AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523
BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY
Batch 72

1. SUBJECT CLASSIFICATION
A. PRIMARY: Food production and nutrition — AL7200000-G100
B. SECONDARY: Pests of animals--Africa

2. TITLE AND SUBTITLE
Report of tsetse fly investigations

3. AUTHOR(S)
(101) U.S. Agr.Research Service; Agr.Research Council of Central Africa

4. DOCUMENT DATE: 1966
5. NUMBER OF PAGES: 40p.
6. ARC NUMBER: ARC

7. REFERENCE ORGANIZATION NAME AND ADDRESS
USDA/ARS

8. SUPPLEMENTARY NOTES *(Sponsoring Organization, Publishers, Availability)*

9. ABSTRACT

10. CONTROL NUMBER
PN-RAB-725

11. PRICE OF DOCUMENT

12. DESCRIPTORS
Tsetse flies
Insect control
Africa
Research

13. PROJECT NUMBER

14. CONTRACT NUMBER
PASA RA-1-00 Res.

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

THIS DOCUMENT HAS BEEN EVALUATED AS SUBSTANDARD COPY FOR ROUTINE REPRODUCTION. EFFORTS IN AID/W TO OBTAIN A MORE ACCEPTABLE COPY OF THE DOCUMENT HAVE NOT BEEN SUCCESSFUL. DESPITE THIS DISADVANTAGE, WE HAVE CHOSEN TO REPRODUCE THE DOCUMENT BECAUSE OF THE SUBJECT TREATED AND TO MAKE THE DISCERNIBLE INFORMATION AVAILABLE.

9774 -MRA copy

Report of Tsetse Fly Investigations - 1966 (1)

Insects Affecting Man and Animals Research Branch
Entomology Research Division, ARS, USDA
and
Agricultural Research Council of Central Africa

SIXTH PROGRESS REPORT

Period: January 1, 1966 to June 30, 1966
Location: Salisbury, Rhodesia

Not for publication without prior approval of the Entomology Research Division and the Agricultural Research Council or for use in sales promotion or advertising which expresses or implies endorsement of the product by the Division, the U.S. Department of Agriculture, or the Agricultural Research Council.

SUMMARY

STUDIES ON THE REPRODUCTIVE BEHAVIOR OF GLOSSINA

Location: Salisbury
Investigators: D.A. Dame, D.R. Birkenmeyer, C. Mousley, L. Tsoka, F. Chayambuka

Normal G. morsitans survival and reproduction in control cages were 21-33% lower than during the previous period. These reductions were consistent with observations that field-collected stock is of inferior quality during the months covered (October-November). (p.5)

Preliminary tests indicate that G. morsitans pupae may be stored for 1 week at 8-16°C or for 2 weeks at 12-16°C without serious loss, but further evaluation is needed to determine the quality of the resulting flies. (p.5)

In standard laboratory cages the flight activity of G. morsitans males declined over a 6-day period by 31% while female flight activity increased by 33%. Further testing is needed to show whether these changes (1) are actually in flight ability or are merely due to changes in phototaxis and (2) differ from changes in the natural population. (p.6)

G. morsitans Colony I has gained strength during the 55th - 76th week. A new G. morsitans colony (II) is producing pupae at a rate which should allow for self-perpetuation and increase in numbers during filial generations. The G. pallidipes colony initiated in November, 1965 is failing rapidly. (p.7)

CHEMOSTERILIZATION OF GLOSSINA

Location: Salisbury
Investigators: D.A. Dame, D.R. Birkenmeyer, C. Mousley, L. Tsoka, F. Chayambuka

Tepa and metepa batches held for up to 18 and 6 months, respectively, were as effective as fresh batches when tested by injection into G. morsitans males. (p. 12)

Permanent sterility occurred in G. morsitans males exposed ad libitum to 25 mg./sq. ft. of metepa or in the wind tunnel to 1.0 ml. of 5% tepa. Reduced longevity following the latter treatment may have been due to inferior quality of field-collected G. morsitans. (p. 12)

Results with topical applications of 0.5 ug. metepa in 0.5 ul. methyl-ethyl-ketone refute the basis of reports that metepa is an unsatisfactory sterilant for G. morsitans. (p. 12)

Injection of sterilants into G. pallidipes males resulted in complete sterility with 1.0 ug. tepa and 5.0 ug. metepa. These dosages sterilized G. morsitans in previous tests. (p. 13)

Permanent sterility was induced in 2-day old G. pallidipes males by 6- minute exposure to 10 mg./sq. ft. of tepa or metepa. Wind tunnel exposure to 0.25 ml. of 5% metepa failed to cause permanent sterility. (p. 14)

G. pallidipes males treated when 2 days old by 30 minute exposure to 10 mg./sq. ft. of metepa or 0.25 ml. of 5% tepa in the wind tunnel were competitive, but other treatments resulted in a reduced production which varied from the expected reduction by more than 10%. (p. 14)

LONG ISLAND POPULATION STUDIES

Location: Kariba
Investigators: D.A. Dame, R.J. Phelps, A.M. Simmonds

During the period from December 1965 through March 1966, over 19,000 individual observations of G. morsitans were made in the Long Island area. No flies were detected moving from the mainland to Long Island; 2 moved from Long Island to the mainland and 1 to Middle Island. Lack of apparent migration was very encouraging because this period offerred optimum conditions for tsetse migration. (p. 15)

Flyround estimates in the Long Island area indicated a slight, gradual increase in G. morsitans population from November 1965 to March 1966. (p. 18)

Formal survey operations on Long Island resulted in Lincoln Index population estimates of approximately 4,100 and 3,000 males per square mile in November and February, respectively. Statistical analysis of the survey data agreed with the August and November 1965 estimate, but provided a higher estimate for February 1966. In addition, the statistical analysis provided estimates of birth and survival rates for G. morsitans males on Long Island. Calculations based on these analyses indicate that a single insecticide application will not reduce the Long Island population to numbers consistent with a practical male release program. It is likely that more than one insecticide application will be required. (p. 18)

Sampakaruma Island in Lake Kariba 10 miles west of Long Island has been selected as a control area for the proposed sterile male release program. (p. 22)

The game population is being studied on Long Island in an attempt to elucidate game-tsetse relationships. The trypanosome infection rate in G. morsitans males was 8.3% on Long Island and 3.8% on Sampakaruma Island. (p. 22)

The monthly percentage of nulliparous G. morsitans females at Chirundu ranged from 26 to 56, and 0 to 37 at Kariba during the period August 1965 through March 1966. Over the period 67% of the nullipars were inseminated and the insemination rate for parous females ranged from 95 to 100%.

Analysis of wingfray determination with G. morsitans females indicated that most females in wingfray categories 4, 5, or 6 (heavy wing damage) can safely be designated as parous; however, it is not possible to separate nulliparous from parous females on the basis of wingfray categories 1, 2, or 3 (light wing damage). (p. 23)

LARGE CAGE REARING STUDIES

Location: Chirundu
Investigators: R.J. Phelps, E. Hajdu, R.B. Borthwick

After modifications to the shelters in the large cage, a further longevity trial was conducted, using oxen as the food source. The longest record of life obtained was 16 days, and, as in previous trials, the majority of flies disappeared soon after release in the cage. Further modifications are now being made in the cage. (p. 24)

VERTICAL-CAGE REARING STUDIES

Location: Chirundu
Investigators: R.J. Phelps, E. Hajdu

As a preliminary to construction of a cage enclosing an entire tree, a tubular cage 30 feet long and 3 feet in diameter has been made. It will be suspended next to a tree trunk, and records will be made of distribution of flies in particular regions of the cage. (p. 24)

PUPAL SEARCHING

Location: Chirundu
Investigators: R.J. Phelps, E. Hajdu, R.B. Borthwick, F. Wilson, J. Paget

Difficult conditions in the field during the rains prevented collection of larger numbers of pupae. The searchers were employed most of the time in collecting adult flies for cage studies. A total of 79 pupae were collected, the number being too small to indicate site preference. (p. 24)

FLYROUNDS

Location: Chirundu
Investigators: G.J. Dean, J. Paget, F. Wilson

Routine weekly estimates of apparent densities of non-teneral male G. morsitans showed a decrease from November to December which continued during the wet season. Densities rose again in April but declined in May. Apparent densities of G. pallidipes varied between zero and eight. Sampling along the majority of the sectors on these flyrounds was discontinued at the end of May except for those sectors associated with trials using cattle paddocks. The data from May 1964 to May 1966 will be given to the biometrics team for analysis. (p. 26)

CONCENTRATION OF TSETSE IN NATURAL HABITATS

Location: Chirundu
Investigators: G.J. Dean, J. Paget, F. Wilson

The grid of 11 oxen in riverine-mopane ecotone failed to produce a permanent concentration of G. morsitans and has been discontinued. A five-acre paddock containing 15 oxen and a one-acre paddock with 6 oxen have been started near the Mwangu River and Camp River, respectively, in a further attempt to concentrate tsetse in a natural habitat. Routine weekly sampling of flies caught off an ox show that fly densities decreased during December and January and then gradually increased up to May. Densities are higher in the riverine-mopane ecotone than in adjacent mopane, Combretum/mopane and mopane/Vangueria/Kirkia habitats. (p. 26)

SURVIVAL OF G. MORSITANS IN A SMALL CAGE

Location: Chirundu
Investigators: G.J. Dean, J. Paget, F. Wilson

The layout of the present small cage has been described. The climates obtained in this cage, the Constant Environment Room, an adjacent Stevenson screen and in a Stevenson screen in the riverine-mopane ecotone along the Mwangu River have been compared, and show that the Mwangu River area is cooler and more humid than the area around the small cage, and the latter is cooler and more humid than the outside air. The Constant Environment Room maintains a fairly constant and favorable climate similar to that used in the Salisbury insectaries. Male tsetse survival was poor in January to February but improved from March to May and was better in small cages than in large cages. Life spans were longer in the large volume of the CE Room than in the "wicker" cage, while flies in small cages in the wicker cage generally lived longer than those in the CE Room. (p. 27)

COMPETITIVENESS OF RADIO- AND CHEMO-STERILIZED FLIES

Location: Chirundu
Investigators: G.J. Dean, D.A. Dame, J. Paget

The small cage has been repaired and is ready for a new series of trials in June and July. (p. 28)

ESTABLISHMENT OF A SUPPLY COLONY OF G. MORSITANS AT CHIRUNDU

Location: Chirundu
Investigators: E.J. Hajdu, G.J.W. Dean, J. Paget

Initial trials were concerned with longevity in the Constant Environment Room. Due to difficulty in locating living and dead flies in the large cage when an ox was kept there full time, a two hour per day routine for ox availability was instituted. Mortality of flies collected in the field and put in the cage was high, but better survivals were obtained from flies emerging from field-collected pupae. Most of the pupae found were located in sand filled boxes placed within the large cage, indicating selection of larviposition sites by female flies. (p. 30)

HOST PREFERENCE STUDIES

Location: Chirundu
Investigators: E.J. Hajdu, R.J. Phelps

Captured bushpigs and warthogs are being trained to act as blood donors for tsetse kept on a one fly per tube system. (p. 32)

INTRODUCTION TO TSETSE BREEDING WORK

The Resident Entomologist and the Senior Experimental Officer at the field station resigned during the period under consideration. Both have been replaced, but there was a considerable drop in the research productivity of the station during the transition period.

A new access road to the station has been completed, and it is hoped that the new route will be an all weather one. The improved transport position has continued, and the new vehicles operated well through the wet months.

Reorganization of field work resulted in less demand on stock on the station, and it was decided to dispose of 50 head of cattle. All stock on the station continue to be free from trypanosomasis.

STUDIES ON THE REPRODUCTIVE BEHAVIOR OF GLOSSINA

Location: Salisbury
Investigators: D.A. Dame, D.R. Birkenmeyer, C. Mousley, L. Tsoka, F. Chayambuka

Standard procedures and experimental conditions. Standard procedures and experimental conditions were described in Report 1965 (2):5. The laboratory was maintained at 78 ± 3°F and 70 ± 5% relative humidity. The reproductive capacity of untreated G. morsitans under standard test conditions is presented in Table 1. An average of 18.1 pupae was produced per cage with 17.6 adults successfully emerging (97%). Male and female survival were 31 and 21% less than reported for the previous period, and pupal production was down by 33%. These tests were initiated in October and November 1965; the higher mortality and lower production rate is consistent with previous observations that field-collected pupae are of inferior quality during those months (Report 1965(1):6).

