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9. ABSTRACT

The first of the project's three goals was the establishment of a thriving colony of Tanga strain Glossina morsitans morsitans in Tanzania. This virtually assures completion of the second goal, expansion of the colony to produce excess pupae for sterilization, release, and ecological studies; and to supply field test operations. These will lead to the third goal of conducting a large-scale field trial to evaluate the sterile-male-release-method against tsetse flies. Two fully operational laboratories were staffed with trained personnel, and construction of the third and final insectary unit was begun. The first irradiation tests on Tanga strain G. m. morsitans using the Cesium unit were performed on April 24, 1975. A useful technique for irradiating flies in a nitrogen atmosphere was developed. Efforts were continued in improving goat-host animal herds to overcome the shortage of hosts while simultaneously striving for maximum efficiency in the fly feeding process and use of animal housing facilities. Finally, preparation of a test site for sterile male releases was continued at Mzeri Hill Ranch.

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REPORT ON TSETSE RESEARCH PROJECT

TANGA, TANZANIA

UNITED REPUBLIC OF TANZANIA

AND

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT No. 931-17-130-030-73. AGREEMENT No. 72-931-1

PERIOD: January 1 through June 30, 1975

Submitted by:

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AGRICULTURAL RESEARCH SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

Office of Agriculture
Bureau for Technical Assistance
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Washington, D. C. 20523

SUMMARY

Tanga strain *Glossina morsitans morsitans* colonies continued to perform well in our laboratories increasing over 2-fold in six months. This was accomplished with self-perpetuating colonies inasmuch as collection of pupae from the field was no longer necessary after October 1974. The laboratory tsetse colony became the largest in existence anywhere in the world. In less than two years, we have successfully achieved the first of three planned targets, namely, the establishment of a thriving colony in Tanzania. This accomplishment virtually assures the satisfactory achievement of the second target: the expansion of the colony to produce excess pupae for sterilization, release, and ecological studies and to adequately supply field test operations. These accomplishments are prerequisites to the ultimate goal of conducting a large-scale field trial to evaluate the sterile male release method against tsetse flies.

Two fully operational laboratories were staffed with trained personnel and construction of the third and final insectary unit initiated. Success in improving overall colony performance has permitted simplification of rearing procedures and development of the production system that will be used to supply the sterile male field trial. Further colony expansion is contingent on completion of the final insectary unit. In the interim, surplus pupae were used for irradiation tests and supplied upon request to tsetse fly research agencies in Austria, Kenya, and Holland. Total monthly pupae production was in excess of 44,000 (pp 1-5).

The first irradiation tests on Tanga strain *G. m. morsitans* using the ^{137}Cesium unit were performed on April 24, 1975. A useful technique for irradiating flies in a nitrogen atmosphere was developed (p. 6). Preliminary studies reveal that best results in terms of survival and mating capacity following sterilizing doses of gamma radiation were achieved with the late stage pupae when compared to adult flies of both sexes that had a blood meal before treatment. Pupae of both sexes were sterilized at doses of 12.6 krads with minimal adverse effects. Release of sterilized males in the field has begun; marked flies were recaptured 16 days following release (pp 7-9).

Efforts were continued to improve goat-host animal herds to overcome the shortage of hosts while at the same time striving for maximum efficiency in the fly feeding process and use of animal housing facilities. We have obtained superior goat breeds for laboratory use and are making offspring available to livestock breeding stations in the country (pp 10-12). A noteworthy additional benefit resulting from success in developing rabbits for laboratory use is that the Ministry of Agriculture has initiated plans to develop rabbit farming as a source of human food in Tanzania (p 13).

The preparation of a test site for sterile male releases was continued at Mzeri Hill Ranch. Field station facilities have been erected and survey lanes installed. A project bottleneck has occurred in the final step of isolating the ranch with a fly barrier. A solution must be found in the near future to avoid unnecessary delays in completion of the program (p 13).

The Tsetse Research Project was strengthened by the addition of counterpart officers with advanced training. One officer received the M.S. degree in U.S.A. and another the B.S. degree in Tanzania (pp 16).

This Semi-Annual Progress Report is a continuation of previous records on development of sterile insect release methods (SIRM) against *Glossina morsitans morsitans* Westw. in Tanzania.

REARING ASPECTS

Colony Management Techniques

G. m. morsitans colonies were, in the past, reared in units designated Internal, External I, External II, Bristol, Rabbit, and Mutant colonies. The purpose of these various designations was explained in previous reports. Success in expanding the Tanga strain stock colony through improved colony performance and the development of trained personnel has allowed simplification of the method and consolidation of flies into a larger production system that will be used to supply the sterile male field trial.

