Mopane Worm Farm, Maunatlala, Botswana

Workshop March 19-21, 2002

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Aims and summary of results.

A) **To establish a pilot Mopane worm farm in collaboration with the Kgetsie ya Tsie community organisation**.

Mopane worm farm established see details in report August 2001.

B) **To develop appropriate pupating, breeding and rearing facilities**.

Appropriate pupating, breeding and rearing facilities have and are being developed, for details see report August 2001.

C) **To determine for how long pupae Remain viable, and which pupation substrate(s) yield best results**.

Hatching time noted after pupae subjected to different conditions (fridge, oven, shadehouse and "normal hut" conditions).

Number of years pupae viable

	Season one		Season two		Season three	
Brood & Season	FirstH. 2000/2001	SecondH. 2000/2001	F.H. 2001/2002	S.H. 2001/2002	F.H. 2002/2003	S.H. 2002/2003
	Wild pupae	hatching	hatching	hatching	not finished	
		Own pupae	hatching	hatching	not finished	
			Own pupae	hatching	not finished	
				Own pupae	not finished	
				Wild pupae	not finished	

Pupae can probably survive for at least two years.

Fridge and oven experiment

Pupae were subjected to different lengths of time in the fridge and oven. The table below shows the results obtained.

The number of days each test group of 10 pupae were kept at a cool temperature (average fridge temperature 11.23^{0}C) followed by a warm temperature (average oven temperature 32.67^{0}C). The number of pupae hatching is for the season that followed.

Number of pupae	days at 11^{0}C	days at 32^{0}C	Hatching
10	2	5	2
10	2	10	6
10	4	5	5
10	4	10	9
10	8	5	9
10	8	10	9
10	16	5	10
10	16	10	9
10	32	5	8
10	28	14	8
10	control	control	8

Substrate

Different soil types were used for pupation and pupal survival recorded (see August report). Substrate did influence survival but results compounded by deaths by 'virus', substrate is still likely to be of importance in mopane worm production. This year we also tested, pit sand and river sand and the use of boxes and drums (again virus a major problem).

D) **To identify methods for ensuring a more reliable harvest from the second generation in each season.**

Egg production

1. Hand mating; so far no success
2. Females in boxes; occasionally mate, but success rate low.
3. Females in bags; occasionally mate, but success rate low.
4. Females in egghouse;
    a) hatching within egghouse (working well but difficult to monitor experiments and control releasing of males and females),
    b) hatching within boxes and releasing into egghouse (works quite well).
5. Females in shadehouse;
    a) hatching within shadehouse (working well but difficult to monitor experiments and control releasing of males and females),
    b) hatching within boxes and releasing into egghouse (works quite well).
6. Females under shadecloth in shadehouse (not very succesful).

There are difficulties in getting males and females to mate. At the moment the most successful is having the adult moths in the shadehouse and egghouse.

Preventing egg parasitism

1. Eggs in containers. Eggs collected from egghouse and shadehouse and placed in containers until hatched then moved to plants.
2. Eggs pinned to leaves, within bag. Larvae moved to trees one day after hatching.
3. Eggs stapled to leaf, within bag. Larvae moved to trees one day after hatching.

Stapling egg masses to leaves has been the most successful and is an easy method of getting first instar larvae onto Mopane trees.

Larval mortality

1. Larvae outside. Only under ideal conditions (deaths occur due to disease, heat and predators).
2. Larvae in bags. Until end of 2^{nd} or 3^{rd} instar but not if conditions sunny and hot.
3. Larvae in egghouse. Watered, but high mortality due to virus in 2^{nd}, 3^{rd} & 4^{th} instars.
4. Larvae in shadehoue. Possibly the best under severe conditions, watering difficult to judge but not generally successful.
5. There is very high larval mortality under all conditions due to viral infection which is seen as one of the major problems in mopane worm production.

Pupal mortality

1. High pupal mortality probably due to virus.
2. Wild pupae killed by Chalcid wasp, pupae need to be protected to prevent spread of Chalcid.

Other points of interest

Moths hatch from October through to March, but have two peek hatching periods.

There may be a possibility of selecting for early hatching moths.
Parasites and diseases build up during the rainy season.

E) **To determine the best stocking density for rearing larvae.**

Mortality of larvae at differing densities is being investigated (various densities have been used but two densities looked at in more detail are 100 and 200 larvae per block). This has again been hampered due to a large number of deaths from viral attack. At present just trying to keep larvae going. Results also influenced by the dry conditions.

F) **To discern the best age at which the larvae can be released onto Mopane trees**.

Experiments have been carried out to see when larvae should be released from bags or placed outside. The results are compounded by the dry conditions and viral diseases.

Under rainy conditions can be released from bags at end of second instar or from shade house during 3rd instar.

With no rain, can be kept in bags under shadecloth, released at second instar into shadehouse.

G) **To develop a simple formula for calculating ideal worm populations for given sizes of trees.**

Not practical, every tree is different, no simple formula to calculate tree size, or leaf area. It is practical to work within a certain tree height.

Possible means of viral prevention
1. Having two areas for breeding, if virus load becomes heavy area closed down.
2. Keeping parts of farm free from mopane worms, for two or three seasons.
3. Coppice trees.

Comments

Local people knew little about the biology of *Imbrasia belina*, and through this project have now greatly improved their knowledge. For example, it was believed that parasitoid wasp eggs were ants and were needed for the eggs to hatch, and many people were not aware that the adult moth was derived from the pupae or larvae.

Production of mopane worms each season would help to stabilize the market and allow a constant yearly income for rural suppliers. There are a few problems with mopane worm production, the most important being the high mortality due to viral attack. There have been important findings in the studies so far conducted and methods of production are being developed. The influence of viral infections could prevent this part of the project from being viable and requires more research and investigation. It is likely there will be inadequate funding and time available for the problem of viral attack to be completely overcome.