Table 1.-- Reproductive capacity of 25 pairs of G. morsitans under standard test conditions.

Percent surviving 28 days: Male	Female	Percent Insemination	Number of progeny: Pupae	Adults
44	40	100	19	19
48	44	91	10	10
52	84	100	22	22
68	84	90	23	22
60	80	100	21	20
60	68	100	26	24
52	32	100	6	6
Mean 54.9	61.7	97.3	18.1	17.6

Storage of G. morsitans pupae. The storage of G. morsitans pupae could be an important factor in a sterile male program based on the release of mass produced males. It is known that pupal metabolism ceases below 4°C. Furthermore, it has been suggested that survival depends upon there being enough energy reserve in the imago not only to eclose but also to sustain flight activity for sufficient time to obtain a blood meal in the natural environment. Jursell has shown that the longer the pupal stage persists, the less likely is the imago to have sufficient energy reserve to seek a blood meal. We theorized that if the pupae could survive temperatures below the threshold of metabolic activity, it might be possible to incubate them indefinitely and still obtain viable adults when the temperature was finally raised to normal. Several tests have been conducted using field-collected pupae of unknown ages.

In 1964, several batches of 100 or more pupae were held at 3°C for 2 or 4 weeks and then brought into the standard holding conditions of the laboratory (78 ± 2°F). The survival of these pupae ranged from 0 to 8%. In another test the holding temperature was gradually reduced to 3°C by incubating pupae for 24 hours at 15°C, then at 10°C for 24 hours, 5° for 24 hours, and finally at 3° for 2 weeks. When returned to standard laboratory conditions, only 8% emerged.

In 1965, another series of pupal storage tests was initiated to determine what temperature range above 3° might be suitable. The series was initiated at 4° and each week the temperature was raised 2° until reaching a maximum of 16°C. Each week one batch of 100 pupae was maintained under standard conditions to serve as a control. Several additional batches were placed in the incubator and held for varying lengths of time before being returned to standard conditions. These tests were not replicated. The results, expressed as a percentage of the control emergence, are given in Table 2. Runts and flies which partially emerged were considered inviable and were not counted as normal emergees.

After 6 days at 4°C emergence was substantially reduced, but at higher temperatures eclosion was near normal. Normal emergence occurred at temperatures of 12 to 16°C but eclosion was not completely inhibited during incubation. These preliminary results indicate that pupal storage might be possible for at least 1 week without serious loss in numbers, but further evaluation is needed to determine the quality of the emerging flies.

Table 2.-- Emergence of normal G. morsitans adults from pupae held at varying temperatures and then returned to 26° ± 1°C (expressed as percentage of control emergence).

Starting temp. (°C)	Percent emergence after being held for indicated no. of days -- at original temp.					at original temp. + 2° increase each week			
	1d	2d	3d	4d	6d	14d	21d	28d	35d
4	96	88	79	75	62	33	0	0	0
6	109	92	117	100	88	57	12	3[a]	0
8	100	96	96	90	99	95	36	10[a]	9
10	-	86	-	90	86[a]	67	-	-	-
12	-	133	-	118	122[a]	94[a]	75[b]	-	-
14	-	104	-	97	96	96[a]	101[b]	-	-
16	-	-	-	-	100	99[a]	-	-	-

a - up to 5% eclosed while in incubator
b - 12-13% eclosed while in incubator, maximum temperature was 16°C

Table 3.-- Flight activity of 0-5 day old G. morsitans adults.

Sex	Number of flies: Initially	Finally	Percentage flying at indicated age in days: 0	1	2	3	4	5
Male	25	18	56	35	41	33	24	17
	20	18	40	50	42	37	47	40
	23	20	52	64	41	50	40	55
	16	16	50	38	50	44	62	31
	39	39	46	38	41	31	33	28
	52	49	42	51	24	51	41	29
		Mean	48	46	40	41	41	33
Female	25	21	28	32	33	30	32	52
	14	12	50	57	79	62	69	67
	20	20	50	40	60	40	40	65
	22	22	50	64	50	73	68	59
	34	30	41	47	33	56	48	47
	50	50	32	28	58	44	40	44
		Mean	42	45	52	51	50	56

Flight activity of G. morsitans adults. Reduced flight activity has been suspected on several occasions when G. morsitans adults have been held in small cages. Preliminary tests have been initiated to determine whether confinement during the first week of adult life results in changes in flight capability. The tests relied on the positive phototaxis of tsetse flies. Adult flies were held in a standard laboratory cage which had a sliding door on the back. Each day the cage was covered with black cloth, placed inside a larger cage, and oriented so that the sliding door faced toward a fluorescent lamp directly above the cages. The sliding door was opened for 2 minutes and then closed. Flies which had left the darkened small cage were then captured and the sliding door was reopened for 3 minutes. Males and females were tested separately. The percentage of flies which responded to these stimuli by flying out of the small cage is recorded in Table 3. Over the 6-day period there was an apparent gradual decline in male flight activity of 31% and an increase in female flight activity of 33%.

Further testing will be necessary to determine whether these changes in flight activity are: (a) actually a result of changes in the phototaxis of the ageing adult; (b) different from those which occur in nature. Analysis of these factors should provide the information necessary to determine whether confinement in small cages actually affects flight ability.

Maintenance of Glossina colonies. After 76 weeks the original G. morsitans colony (I) continues to produce 5 to 10 pupae per week. The slight increase in pupal production probably results from the change in the ratio of males and females being introduced in colony cages. The original ratio of 1 male to 5 females was subsequently changed to 2:5 and more recently to 1:1. The statistics of G. morsitans Colony I are presented in Table 4.

In the recently initiated G. morsitans Colony II, the maintenance routine differs from that of Colony I only in respect to mating and the stocking of the colony cages. Mature females are placed in mating cages with an equal number of males. After 48 or 72 hours the males are removed and the females are transferred to colony cages at rates of 25 females per cage. Males are reused if necessary, up to a maximum of 3 times. Using such a routine in a mass production scheme would release 67% of the males for non-colony purposes.

G. morsitans Colony II was initiated in February with flies which had emerged from field-collected pupae. During the previous year we had observed that fly quality, in terms of size and vigor, appeared to be at its maximum during the period January through June. It was felt that a severe degree of natural selection occurred in the field under the extreme environmental stresses in the Kambeni Valley late in the dry season (September to November). By January the selection process appeared completed and it is assumed that only the most hardy individuals had survived. It is this hardy, field-selected population, which has been utilized for the parental stock of Colony II.

Five-hundred females were mated using the forementioned routines and placed in groups of 25 in 20 separate cages. Pupae produced by these females were weighed and two sub-colonies have been initiated with the filial generation flies. One colony (lightweight) stems from F_1 pupae weighing less than 25 mg. and the other (heavyweight) from F_1 pupae weighing 25 mg. or more. This selection by pupal weight is being conducted only on F_1 pupae, and the progeny of F_1 adults are maintained within their respective sub-colony irrespective of pupal weight. The statistics of this G. morsitans Colony II are given in Table 5.

The figures of Colony II can be compared with those of Colony I (Report 1965 (1):4) for production by the parental stock (F_0 pupae first appeared in week 11 in Colony I and week 9 in Colony II). At the end of 11 weeks 1,262 F_1 pupae had been produced by the 500 females in Colony II, resulting in a mean of 2.52 pupae per female. Because the parental stock is expected to continue pupal production until about the 25th week, it is reasonable to expect that the parental females will eventually have produced pupae in excess of 3.0 per female. By comparison, after 11 weeks in Colony I the original 1,350 females had produced 158 pupae and then went on to produce a total of 1,468 pupae; the mean pupae per female was 0.12 after 11 weeks and 1.09 during the lifespan of the parental stock. The mean weight of pupae produced during the 11 week period was 25.3 and 22.1 in Colony II and Colony I, respectively. After selection of pupae for the two filial subcolonies, the mean pupal weight of the heavyweight colony was 28.7 and of the lightweight colony was 21.3 (these figures are for F_1 pupae only). If these results persist in the filial generations, this colony will have the potential for marked increase in numbers.

A G. pallidipes colony was initiated in November. Although that season had been demonstrated as a poor time to initiate colony work using field-collected stock, we had no alternative due to other commitments and considerations. Mature females were caged with mature males for 7 days and the females were then placed in groups of 25 in colony cages. Nine parental cages were set up with a total of 223 females. The data for the first 22 weeks of this colony are presented in Table 6. Although no reduction in pupal weight between the F_1 and subsequent generations (F_2-n) has been seen, pupal production has been poor. The mean number of pupae produced per female in the parental generation is 1.05. This production rate is far below that necessary for the colony to be self-sustaining. Of 250 adults produced, 48.8% were male. The future of this G. pallidipes colony is questionable.

Table 4.-- Number and weights (mg.) of pupae produced and adult emergence in *G. morsitans* Colony I

	Week Number										
	55	56	57	58	59	60	61	62	63	64	65
No. produced	3	5	4	5	5	4	7	4	6	6	6
No. weighed	1	4	3	5	4	0	3	4	4	5	3
Mean weight	28.4	23.9	22.5	25.0	21.0	-	19.1	24.9	25.2	23.3	25.5
Maximum weight	-	26.9	24.1	29.9	26.7	-	24.0	26.6	26.3	27.8	33.0
Minimum weight	-	18.9	21.4	20.0	16.1	-	13.0	23.7	24.4	20.5	20.0
Adult emergence (%)	100	100	100	100	80	100	57	100	83	83	83

	Week Number											Summary of Weeks 55-76	
	66	67	68	69	70	71	72	73	74	75	76	Total	Mean
No. produced	3	5	12	7	8	8	5	7	8	9	10	137	-
No. weighed	2	3	5	3	5	4	4	2	4	6	8	82	-
Mean weight	21.6	24.4	26.0	25.4	20.0	23.4	29.5	29.6	22.3	21.5	25.3	-	24.2
Maximum weight	26.8	33.1	30.7	30.2	23.6	27.0	32.0	30.0	26.0	32.9	35.1	-	28.6
Minimum weight	16.4	16.3	21.8	20.4	15.6	15.7	25.3	29.1	17.6	16.0	18.8	-	19.6
Adult emergence (%)	67	100	75	100	100	62	-	-	-	-	-	-	87.6

Table 5.-- Number and weights (mg.) of F_1 pupae produced and adult emergence in *G. morsitans* Colony II.

	Week Number												
	1	2	3	4	5	6	7	8	9	10	11	Total	Mean
No. produced	0	55	214	193	186	153	120	112	89	73	67	1,262	-
No. weighed	-	44	126	129	132	99	65	76	62	59	45	857	-
Mean weight	-	22.7	24.3	24.0	25.6	25.6	26.7	26.6	25.0	27.5	26.4	-	25.4
Maximum weight	-	30.9	30.8	33.1	36.9	34.3	35.1	35.0	34.4	34.8	35.0	-	34.0
Minimum weight	-	16.9	16.0	15.3	12.4	11.2	17.7	15.9	9.0	13.7	15.4	-	14.4
Adult emergence (%)	-	93	93	94	92	72[a]	-	-	-	-	-	-	88.8
% pupae wt. 25 mg. or more	-	27	41	46	54	55	60	70	60	80	70	-	56
Mean wt. of pupae 25 mg. or more	-	27.5	27.2	27.8	29.4	29.0	29.3	28.8	28.4	29.5	29.0	-	28.7
Mean wt. of pupae under 25 mg.	-	21.3	21.7	20.7	20.9	21.1	22.8	22.0	21.4	20.5	21.2	-	21.3

[a] Several pupae discarded due to fungus.

Table 6.-- Number and weights (mg.) of pupae produced and adult emergence in *G. pallidipes* colony.

