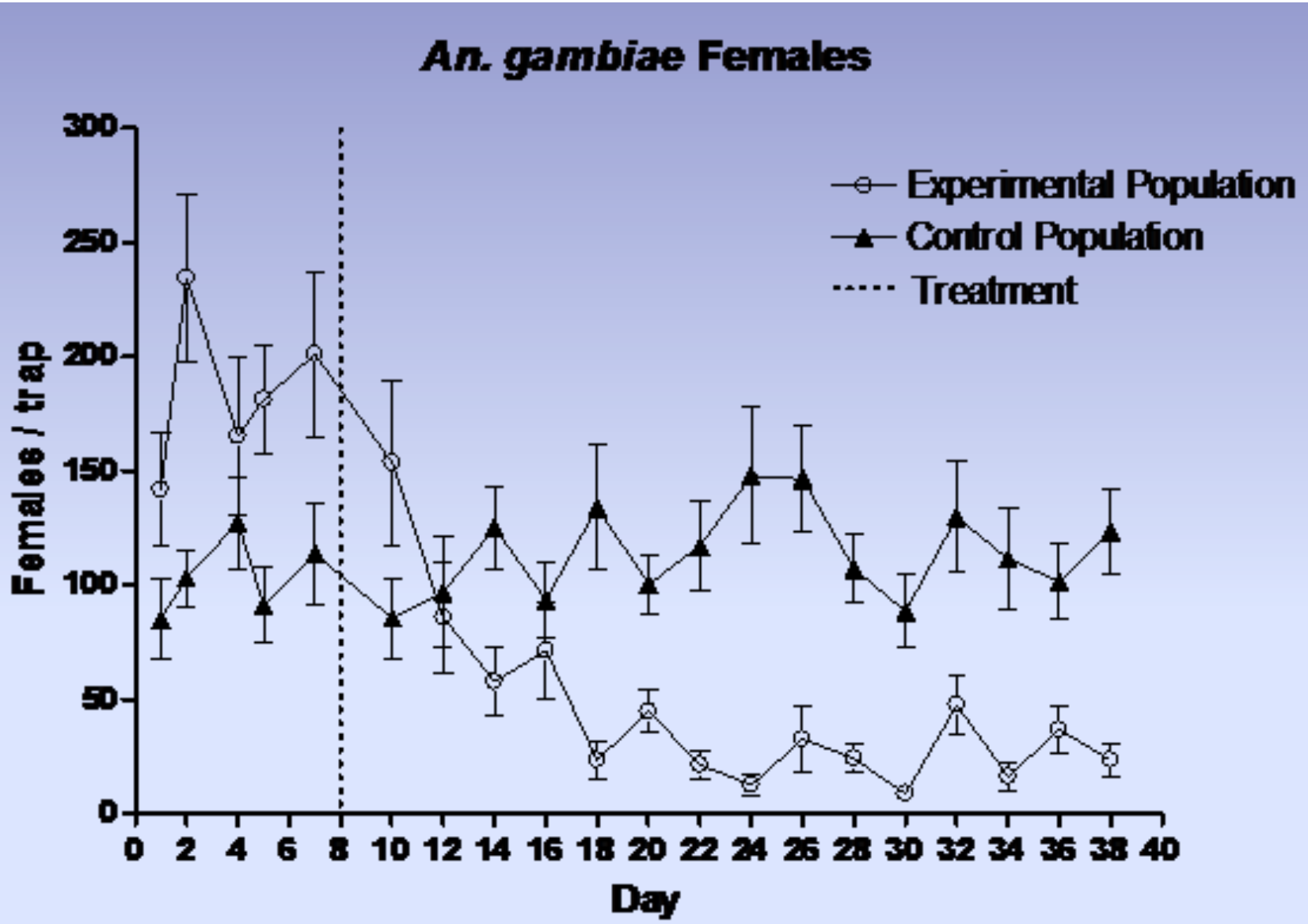
Attractive Toxic Sugar Bait (ATSB) the application:

III ATSB:

Control experiments in different types of habitats

Mosquito control with ATSBs in rice paddies

ATSB was sprayed with a 16 liter back-pack sprayer in spots of 1 square meter (80ml of bait/ spot) every 3 meters in the vegetation around the breeding sites as a barrier.



Similar good results were obtained with nuisance mosquitoes, mainly *Aedes* sp. and *Culex* sp.

Conclusion:

Within a short time the local mosquito population collapsed. The rest of the remaining population was to young (less than 12 days old) to transmit Malaria.


Sand fly control with ATSB sprayed
on vegetation in an agricultural area

Conclusion:

Within the first day about 60% of the local population were stained with non toxic sugar baits, in the experiment with the toxin within a short time the local sand fly population collapsed (reduction of more than 80% and after a month more than 95%). The rest of the remaining population were mainly young flies not able to transmit *Leishmania* parasites.

Mosquito and sand fly control within a village with ATSB bait stations

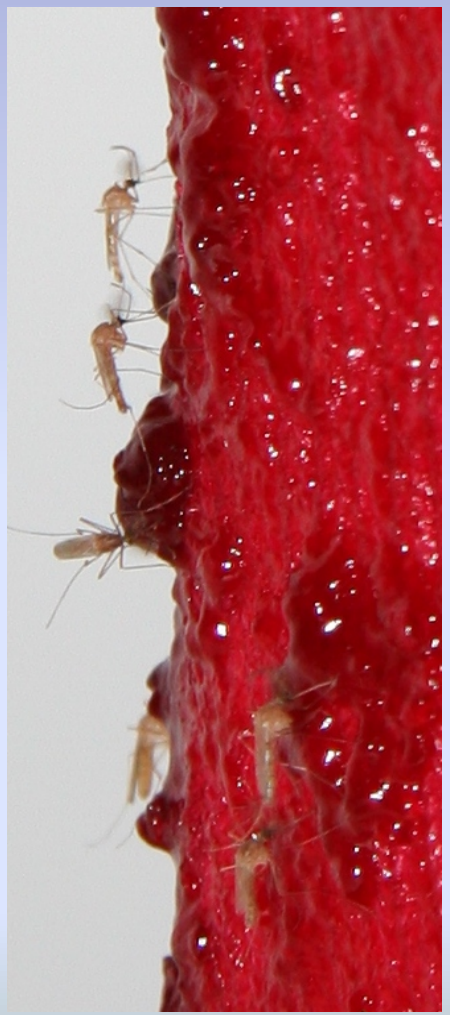

Bait station design developed
within the DWFP-program
OKI

Conclusion:

Within the first day about 50% of the local population were stained with non toxic sugar baits, in the experiment with the toxin within a short time the local sand fly population collapsed (reduction of more than 70% and after a month more than 90%). The rest of the remaining population were mainly young flies not able to transmit *Leishmania* parasites.

Mosquito control near ponds and rice paddies with ATSB in bait stations

Bait station design developed to reduce impact on no-target organisms



Conclusion:

Results were similar like ATSB application in vegetation.

Within a short time the local mosquito population collapsed. The rest of the remaining population was to young (less than 12 days old) to transmit Malaria.

Mosquito control indoors with ATSB in bait stations

Conclusion:

Experiments were conducted during the dry season. Within a short time the indoor mosquito population collapsed. At the experimental site there were no breeding sites nor young dispersing mosquitoes which could have replenished the population.

Apart from mosquitoes, mainly *An. gambiae* and *Culex* sp. also house flies, cockroaches and ants were attracted and killed.

Indoors we observed no non-targets.

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