Genetic profiling of *Gonimbrasia belina* populations in South Africa and Botswana support concerns over the sustainability of the mopane worm harvesting and trade

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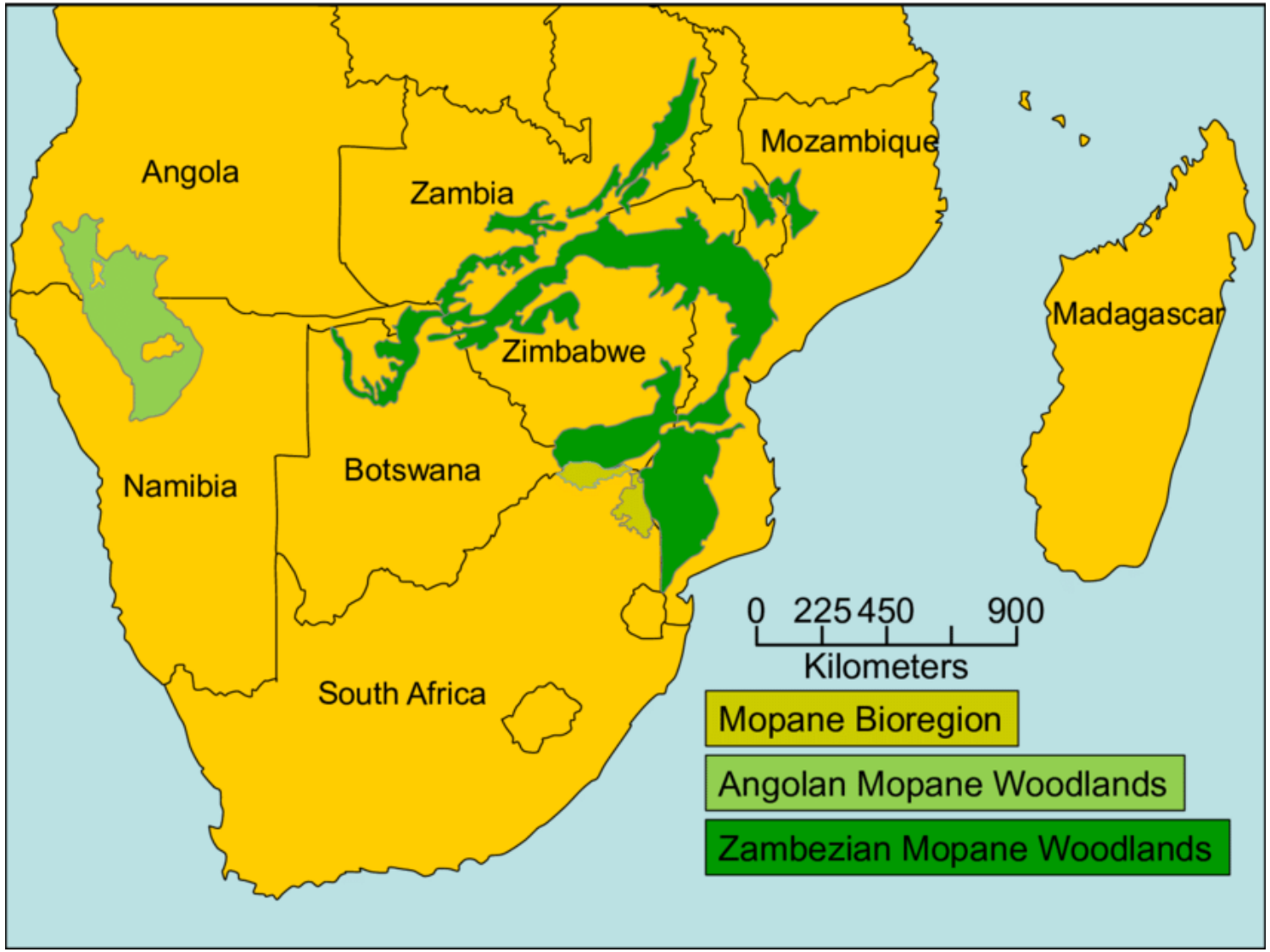
Skukuza – Kruger National Park

The mopane worm life cycle

Gonimbrasia belina

Mopane woodlands: dwindling resources?



