Mauritius Research Council

Control of *Stomoxys nigra* Macq. (Muscidae: Diptera) in Mauritius

Final Report: Phase II

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Agricultural Research and Extension Unit

Control of *Stomoxys nigra* Macq. (Muscidae: Diptera) in Mauritius

End of Project Report
Phase II
2002-2006

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Introduction

The *Stomoxys* fly is blood sucking fly of livestock in Mauritius. During summer months, high temperatures cause a seasonal increase in fly abundance and activity in humid and super humid areas where adult flies (due to their biting habits) cause great nuisance to deer. Members of Meat Producers' Association (MMPA) consider this pest a threat to deer farming and they had estimated an annual shortfall of about Rs 1 million rupees due to the pest.

The Entomology Division in collaboration with MMPA undertook a project to improve fly control in ranches. This project was partially financed by Mauritius Research Council (MRC).

The study consisted of 2 phases:

1. Development of a trapping system in deer ranches (1999 – 2001)
2. Setting up of a laboratory for MMPA to produce their own parasitoids for releases in sugar can fields around their ranches (2002 – 2006)

(1) Development of a trapping system in deer ranches during Phase I (1999 – 2001)

The efficacy of insecticide-impregnated targets and Nzi trap with and without host odours (octenol, butanone, and cow urine) against flies was tested in deer ranches.

Insecticide-impregnated targets were not effective against adult flies. Whereas the Nzi trap caught comparatively higher numbers (510 flies/day) and did not have adverse effects on beneficial insects. Octenol, butanone and cow urine (host odours) incorporated in traps, did not increase catches.

The Nzi trap is being used in ranches affected by *Stomoxys* flies.

(2) Setting up of a laboratory for MMPA to produce their own parasitoids for releases in sugar can fields around their ranches during Phase II (2002 – 2006)

The project was initiated in June 2002 with an objective to set up a laboratory for MMPA and give technical assistance to MMPA that would eventually run the laboratory on its own.

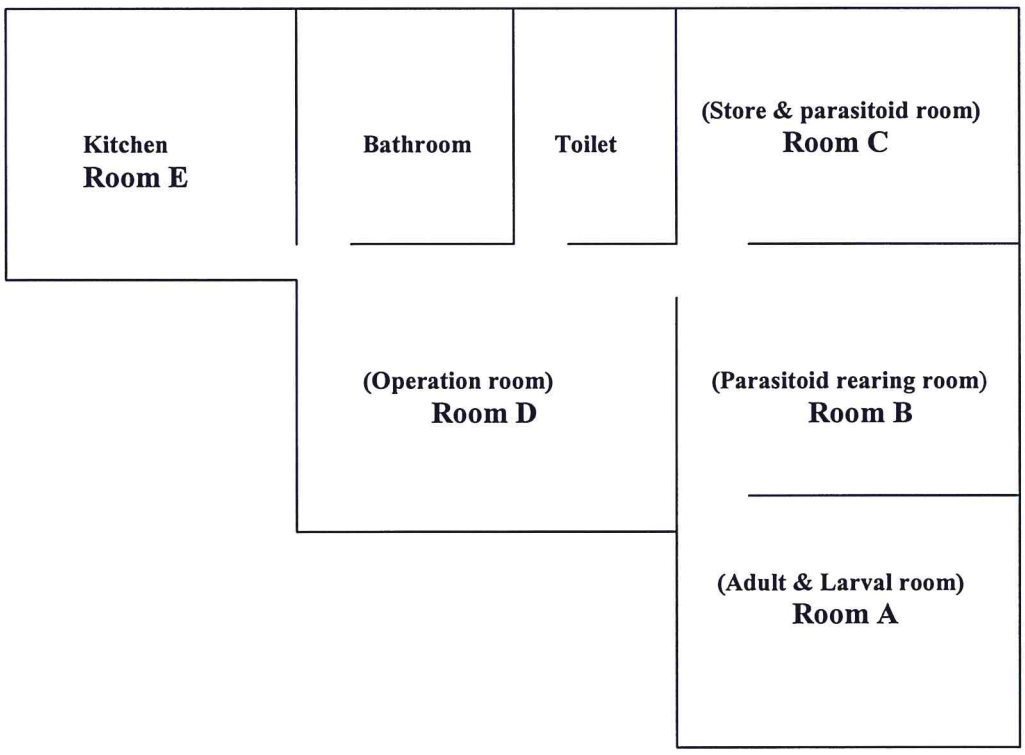
Activities that were implemented were:

1. Identification of appropriate site/building
2. Training of personnel of MMPA
3. Setting up of a laboratory colony
4. Production and delivery of parasitoids
5. Releases of parasitoids

(1) Identification of appropriate site/building

MMPA provided a building of about 720 square feet at Olivia. By December 2002, renovation of the building was effected by Deep River Beau Champ Sugar Estate. The building was made insect proof and split into an adult/larval room, parasitoid room, Kitchen, store and operation room (Figure 1).