The External I colony was terminated January 15 since field-collected pupae were no longer necessary for colony expansion. The Bristol colony was terminated on April 8 because those tsetse of Rhodesian origin no longer served as a useful index of comparison with Tanga strain performance. Phasing out the Rabbit colony was begun May 6 and the rabbits will be used primarily as hosts for experimental flies, viz. irradiation tests and maintenance of a Mutant colony. Efforts will be aimed at increasing the number of rabbits available to serve as an alternate host. External II colony pupae were shifted into the second insectary unit beginning April 9 and the shift was completed by June 19. This colony will be designated Internal II colony. Ultimately each insectary will house the Internal colony identified as I, II, and III for the respective goat-host insectary building. A fourth building will be used for rabbit-fed flies. This approach should facilitate training, colony management, and reporting.

Acccunting for every fly each week in the present colonies of more than 36,000 has reached the point of diminishing returns. A sampling system equivalent to quality control checks on assembly line production is being introduced. The technique recently initiated will consist of a rack of 10 cages (270 fertilized females) identified as a colony sample selected on the 15th and 30th day of each month. Since newly mated females are kept for a period of about 3 months, sampling will include the age-range of youngest to oldest females. Data on mortality, fecundity, longevity, and pupal weight will be determined weekly from the sample in the same manner previously used for the entire stock. Remaining cages will be checked weekly for removal and recording of dead flies. An insectary containing 20,000 flies at Tanga contains approximately 80 racks of fertilized females. Thus 6 sample racks (2/month maintained for periods of 3 months) will constitute rougly a 7 percent sample of the colony within an individual insectary.

Performance of Laboratory Colonies

Good performance of *G. m. morsitans* colonies was maintained during the past six months. The number of goat-fed, fertilized females increased from 10,485 to 25,129. It became necessary to restrict further expansion until the third and final insectary is constructed and sufficient host animals become available. The almost 2.5 fold increase of producing females was less than the number that actually could have been added to the stock because 23,516 pupae and 465 females were not used for colony expansion. Surplus pupae were used for irradiation tests and field releases which are discussed under respective headings in this report. In addition, pupae were sent to the International Atomic Energy Agency, Austria, the University of Amsterdam, Holland, and the International Center for Insect Physiology and Ecology, Nairobi, to assist their tsetse research efforts. The planned stock colony of 60,000 flies could be produced at Tanga in the next 6 months, however, fly colony expansion will be dictated by the accomplishment of other aspects of the project.

Monthly pupal production in the stock colonies exceeded 44,000 by June. Establishing optimum conditions for pupae during the 30+ days of development is prerequisite to maintaining viable laboratory colonies. Losses which occurred among Tanga strain females from the pupal stage through separation from mating were determined and compared between three separate colonies (Table I).

TABLE I

SURVIVAL OF LABORATORY REARED *G. m. morsitans* FROM PUPAL STAGE THROUGH MATING SEPARATION MAINTAINED AT 24°C ± 1° AND 70% RH ± 5%

Colony	Number pupae	Period of deposition	% Pre-eclosion mortality	% Emergence Female	% Emergence Male	% Pre-mating, mating and* other losses	Mean no. mated females from 100 pupae
Internal	66,693	18-11-74 - 18 -5-75	3.99	48.28	47.73	2.06	92.4
External II	62,676	6-11-74 - 15- 5-75	6.45	47.75	45.80	2.42	90.6
Rabbit	7,318	13-11-74 - 11- 5-75	6.01	48.16	45.83	5.51	85.3

*Includes escaped flies and counting errors.

Pre-eclosion losses ranged from about 4 to 6.5 percent in the Internal and External II colonies, respectively. During the sampling period the Internal and External II colonies were housed in the same insectary and handled in the same manner. The better pupal eclosion and lower percentage of losses through the completion of mating in the Internal colony further substantiates its higher degree of laboratory adaption. The Internal colony has been a closed colony since December 1973. External II colony, which until February 15, 1975, had received F_1 progeny from field-collected pupae as well as pupae from the Rabbit colony, has never performed as well as the Internal colony. However, in the last six months the gap in overall performance between these two colonies has narrowed indicating an improvement in laboratory performance of the External II colony.

Superior performance of fertilized females reared on rabbits at Tanga was confirmed and the comparatively poor results of pupal eclosion and premating/mating losses are likely due to improper insectary conditions and handling techniques. Females fed on rabbits have a higher fecundity rate (Table II) and consistently produce heavier pupae than goat-fed flies. The degree of pre-eclosion mortality (6.01%) in the rabbit colony was higher than expected. The suspected cause was difficulty in maintaining desired climatic conditions for pupae in the unfinished rabbit-insectary building. Under such conditions higher mortality would also occur early in the adult life. This factor coupled with the practice of single-pair mating of Rabbit colony flies probably contributed strongly to the 5.51% losses during the premating/mating period. Mating mortality was reduced in goat-fed colonies after the introduction of chiller units and mass-mating techniques which replaced paired matings in glass tubes. Although the present Rabbit colony is being phased out, these factors will be investigated and improved during subsequent use of the rabbit-insectary building.