Makhado et al. 2012

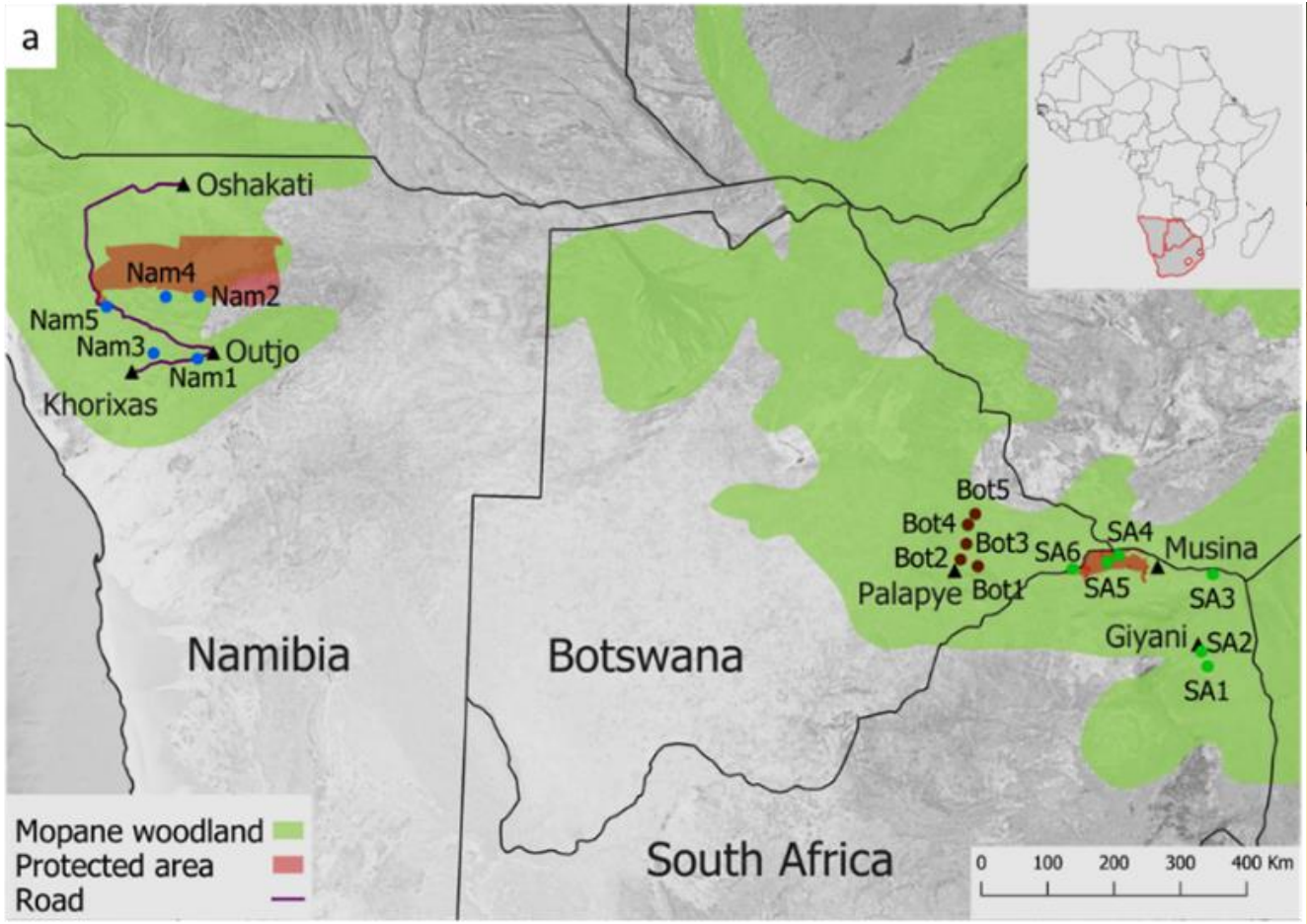
- **Building materials** for rural houses: 4.1-5.4 m3 for a family
- **Fuel wood** for 80% of rural people: 2.8 metric tons consumed per family/year
- **Mopane worm** harvest and trade: estimated US$85 million