		1	2	3	4	5	6	7	8	9	10	11
No. produced	F_1	-	-	38	83	37	3	19	4	7	5	2
	F_2-n	-	-	0	0	0	0	0	0	2	6	9
	F_1+F_2-n	-	-	-	-	-	-	-	-	9	11	11
No. weighed	F_1	-	-	37	51	30	10	9	4	5	3	1
	F_2-n	-	-	-	-	-	-	-	-	2	3	3
	F_1+F_2-n	-	-	37	51	30	10	9	4	7	6	4
Mean weight	F_1	-	-	32.9	31.9	32.4	29.5	31.5	27.6	35.8	28.5	38.3
	F_2-n	-	-	-	-	-	-	-	-	27.8	34.6	30.8
Maximum weight	F_1	-	-	42.8	44.1	40.8	39.9	37.9	34.9	40.3	34.0	-
	F_2-n	-	-	-	-	-	-	-	-	30.7	35.2	34.1
Minimum weight	F_1	-	-	24.4	16.0	24.4	20.8	23.0	21.4	30.6	25.4	-
	F_2-n	-	-	-	-	-	-	-	-	25.0	33.4	26.7
Adult emergence (%)	F_1+F_2-n	-	-	87	88	86	60	95	100	100	91	82

Table 6.-- (Continued)

Summary of 1-22

		12	13	14	15	16	17	18	19	20	21	22	Total	Mean
No. produced	F_1	1	1	0	0	2	0	0	0	0	0	0	234	-
	F_2-n	10	13	7	6	4	5	2	1	0	2	2	69	-
	F_1+F_2-n	11	14	7	6	6	5	2	1	0	2	2	303	-
No. weighed	F_1	0	0	0	0	2	0	0	0	0	0	0	152	-
	F_2-n	5	9	7	2	2	4	1	1	0	1	0	40	-
	F_1+F_2-n	5	9	7	2	4	4	1	1	0	1	0	192	
Mean weight	F_1	-	-	-	-	36.4	-	-	-	-	-	-	-	32.1
	F_2-n	32.5	30.8	32.8	33.2	27.8	33.0	32.8	36.5	-	23.0	-	-	31.7
Maximum weight	F_1	-	-	-	-	37.4	-	-	-	-	-	-	-	39.1
	F_2-n	34.7	40.0	38.7	38.1	31.9	38.5	-	-	-	-	-	-	35.8
Minimum weight	F_1	-	-	-	-	35.3	-	-	-	-	-	-	-	24.6
	F_2-n	26.6	24.1	24.1	28.4	23.8	28.1	-	-	-	-	-	-	26.7
Adult emergence (%)	F_1+F_2-n	91	100	86	100	67	-	-	-	-	-	-	-	86

CHEMOSTERILIZATION OF GLOSSINA

Location: Salisbury
Investigators: D.A. Dame, D.R. Birkenmeyer, C. Mousley, L. Tsoka, F. Chaymbuka

Bioassay of sterilants. The effectiveness of sterilant batches which have been received during 1964 and 1965, was assayed by injection into the proboscis of G. morsitans males. All sterilant batches had been kept under refrigeration in the original containers and were used regularly to prepare stock solutions for testing until the arrival of a fresh batch. The testing techniques used were described in Report 1964 (2):4. The results are given in Table 7. Similar results were obtained with fresh and 6 month old samples of metepa and fresh and 12 or 18 month old samples of tepa. The dosage response was similar to that obtained in the original series of tests (Report 1964 (2):Table 2).

Table 7.-- Reproductive capacity of 25 G. morsitans females mated with males injected with 1 ul. of chemosterilant solution.

Dosage (ug.)		Tepa: Percent males surviving 6 days	Tepa: Percent males surviving 4 weeks	Tepa: Number of Pupae	Tepa: Number of Adults	Metepa: Percent males surviving 6 days	Metepa: Percent males surviving 4 weeks	Metepa: Number of Pupae	Metepa: Number of Adults
5.0	a	27	0	0	0	c 54	0	0	0
	b	2	0	0	0	d 64	0	0	0
	d	26	0	0	0	-	-	-	-
1.0	a	57	0	1	0	c 55	-	2	2
	b	49	0	0	0	d 68	-	3	3
	d	76	0	1	0	-	-	-	-
0.5	a	62	0	0	0	c 54	0	11	11
	b	62	0	1	1	d 74	96	15	11
	d	73	0	1	1	-	-	-	-
0.1	a	65	0	15	15	c 49	0	12	10
	b	59	0	7	6	d 78	4	20	16
	d	76	0	21	18	-	-	-	-

a 18 month old sterilant
b 12 month old sterilant
c 6 month old sterilant
d fresh sterilant

Permanence of sterility in G. morsitans males. The results of further tests in the permanence of sterility series (Report 1965 (2): Table 8) are presented in Table 8. The ad libitum treatment of emerging males by exposure to 25 mg./sq. ft. of metepa on glass produced permanent sterility without affecting the longevity of those males which survived the first 6 days. However, the survival during the first 6 days was only 82% as opposed to 92% in the controls. Wind tunnel exposure of 2-day old males to 1.0 ml. of 5% tepa in methanol resulted in an initial survival of only 65% during the first 4 days after treatment. Male longevity thereafter was reduced by 40% (based on the number of weeks which 50% or more survived). This degree of mortality was not observed in preliminary tests and may have been influenced by the seasonal drop in quality of field-collected G. morsitans which occurred at the time these tests were conducted. Except for a single escapee these males remained sterile for the duration of the test.

Topical application of metepa. Chadwick (Nature, 1964, 204:298) reported that topical application of 0.5 ug. of metepa in 0.5 ul. methyl-ethyl-ketone were detrimental to G. morsitans survival without causing complete male sterility. Because our results have demonstrated (1) that 0.5 ug. of metepa constitutes a sub-sterilizing dose and (2) that sterilizing dosages are not necessarily detrimental to male survival, we have repeated Chadwick's test in our laboratory. Freshly emerged males were treated topically (thorax) with 0.5 ul. of methyl-ethyl-ketone containing 0.5 ug. metepa. Control males were tested with 0.5 ul. of methyl-ethyl-ketone. When 6 days old, the males were tested for sterility using standard procedures. The results are given in Table 9. No sterility was achieved and survival was normal. It would seem that Chadwick's conclusion that metepa could not be used for G. morsitans was incorrect.

Table 8.-- Permanency of sterility in G. morsitans males following contact and wind tunnel exposure to tepa or metepa (25 females).

Sterilant and Dosage	Exposure time or volume	Male age (days)	Number of males	Percent Insemination	Number of progeny: Pupae	Number of progeny: Adults
		CONTACT EXPOSURE				
Metepa 25mg/ft.^{2}	ad lib.	6-14	25	100	0	0
			23	100	0	0
		13-21	20	93	0	0
			20	100	0	0
		20-28	18	72	0	0
			17	73	0	0
		27-35	16	43	0	0
			14	50	0	0
		34-42	15	17	0	0
			13	5	0	0
		WIND TUNNEL EXPOSURE				
Tepa 5%	1.0 ml.	6-14	25	100	0	0
			25	100	0	0
		13-21	14	92	0	0
			16	64	1	1
		20-28	7	41	0	0
			12	73	0	0
		27-35	4	6	1	0
			7	14	0	0
		34-42	2	0	0	0
			7	0	0	0
		CONTROL				
see Report 1965 (2): Table 8						

Table 9.-- Reproductive capacity of 25 G. morsitans females mated with males treated when 0-24 hours old with 0.5 ul. of methyl-ethyl-ketone containing 0.5 ug. metepa.

Dosage (ug.)	Percent males surviving 6 days	Percent males surviving 4 wks.	Percent Insemination	Number of progeny: Pupae	Number of progeny: Adults
0.5	71	71	100	21	20
	84	80	100	13	13
0.0	80	72	100	12	10
	66	80	100	22	19

Injection of G. pallidipes males with chemosterilants. G. pallidipes males were injected with chemosterilants to determine the sterility and toxicity caused by known dosages. Following the methods described in Report 1964 (2):4, 10 ul. of aqueous solutions of tepa or metepa were injected into the thorax of freshly emerged males. The results are given in Table 10. The initial and longterm survival rates after treatment with tepa were similar to those experienced by G. morsitans, while sterilizing dosages of metepa produced a slightly higher initial mortality than occurred with G. morsitans. However, insemination rates were normal at all levels and complete sterility occurred with 1.0 ug. of tepa and 5.0 ug. of metepa. Sterility occurred previously at the same dosages with G. morsitans males.

Table 10.-- Reproductive capacity of 25 G. pallidipes females mated with males injected with 1 ml. of chemosterilant solution.

Dosage (ug.)	Tepa: Percent males surviving 6 days	Tepa: Percent males surviving 4 wk	Tepa: Number of Pupae	Tepa: Number of Adults	Metepa: Percent males surviving 6 days	Metepa: Percent males surviving 4 wk	Metepa: Number of Pupae	Metepa: Number of Adults
5.0	45	0	0	0	69	0	0	0
	71	10	0	0	73	48	0	0
1.0	74	0	0	0	30	0	4	3
	100	0	0	0	90	0	3	1
0.5	62	0	5	4	95	0	23	20
	95	0	1	1	95	0	16	16
0.1	77	0	16	12	69	0	22	18
	88	0	18	12	88	0	25	24
0.0	20	0	18	13				
	91	0	10	10	see under tepa			

Permanence of sterility in G. pallidipes males. The results of further tests in the permanence of sterility series (Report 1965 (2): Table 12) are presented in Table 11. Due to a shortage of females these males were held with their mates for 14 days (instead of 7 days) and then transferred to fresh groups of females for a further 14 days. Permanent sterility was achieved following a 60 minute exposure of 2-day old males to 10 mg./sq. ft. of metepa, and except for a single escapee, the same exposure to tepa caused permanent sterility. Exposure of 2-day old males to 0.25 ml. of 5% metepa in the wind tunnel failed to cause complete initial or permanent sterility. Male survival was normal in all tests.

Table 11.-- Permanency of sterility in G. pallidipes males following contact and wind tunnel exposure to tepa and metepa (25 females).

Sterilant and Dosage	Exposure time or volume	Male age (days)	Number of males	Percent Insemination	Number of progeny: Pupae	Number of progeny: Adults
			CONTACT EXPOSURE			
Tepa 10mg/ft^2	60 min.	7-22	25	100	0	0
			25	100	0	0
		21-36	20	94	1	1
			15	94	1	0
Metepa 10mg/ft^2	60 min.	7-22	25	100	0	0
			25	95	0	0
		21-36	18	89	0	0
			22	100	0	0
			WIND TUNNEL EXPOSURE			
Metepa 5%	0.25 ml.	7-22	25	96	0	0
			25	88	4	4
		21-36	22	77	2	2
			23	100	2	2
		35-50	12	75	0	0
			13	60	8	6
			CONTROL			
see Report 1965(2):Table 12						

Competitiveness of sterile G. pallidipes males. The competitiveness of mature 7-day old G. pallidipes males treated when 2 days old was evaluated by caging 20 treated males with 5 untreated males and introducing 25 untreated virgin females 30 minutes later. Standard methods were then used for determining productivity. The males were exposed for 30 or 60 minutes to 10 mg./sq. ft. deposits of tepa or metepa or to wind tunnel applications of 0.25 ml. of 5% tepa or metepa in methanol. The results are given in Table 12. The actual reduction

in progeny was within 10% of the expected reduction only with males exposed to metepa by contact for 30 minutes or to tepa in the wind tunnel. Both treatments have been shown previously to produce permanent male sterility without reducing longevity (Report 1965 (2):29). The metepa wind tunnel exposure severely reduced the competitiveness of the males, although a separate sterility test produced complete sterility (as opposed to the results presented in Table 11.).

Table 12.-- Competitiveness of G. palliditens males sterilized when 2 days old by various treatments when caged at a ratio of 20 treated males:5 untreated males:25 untreated females (expected reduction in progeny: 80%).

