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RESEARCH ON THE STERILITY METHOD OF TSETSE FLY CONTROL
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SECOND PROGRESS REPORT (JANUARY - JUNE, 1964)

Research on Chemosterilization of the Tsetse Fly, Glossina morsitans orientalis - ARS

From January, 1964 when research investigations were initiated on chemosterilization, until April, 1964, research effort was entirely concentrated on the development of handling and testing techniques suitable for evaluating chemosterilants against the tsetse fly, Glossina morsitans orientalis. Meaningful evaluation of chemosterilants depends on testing techniques that allow maximum survival and reproduction under laboratory conditions. Such factors as type of cages, methods of feeding, substitutes for blood-meals, means of anesthetizing adults for sexing and transfer, the effect of age on mating and fertilization, were studied. The criteria of evaluation in studies on these factors were the survival of males and females, the rate of insemination, the inseminating capabilities of males, and the degree of reproduction.

Based on the results of these investigations a standard procedure for the evaluation of chemosterilants on fertility was adopted as follows: Six- to seven-day-old males are caged in equal numbers with twenty-five, 2- to 3-day-old females in feeding cages. These cages are 8 inches wide, 11 inches deep, and 8 inches high with a plywood back, a sleeve at the front and screening over the remainder of the cage. An oval hole in the floor of the cage with a screened enclosure projecting into the interior of the cage allows feeding of tsetse flies on a guinea pig which is outside the cage. This technique causes a minimum of disturbance to the flies. Each cage of flies is fed on a guinea pig daily for one hour and then placed over a tray of sand for larviposition. On the twenty-eighth day after initiation of the test, pupae are collected and the surviving adults counted and examined. The pupae are held for six weeks to determine adult emergence. When desirable or necessary, a separate test cage is set up concurrently with 10 to 25 pairs of similarly treated flies and after 72 hours the degree of insemination is determined by microscopic examination of the females' spermathecae. In this way, the effects of chemosterilants on survival, mating, and reproduction is determined.

Using this technique, research was initiated in April, 1964 on the effect of three chemosterilants on the tsetse fly, Glossina morsitans orientalis. Tests have been completed in which male tsetse flies 2 days old were exposed to residual deposits of tepa and metepa (10 mg. per square foot of glass surface) and apholate (100 mg. per square foot of glass surface). Exposure periods were 2 and 4 hours. Both tepa exposures caused some male mortality in 4 days; however, no initial mortality was noted with metepa or apholate. Survival over a 4-week period was not affected by the apholate treatment, but was affected by the tepa and metepa treatment. Tepa and metepa caused a high degree of sterility in male tsetse flies. Apholate produced a high degree of sterility in some tests, but not in others. Examination of untreated females mated to treated males indicated normal ovarian development in most instances. No evidence of embryonic development was seen in those tests in which full sterility was attained.

Tests on the application of chemosterilant's by other methods of exposure such as pupal dipping and adult feeding have been initiated. Inasmuch as these tests are as yet incomplete, the preliminary results are not included.

Results obtained thus far in research with chemosterilants are extremely encouraging. However, a great deal of further study is necessary to determine the most effective means of sterilizing tsetse flies without influencing their sexual vigor or competitiveness.

Mass Rearing, Biological, and Ecological Studies - ARC

(1) Introduction.

The U.S. Fiscal Year coincides reasonably well with the Rhodesian Glossina year and a project beginning in July ought to have been well established by the onset of the rains in December. Unfortunately research began in February when most of the access tracks in the Zambezi valley were impassable.

The first tasks were: -

- (a) to begin training junior staff and
- (b) to select a site for the project; the next were
- (c) to recruit the more senior staff
- (d) to make as much use as was possible of available funds so that as soon as staff were ready to work, the basic equipment would be installed.

(2) Staff.

Seven Field Assistants have received an initial three months training at the Government Tsetse Field Research Station at Rekomitje. They began work at the Project Station during May. Mr. K. Rhodes was engaged as an Experimental Officer at the end of February and was thus able to begin work on the Project Site as soon as it was selected. Mr. F. Wilson, who has just retired from service with the Uganda Government, and who has had a long experience in tsetse-fly and trypanosomiasis field work in cattle management, accepted appointment as a Senior Experimental Officer and took up his duties on June 22nd. An approach was made to Dr. E. Buyckx, of I.N.E.A.C., who has been in charge of anti-tsetse operations in Rwanda and who had expressed interest in the present work. However, no reply to the offer has been received and it has been withdrawn.

(3) The Project Station.

Sites within the Zambezi fly-belt which are well supplied with water and are easily accessible are rare. Dr. R. J. Phelps of the A.R.C. Tsetse Research Team suggested that the south bank of the Zambezi River, just east of the Chirundu Sugar Estate might prove suitable. The Officer-in-charge of the area for the National Parks and Wild Life Management Department of the Southern Rhodesian Government also suggested this as a suitable area and in early March, as soon as the country had dried off somewhat, he was good enough to loan one of his officers and some labourers to open up the track into the area. Access via the Sugar Estate, which had been closed in February by bush-clearing operations, was also now opened and a good road now runs to the Great North

Road, only 12 miles from the site selected. The distance of the site from Salisbury is about 230 miles of which all but the last 12 are on tar. There is an air-strip on the Sugar Estate, as well as Post Office, Store and Clinic. The Chirundu Sugar Estates Limited have already been most helpful to us in many ways.