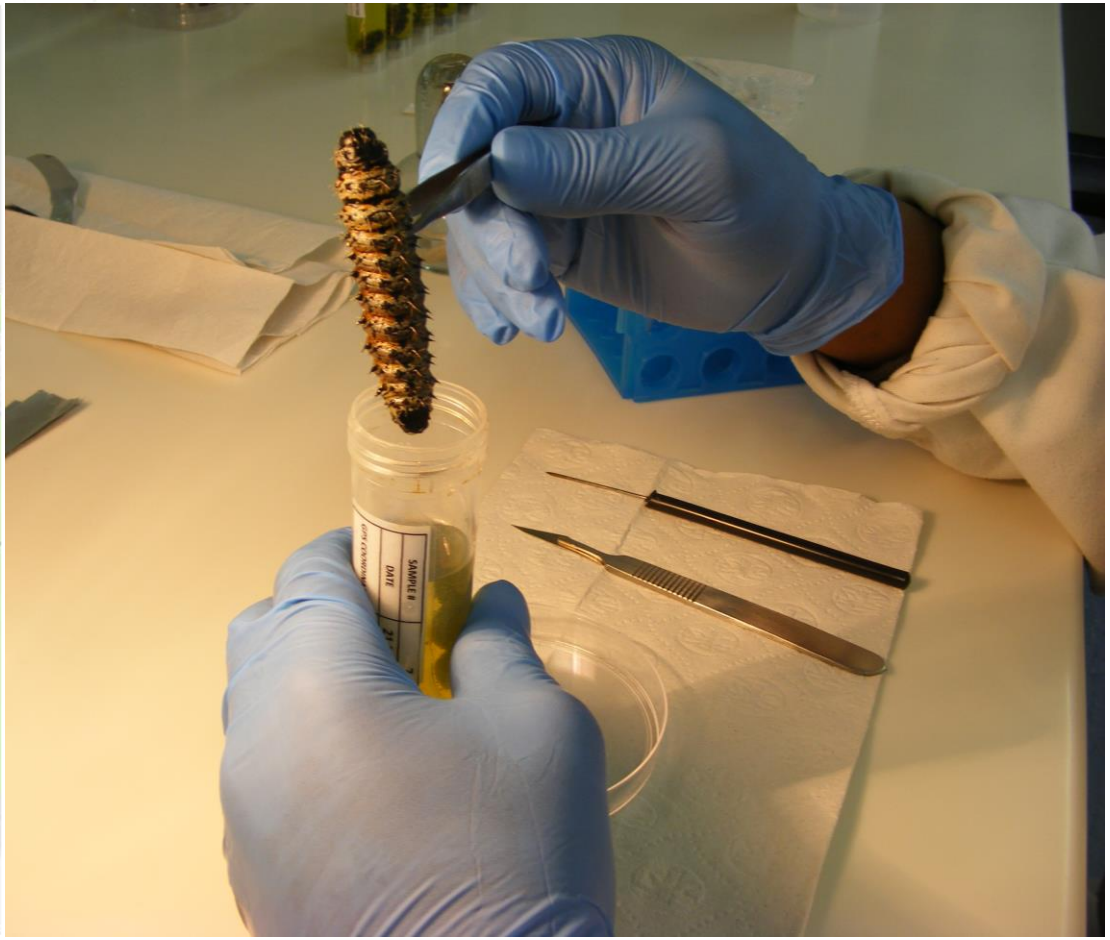
- **Unsustainable** resource use
- **Irresponsible management**

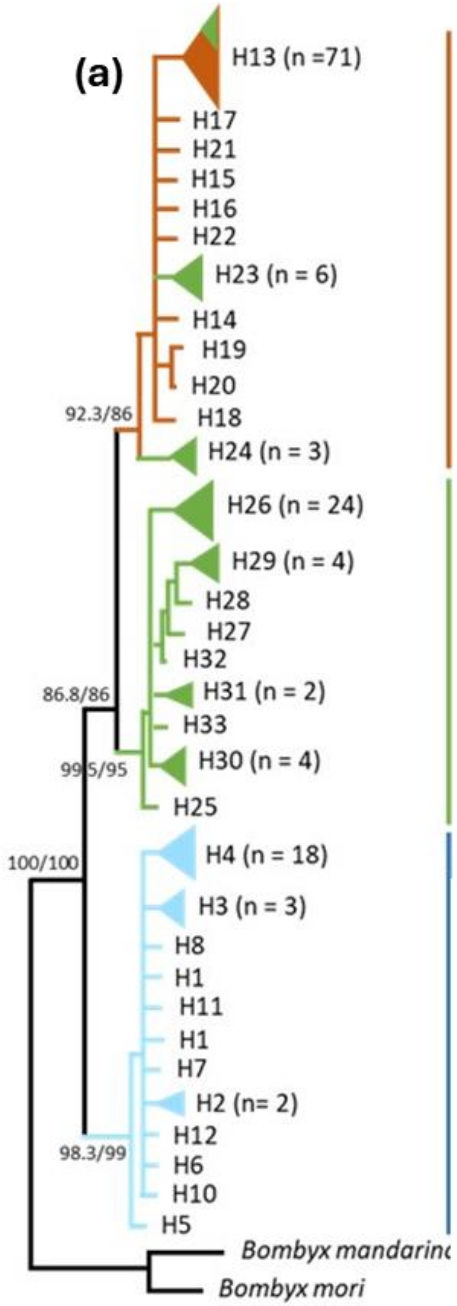
Namibia, Botswana and South Africa (24 sampling sites)