Sterilant and Dosage	Exposure time or volume	Number of progeny: Pupae	Number of progeny: Adults	Actual percent reduction in progeny: Pupae	Actual percent reduction in progeny: Adults
		CONTACT EXPOSURE			
Tepa 10mg/ft²	30 min.	13	10		
		10	9		
		8	3	59	62
	60 min.	1	1		
		13	10	69	72
Metepa 10mg/ft²	30 min.	0	0		
		6	6	87	81
	60 min.	10	9		
		18	15	38	38
		WIND TUNNEL EXPOSURE			
Tepa 5%	0.25 ml.	4	2		
		9	9	71	72
Metepa 5%	0.25 ml.	30	26		
		15	12	0	2
		CONTROL			
		20	15		
		16	15		
		35	31		
		19	16	-	-

LONG ISLAND POPULATION STUDIES

Location: Kariba
Investigators: D.A. Dame, A.J. Phelps, A.M. Simmonds

Migration studies. The ability of tsetse to migrate from the mainland to Long Island (see Fig. 1, Report 1965 (2)) is being investigated by surveillance of the movement of marked flies. During the period December 1965, through March 1966, a total of 9,708 and 7,369 G. morsitans adults were marked on Long Island and the mainland, respectively. A total of 17,782 G. morsitans males and 1,473 females were captured on Long Island, Middle Island and the mainland. In addition, a small number of G. pallidipes were captured and/or marked during this period. A summary of marking activities on the mainland is given in Table 13, and for Long Island in Table 16. A summary of the surveillance of marked flies is given in Table 14.

Migration from the mainland to Long Island was not detected. Two G. morsitans males were found to have moved from Long Island to Middle Island and one female was detected on the mainland. In addition, one female from the mainland was found on Middle Island. The sample of G. pallidipes was probably too small to allow detection of movement. These results, plus those of the previous report, provide seven months of surveillance during which no flies have been detected moving from

the mainland to Long Island. During the period January-March the lake level dropped approximately 15-20 feet and the span of water separating Middle Island and Long Island, was considerably narrowed. This event provided optimum conditions for movement and the failure to detect migration at this time is extremely encouraging. The lake level started to rise in March and is expected to reach its maximum late in the year. Surveillance will be continued until a full 12-month period has been evaluated.

Table 13.-- Summary of *Glossina* marking on the mainland.

	Number of *Glossina*[a] marked during . . .							
	December		January		February		March	
	G.m.	G.p.	G.m.	G.p.	G.m.	G.p.	G.m.	G.p.
				Flyrounds				
A Times sampled	4	4	5	5	3	3	5	5
Males	165	1	313	0	211	0	325	0
Females	2	0	23	0	6	0	10	0
B Times sampled	3	3	3	3	3	3	5	5
Males	215	0	256	0	268	0	549	0
Females	12	0	11	1	5	1	9	1
C Times sampled	2	2	4	4	3	3	5	5
Males	131	0	417	2	514	1	873	3
Females	2	0	17	1	17	0	39	1
D Times sampled	3	3	5	5	3	3	5	5
Males	147	1	422	7	332	1	915	1
Females	7	0	44	3	29	1	46	2
				Standing Bait				
I Times sampled	1	1	1	1	1	1	1	1
Males	95	1	63	0	110	0	31	1
Females	0	0	0	0	4	0	2	2
II Times sampled	1	1	2	2	0	0	2	2
Males	33	0	130	0	-	-	80	2
Females	7	0	11	1	-	-	8	3
III Times sampled	1	1	1	1	0	0	1	1
Males	51	2	71	2	-	-	19	14
Females	3	3	4	4	-	-	7	9
IV Times sampled	1	1	1	1	0	0	1	1
Males	51	0	79	1	-	-	122	1
Females	6	2	9	0	-	-	41	4
Totals								
Males	888	5	1751	12	1435	2	2914	22
Females	39	5	119	10	61	2	162	22

[a] G.m. = *G. morsitans*

G.p. = *G. pallidipes*

Table 14.-- Summary of marked *Glossina* movement in Long Island area.

	Number of *Glossina* observed on											
	Long Island				Middle Island				Mainland			
	morsitans		*pallidipes*		*morsitans*		*pallidipes*		*morsitans*		*pallidipes*	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
December												
Total No. observed	87	9	0	0	219	16	0	0	990	41	5	5
No. from Mainland	0	0	0	0	0	0	0	0	-	-	-	-
No. from Long Island	-	-	-	-	1	0	0	0	0	1	0	0
January												
Total No. observed	475	46	0	1	151	11	0	0	1931	130	13	10
No. from Mainland	0	0	0	0	0	0	0	0	-	-	-	-
No. from Long Island	-	-	-	-	0	0	0	0	0	0	0	0
February												
Total No. observed	8772	936	6	12	256	24	0	0	1435	61	2	2
No. from Mainland	0	0	0	0	1	0	0	0	-	-	-	-
No. from Long Island	-	-	-	-	0	0	0	0	0	0	0	0
March												
Total No. observed	256	19	0	0	186	9	1	0	3094	168	22	23
No. from Mainland	0	0	0	0	1	0	0	0	-	-	-	-
No. from Long Island	-	-	-	-	1	0	0	0	0	0	0	0

Population trends. Trends in population fluctuations are observed once or twice monthly using techniques described in Report 1965 (2):23. The results of these surveys for the period December, 1965 - March, 1966, are given in Table 15. The mainland population, which had a mean capture per flyround of 62 flies in November, (Report 1965 (2):Table 16) rose from 107 to 191 flies per flyround between December and January and remained at that level in March. On Long Island the mean capture per flyround rose from 65 in November to 96 and 138 in December and March; the 521 mean for January suggests a sharp rise in population -- such an increase, however, is not consistent with the general trends in the Long Island area at that time. The population on Middle Island appears to have remained fairly stable during the period with the mean capture ranging from 81 to 140; the mean in November was 135 flies captured per flyround.

Quarterly population survey. The second and third quarterly population surveys of Long Island were conducted in November, 1965 and February, 1966. The procedures followed were similar to those described in Report 1965 (2):24, except that the entire survey was conducted with horses and without cattle. Five surveys were conducted at four day intervals. To insure adequate recording and marking, the field assistants were subjected to an intensive training program. On the fourth and fifth days, when the recording became quite detailed, senior members of the staff accompanied each team and maintained the records.

In February, the flies captured in the morning of the first day were marked with pink paint and all flies caught thereafter and on subsequent days were marked with yellow paint. Thus, the pink-marked flies provided a separate population of known size, which was used to check the accuracy of the techniques used. The results are given in Table 16. Using the Lincoln Index system outlined in Report 1965 (2):29 the G. pallipes population was estimated at approximately 7,[illegible] males and 3,100 females in November and 5,500 males and 2,200 females in February. These estimates converted to numbers per square mile are 4,100 males and 1,700 females in November and 3,000 males and 1,200 females in February. The estimates derived similarly in August were 8,300 males and 2,800 females per square mile (Report 1965 (2):29). Captures of G. palpalis were insufficient for population estimates.

The data from the August, November, and February surveys have been statistically analyzed by Mr. W.R. Mills, Senior ARC Biometrician, following the method provided by Jolly (Biometrika, 1965, 52:225). This method allows estimation of the following parameters at the time of a given sample:

a = proportion of marked flies in the population
$\hat{M}$ = total number of marked flies in the population
$\hat{N}$ = total number of flies in the population
$\hat{\phi}$ = the probability that an individual alive at the time of the sample will be alive at the time of the next sample (includes any emigration and death)
$\hat{B}$ = the number of new flies joining the population between the current sample and the subsequent sample (includes immigration and birth)

The more pertinent estimates derived from the analysis ($\hat{N}$, $\hat{\phi}$, $\hat{B}$), are presented in Table 17, with estimations of standard errors. The standard errors are slightly low due to assumptions inherent in the statistical model. Because we have demonstrated a very low emigration rate and have seen no immigration over a 7 month period, $\hat{\phi}$ and $\hat{B}$ are interpreted as estimates of survival and birth, respectively. The estimates for females are very tenuous due to the small samples and no standard errors can be reliably estimated.

Table 15.-- Monthly summary of normal flyrounds in Long Island area.

	December		January		February		March	
	G.m.[a]	G.p.	G.m.	G.p.	G.m.	G.p.	G.m.	G.p.
Mainland								
No. of flyrounds	1	1	1	1	[illegible]	0	1	1
No. of males captured	102	0	100	1	-	-	[illegible]	0
Percentage marked locally	1	-	3	0	-	-	[illegible]	-
No. of females captured	5	0	11	0	-	-	[illegible]	1
Percentage marked locally	0	-	0	-	-	-	0	0
Mean capture per flyround	107	0	1[illegible]1	1	-	-	10[illegible]	1
Long Island								
No. of flyrounds	1	1	1	1	0	0	2	2
No. of males captured	87	0	[illegible]75	0	-	-	25[illegible]	0
Percentage marked locally	2	-	0.[illegible]	-	-	-	2[illegible]	-
No. of females captured	9	0	[illegible]	1	-	-	19	0
Percentage marked locally	0	-	0	0	-	-	11	-
Mean capture per flyround	96	0	521	1	-	-	130	0
Middle Island								
No. of flyrounds	2	2	2	2	2	2	2	2
No. of males captured	2[illegible]9	0	151	0	256	0	186	1
Percentage marked	0.[illegible]	-	0	-	0.[illegible]	-	1	0
No. of females captured	16	0	11	0	2[illegible]	0	9	0
Percentage marked	0	-	0	-	0	-	0	-
Mean capture per flyround	13[illegible]	0	81	0	1[illegible]0	0	9[illegible]	1

[a] G.m. = G. *nordiana*, G.p. = G. *pallidipes*

Table 16.-- Summary of G. [illegible] survey on Long Island.

Mark	No. of males on day -- 1	2	3	4	5	No. of females on day -- 1	2	3	4	5
				NOVEMBER						
Unmarked	2185	1501	1504	1382	1028	476	256	131	120	148
1	-	362	202	99	61	-	36	16	0	1
12	-	-	129	22	-	-	-	11	0	-
13	-	-	-	33	-	-	-	-	0	-
123	-	-	-	16	-	-	-	-	0	-
1234	-	-	-	-	7	-	-	-	-	0
Other 1's	-	-	-	-	67	-	-	-	-	0
2	-	-	293	148	-	-	-	19	0	-
23	-	-	-	55	-	-	-	-	0	-
3	-	-	-	255	-	-	-	-	3	-
Rest	-	-	-	-	514	-	-	-	-	0
Total	2185	1863	2128	2010	1677	476	292	177	123	149
				FEBRUARY						
Unmarked	2001	1512	1324	810	721	191	205	222	149	129
1	-	448	304	105	65	-	12	8	0	1
12	-	-	111	49	15	-	-	2	0	0
13	-	-	-	63	33	-	-	-	0	0
14	-	-	-	-	24	-	-	-	-	0
123	-	-	-	19	11	-	-	-	1	0
124	-	-	-	-	9	-	-	-	-	0
134	-	-	-	-	13	-	-	-	-	0
1234	-	-	-	-	2	-	-	-	-	0
2	-	-	203	137	70	-	-	9	0	1
23	-	-	-	64	17	-	-	-	0	0
24	-	-	-	-	44	-	-	-	-	0
234	-	-	-	-	14	-	-	-	-	0
3	-	-	-	229	117	-	-	-	4	0
34	-	-	-	-	41	-	-	-	-	0
4	-	-	-	-	197	-	-	-	-	2
Total	2001	1960	1942	1476	1393	191	217	241	154	133
Pinks	(included in above totals)									
Unmarked	1475	-	-	-	-	135	-	-	-	-
1	-	337	226	74	42	-	9	5	0	1
12	-	-	77	37	10	-	-	1	0	0
13	-	-	-	46	26	-	-	-	0	0
14	-	-	-	-	18	-	-	-	-	0
123	-	-	-	14	10	-	-	-	1	0
124	-	-	-	-	7	-	-	-	-	0
134	-	-	-	-	12	-	-	-	-	0
1234	-	-	-	-	2	-	-	-	-	0
Total	-	337	303	171	127	-	9	6	1	1

Table 17.-- Population estimates for *G. morsitans* derived from Long Island survey.