A comparison of colony performance (Table II) with similar records for the previous year shows a trend of improvement in survival of fertilized females. The results are encouraging because mean daily mortality has decreased while a 26.5 fold increase in nucleus colony size was accomplished (948 fertilized females in January 1974 to 25,129 in June 1975 for the Internal and External II colonies). As the colonies have expanded, however, a general decline in pupae/100 females has occurred. This decline could be expected in a rapidly expanding colony, however, and an upward trend in this category has begun since steps were taken to regulate colony expansion. Records maintained on female emergence has revealed that laboratory climatic conditions are stable and peak emergence is successfully contained in the narrow range of 29-30 days.

TABLE II

MEAN DAILY PERFORMANCE OF *G. m. morsitans* AT 24°C ± 1° AND 70% R.H. ± 5%

1975 month	Colony	Mean number of fert. females	% Daily mortality of fert. females	Number of pupae/100 females/day
January	Internal	5758	1.4	5.3
	External II	7507	1.6	4.4
	External I	Terminated		
	Bristol	472	1.6	6.9
	Rabbit	624	0.5	7.7
February	Internal	6959	1.2	5.2
	External II	8251	1.5	4.6
	Bristol	508	1.1	6.9
	Rabbit	602	0.6	7.4
March	Internal	8319	1.2	4.8
	External II	9172	1.4	4.6
	Bristol	526	0.9	6.9
	Rabbit	550	0.8	6.3
April	Internal	9754	1.3	5.9
	External II	10145	1.5	4.9
	Bristol	Terminated		
	Rabbit	541	0.8	5.8
May	Internal	12009	1.1	5.6
	External II	10574	1.3	5.3
	Rabbit	568	0.6	6.6
June	Internal	13727	1.2	5.9
	External II	11402	1.2	5.4
	Rabbit	378	1.2	7.9

Although the fecundity and survival of fertilized females must be known to maximize rearing efforts, the product sought is males for sterilization and field release. It follows that the more robust laboratory male would be better equipped for survival following sterilization and release in the field. This quality of the male to be released can be influenced by laboratory rearing procedure. An improvement in male longevity was observed between November 1974 and February 1975 in the External and Internal colonies (Table III). The slight decrease in survival of Rabbit colony males, even though survival still exceeded goat-fed males, was probably related to the reasons discussed above for female rabbit-fed colony performance. In addition 0.16 ppm DDT was discovered in rabbit pellets purchased locally in March 1975 which might have had a detrimental effect on male survival on rabbit hosts.

TABLE III

SURVIVAL OF UNMATED MALE *G. m. morsitans*

9 Day AGP	% Survival at middle of indicated Age Group period					
	External		Internal		Rabbit	
	Nov. 74	Feb. 75	Nov. 74	Feb. 75	Nov. 74	Feb. 75
1	98	100	97	99	100	99
2	86	97	92	96	99	97
3	84	90	91	95	99	97
4	82	88	79	94	99	96
5	76	87	75	90	99	96
6	64	74	70	83	96	93
7	16	58	56	78	90	84
8	1	41	30	52	85	69
9	-	32	-	33	-	40
10	-	8	-	15	-	26

Mutant Strain

The introduction of a mutant strain of *G. m. morsitans* at Tanga was discussed in the previous semi-annual report. The colony has continued to increase in size on rabbit hosts. Inasmuch as the flies are of Rhodesian stock, their usefulness to our program is limited. We have requested assistance from the University of Amsterdam, which supplied the original pupae, to use Tanga strain flies shipped to them and introduce the *ocra* gene marker into our strain. This work is in progress in Amsterdam.

On February 20, 1975, a single teneral male *G. m. morsitans* was caught out-of-doors in a field adjacent to the west side of our laboratory. The insect was captured alive and upon examination found to be a lighter color variation than our laboratory colonies. The single male was mated with 10 females from our stock colony. The unusual male fly was fed on a guinea pig which was later removed from the lab as a precaution against possible infection from the field-collected fly. Some pupae have been obtained and are being mated for the exercise of trying to isolate the color variation and produce a mutant strain with an easily identifiable external mark for field use. At present, the most interesting aspect is that the field-collected fly was used for mating each second day, i.e., fed and rested one day, mated for 24 hours the next, for 10 successive matings. All ten females were impregnated and were producing pupae. The selection will be continued in the rabbit-fed colony.

Irradiation Tests

The ^{137}Cesium gamma radiation unit was used for the first time to irradiate Tanga strain *G. m. morsitans* on April 24, 1975. Two sets of

dosimetry data are available for the Model M Gammator unit at Tanga; dosimetry was performed using lithium borate TLD devices on March 26, 1973, and Fricke dosimetry was performed on September 23, 1974. The dosages given in this report are based on the lithium borate TLD dosimetry with a reported accuracy of ± 3% at 4 inches above the turntable and averaged between the centerline and edge of the turntable. After correcting the dosimetry with the current decay factor as of July 1975, the dosage was 1,580 rads/min within the area of the irradiation chamber described above.