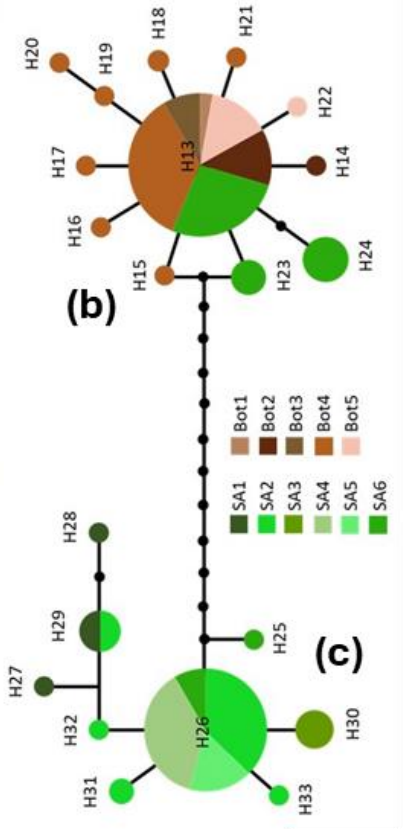
Mitochondrial sequencing

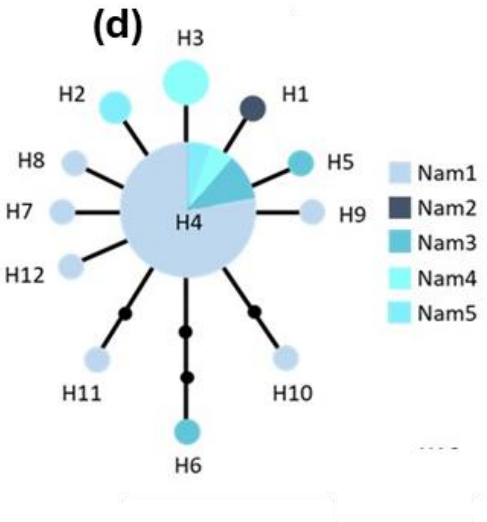
Genome wide sequencing (RAD-seq)

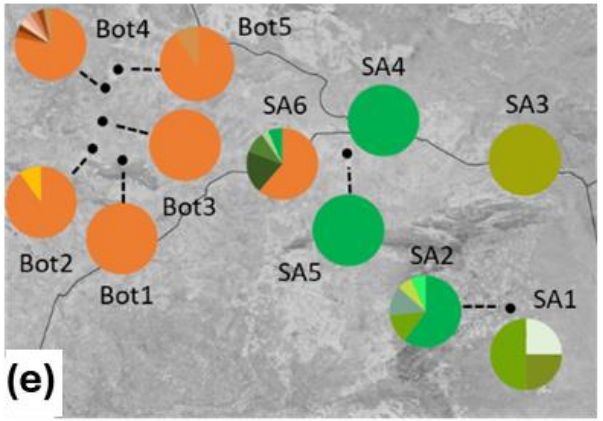






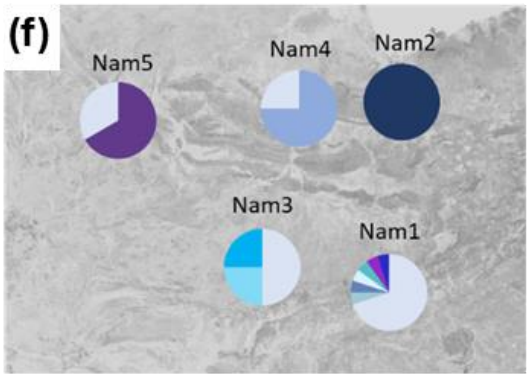






Limpopo River Basin
(Botswana/South Africa)