Month	Day	Total population: Estimate	Total population: Standard error	Survival rate (%) over 4 days: Estimate	Survival rate (%) over 4 days: Standard error	Birth rate over 4 days: Estimate	Birth rate over 4 days: Standard error
				MALES			
Aug., 1965	1	-	-	91.8	3.4	-	-
	2	16,568	1,093	-	-	-	-
Nov., 1965	1	-	-	59.9	2.7	-	-
	2	6,739	606	78.9	4.5	2,248	348
	3	7,567	784	-	-	-	-
Feb., 1966	1	-	-	101.8	4.1	-	-
	2	8,907	833	61.1	2.9	1,872	304
	3	6,409	528	59.4	3.2	550	137
	4	4,555	387	-	-	-	-
(pinks)	2	1,267	78	64.6	6.0	0	-
	3	817	55	68.1	9.3	0	-
	4	557	65	-	-	-	-
				FEMALES			
Aug., 1965	1	-	-	89.3	-	-	-
	2	5,675	-	-	-	-	-
Nov., 1965	1	-	-	32.7	-	-	-
	2	1,263	-	11.2	-	36	-
	3	177	-	-	-	-	-
Feb., 1966	1	-	-	91.6	-	-	-
	2	3,160	-	64.6	-	-	-
	3	1,464	-	68.1	-	-	-
	4	4,892	-	-	-	-	-

The male estimates for total population agree well with those derived by the Lincoln Index for August (15,000) and November (7,400), while the February estimate (mean 6,470) is substantially higher than the Lincoln Index estimate (5,500). Although the Lincoln Index modification provides an estimate of the population on day 1, it is not expected that large fluctuations in the population would occur over a 4- or 8-day period. Thus, the discrepancy in February between the day 1 Lincoln Index estimate, and the day 2 and 3 estimates by the Jolly method is unexpectedly large. The survival rates obtained for the total February population on days 2 and 3 agree with those of the pink-marked flies and provide supporting information for the reliability of the results. Further testing will be attempted to demonstrate behavioral factors of *G. morsitans* males which might affect the reliability of these estimates. As in August, the female estimates in November and February were much lower than expected. However, in a 6-day trial immediately following day 5, Mr. Nilsen (Rhodesian Ministry of Agriculture) obtained a sex ratio approaching 1:1 in a sample of 129 nonteneral flies which fed on a bait animal. This evidence supports the theory that the female population is actually similar in number to the male population, although our survey methods do not show this.

Inspection of the survival and birth estimates suggests that the use of the sterile male technique with populations of this density may be feasible only after the use of more than one well-timed application of a non-residual insecticide. Rough calculations suggest that the entire male population is reproduced in a 13-day period in November or a 26-day period in February. Thus, it is unlikely that a single insecticide application will suffice to reduce this population to numbers consistent with a practical sterile male release program.

Control area for sterile male release program. An island harboring an apparently low density G. morsitans population has been selected to serve as a control for the proposed sterile male release program. The island, Sanpakaruma, is the largest of a cluster of small islands about 10 miles west of Long Island. The Glossina population is being checked by means of flyrounds on a quarterly basis to ascertain its viability over the reason. A flyround path was established in February and a total of 55 G. morsitans were captured by traversing the 3,100 yard path with screens.

Relationship of game animals and tsetse population. The Long Island exercise has offered a unique opportunity to study the relationship of game animals and Glossina populations. Both populations are reasonably isolated so that their total numbers can be estimated rather accurately. Thus, the Rhodesian Ministry of Agriculture has sponsored a study of game relationships on Long Island. An initial game survey was made in February immediately after the tsetse population survey, and was repeated similarly in May. At these times game counts and tsetse fly blood meals analyses were conducted. In addition, the trypanosome infection rate in G. morsitans on Long Island and Sanpakaruma Island was evaluated. The February results are given in Table 18. The higher infection rate on Long Island coincides with an apparently greater game population, but the significance or association of these factors has not been established.

Table 18.-- Infection rate of G. morsitans males in February, 1966.

Site	Number dissected	Number having Trypanosoma spp. in Labrum only	Hypopharynx only	Labrum and Hypopharynx	Percent infected
			LONG ISLAND		
Sector A	25	1	0	0	4.0
B	33	2	0	0	6.1
C	27	1	1	0	7.4
D	15	1	0	1	13.3
E	23	1	1	0	8.7
F	21	1	0	2	14.3
Total	144	7	2	3	8.3
			SANPAKARUMA		
Flyround	53	2	0	0	3.8

PHYSIOLOGICAL AGEING STUDIES ON G. MORSITANS

Location: Chirundu and Kariba
Investigators: D.A. Dame, C. Mousley, E. Hajdu, A. Simmonds

The studies of the reproductive status of G. morsitans females in natural populations has been aided by recent improvements in preserving and transporting. The flies are transported monthly by automobile from the field stations to Salisbury, where the dissections are performed. In several instances frozen flies have thawed due to mechanical failure of refrigeration units or overheating during transport. After once thawing, the reproductive tract deteriorates rapidly and accurate determinations are impossible. In order to forestall the possibility of thawing either in a faulty deep freezer or during transportation, each group of flies is frozen and placed in a stoppered vial. The vial is immersed in methanol in a thermos flask which is held in the deep freeze. The flask remains in the deep freeze continuously and further vials are added as available. For transportation to Salisbury, the flask is put in a thermos bag along with 2 frozen "dry ice" cans. The temperature of the methanol in the deep freeze ranges between -5 to -12°C, and after transport to Salisbury is -5 to -3°C. Adoption of this method has provided satisfactory material for dissection.

The results of dissections for the period August, 1965 through March, 1966 are given in Table 19. The monthly percentage of nulliparous females was as follows:

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Chirundu	56	40	35	47	56	43	26	-
Kariba	-	-	0	-	37	13	-	13

Over the entire period, 67% of the nulliparous females were inseminated, while the insemination rate of parous females ranged from 95 to 100% (Table 20). The mean insemination was 86% for Chirundu females and 95% for Kariba females, with the former having a generally higher percentage of nulliparous.

Table 21 gives the results of wingfray determinations of 561 G. morsitans females whose gonotrophic age was subsequently determined by dissection. The data concerning the determinations made from the Chirundu and Kariba females from August through March. It appears that wingfray determinations are of little value in attempting to assess absolute values for gonotrophic or chronological age. Since 26% of the females in wingfray category 1 were parous, it is not possible to accurately separate all nulliparous from parous females. It does appear, however, that most females in wingfray categories 4, 5, or 6 can safely be considered as parous.

Table 19.-- Age composition of G. morsitans females from Chirundu and Kariba.

Month	Number dissected	Gonotrophic cycles completed: 0 No.	0 %	1 No.	1 %	2 No.	2 %	3 No.	3 %	4 or more No.	4 or more %
						CHIRUNDU					
Aug.	32	18	56	7	22	3	9	0	0	4	13
Sept.	91	36	39	5	6	13	14	11	12	26	29
Oct.	84	29	35	7	8	7	8	6	7	35	42
Nov.	68	32	47	7	10	6	9	5	7	18	27
Dec.	27	15	56	5	18	2	7	1	4	4	15
Jan.	70	30	43	5	7	12	17	4	6	19	27
Feb.	53	14	26	5	10	6	11	6	11	22	42
						KARIBA					
Oct.	19	0	0	2	10	0	0	0	0	17	90
Dec.	19	7	37	2	10	4	21	2	11	4	21
Feb.	46	6	13	3	7	6	13	3	6	28	61
Mar.	88	11	13	9	10	8	9	7	8	53	60

Table 20.-- Insemination of G. morsitans females.

Station	Number dissected	0	1	2	3	4 or more	Mean percent insemination
Chirundu	425	67	95	96	97	100	86
Kariba	172	67	100	100	100	99	95

Table 21.-- Female wingfray estimation[a] vs. gonotrophic age in G. morsitans

Wingfray number	Number having completed the indicated number of gonotrophic cycles: 0	1	2	3	4 or more
1	182	37	19	6	2
2	6	15	28	16	20
3	0	1	9	13	61
4	0	3	3	6	59
5	1	0	2	0	56
6	0	0	0	0	16

[a] Increase in wingfray no. indicates increasing damage to the wing

LARGE CAGE REARING STUDIES

Location: Chirundu
Investigators: R.J. Phelps, E. Hajdu, R.B. Borthwick

Modifications were made to the shelters in the large cage following termination of the second longevity trial (Report 1965(2):31). Shelters in squares E8, E10, G10, and J10 (Report 1965(2):Fig. 2) were provided with cavity-block walls (Report 1965(2):32). A third longevity trial was then initiated, using locally caught flies with no attempt being made to separate the sexes. Walls of the shelters were kept moist throughout the trial, but, apart from this, conditions were the same as in previous trials (Report 1965(2):30-32). Flies were colored with the mark of the day when put into the cage, and marked flies feeding on the oxen were recorded without being captured. The results are given in Table 23, and indicate only maximum longevity from a group of flies.

To find how many flies were put into the cage on a given day, for example 26th November, one looks at the appropriate row in Table 23, and it is seen that 142 flies were added all marked R5. Flies seen feeding on that day included 42 having the mark of the day, 30 marked the previous day, 18 marked 2 days previously, etc. To follow the history of any daily intake, one looks at the columns. For example, of the group marked R17, flies were seen feeding on marking day, 11 the following day, 3 two days after fledging and 3 three days after feeding. The figures for the longest intervals show that some flies lived as long as 16 days, but it is apparent that most flies die off very soon after being put in the cages. It is not possible to get information on maximum period between feeds from this data, as records depend on visual observation of feeding flies which are easily missed.

On completion of this trial, it was decided that further cavity-block shelters would be made as there was an observed preference for these sites by flies used in the trial. Further, it was thought that having animals resident in the cage all the time would cut down on flies entering and leaving the cage when animals were brought into the cage. A pen has been built in the cage, and two bushpigs will be kept in it all the time.

A second large cage, 90' X 90' X 7' is nearing completion. It follows the same pattern of construction as the present large cage, and has been erected in a suitable piece of tsetse habitat. All the material for a third large cage has been obtained and it will be assembled shortly.

VERTICAL-CAGE REARING STUDIES

Location: Chirundu
Investigators: R.J. Phelps, E. Hajdu

Enquiries are being made into methods of building a cage big enough to enclose an entire tree. As a preliminary, a 3 foot diameter, tubular cage 30 feet long, has been made, and will be suspended parallel to, and next to, a growing tree trunk. Temperature records will be taken at different heights, and flies will be released in the cage in an attempt to determine their preference in relation to height from the ground.

PUPAL SEARCHING

Location: Chirundu
Investigators: R.J. Phelps, E. Hajdu, R.B. Borthwick, F. Wilson, J. Paget

Pupal searching with one unit of 5 searchers and 1 recorder continued sporadically. The wet season proved a very difficult time for detecting pupae near Chirundu station and impassable roads made it impossible to base the unit further afield. It was found better to use the team for catching flies required for cage experiments, rather than having them look for pupae.

Table 24 indicates the pupae found, but numbers are too small to be of use in determining site preferences.

Table 23.-- Survival of marked flies in the large cage.

Date	Mark	Flies Added	Mark of flies seen feeding 0	2	3	4	5	6	7	8	9	10	12	13	14	15	16	17	18	19	20	21
Nov. 22	R0	179	33																			
23	R2	30	29	18																		
24	R3	50	14	19	16																	
25	R4	57	8	7	15	18																
26	R5	142	7	8	15	30	42															
27																						
28																						
29	R6	36	5	1	4	9	13	9														
30	R7	67	2	5	1	6	9	10	7													
Dec. 1	R8	15	2					1	3	?												
2	R9	41	1				2	2	2	2	?											
3	R10	51	2				3	2	1	3		?										
4																						
5																						
6	R12	58	1				1	1		1	3	1	2									
7	R13	27					1	3	1		1	2	1	7								
8	R14	21	1		1	1		1		1			2	1	5							
9	R15	42		1			1	1					1	3	1	3						
10	R16	22				1							1		2		4					
11																						
12																						
13	R17	13													1		4	5				
14	R18	139															1	11	57			
15	R19	38								1				1	1		1	3	31	24		
16	R20	73															2	3	7	13	13	
17	Ry21	20																	3	13	10	3
Longest life span			16	16	14	15	13	10	7	14	5	4	4	8	7	0	6	3	3	2	1	0 Days

R = marked red Ry = marked red and yellow ? = no record made

Table 24.-- Pupal collections from Chirundu.

Date	No. of pupae obtained from: Ant bear holes	Under fallen logs	Holes in living trees	Others	Total	Number of searches
12/65	29	5	35	6	74	3
1/66	0	1	0	3	4	1
2/66	0	0	0	0	0	0
3/66	0	0	1	0	1	5

FLYROUNDS

Location: Chirundu
Investigators: G.J. Dean, J. Paget, F. Wilson

Sampling for the apparent densities of non-teneral male G. morsitans has continued along five transects through the main working area (Fig. 1). The population declined sharply in November and December, 1965, and remained at a low level during the wet season (November - March). Densities increased on rounds 2 to 4 during April and decreased in May, while they remained continuously low on No. 1, presumably because of an adjacent road and more rch activity. The apparent densities of G. pallidipes was very low and varied between zero and eight. A preliminary survey of the vegetation profile, in particular trees, has been made along these five transects.