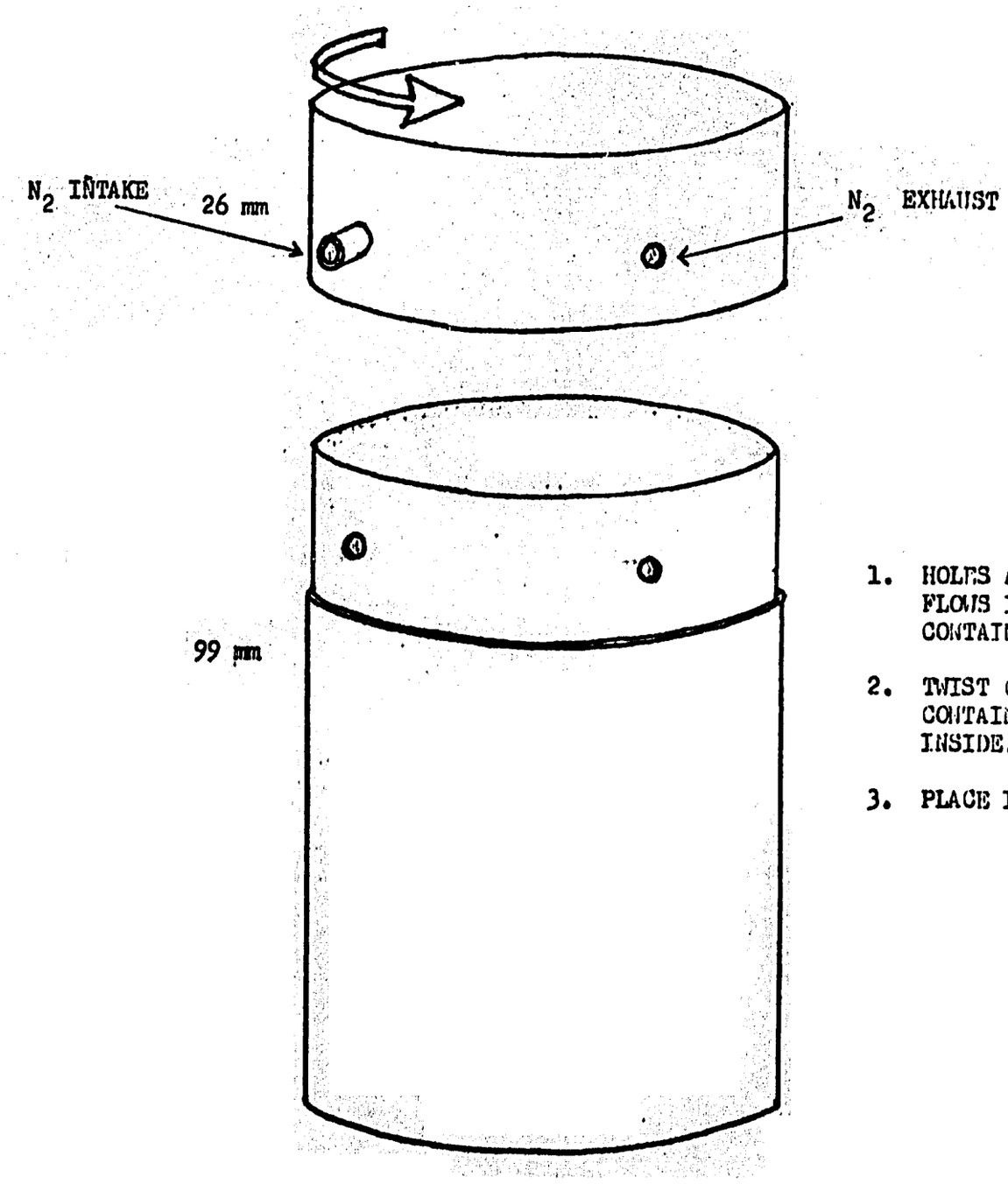
The irradiation technique involved the use of a cylindrical container 100 mm x 72 mm I.D. (The container is manufactured for Hoechst Company for merchandising aspirin and twenty have been supplied free to us by this Company in Germany.) For irradiating the adults, a stainless steel wire frame covered with netting was made to fit inside the plastic cannister. By passing N_2 into the INTAKE port, drilled through the lid and cup, and out through an EXHAUST port (Fig. 1) the adults inside were immobilized in less than 3 minutes. The flow of N_2 was roughly regulated at 10 bubbles/sec. in a flask of water. Nitrogen was introduced for 10 minutes before the container was sealed by twisting the lid.

In the TX1 experiment, a total of 76 adults (38 ♂ and 38 ♀) were irradiated with a dose of 12.6 krads on the day of emergence and prior to receiving the first blood meal. An equal number of males and females received the same treatment with N_2 but were not irradiated. Two criteria were used to compare the effect of irradiated flies to unirradiated controls: (1) the sterility observed after mating irradiated sexes with untreated sexes, and (2) the number of flies alive in each successive Age Group Period (AGP). All males in the experiment were used only once for mating. A primary reason for using adults in the beginning was to have an active life stage to test the newly designed technique for irradiating the insect in a nitrogen saturated atmosphere. To date complete sterility has been exhibited by both sexes without significant reduction in survival (Table IV).