H13 H15 H17 H19 H21
H14 H16 H18 H20 H22
H23 H25 H27 H29 H31 H33
H24 H26 H28 H30 H32

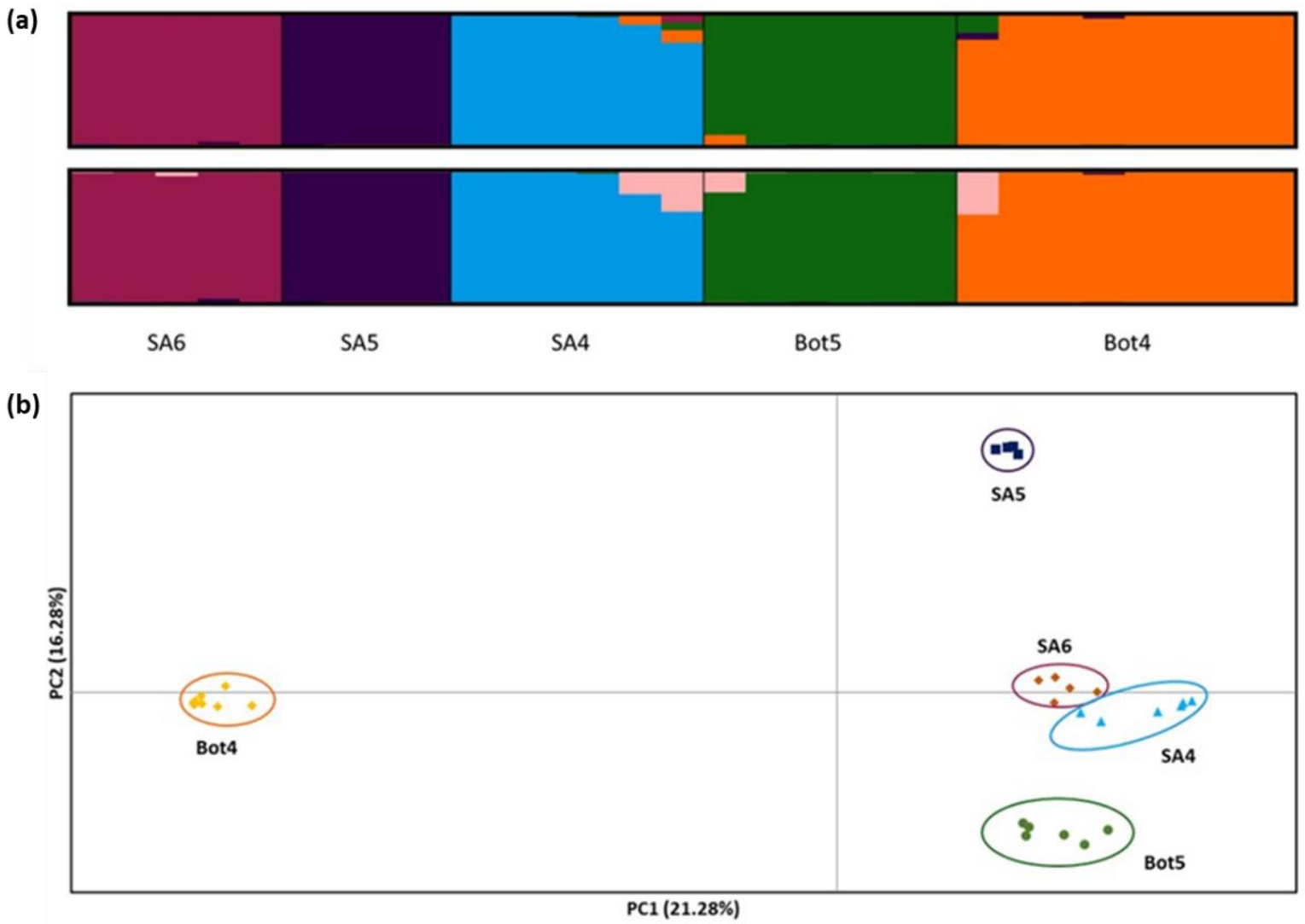


North central Namibia

H1 H3 H5 H7 H9 H11
H2 H4 H6 H8 H10 H12

Mitochondrial DNA take-aways

- Strong phylogeographic structure at the broad
- Genetic diversity varies among sites
- Lowest genetic diversity in Botswana
- Contact zone at the Bots-SA border
- Isolated populations with limited gene flow in the Limpopo River Basin