These transects had been sampled weekly for exactly two years by the end of May, and the majority of them have been discontinued, except for certain sectors on No.'s 2, 3, 4, and 5 associated with the cattle paddocks at the Mwangu and Camp Rivers, as they did not contribute sufficiently or directly to tsetse breeding. The data will be given to the biometrics team for a more detailed analysis than has been attempted by other organizations. This may give information on tsetse foci and variations in density that can be related to climatic and vegetation changes.

CONCENTRATION OF TSETSE IN NATURAL HABITATS

Location: Chirundu
Investigators: G.J. Dean, J. Paget, F. Wilson

Three related projects are grouped under this title.

Cattle grid. In this trial, 11 oxen were permanently tethered in the riverine-mopane ecotone along the Mwangu River in an attempt to concentrate tsetse breeding, and previous results have been given in the Third Progress Report and 1965(2):38-41. It was obvious that this technique was unlikely to succeed when mean daily catches of G. morsitans from the grid and the adjacent control continued to be similar in December, January and February (Fig. 2). This trial had been running for a year when the oxen were removed in mid-February. Weekly sampling continued until May and the results show that fly densities within the grid area dropped below those at the control point.

Cattle paddocks. The apparent failure to concentrate tsetse around and in the cattle grid could have been due to the relatively stationary and scattered positioning of the oxen, and also to the necessary disturbance from herdsmen, fly-boys and supply vehicles. These objections were generally removed by building a five-acre paddock, containing a complete sequence of pupal sites used during the year, in the riverine-mopane ecotone at the junction of the Mwangu River and No. 5 flyround, and a one-acre paddock around a thicket on No. 2 flyround east of Camp River. The herdsmen's huts and food dumps were sited up to half a mile away from the paddocks. The tsetse at the five-acre paddock were sampled each week from November onwards by No. 5 flyround and by an all-day catch of flies off one out of three tethered oxen. The control point further north along the river, and used for the cattle grid, was retained for this trial. The smaller paddock near Camp River was surveyed only by

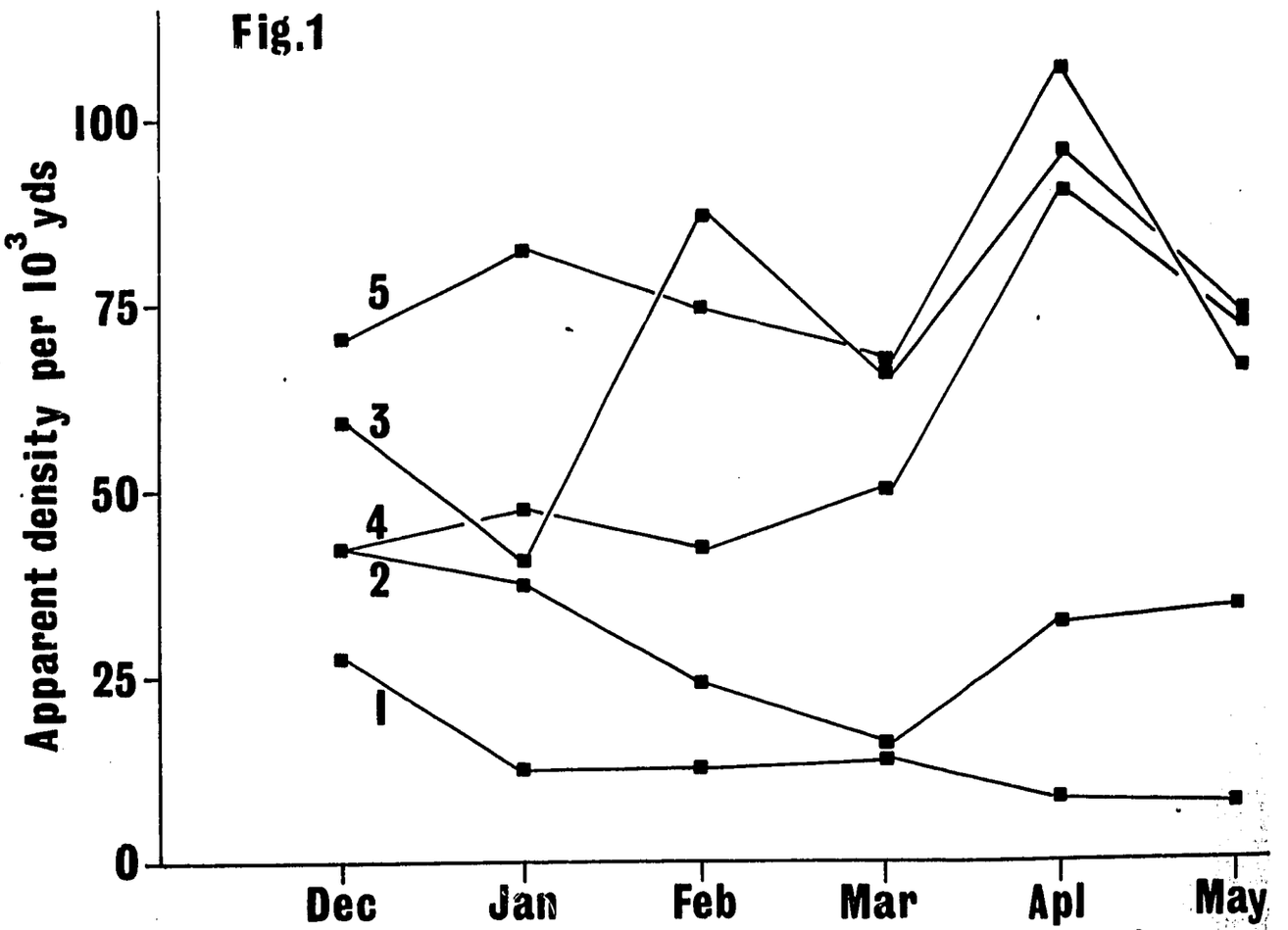


Fig.1
Apparent density per 10^3 yds
100
75
50
25
0
5
3
4
2
1
Dec
Jan
Feb
Mar
Apl
May

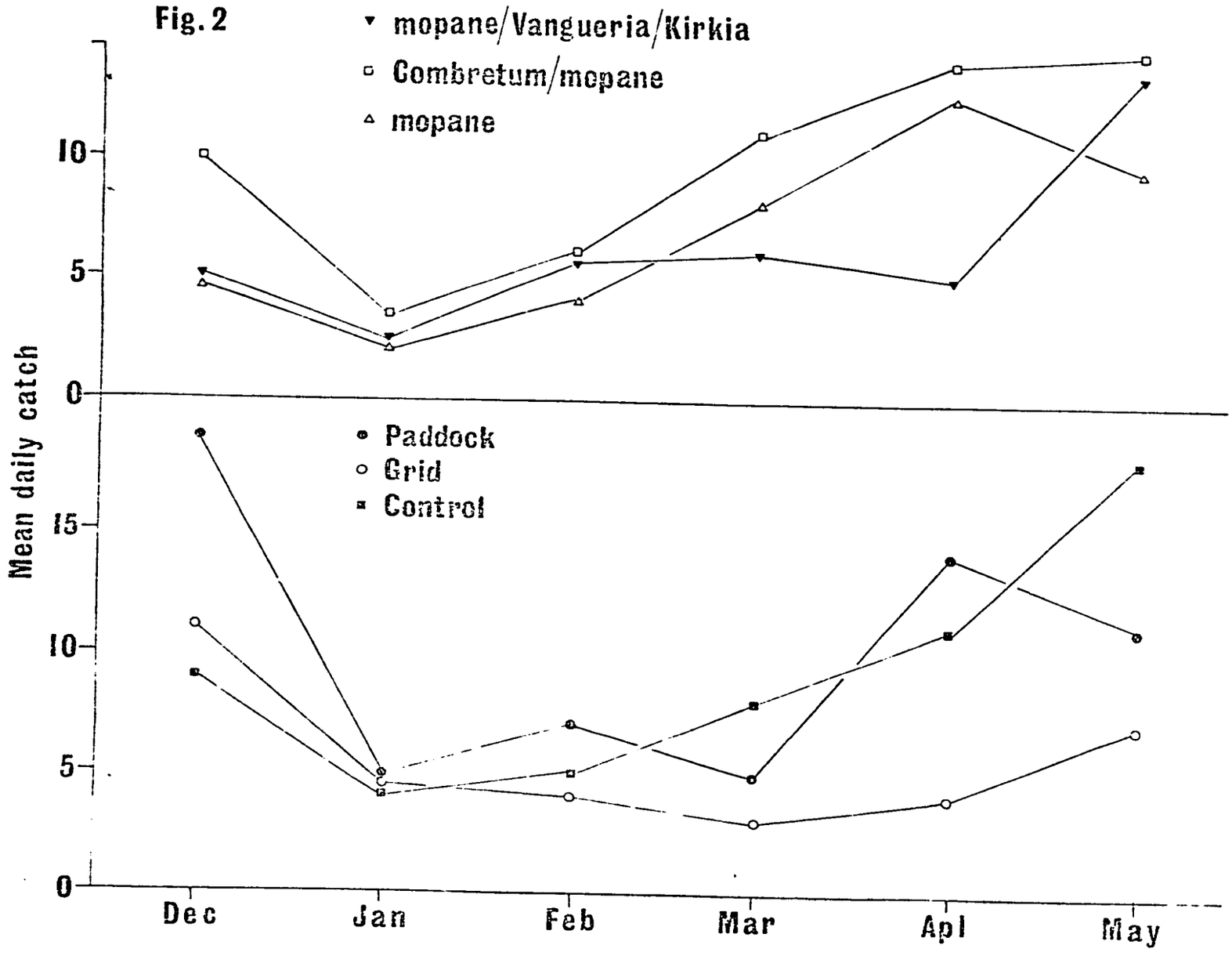


Fig. 2
mopane/Vangueria/Kirkia
Combretum/mopane
mopane
Paddock
Grid
Control
Mean daily catch
10
5
0
15
10
5
0
Dec
Jan
Feb
Mar
Apl
May

No. 2 flyround, with a parallel section of No. 3 as a control. Fifteen oxen were put into the five-acre paddock, and six oxen into the smaller paddock, during January.

The mean daily catches (December - May) showed that there were fewer C. [illegible] (19[illegible].2) and C. [illegible] than during the second half of 1965 (19[illegible](2):[illegible]) and more were caught on the edge of the five-acre paddock than at the control point. Numbers sharply declined from January to March and increased in April and May. This fluctuation in fly numbers generally corresponded to the apparent densities obtained from the flyrounds. The fly-mortality is still far too low for any conclusions to be drawn from the first four months of this trial. The small paddock east of Cape River also has not demonstrated any increase that could be attributed to the oxen.

Relationship between hosts and habitat. Surveys of fly density in repeats, [illegible] the mopane/[illegible] and [illegible] stands are continuing both as the controls for the paddock trial, and as a study into the distribution between different habitats. Results are given in Fig. 2. Densities of C. [illegible] were generally similar in all habitats, but C. [illegible] was less [illegible] and occurred primarily in the riverine-mopane zone [illegible] Cape River.