Figure 1. Site Plan of Insectarium for *Stomoxys* and its Parasitoids at Olivia



Renovation work included:

1. Painting of building (interior & exterior)
2. Electrical & water installation
3. Insect proofing of building
4. Construction of stands
5. Making of cages for *Stomoxys* and parasitoids

(2) Training of Personnel of MMPA

One personnel from MMPA underwent training on rearing of *Stomoxys* and parasitoids at the Entomology Laboratory of AREU from 15 October 2002 to January 2003.

During the 3 months, the worker was trained on the various rearing techniques and became very familiar with the daily activities (Appendix 1). He has trained another worker and is actually running the laboratory under the supervision and control of the Secretary of the MMPA. .

(3) Setting up of a laboratory colony

Equipment required for rearing of parasitoids was purchased and the laboratory became fully functional as from 30th January 2003. By March 2003, about 139,000 parasitoids (*Trichopria* sp.) were produced. The production was gradually increased from month to month as per the increasing demand of parasitoids by MMPA members. Thus there had been a significant increase in parasitoid production from 2004 to 2006) (Table 1)

Table 1. Approximate number of parasitoids produced in the Olivia laboratory during 2003 and 2006

Month	**Year**			
	2003	**2004**	**2005**	**2006**
January		865,038	1,106,308	1,607,481
February		585,519	953,308	1,145,538
March	139,269	499,212	1,204,385	1,330,904
April	230,481	867,000	1,072,962	1,354,442
May	293,250	1,040,596	1,252,442	
June	222,635	817,962	1,364,250	
July	277,558	1,222,038	1,774,212	
August	256,962	1,167,115	1,673,192	
September	871,904	1,124,942	1,593,750	
October	1,009,212	1,371,115	1,572,173	
November	844,442	1,574,135	1,870,327	
December	752,250	1,377,000	1,869,346	
Total	**4,897,962**	**12,511,673**	**17,306,654**	**5,438,365**

Delivery of Parasitoids

Initially, about 32,365 parasitoids were delivered to MMPA members as from March 2003. During peak fly season, up to 1 million parasitoids were delivered (Table 2).

Table 2. Approximate number of parasitoids delivered to MMPA members during 2003 and 2006

Month	Year			
	2003	**2004**	**2005**	**2006**
January		296,192	836,596	1,085,712
February		341,308	614,942	879,750
March	32,365	396,231	872,885	921,923
April	167,712	357,000	532,558	700,269
May	173,596	412,904	634,558	
June	101,019	349,154	650,250	
July	90,231	455,077	660,058	
August	114,750	604,154	951,346	
September	306,000	660,058	994,500	
October	439,385	485,481	1,044,519	
November	376,615	961,154	910,154	
December	455,077	927,808	1,101,404	
Total	**2,256,750**	**6,246,519**	**9,803,769**	**3,587,654**

(4) Release of Parasitoids

MMPA members were trained on the procedure to make parasitoid releases in the field.

They were advised to follow the methodology mentioned below:

1. Observe weather conditions for releases (i.e. fine weather)
2. Remove upper thrash at about a depth of 5 cm
3. Check presence of ants that will predate on parasitised pupae
4. Check for presence of larvae and pupae of *S. nigra* in decaying thrash
5. Release one jar of parasitoids (containing 10,000 parasitoids) at 2 selected sites (split the contents of jar into 2 parts, each containing about 5,000 parasitoids).
6. Place parasitised pupae in thrash with the small piece of sponge soaked in 10% honey solution.
7. Cover the pupae with the thrash to avoid direct exposure to sunlight
8. Remove adult parasitoids gently with the covering cloth
9. Make releases at 0.5 km from ranch boundary. Releases to be made around the boundary i.e. if 1st release is made at a point and the next one should be about 0.5 km from the previous, keeping in mind the 0.5 km from boundary ranch (Appendix 3).
10. Follow the schema to make releases around ranches

Conclusion

The project's objectives have been attained. During phase I, a trapping system was developed to mass capture *Stomoxys* flies in ranches during peak fly season. Traps are being widely used in ranches.