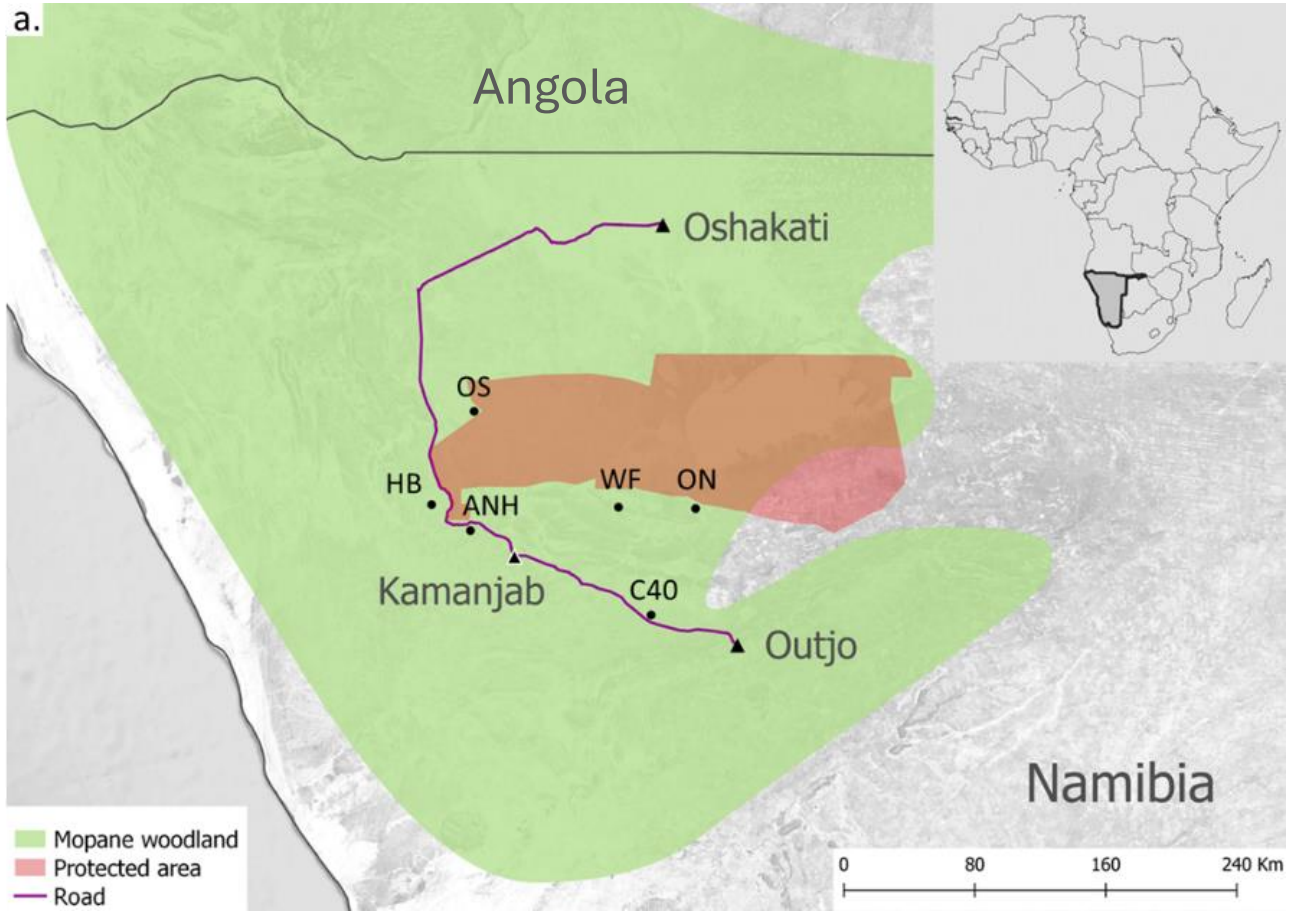
Nuclear DNA take-aways (only performed for SA and Bots)

- Strong genetic differentiation
- Unique gene pools in some sampling areas
- Low genetic diversity in all areas
- Alarmingly small effective population size
- Signs of recent bottlenecks