SURVIVAL [illegible] IN A WALK-IN CAGE

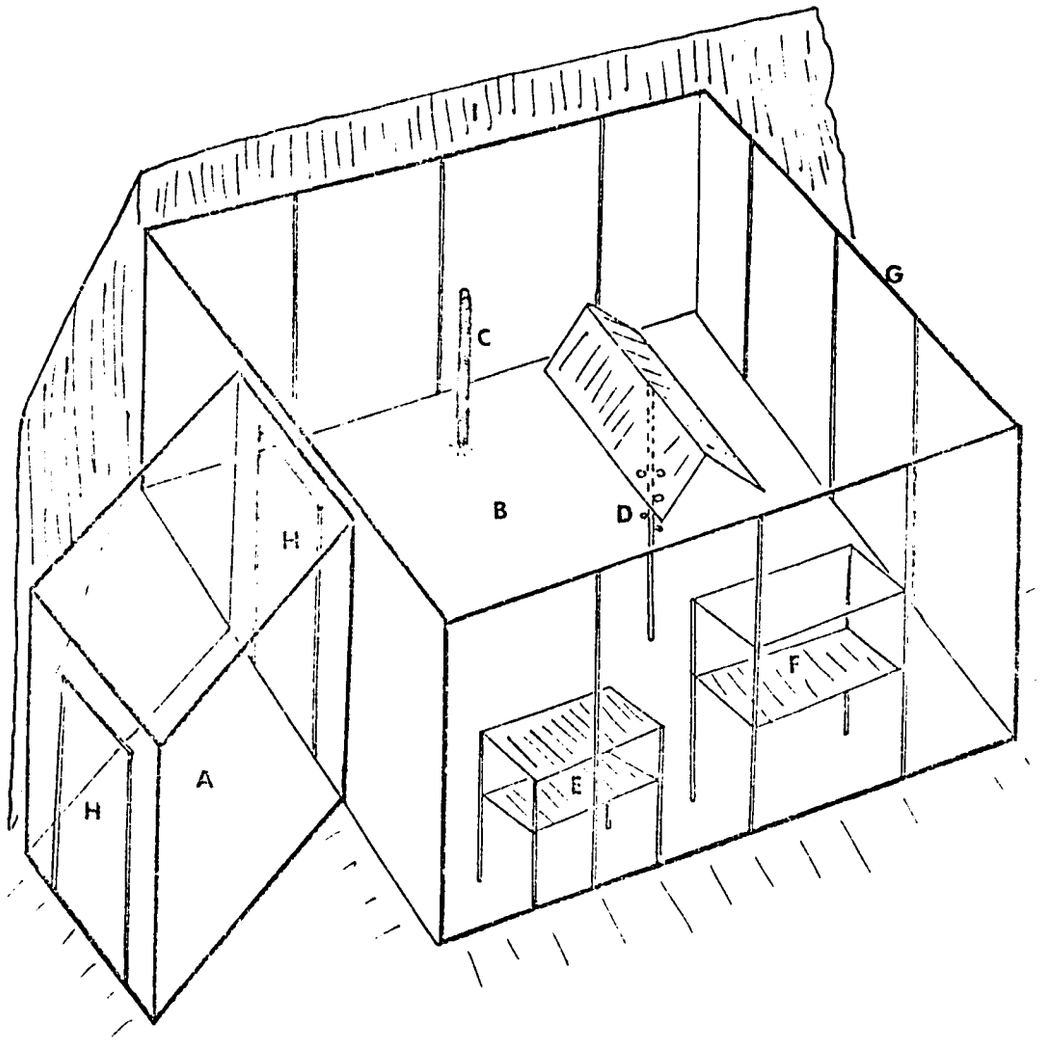
Location: Chirundu
Investigators: G.J. Dean, J. Paget, T. Wilson

Preliminary results from the project have been described in the Third Progress Report and 19[illegible](2):41. The primary intentions in this project have been to provide a suitable environment for stable male competitive trials, which has been achieved (19[illegible]5(2):42), and to obtain a viable breeding population of G. [illegible].

The "wicker" cage in current use is 8 X 16 X 16 feet of mosquito mesh on wooden frame standing on a cement floor. It is covered with reeds to exclude sunlight and contains a central battery of 60 watt bulbs as source of a 12 hour light cycle (Fig. 3). A water sprinkler system was built into the top of the frame work, but it has not been used so far as the relative humidities have been high, and there is a large de-flying chamber. A 12 foot high screen on two sides shields the cage from the predominantly easterly winds. A mosquito mesh on wooden frame insertion into one side of the cage can be opened from the outside, and this contains 8 X 8 X 11 inch control cages. The ox used as a blood donor is either kept permanently in the cage or is placed in it for two hours every morning. The flies held in the 8 X 8 X 11 inch cages are fed by placing the cages against the flank of an ox for 20 minutes every morning.

It was intended to run a continuous series of trials with locally caught flies, and with flies emerging from pupae in the laboratory, which would compare fly viability in large and small cage volumes, and under variable ambient, and controlled climatic conditions. The latter condition is obtained in the adjacent Constant Environment (CE) Room. This trial could assist the larger cage rearing, sterile male competitive, and constant environment room projects. Unfortunately, sufficient laboratory reared flies have not been available so far, and co-ordination with the CE room project has not always been possible.

Climate recording was carried out in the "wicker" cage, CE room (100 yards away), and in two Stevenson screens. One screen (A) was located between the "wicker" cage and CE room, the other (B) in the riverine-mopane ecotone of the Kafunta river. Thermohygrographs were used in all sites, and were checked by maximum and minimum thermometers in the same places and also by wet/dry bulb thermometers. Data recorded is given in Table 2. The mean high screen temperatures at these field sites declined from 36° to about 30°C at A and from 36.3° to about 30°C at B between early January and late May, while the relative humidity did not start to decrease until after the end of the heavy rains in early March. Generally, the Kafunta River site (B), which usually contains the highest tsetse densities, was slightly cooler and more humid than the bush around the "wicker" cage and CE room (A). The mean maximum temperatures in the



A De-flying chamber

B 8 x 16 x 16 ft. cage

C Tethering post for ox

D Battery of 60 watt bulbs

E Thermohygrograph, etc.

F Storage for 8 x 8 x 11 in. cages

G Water sprinkler

H Door

I Windbreak

Fig.3

"wicker" cage were 0.9° to 5.5°C lower than adjacent screen temperatures (A), while mean minimum humidities in the cage were 2% to 47% higher. These results indicate that the climate in the "wicker" cage at midday is generally more favorable for tsetse survival than that in the surrounding bush. The CE room, with two air conditioners and a humidifier, has a relatively stable climate which is similar to that maintained in the insectaries in Salisbury where there is fairly good fly survival and breeding.

Fig. 4 shows the percentage survival of wild flies kept in cages of small (6 X 6 X 36 inch) and large (8 X 16 X 16 foot) volume within the "wicker" cage and CE room. The limiting climatic factors for survival of tsetse at Chirundu are probably minimum humidity and maximum temperature, and these measurements in the "wicker" cage are shown, with the station rainfall, in the two top graphs. The tests in the CE room were run at about 25°C and 60-65% humidity (Table 3) and are not shown in this figure.

Survival was poor in both cage volumes associated with the "wicker" cage during January and February, and small cage controls in the CE room exhibited similar high mortalities. There was a gradual improvement in all tests from March onwards. It appeared that survival in a large volume was better than in a small volume under constant climatic conditions, and that in the small cages under variable ambient conditions lived better than those in the small cages in the CE room. Flies in the large volume of the "wicker" cage died off faster than those in the associated small cages.

It is generally accepted that air temperatures below 35°C and humidities above 40% lie within the extremes of climate that are lethal for adult tsetse. Thus, the climates in both the "wicker" cage and the CE room during the period up to the last week in May (low humidity) must be considered as relatively favorable, though the improved survival from March onwards was associated with somewhat lower maximum temperatures. The minimum and maximum temperatures were also lower after February and this may have done no direct harm, therefore, damage due to colliding with the walls of the "wicker" cage, and fat utilization. It is possible also that the male flies were less viable in January and February, but this hypothesis is not supported by the good emergence obtained from wild pupae (Dean and Vertuma unpublished). The reason for the males apparently surviving better in the small cages in the "wicker" cage than in the CE room during April and May is unlikely to be the climate, as Salisbury controls indicated good survival under conditions similar to those in the CE room.

The flies in the "wicker" cage were classified by their hunger stage during recapture; abdomen red and distended with engorged blood (I), abdomen black but less distended (II), abdomen milky-white and normal size (III), and abdomen thin and concave (IV). The results clearly indicated that few flies were fully engorged (I) or starving (IV), and that the majority were in stages II and III.

COMPETITIVENESS OF RADIO- AND CHEMO-STERILIZED FLIES

Location: Chirundu
Investigators: G.J. Dean, D.A. Dame, J. Paget

The small cage used in 1965 has been repaired and is ready for a new series of trials in June and July.

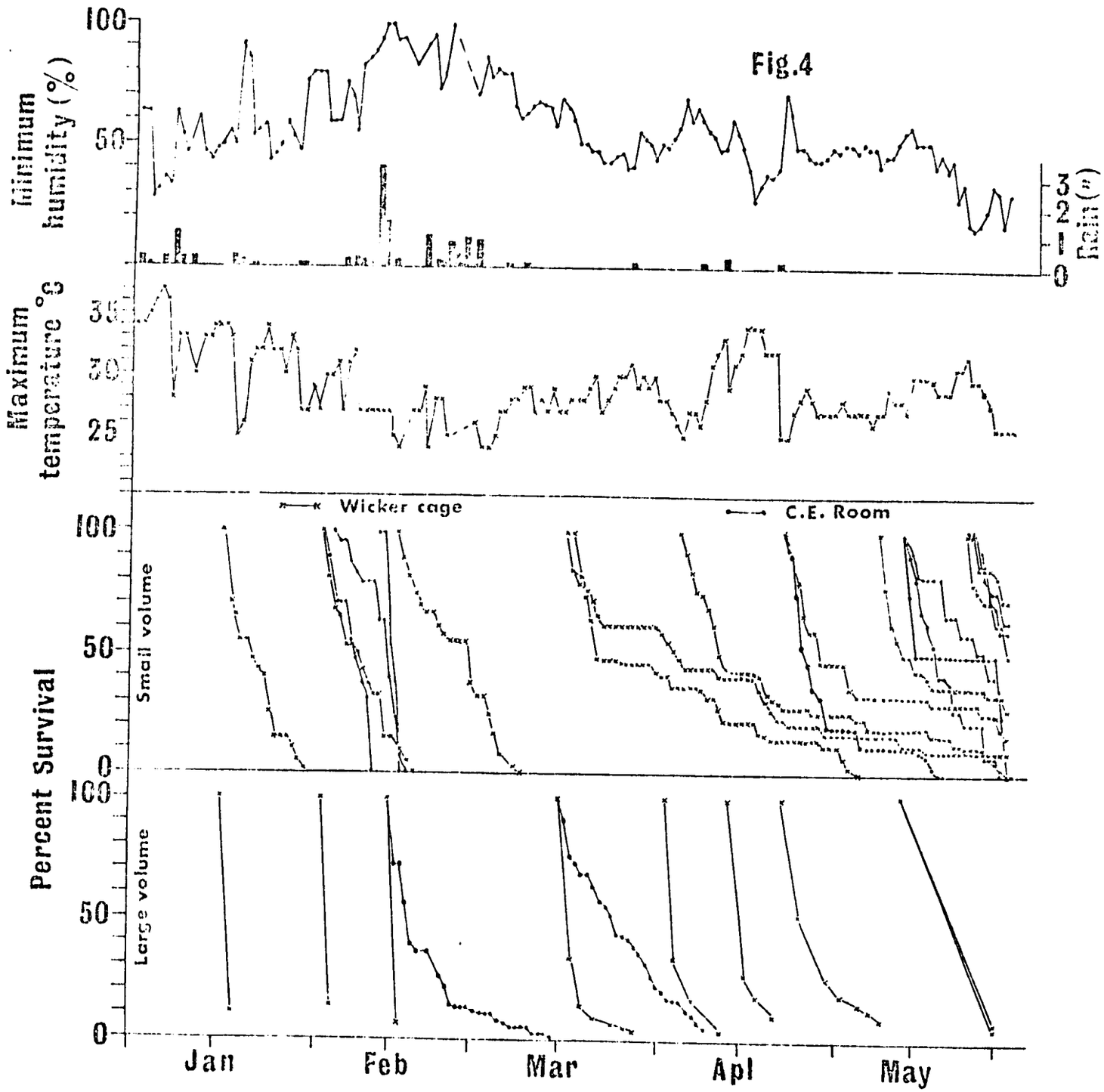


Fig.4
Minimum humidity (%)
100
50
Rain (")
3
2
1
0
Maximum temperature °C
35
30
25
Wicker cage
C.E. Room
Percent Survival
Small volume
Large volume
100
50
0
Jan
Feb
Mar
Apl
May

Table 25.-- Mean weekly climatic conditions recorded in the "Wicker" cage, Constant Environment [illegible] and [illegible] Stevenson screen between the two; and by a Stevenson screen in the grid and within the [illegible]/diverting [illegible] at the [illegible] River, and total weekly rainfall.