The next test (TX2) was performed with lots of 20 fed adults treated in the same way as the unfed adults except subjected to dose rates of 9.5, 12.6, 15.8, and 19.0 krads irradiation (Table V). Flies fed in the morning and irradiated the same afternoon exhibited high mortality shortly after treatment with sterilizing doses. A comparison of longevity between unfed and fed males irradiated at 12.6 krads (Tables IV and V) reveals 15 percent higher mortality in fed males soon after irradiation. If these observations are confirmed in subsequent replications, it appears that irradiation of adult males would have to be done before receiving a blood meal to avoid heavy losses at sterilizing dose rates.

FIG. 1

IRRADIATION CONTAINER (Scale 1:1)



1. HOLES ALIGNED SO N_2 FLOWS INTO CONTAINER FOR 10 MIN.
2. TWIST CAP TO SEAL CONTAINER WITH N_2 INSIDE.
3. PLACE IN IRRADIATOR

TABLE IV

TX1. STERILITY AND LONGEVITY OF ONE-DAY OLD UNFED *G. m. morsitans* ADULTS AFTER 12.6 KRADS IRRADIATION (n indicates number of mating pairs)

	Percent alive at end of indicated Age Group Period (AGP)				
AGP	(n = 38) IR ♂	(n = 38) N ♀	(n = 38) N ♂	(n = 38) IR ♀	(n = 37) Untreated control (N♀)
1	100	95	100	97	92
2	100	95	95	97	89
3	100	92	95	95	89
4	100	92	95	92	84
5	97	82	87	92	81
6	95	76	76	92	81
7	92	71	74	82	73
8	84	68	74	76	65
9	53	60	63	66	65
10	45	55	50	60	57
Pupae Produced		0		0	145

TABLE V

TX2A. STERILITY AND LONGEVITY OF TWO-DAY OLD *G. m. morsitans* MALES FOLLOWING THE FIRST BLOOD MEAL AND EXPOSED TO 9.5, 12.6, 15.8, 19.0 KRADS GAMMA RADIATION (n indicates number of mating pairs)

	Percent alive at end of indicated Age Group Period (AGP)									
	9.5 Krads (n = 19)		12.6 Krads (n = 17)		15.8 Krads (n = 11)		19.0 Krads (n = 4)		Control (n = 19)[a]	
AGP	IR♂	x N♀	IR♂	x N♀	IR♂	x N♀	IR♂	x N♀	N♂	x N♀
1	95	100	85	100	55	100	20	100	100	100
2	95	95	85	94	50	100	15	100	100	100
3	85	90	85	94	50	100	15	100	100	100
4	85	90	80	94	50	100	15	100	100	100
5	85	90	80	94	50	100	15	100	95	100
6	80	90	65	88	50	100	15	100	90	100
7	80	90	60	82	50	100	15	100	90	100
8	70	84	60	82	50	100	10	100	90	100
9	70	84	55	71	30	100	0	100	90	100
10	45	—	35	—	15	—	0	—	79	—
No. pupae produced		0		0		0		0		82

a/ Initial stock was 19 pairs.

TABLE VI

TX2B. STERILITY AND LONGEVITY OF TWO-DAY OLD *G. m. morsitans* FEMALES FOLLOWING THE FIRST BLOOD MEAL AND EXPOSED TO 9.5, 12.6, 15.8 AND 19.0 KRADS GAMMA RADIATION (n indicates number of mating pairs)

	Percent alive at end of indicated Age Group Period (AGP)											
	9.5 Krads (n = 15)			12.6 Krads (n = 19)			15.8 Krads (n = 15)			19.0 Krads (n = 12)			Control (n = 20)		
AGP	IR♀	x	N♂	IR♀	x	N♂	IR♀	x	N♂	IR♀	x	N♂	N♀	x	N♂
1		70			95			70			60			100	
2		70			95			70			55			95	
3		70			95			70			55			95	
4		70			95			70			55			95	
5		70			95			70			55			95	
6		70			90			65			55			95	
7		70			90			65			50			90	
8		70			90			65			50			90	
9		70			85			60			45			90	
No. pupae produced		0			0			0			0			79	

There was an apparent increase in mortality among the irradiated females, but not as great at higher dosages as found in the males. Survival was better in the 12.6 krad females than the 9.5 krad group, in fact, nearly as good as the control. However, no pupae were produced by the end of AGP 9. The reason for the high survival among those fed females compared with male survival has not been determined.