During phase II, a laboratory for mass production of parasitoids has been successfully established at Olivia for MMPA. The laboratory is capable of adjusting parasitoid production whenever required to satisfy demand of MMPA members. This represents a successful case of technology transfer to the private sector.

Members of MMPA have witnessed the successful control of stable fly in ranches (eg L'Etoile) as a result of regular releases of parasitoids. The production of parasitoids is increasing from year to year.

Members of MMPA will continue to use traps in deer ranches and to effect regular release of parasitoids in sugar cane fields around deer ranches to achieve control of *Stomoxys*.

Acknowledgement

Authors are grateful to MRC for funding the project partially and to members of MMPA for providing facilities to conduct research on their ranches during the first phase. They also extend their gratitude to the Director of AREU and to the Manager of Deep River Beauchamp Sugar Estate for their support.

Appendix 1. List of operations in rearing of *Stomoxys* flies in laboratory

1. Feeding of adult *Stomoxys* (twice per day)
   Blood is warmed in a water bath. A sponge (6 cm x 6 cm x 1 cm) is dipped in the warm blood and placed on top of a fly cage. After 30 minutes, the sponge is removed and washed. The top of the cage is also cleaned.
   Feeding is normally done twice a day (at 730 hrs & 1230 hrs) except on Saturdays & Sundays (2^{nd} feeding done at 1030 hrs).
2. Preparation of an egg laying pad
   Mix about 125 g wheat bran, 1000 g shredded grass & water.
3. Placement of egg laying pads
   Prepared laying pads in petri dishes are placed under adult cages
   Female flies start laying on the 5^{th} day after emergence.
4. Removal of egg laying pads.
   Laying pads are removed daily and replaced by new ones
5. Egg seeding
   About 2000 eggs are placed in a tray containing 1000 g of a mixture of wheat bran and grass as above to which 5 mL of stock solution of formalin is added.
   The stock solution is prepared by adding 10 ml of 40 % formalin to 990 mL of water.
   The trays are covered with a cloth material.
6. Larval rearing
   Trays (seeded with eggs) are dated and placed in the larval room. The optimum temperature for adult and larval rearing is 25 °C – 27 °C.
   In winter when temperature is low, a heater is used to warm the room.
   On the 4^{th} day after egg seeding, 500 g of larval medium is added to the trays. If water is not enough in the trays (medium is drying), about 150 mL is added.
   On the 7^{th} day, the texture of medium in tray is checked again & water is added.
7. Collection of pupae
   On the 12^{th} day, pupae are collected by "float system". The medium containing pupae is submerged in water. The pupae would float and can be easily collected.
   Whenever many larvae have not formed pupae on the 12^{th} day (in winter), the trays are held until complete pupation.
8. Collected pupae are allowed to dry and are cleaned. Cleaned pupae are measured with a measuring cylinder and recorded in a production book.
   The volume of a sample of 100 pupae is measured to calculate the number of pupae produced.
9. Adult rearing
   2000 pupae are placed on a moist sponge in a cup/cage for adult emergence.
10. An insect cage is kept for about 10 days.

Appendix 2. List of operations in rearing of parasitoids of *Stomoxys* flies in laboratory

Two species of parasitoids are reared namely *Trichopria* sp. (pupal parasitoid) and *Tachinaephagus stomoxicida* (larval parasitoid).

Rearing of *Tachinaephagous stomoxicida*

1. Collection of larvae
   On the 7th day after seeding eggs in medium, mature larvae are removed from trays together with some grass medium.
2. Collected larvae are placed in perspex cages and newly emerged *Tachinaephagus* adults are released in the cage. A sponge dipped in10% honey soln is placed in cage. The larvae are removed from the parasitoids after 48 hours and allowed to pupate.
3. Collection of pupae
   On the 12th day the pupae are collected from the medium as in operation 8 above.
   The total volume of parasitised pupae is measured as method described above.
   A sample of 100 pupae is measured for calculation of number of parasitised pupae.
   The sample is kept aside for observation. The number of flies (N) and parasitoids emerged (P) is counted. The number of unemerged pupae (U) is also counted.
   % parasitism = [100 – (N + U)]/100 ..... (1)
   Number of parasitoids per pupa = P/[100 – (N + U)].....(2)
   From (1) & (2) the production of parasitoids can be calculated.

