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## RESEARCH ON THE STERILITY METHOD OF TSETSE FLY CONTROL OR ERADICATION

SIXTH PROGRESS REPORT (January 1966 - July 1966)

ENTOMOLOGY RESEARCH DIVISION AND ARC OF CENTRAL AFRICA

Two Resident Entomologists and one Senior Experimental Officer resigned during the period under consideration. Replacement staff have been recruited, but the tempo of work at the Chirundu Field Station slowed up temporarily as a result of these staff changes. The rainy season occurred during the first half of the period covered by this report, and field work was hampered by conditions typical of the season. Transportation difficulties were few, and the new vehicles proved reliable under very trying conditions. A new access road to the Field Station at Chirundu has been completed, and an air conditioned treatment room and office block has been constructed at the Agricultural Research Council's station at Kariba.

Research work during the period covered by this report includes continuation of projects initiated previously as well as the first report from the investigations on tsetse rearing in a large cage within a controlled environment room. Work on the attempt to concentrate tsetse on an area in which tethered oxen were present has ceased, and the data collected are being analyzed statistically. Attempts to localize tsetse by stabilizing the food supply are now being made in small paddocks containing up to fifteen oxen.

Investigations on the effect of chemosterilants on G. morsitans males in the laboratory have shown permanent sterility to be induced by ad libitum exposure to 25 mg./sq. ft. deposits of metepa or wind tunnel exposures to 1.0 ml. of 5% tepa. Reports in the literature indicated that topical application of 0.5 ug. metepa in 0.5 ul. methyl-ethyl-ketone was detrimental to survival of G. morsitans males and did not cause complete sterility. Results of previous trials here had shown 0.5 ug. metepa to be a substerilizing dose, and a repeat of tests on survival showed no deleterious effect. Permanent sterility was induced in G. pallidipes males both by injection of chemosterilants and by exposure to treated surfaces. Wind tunnel exposures did not cause permanent sterility at the dosage used. Competitive mating trials with treated G. pallidipes males showed that flies exposed to surface deposits or treated in a wind tunnel were able to compete with normal males, but results from other treatments did not give the expected reduction in pupae produced from the test.

Measurements of fly survival and reproduction in control cages have shown that there is a marked difference in the quality of flies emerging from pupae collected in the field at different seasons. Pupae collected in the October-November period give the lower quality flies, while those collected in January-June give the best flies. The original G. morsitans colony has shown improved productivity recently, following a change in the ratio of males to females in the cages. Using the new sex ratio and flies from pupae collected at the optimum season, a second G. morsitans colony has been started. The pupae produced by parental females were divided into a high and a low weight colony. No further selection was made, and adults and following filial generations are kept within their respective sub-colonies. The new attempt at colonization is yielding pupae at a rate which should permit increase in numbers in filial generations. Success with the attempt to colonize G. pallidipes has been limited, and the colony is failing.

Work in the laboratory had indicated that flies held in small cages showed reduced flight activity when released in larger cages in the field. A test was devised, using the response of the flies to light, to measure the flight activity in the laboratory. Indications are that the activity of males declined over a six-day period, while that of females increased. Investigations continue in an attempt to determine whether the change is actually one of flight ability or one of change in phototaxis. Storage of pupae would be desirable to accumulate enough material for large scale releases, but only if the resulting flies are comparable to wild flies with respect to vigor. Temperatures have been determined at which flies may be stored for up to two weeks without serious reduction in subsequent emergence of flies, but tests of quality of flies resulting have not yet been made.

Attempts at colonization in the controlled environment room at Chirundu have been confined largely to determining the best way to manage the feeding of the flies, and solution of problems of locating flies in the cage. It has been found that flies emerging from field-collected pupae survive better in this cage than flies caught in the field and transported to the cage. Artificial pupal sites have been placed within the cage, and the majority of pupae found in the cage have been located in these sites. Pupae have been produced from flies put into the cage as teneral, indicating that mating and survival at least to the time of first larviposition has been achieved. A further survival trial was conducted in the large (100 X 100 X 10 feet) cage, and the maximum longevity obtained was 16 days. Various modifications have been made to the furnishings within the cage, and it is hoped that improved survival will be achieved. A small (8 X 16 X 16 feet) cage, covered with reeds to exclude daylight, and supplied with artificial light and a sprinkler system to modify humidity and temperature, has been constructed. Detailed comparisons have been made of the environment within this cage and that pertaining in pieces of natural habitat and that within the controlled environment room. The conditions within the small cage have been shown to fall within the climatic limits for fly survival. Using containers of various volumes within the small cage, it was shown that flies in small containers survived better than those in large containers. Production of pupae by field collection near Chirundu has been poor during the period under consideration, primarily because of the dispersal of flies during the wet weather and the poor state of the roads leading to the pupal collection areas.

Results from the fly transects showed a similar trend in the G. morsitans population index to that of previous years. Catches of G. pallidipes remained low. Fly transect work has now been dropped, and data for the full two years are being analyzed. A paddock of five acres containing fifteen oxen, and a one acre paddock containing six oxen have been constructed, and it is hoped that these herds will act as a focus for a build up of tsetse densities in the field. The paddocks are situated in secluded spots, and were constructed with the minimum of disturbance to the environment. Numbers of flies caught so far are comparable to those taken at control points, and fly densities are as yet too low for any conclusions to be drawn.

Dissections of field-collected female flies from Kariba and Chirundu have shown an insemination rate of 67% for nulliparous females, while that for parous flies ranges from 95% to 100%. Comparisons of age based on wing wear with that based on

ovarian conditions showed that heavy wing damage can safely be correlated to parous flies but light damage does not serve to separate parous from nulliparous flies. Wing fray values appear to be of little value in determination of chronological age in females.

Population estimates on Long Island have continued, and both the Lincoln Index system and a more comprehensive approach devised by the Biometrics Unit of the Agricultural Research Council have been used. Estimates of male G. morsitans population indicate a slight increase from November to March. Attempts to obtain reasonable estimates of the female G. morsitans population, and that of G. pallidipes have not been successful. At the level of male G. morsitans population existing, it is unlikely that a single insecticide application will reduce numbers enough to make a sterile male release program practical at present. A second island, Sampakaruma, has been selected as a control island for the program, and population indices are being obtained. Both G. morsitans and G. pallidipes exist on this island. No fly movement has been detected from the mainland to Long Island. Two flies have been recorded as moving from Long Island to the mainland and one from Long Island to Middle Island. In view of the large number of flies marked and caught in the Long Island area, the lack of migration records indicates good isolation of the Long Island population. In co-operation with the Rhodesian Ministry of Agriculture, game surveys are being conducted on Long Island, and analysis of tsetse blood meals is being carried out. Infection rates of the flies on Long Island and on Sampakaruma were determined in February and May, and the information available from this work and the game survey should provide good material for study of the relationship between tsetse and their natural hosts.