TX3 was an experiment using male pupae after most females had emerged from a group of pupae of the same age. The dosage rates used were 3.2, 6.3, 9.5, 12.6, and 15.8 krads plus an untreated control. Thirty males from each dosage rate were mated with normal females. Flies were mated in pairs in glass vials and reared on rabbits as in the other experiments.

Sterility was 100% in males irradiated at 12.6 krads through AGP 7 while survival was equally as good as the control. At the higher dose rate survival was slightly lower than the control. The results obtained so far are very encouraging.

Field release of sterile flies began near the end of this report period. Until more results were available from our tests all pupae were irradiated at 15.8 krads in N_2. The exposure used for a recent shipment was reduced to 12.6 krads based on our results. A total of 869 male and female flies had been marked and released at Mzeri Hill Ranch. Sterilized, marked flies were recaptured up to 16 days after release.

TABLE VII

TX3. STERILITY AND SURVIVAL OF MALE *G. m. morsitans* IRRADIATED AS PUPAE AT DIFFERENT DOSAGE RATES AND MATED ONCE WITH NORMAL FEMALES (30 mating pairs per test)

	Percent alive at end of indicated Age Group Period (AGP)											
	3.2 Krads		6.3 Krads		9.5 Krads		12.6 Krads		15.8 Krads		Control	
AGP	IR♂ x N♀		IR♂ x N♀		IR♂ x N♀		IR♂ x N♀		IR♂ x N♀		N♂ x M♀	
1	100	100	97	100	100	100	100	97	100	100	100	97
2	100	100	90	100	100	97	100	93	100	100	100	93
3	100	100	90	100	100	97	100	87	97	100	100	90
4	100	97	90	100	100	97	100	83	97	100	100	90
5	100	97	90	100	97	97	100	83	97	93	100	90
6	97	93	90	73	93	97	97	83	93	93	97	90
7	90	93	90	73	93	97	93	77	83	93	90	90
No. pupae produced		38		13		3		0		0		73

The early releases have allowed trials of transporting pupae by vehicle to the field in cages and cool boxes, marking techniques, and recapturing methods. This will become a major area of work in the next six months. Attention will be focused on improving sampling and recapture methods and initiation of field population sampling.

Two project entomologists received two weeks training in protozoology (trypanosomiasis survey) and tsetse fly survey methods in Kenya under the auspices of the Kenya Veterinary Division of the Ministry of Agriculture.

HOST ANIMALS

Goat Husbandry

In theory, 60,000 *G.m. morsitans* can be maintained on 360 goats capable of feeding 500 flies/animal. This would provide for alternate use of 3 groups of 120 animals each. We had 413 goats at the end of June, but were experiencing a shortage of animals to maintain 30,000 flies. Although we do have goats that feed 500 flies/day without adverse effects to the host, the insufficient number of such animals presented a problem. Roughly one-third of our goat herd was comprised of kids under one year old. In addition, replacement of small animals that cannot feed more than 300 flies/animal had not been completed. Newly acquired animals are also continually being introduced into the fly feeding regimen and are challenged with a low number of flies during a training period of six weeks. The procedure for introducing these animals into the fly feeding regimen contained in the previous report

has been lenghtened. Animals now receive 25 flies on the first two feeding days, 50 the next two, 75 the next one, then 100 which is then increased by increments of 50 flies each feeding day up to 500.

Efforts were continued to improve the quality of our goat-host animal herds to ease the problems created by the shortage of hosts, while striving for maximum efficiency in the fly feeding process and use of animal housing facilities. Purchase of animals superior in size and fly-host characteristics to the small indigenous East African breed of goat was one approach. Breeding these animals cannot keep up with fly colony expansion, however, because the offspring are not fully grown until about 1.5 years. A favourable response to our inquiries to livestock breeding stations in Tanzania was obtained and suitable animals were issued to this project (Table VIII). An arrangement was worked out whereby our breeding will continue with high quality animals at our station, such as pure-bred Toggenburgs, which will be issued to the livestock research stations in return for mature animals suitable for use in our laboratories. Our experience with the Kamorai type goat reveals that the animal is hardy and relatively disease free under our laboratory conditions and compares favourably with other breeds as a fly host (Table IX). This breed is available at the livestock research stations.

TABLE VIII

SOURCE OF GOATS USED AS HOSTS FOR *G. m. morsitans*

Date	Source		Number
1975			
January 11	Mombasa, Kenya	(Purchased)	25
February 20	West Kilimanjaro Breeding Stn	(Issued)	10
March 25	Korogwe	(Purchased)	5
April 11	West Kilimanjaro Breeding Stn	(Issued)	28
May 2	Tanga Livestock Breeding Stn	(Issued)	11
May 29	Kongwa Pasture Research Stn	(Issued)	20
May 30	Ilonga Research & Training Inst	(Issued)	15
June 27	West Kilimanjaro Breeding Stn	(Issued)	40
		Total:	154