Rearing of *Trichopria* sp

Collection of pupae

1. On the 7th or 8th day freshly formed pupae (white or pale reddish brown in colour) are collected and put into contact with adult *Trichopria*.
2. Feeding of adult parasitoids & collection of pupae & estimation of parasitised pupae is done as per method described in procedures for *Tachinaephagus* rearing.

Sanitation

All insect cages, larval trays, tray covers, jars, sponges etc should be washed and disinfected before use.

Requirements

1. Larval medium

It consists of elephant grass/or green sugar cane top and wheat bran.

Elephant grass/or green sugar cane top is cut from field and shredded at the Entomology Division.

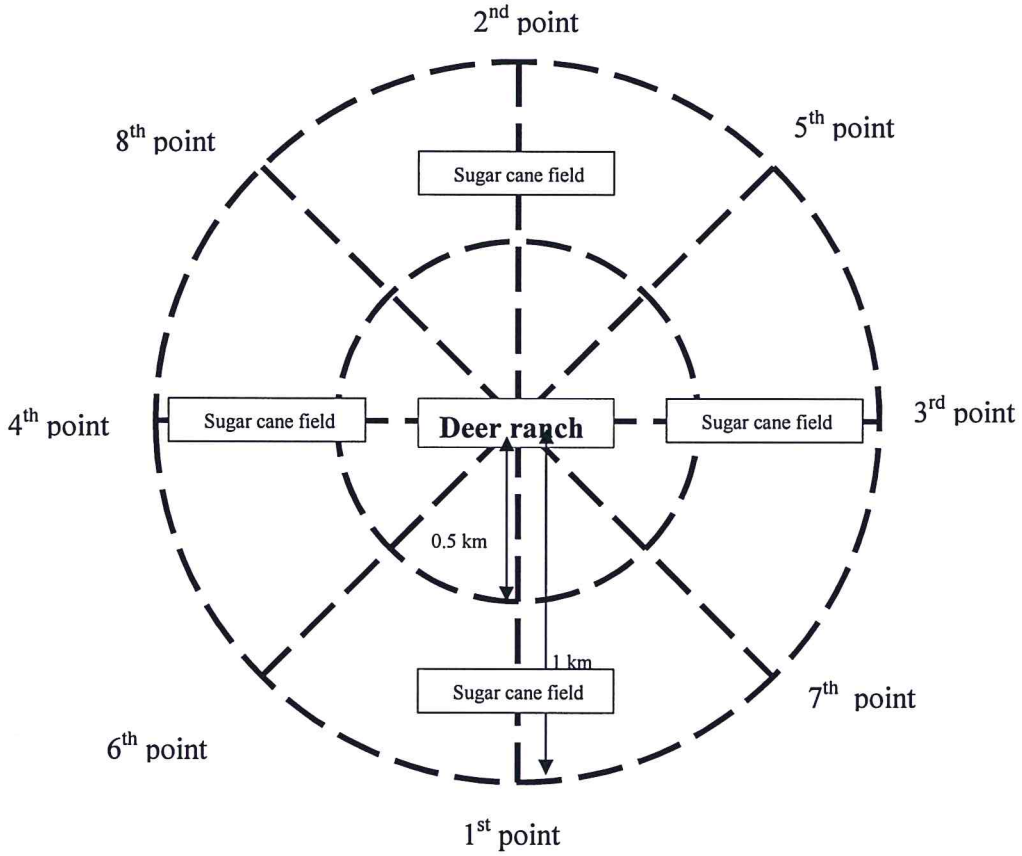
2. Bovine blood

Blood is collected from the slaughter house at Roche Bois). At the time of blood collection, sodium citrate is (10 g/L of blood) is added to prevent coagulation. It is important to stir the blood well to assure complete mixing of sodium citrate.

3. Preparation of sodium citrate solution

Dissolve 100 grams of sodium citrate in one litre of water.

Appendix 3. Schema for release of parasitoids of *Stomoxys nigra* in sugar cane fields



5,000 parasitoids at 1 point of release
(about 500 to 600 parasitised pupae) at 15-21 days interval)

N.B. 1st round of release on 0.5 km from ranch & 2nd at 1 km