The Project Station lies two miles east of the Sugar Estate boundary which is formed by the Mwangu River. The area is known as Kakomakomorara. Application for a temporary title to the site was made on 19th March to the Department of Lands. No written reply has been received so far, although a verbal assurance has been given that no objection is likely.

(4) Work in Progress.

- (a) A small pumping station has been installed, which will yield one thousand gallons per hour. It is connected to tanks from which water may be gravitated to the camp site and to cattle watering troughs in the paddocks. The majority of cattle will normally be watered at the river bank.
- (b) The basic pattern of cattle paddocks has been marked out to cover an area of $2 \times 1/2$ square miles which will be divided into six large paddocks. These will be fenced with standard type 4-strand fences (but using high-strain steel wire and not barbed wire) hung with warning markers. The contractors are expected to complete this fencing in June. A roofed sheep pen has been built and a high-fenced kraal to take 100 head of cattle as well as an inspection crush. However, before the livestock are introduced these structures are to be surrounded by a game fence. Fire breaks have been made to enclose the whole operational area.
- (c) One hundred and five head of cattle (for the most part tollies, heifers and calves ready for weaning) have been bought and are being held free on the seller's farm in the Doma area. Similar arrangements have been made for the purchase and holding of 75 head of sheep near Sinoia. (We are much indebted to the Senior Veterinary Officer, Sinoia, for arranging the sales and for giving up a day to do the buying for us). It is planned, later, to introduce a small herd of pigs. The Chief Veterinary Trypanosomiasis Officer of the Government Veterinary Service has offered to provide a regular inspection for the livestock and, so far as trypanosomiasis goes, to treat them as an experimental herd. He proposes that the cattle should be maintained on Samorin (Isometamidium) which has a prolonged prophylactic action and has proved very satisfactory at Lusulu. The sheep will be treated with Berenil when necessary. It is hoped to be able to induce immunity in the pig herd by using preliminary antrycide treatment. Ticks will be controlled by a Toxaphene spray (although if this is not adequate it may be necessary to build a dip).
- (d) It is expected that at least one of the two initial trial cages will be operating in July. This will be the roofless cage, with 15 feet walls constructed of tobacco seed cloth. It will be approximately one acre in area. A second roofed cage will be erected as soon as scaffold material, which is on order is received. This will be a small version (90 x 90 feet in area) of the Wisconsin Bee Cage and will be constructed from scaffold units 10 x 10 feet and will thus

be extendable by addition of further units as required. In both cages additional artificial shade will be supplied as well as artificial larviposition sites. The first operation in each will be to introduce a relatively large number (say 5000) of puparia and to observe the behavior of the emergent flies, both as to feeding (on a tethered ox) and as to larviposition.

- (e) Routine observations on the Glossina population began in May by the conventional fly-round method, without bait animals or screens. The two long sides and the centre trace of the paddocks were used as transects, each giving thirty sectors of 100 yards each. The Apparent Density (mean) for the period 15 May to 2 June was 98.7 non-teneral males per 10,000 yards. The two north-east paddocks (on this basis) gave an A.D. 53.9 and the two south-west (covering the Mwangu stream) an A.D. of 206.9. The two middle paddocks, lying on a watershed between the Mwangu and the unnamed stream just skirting the north-east end of the paddocks, gave an A.D. of 31.9. These figures were derived from a total catch of 1421 non-teneral males, 23 n-t females and 40 tenerals of both sexes. They are of little significance except to show that the area appears to support fair population of Glossina morsitans and this species is distributed in the manner to be expected from an inspection of topography and vegetation. A collection of blood meal samples is being made for analysis at the Lister Institute of Preventive Medicine of the natural hosts prior to the introduction of domestic livestock. Puparia of G. morsitans are comparatively easily found at present in sandy river beds, but not elsewhere. This is in line with experience in other parts of the Zambezi valley at this time of year. In addition to the 1484 G. morsitans taken on the routine patrols three non-teneral males and two teneral females of G. pallidipes were taken, all on the 19th May.
- (f) Of 211 live puparia collected mostly in the Mwangu River, one was a G. pallidipes. In addition 679 shells of G. morsitans were taken. These were collected by six assistants in six mornings searching, unsupervised. Subsequently, on a three hour supervised search, 55 whole puparia and 75 shells were found in a previously searched section of the Mwangu. The difference in proportion of whole puparia to shells in the second search is according to expectation.
- (g) Animals recorded on the fly transects either as spoor or seen were baboon, buffalo, bushpig, duiker, elephant, grysbok, hyaena, impala, kudu, warthog, waterbuck and wild dog. In addition to these eland, hippopotamus, lion and leopard have been seen or heard.

(5) Future Programme.

The livestock will be brought in during the first week of July. By the end of that month a start should have been made on experimental attempts to concentrate the morsitans population or to retain in a confined area an artificially introduced population. This building up of a dense population is seen as a separate exercise from the task of facilitating harvesting of puparia, which will be pursued at the same time. By the end of the coming fiscal year one should be able to say whether the methods used are likely to be successful for the mass production of tsetse-flies.