TABLE IX

AVERAGE WEIGHT OF FIVE BREEDS OF GOATS AND THE HOST SUITABILITY

Breed	Sample size	Average wt. (lbs)	Average no. tests	Host suitability: Average % and range	Host suitability: Number below 90%
Kamorai X	20	75 (51-102)	2	94 (90-98)	0
Toggenburg	14	90 (63-129)	1	99 (96-100)	0
Toggenburg X	20	75 (49-104)	2	95 (86-100)	3
Saneen X	12	75 (55-102)	2	96 (89-100)	1
East African	20	57 (31-85)	2	90 (73-99)	10

Host suitability tests are performed using 2-day old starved male flies to determine percentage fed after 15 minutes on a test animal. Usually 20 flies are used per test; 10 flies on each flank. Under the present system, each animal is tested for host suitability at intervals of 4 - 5 months. Animals below 90% suitability are retested within 3 days if the skin appears unaffected by feeding. Animals with skin reaction or with a lower than 90% suitability index for two tests are rested for approximately six weeks.

Observations on the impact of overchallenging goats were noted during periods of insufficient host animals. Some animals recovered without resting when fly numbers were reduced from more than 600 to below 500. Increasing fly mortality could be corrected in 2 to 3 weeks following replacement of overchallenged animals with suitable hosts. Our observations corrobrate the documented report that large mature goats cannot feed more than 500 flies at 3-day intervals without adverse effect to both fly survival and host suitability.

There is a very strong pecking-order among goats housed in the insectaries and fighting injuries became increasingly troublesome as the stocking rates in the pens were increased. A few animals died from horn wounds. In March, we started applying rubber elastrators on the horns and in April began using a budding iron on kids under 3 weeks old to eliminate the horns and curb the problem. By June 1, elastrators had been applied to 195 goats and 43 kids had been debudded. Thirty-four goats had lost horns with only one showing regrowth. In mature animals the horns fall off in about 10 weeks. There were no infections. Of 43 kids debudded, horn regrowth occurred on only 6; these were burned off again and no infections occurred on any of the animals. Application of elastrators is painful to the animals for several hours, but more humane than permitting animals to be maimed or killed by fighting. Also, working conditions in the fly feeding room are safer with hornless animals. Goats to be left out-of-doors, such as stud males, are not dehorned and therefore are not deprived of their natural defense mechanism.

Rabbit Husbandry

Rabbits can be successfully reared under the tropical environs of Tanzania and used for tsetse fly hosts in the laboratory. The purpose of rabbits at Tanga remains the same as originally planned, which is to provide an alternate host for the goat-fed colonies should the need arise. The 44 rabbits maintained at Tanga at the end of June were being used to feed experimental fly colonies including a mutant strain and flies from irradiation tests. When additional hutches are obtained, the number of rabbits will be increased to around 100.

Although rabbits are excellent hosts for *G. m. morsitans*, several disadvantages exist with their use in our large mass rearing program. The primary disadvantage is the increased amount of time required to handle numerous small cages with fewer flies compared to rearing on goats. More than 30,000 flies are fed on goats in approximately 4.5 hours, a rate which could not be achieved by the same system on rabbits. Although no differences in disease susceptibility or life span have been apparent between the different breeds of rabbits, breeding the desired lop-eared varieties has been difficult. During the past six months nine rabbits either died or were destroyed due to posterial paralysis. The cause was due to spinal injury received from handling and while tethered for fly feeding. These are among the primary reasons that goats will continue to be employed as the principal fly-rearing host.

One noteworthy benefit of our work in establishing rabbits, which have been reasonably healthy and disease free, is the interest in developing this animal as a source of human food within the country. The Ministry of Agriculture has requested a proposal by a Livestock Breeding Station to pursue the results we have obtained on a large scale. The development of rabbit farming as a source of human food has not been investigated before in Tanzania and the system we use at our laboratory would be adaptable to such a program.

DEVELOPMENT OF RELEASE SITE

A field station has been erected at Mzeri Hill consisting of two prefabricated laboratory/living quarters, 5 metal uniport buildings on cement foundations, and installation of water lines. In addition, some 120 linear miles of survey trails have been brush-cleared and marked. Fly round surveys have been initiated in the area along with test releases of sterilized flies.

A suitable release site has been selected and considerable time and effort expended to prepare Mzeri Hill Ranch for the sterile male tsetse release (see reports for previous year). A major prerequisite for this test is the creation of a fly barrier around the test site in order to isolate it from surrounding tsetse populations. Construction of the barrier has been delayed for several months because the original plan

to utilize heavy equipment became unfeasible. Among the efforts to resolve the problem was a meeting with AID officials in Washington in February 1975 to settle on a workable solution that could be funded entirely, if necessary, by AID. A labor intensive approach of hand-clearing the 16,000 acre barrier in conjunction with painting fresh-cut stumps with herbicide to prevent regeneration could be accomplished for an estimated US $50,000. This cost estimate was based on the acquisition of free surplus herbicides from United States stocks. Prompt action is required inasmuch as the work would take 12 to 18 months to complete the barrier and test its effectiveness. Other means such as bulldozer sheer-clearing or aerial application of herbicide were financially unfeasible.