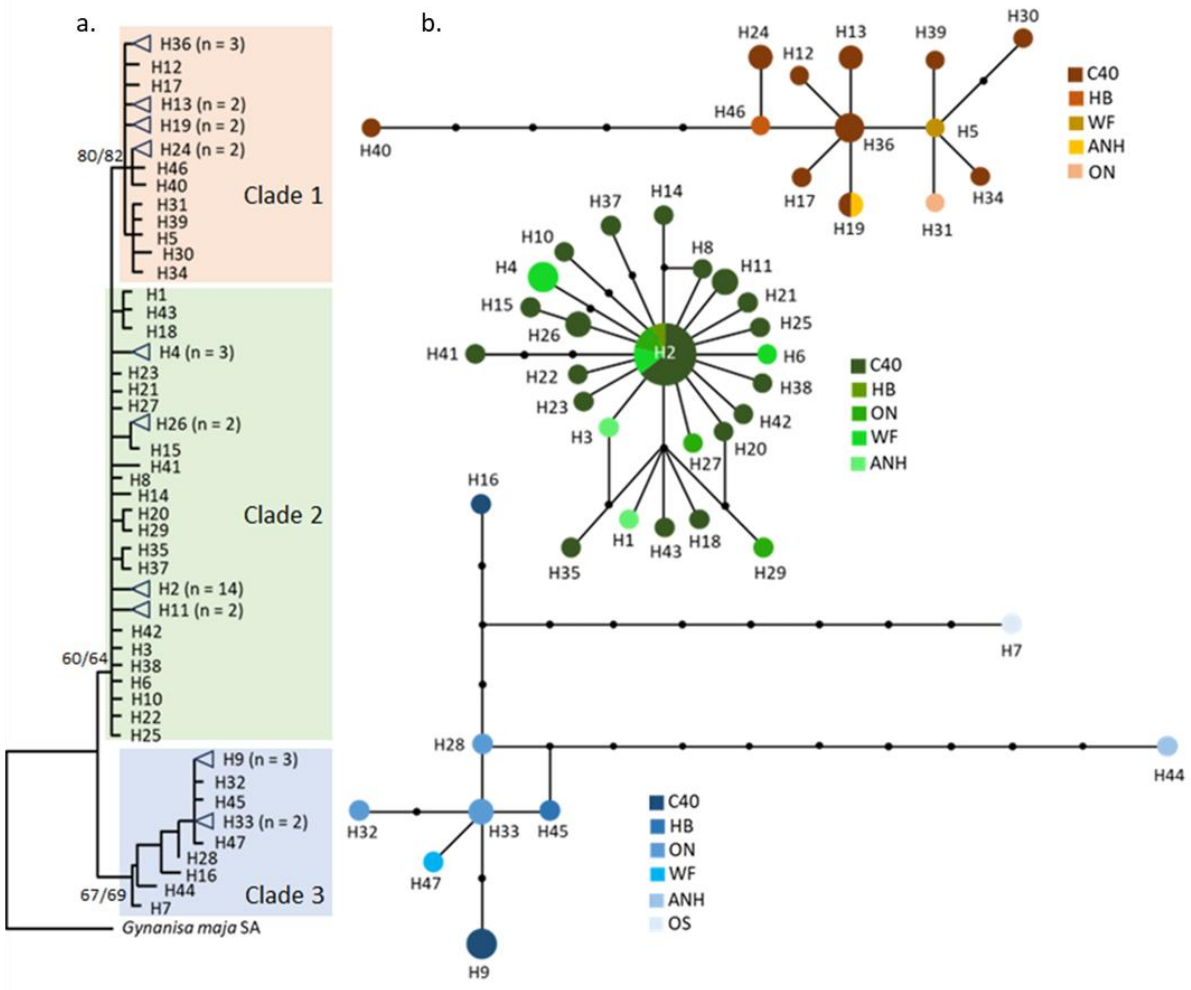
Gynanisa maja

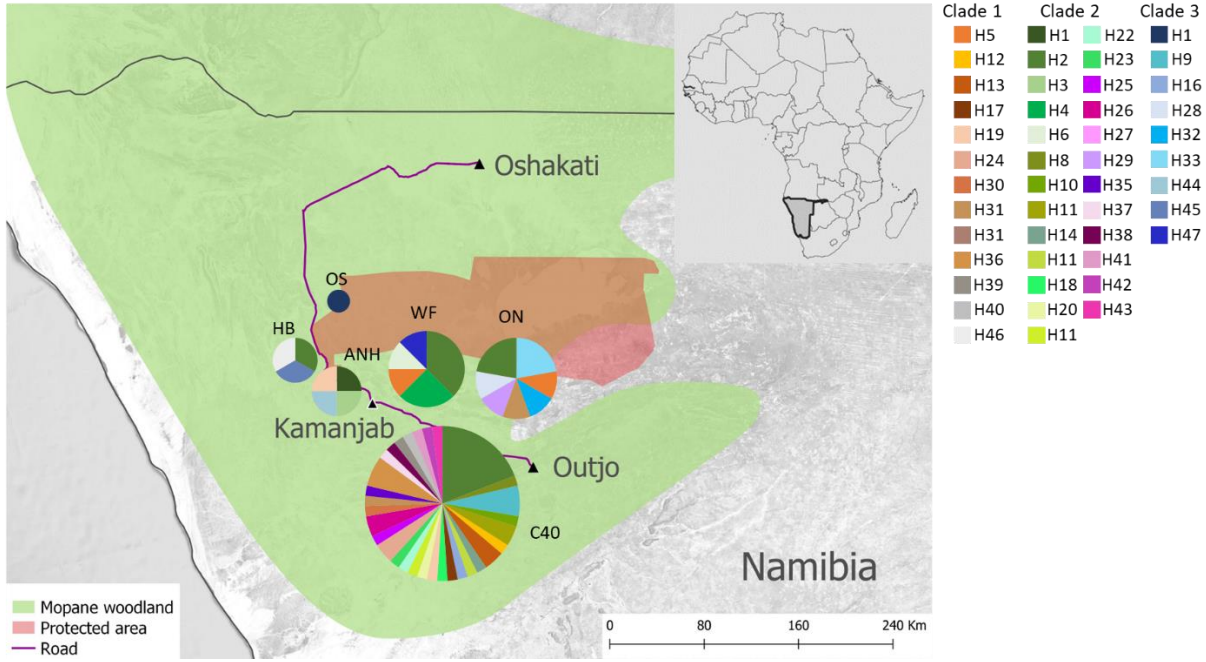
Northwestern Namibia (six sampling sites; n = 72)

Mitochondrial sequencing



Total of 47 mitochondrial haplotypes
Haplotype diversity across individual sampling sites is high (0.86 – 1.0)
Low genetic differentiation between sampling sites
Population expansion





What does this mean for mopane worm conservation?

Both species

- Main habitat is mopane woodlands
- Impacted by natural cycles of population abundance and crash

***Gonimbrasia belina* in Botswana and South Africa**

- Population fragmentation, low effective population size, decreased genetic diversity, recent bottle necks

***Gynanisa maja* in Namibia**

- Panmixia, high haplotype diversity, possible population expansion

Future work

- Monitoring over time is necessary for reaching definitive conclusion
- Sampling across in wider areas is necessary (e.g. *Gy. maja* in Zambia and *G. belina* in Zimbabwe)

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Mitochondrial genomes and polymorphic regions of *Gonimbrasia belina* and *Gynanisa maja* (Lepidoptera: Saturniidae), two important edible caterpillars of Southern Africa

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PeerJ