Week ending	"Wicker" cage Temperature (°C) Max.	"Wicker" cage Temperature (°C) Min.	"Wicker" cage Humidity (%) Max.	"Wicker" cage Humidity (%) Min.	Stevenson screen (A) outside cage Temperature (°C) Max.	Stevenson screen (A) outside cage Temperature (°C) Min.	Stevenson screen (A) outside cage Humidity (%) Max.	Stevenson screen (A) outside cage Humidity (%) Min.	Constant Environment [illegible] Temperature (°C) Max.	Constant Environment [illegible] Temperature (°C) Min.	Constant Environment [illegible] Humidity (%) Max.	Constant Environment [illegible] Humidity (%) Min.	Stevenson screen (B) at the [illegible] River Temperature (°C) Max.	Stevenson screen (B) at the [illegible] River Temperature (°C) Min.	Stevenson screen (B) at the [illegible] River Humidity (%) Max.	Stevenson screen (B) at the [illegible] River Humidity (%) Min.	Rainfall (mm.)
1/9/66	34.0	23.0	99.1	42.1	38.0	22.0	98.7	43.9	26.4	25.1	82.7	62.3	[illegible]	[illegible]	99.7	49.3	35.5
1/16/66	33.0	23.5	98.2	51.0	33.9	22.4	99.0	49.0	26.6	23.3	84.9	[illegible]	34.1	20.7	100.0	56.4	5.6
1/23/66	30.4	23.1	99.7	62.9	32.9	21.3	98.4	50.6	25.9	25.0	87.3	76.5	[illegible]	[illegible]	100.0	56.4	12.8
1/30/66	30.4	22.9	98.7	59.0	33.1	22.1	99.6	49.4	26.4	25.7	91.6	74.7	33.9	22.1	97.9	49.1	3.1
2/6/66	29.3	22.9	98.1	69.4	31.0	22.1	99.0	55.4	26.0	[illegible]	95.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.1
2/13/66	27.7	24.1	99.9	86.9	31.0	22.3	94.7	51.3	26.0	25.7	93.6	[illegible]	31.4	[illegible]	[illegible]	[illegible]	139.8
2/20/66	27.0	23.3	97.2	91.4	31.4	21.9	91.9	[illegible]	25.4	24.4	[illegible]	[illegible]	30.9	[illegible]	[illegible]	[illegible]	22.6
2/27/66	27.0	23.0	100.0	84.7	29.4	21.4	91.9	56.3	25.7	24.2	99.0	88.3	29.3	22.9	100.0	86.3	55.9
3/6/66	25.9	21.9	96.7	77.9	28.3	21.3	93.6	52.1	26.0	24.9	97.9	85.7	29.0	21.3	98.1	[illegible]	22.1
3/13/66	24.1	22.0	97.3	64.4	32.0	21.9	92.3	44.7	24.0	23.1	99.0	76.9	30.3	21.1	97.9	41.4	Trace
3/20/66	24.1	18.7	99.6	56.9	30.9	18.1	93.4	33.3	26.1	24.7	95.3	76.3	30.0	18.1	100.0	54.6	0
3/27/66	29.1	17.4	96.0	45.7	34.3	18.4	87.0	27.6	27.4	23.1	97.3	74.9	31.7	17.1	99.0	46.0	Trace
4/3/66	28.3	18.6	97.9	52.1	32.0	19.0	85.4	31.9	24.6	23.3	94.3	74.1	32.4	18.9	95.3	44.7	0
4/10/66	28.0	19.9	99.3	59.9	31.4	20.3	87.0	38.6	26.3	24.9	97.7	78.7	29.1	19.0	100.0	58.3	1.0
4/17/66	29.1	21.0	100.0	46.1	37.9	21.1	87.0	26.3	27.5	25.9	91.3	[illegible]	34.9	19.4	100.0	48.1	6.6
4/24/66	29.7	19.4	96.4	50.9	33.6	20.3	87.1	33.1	27.1	23.6	88.0	69.7	30.8	18.9	100.0	48.9	2.2
5/1/66	25.6	15.7	93.0	47.9	31.1	16.1	84.1	30.1	27.0	24.1	81.1	71.1	29.0	14.7	99.9	42.7	0
5/8/66	25.9	14.3	98.1	48.9	30.6	14.7	88.3	31.0	25.7	21.9	76.6	67.0	29.7	13.3	100.0	42.6	0
5/15/66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5/22/66	30.1	16.4	98.7	38.1	33.3	15.9	93.7	28.0	24.9	20.9	75.1	58.9	33.0	14.6	97.0	36.4	0
5/29/66	27.9	8.4	94.9	29.3	30.4	7.1	90.7	20.1	23.1	20.7	87.1	76.3	30.7	7.3	99.0	28.0	0

ESTABLISHMENT OF A SUPPLY COLONY OF *G. MORSITANS* AT CHIRUNDU

Location: Chirundu
Investigators: E.J. Majlu, G.J.W. Dean, J. Paget

The layout and principles of the Constant Environment Room (CER) were described in a previous report (1965(2):36). The principle function of the CER is to investigate possibilities of breeding in a controlled environment, and to maintain a colony of flies kept alive in 11 X 8 X 8 inch cages and emerging from pupae so that a supply will be available for research projects at Chirundu.

Trial runs were conducted initially to establish the longevity of flies under controlled conditions. Various numbers of flies were placed in the large cage, and an ox was kept there throughout the daylight hours as a food supply. Results given in Table 26 show a high mortality.

In April, 1966, the arrangement within the CER was altered as it had been found that no satisfactory check could be made on the flies, owing to the following conditions. 1) It was thought that the presence of the ox in the cage during the hours of daylight resulted in a high loss of flies due to movements such as tail flicking and kicking. 2) Unwanted predators such as spiders and lizards were observed in the cage, and they had been seen feeding in the litter on the floor around the ox. A high mortality rate was observed, but few dead flies were found due to difficulty in locating dead insects in the litter covered floor around the ox.

In the new trial runs, the cage was cleaned completely and the oxen were kept in the cage, without hay or any other type of food, from 0800 to 1000 hours. This two hour daily feeding appeared to be adequate for fly nutrition. The first test under the new conditions utilised field caught flies, which soon showed high mortality. A large percentage of dead flies were located, and the precision of the trial was an improvement over previous work (Table 27).

Table 26.-- Mortality checks on *G. morsitans* adults in the CER. Ox permanently in room during hours of daylight.

Trial No.	No. of G. . [a] at start of trial male	No. of G. . [a] at start of trial female	Date of check	Flies found alive	Trial No.	No. of G. . [a] at start of trial male	No. of G. . [a] at start of trial female	Date of check	Flies found alive
1	79	10	2/14/66		2	86	9	3/15/66	
			2/15/66	55				3/16/66	85
			2/16/66	55				3/17/66	72
			2/17/66	50				3/18/66	70
			2/18/66	35				3/19/66	65
			2/19/66	32				3/20/66	65
			2/21/66	32				3/21/66	60
			2/23/66	22				3/22/66	54
			2/24/66	19				3/23/66	52
			2/25/66	12				3/24/66	49
			2/26/66	12				3/25/66	42
			2/27/66	12				3/26/66	41
			2/28/66	12				3/27/66	40
			3/1/66	11				3/28/66	36
			3/2/66	9				3/29/66	34
			3/3/66	9				3/30/66	30
			3/4/66	8				3/31/66	25
			3/5/66	6				4/1/66	21
			3/6/66	5				4/2/66	19
			3/7/66	4				4/3/66	16
			3/8/66	4				4/4/66	15
			3/9/66	3				4/5/66	15
			3/10/66	3				4/6/66	11
			3/11/66	2				4/7/66	9
			3/12/66	2				4/8/66	6
			3/13/66	2				4/9/66	4
			3/14/66	2					
			3/15/66	1					

[a] G. . = *G. morsitans*

Table 27.-- Mortality checks on C. [illegible] adults in the CER. Cage completely cleaned out ex brought in from 0800-1000 hrs. daily.

Date	Found dead male	Found dead female	Counted alive	Missing	Adult flies added male	Adult flies added female	Total flies in cage	Pupae added
4/14/66	0	0	23	0	5	23	56	-
4/15/66	2	5	12	9	0	20	52	-
4/16/66	0	6	20	0	0	44	70	-
4/17/66	1	16	52	1	0	75	127	-
4/18/66	1	16	52	1	0	75	127	-
4/19/66	2	29	68	28	0	77	145	-
4/20/66	2	42	24	79	0	15	39	-
4/21/66	6	10	28	1	0	0	28	-
4/22/66	2	23	3	2	0	21	24	-
4/23/66	2	2	19	3	0	0	19	-
4/24/66	2	5	6	8	0	0	6	-
4/25/66	0	1	4	1	0	0	4	-
4/26/66	2	0	4	0	0	0	4	-
4/27/66	0	0	4	0	0	31	35	-
4/28/66	0	5	25	5	0	0	25	-
4/29/66	1	6	19	0	5	5	29	-
4/30/66	0	3	23	3	0	0	23	-
5/1/66	1	3	19	1	0	0	19	-
5/2/66	0	0	19	0	0	0	19	-
5/3/66	1	3	13	2	0	0	13	-
5/4/66	1	0	13	0	0	4	17	-
5/5/66	0	3	12	2	0	0	12	-
5/6/66	0	3	7	2	0	0	7	-
5/7/66	0	0	6	1	0	7	13	-
5/8/66	0	1	10	2	0	0	10	-
5/9/66	0	1	8	1	0	8	16	-
5/10/66	0	1	14	1	0	0	14	-
5/11/66	0	1	11	2	2	5	18	-
5/12/66	0	2	15	1	0	0	15	-
5/13/66	1	0	13	1	0	0	13	-
5/14/66	1	1	9	2	0	0	9	-
5/15/66	1	0	7	2	0	0	7	-
5/16/66	1	1	5	2	0	13	18	-
5/17/66	1	1	1	15	0	0	1	570
5/18/66	2	0	40	-	0	0	40	83
5/19/66	4	0	31	-	0	0	31	89
5/20/66	0	0	35	-	0	0	35	125
5/21/66	6	1	39	-	0	0	39	25
5/22/66	1	2	24	-	0	0	24	90
5/23/66	0	2	31	-	0	0	31	

To eliminate the possibility that field-collected flies might be injured in catching, flies newly hatched from pupae were released in the CER during late May. These flies appeared to show a better survival rate (Tables 27 and 28).

Three boxes 3 feet by 4 inches by 12 inches filled with sieved sand were placed in the large cage within the CER, and logs of 3 inches in diameter were placed over and just above the sand to imitate natural larviposition sites. Shortly after these boxes were placed in the cage, a group of field-collected female flies commenced depositing pupae in the boxes, and this has continued with the females emerging from pupae, though a few pupae were found elsewhere in the cage (Table 29). This test was run to obtain information on the selectiveness of tsetse with regard to larviposition sites.

Table 28.-- Results of deposition of pupae in the CER.

Date	No. of flies counted in the cage	No. of pupae deposited in boxes	No. of dead flies found
5/17/66	1	0	2
5/18/66	40	2	2
5/19/66	31	0	4
5/20/66	35	0	0
5/21/66	39	3	9
5/22/66	24	0	3
5/23/66	31	3	2
5/24/66	35	1	0
5/25/66	39	1	0
5/26/66	39	0	0
5/27/66	39	0	0
5/28/66	49	0	0
5/29/66	56	0	4
5/30/66	58	6	3
5/31/66	49	0	4
6/1/66	66	0	6

HOST PREFERENCE STUDIES

Location: Chirundu
Investigators: E.J. Hajam, R.J. Phelps

Various investigators have found that tsetse flies have a food preference for certain species of wild animals. Indications are that the warthog is a preferred host of G. morsitans. It is possible that the blood of preferred animals could favorably influence the reproductive potentiality of the flies.

Young bushpigs and warthogs were acquired last year (1965(2):5) and are being trained to act as blood donors for tsetse flies. Flies will be kept on the single fly per tube system, using flies emerging from field-collected pupae. Evaluations will be on the basis of number and quality of pupae produced.