The selective use of surplus herbicides for controlling brush regeneration in a fly barrier zone would, in addition to saving the project $200,000, also afford a useful means for reducing the surplus of this chemical planned for disposal in the U.S. The first step necessary to obtain the 2, 4, 5,-T and 2, 4-D compound was for the host country to submit a request to the U.S.A. A request was forwarded through Tanzanian Government channels on June 14, 1975. The present disposition of the request is unknown.

The need for isolating the ranch is an urgent matter which, if not resolved soon, will disrupt the synchrony of the various phases of the program and ultimately jeopardize the completion of the research project.

LABORATORY FACILITIES

The construction, modification, and maintenance of needed laboratory/office facilities continued to constitute a large part of our activities.

Main Office Building

The construction and modification of the building is complete with the only remaining work being the installation of laboratory and office hardware, i.e., equipment and tables in the veterinary laboratory. The shortage of office space was remedied with the completion of two large rooms for this purpose. All ceilings were completed along with electrical wiring and the entire interior of the building repainted. An office has been designated for use by the political party TANU, which is normally done at installations having as many employees.

Insectaries No. 1 and No. 2

Both insectaries are fully operational and contain nearly equal numbers of flies. Insectary No. 1 is fully stocked with the planned 20,000 flies and sufficient animals can be housed in this building to maintain the colony.

Insectary No. 3

Procurement of needed materials was delayed due to shortage of commodities and funds. The site has been prepared and work will proceed immediately in the next fiscal year, receiving high priority.

Irradiator Unit

The Gammator ^{137}Cs Unit was in perfect working order and is being utilized on a routine basis.

Standby Generator

A purchase order was submitted for a second unit which will supply emergency requirements for the total planned laboratory.

Water Reservoir for Laboratory Humidifiers

A tank system to collect rainwater from the roofs of Insectaries Nos. 1 and 2 was successfully accomplished.

Irrigation Well Exploration

Tanga Water Master Plan Unit drilled an exploratory water well which proved to be too saline for irrigation purposes. We were advised that another well could be drilled in late September at a site which tests have shown to be suitable.

Animal Forage Crops

Tanga Dairy issued 500 bales of hay for testing its usefulness in our laboratory herd management. The hay was suitable but supplies are not readily available. We are considering the purchase of a mower and baler since our fields will be planted in hay-type grasses.

Field Station

Mzeri Hill Ranch was still being developed as the proposed release site, the only obstacle being the creation of a barrier to isolate tsetse fly movement. Living quarters and survey preparations, i.e., fly rounds and map surveys were accomplished.

Vehicles

Vehicles required for the field release phase of the program have deteriorated rapidly. Availability of spares continues to be a problem. Additional vehicles will be needed to replace machines which are no longer dependable for highway travel.

ADMINISTRATIVE MATTERS

Personnel

The total staff at the Tsetse Research Project was 97 which fluctuates depending on the need for temporary laborers. With the construction requirements at the laboratory, temporary labor comprises about one-quarter of the total manpower. A breakdown of the management and staff is: 18 Officers (including expatriates), 35 Field Assistant/ Lab Attendants, 14 Craftsmen (mechanics, artisans, drivers), 3 Watchmen, and 27 temporary Laborers.

The officer staff was increased and improved in the past six months. During this period Mr. P. E. Cobb, entomologist, joined the project to increase our strength in field studies. Also, one officer returned after completing the Master of Science (Entomology) Degree in the U.S., and a Research Officer with the B.S. (Biology) degree from the University of Dar es Salaam was posted to our project. The tabulation below shows our Tanzanian Officers of the various departments who are being trained by expatriate staff.

	Name of officer	Designation	Name of expatriate	Designation	Counterpart department
1.	S. A. Tarimo	Research Officer	H. Baumgartner	Laboratory Technician	Laboratories
	E. A. Mwakyolo	A.F.O. I (T)			
	O. S. Chalo	A.F.O. II (T)			
2.	H. S. Nkungu	A.F.O. II (T)	D. B. Gates	Entomologist	Field
	B. G. Bakuli	A.F.O. II (T)	P. E. Cobb	Entomologist	
3.	E. M. Karosi	A.F.O. II (V)	D. J. Gregory	Veterinarian/ Entomologist	Veterinary
	A. S. Isangya	A.F.O. II (V)			
	*J. J. Lubuva	A.F.O. II (V)			
	E. Mrisho	A.F.O. II (V)			
4.	M. C. Kenogo	Accounts Clerk	B. F. Semelhago	Administrative Assistant	Office and Accounts
5.	A. M. Mwashala	Tsetse Officer I and designated Project Counterpart Manager	D. L. Williamson	Entomologist and Project Manager	Management/ Research
	S. R. Mbise	Field Officer II Acting Co-Manager (outgoing)			

*In National Service training until December 1975.