Mitogenomics and phylogenetics of twelve species of African Saturniidae (Lepidoptera)

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Pre-print

Multimarker genetic analyses of Gonimbrasia belina, the most harvested wild edible insect of mopane woodlands in southern Africa supports concerns over the sustainability of the species

GENETICS | INVERTEBRATE | MOLECULAR GENETICS | SEQUENCING | TERRESTRIAL

Zwannda Nethavhani, Ruan Veldtman, Casper Nyamukondiwa, William Versfeld, Barbara van Asch

Under review

INTEGRATIVE CONSERVATION Open Access

XTBG

Genetic diversity and phylogeographic structure of the edible caterpillars of Gynanisa maja and implications for the sustainability of the species in Namibia

Ongoing and future/necessary work on *G. belina*

Ecology & Biology

University of Venda

- Frass
- Soil nutrients

Needed

- Mopane woodlands
- Diapause
- Pests and diseases
- Climate change impact
- Outbreak dynamics
- Other species

Socio-Economy

Updates needed

- Market size
- Regulations
- Harvesters & traders
- Traceability

Genomics (my lab)

- Complete genome
- Pangenome
- Microbiome

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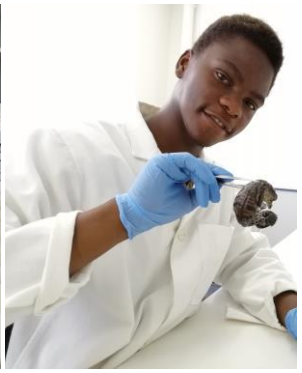
Alex Dijkerman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Thank you

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