

Paper No. 3.

SOME ASPECTS OF THE TSETSE FLY PROBLEM IN A COLONY DEVELOPING ON THE BASIS OF EUROPEAN SETTLEMENT.

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IN the following notes it is proposed to present very briefly certain aspects of the Tsetse Fly problem in Southern Rhodesia as viewed from the purely entomological aspect at the present day. It will, it is hoped, be understood that the equal importance of approach from the veterinary, proto-zoological and other standpoints is fully realized, as also is the fact that advance along other lines of research might considerably modify the problem as it now faces the entomologist. Experience in connection with Protozoan diseases other than Trypanosomiasis would, however, appear to indicate that eradication of the vector must ever constitute a major consideration in reference to control of the diseases conveyed.

The species of *Glossina* mainly involved in Southern Rhodesia is *morsitans*, although *pallidipes* and *brevipalpis* are concerned in the Melssetter district in the south-east. Whilst Human Trypanosomiasis occurs in one remote district, the problem in the colony is almost entirely concerned at present with Trypanosomiasis in domestic animals.

Approximately half the area of the colony was infested with tsetse during the past century, the infested country being divided into two areas by the elevated high veld which traverses the colony roughly in a north-east and south-west direction. Tsetse disappeared from the southern area following the year 1896 and in the north shrank to comparatively small belts in the Sebungwe, Hartley and Lomagundi districts. The southern area as far as is known has not yet been reinvaded, though in apparent danger of eventual re-invasion from Portuguese East Africa. The fly has, however, been spreading steadily in the northern area during the past thirty years and now occupies fully 18,000 square miles of country. Ten years ago the infested area was estimated at 9,000 square miles. Twenty years ago it is doubtful if 4,000 square miles were involved. The separate areas have now coalesced to form a vast fly area extending across the northern part of the colony from the Darwin district in the north-east to the Wankie district in the west. The tendency of the fly is to continue to spread on a front which, following its convolutions, exceeds 600 miles in length.

The presumably climatically protected high veld is now almost all occupied or alienated and much settlement has taken place in potential fly country known to have been infested in the past. Land available for new settlers, whom the colony so greatly needs, is now almost confined to the potential fly country.

Encroachment of fly and extension of settlement have resulted in contact being established in more than one district, with consequent loss of stock and actual or threatened evacuation of farms.

Loss of stock owned by natives has also occurred in various districts and certain native reserves have been invaded or are threatened with invasion by the fly.

From the practical standpoint the problem, therefore, includes the following features:—

- (1) Saving from evacuation certain areas in European occupation affected by the fly.
- (2) Prevention of invasion of Native Reserves and other areas of native occupation.
- (3) Arrest of the general spread of the pest.
- (4) Reclamation of infested area.

It may be said that the solution of the problem in all four of the above-mentioned aspects is in the long view vital to the health and development of the colony. There is, however, this is to be considered, namely, that scarcely a generation has passed since the fly evacuated the major portion of the potential fly area and that consequently the natives inhabiting this area are accustomed to living without cattle, and do not in general desire to leave their home areas when this is reinvaded by the fly. The European settler on the other hand, in spite of the possibilities of tractors, etc., can hardly at present maintain his position on an economic basis in the presence of the fly and in point of fact would not attempt to do so except in prospect of a not too distant improvement in the position.

It has been necessary, therefore, on considerations of urgency, to devote attention in the first place to the protection of European settlement, but the needs of the natives have not been ignored.

Before attempting to consider various possible measures against the fly it is necessary to grasp the fact that development of a colony on the basis of European settlement has a considerable influence in regard to what is practicable or otherwise. In Southern Rhodesia industrial development, even at the present day, absorbs almost all the available native labour. To such an extent is this the case that thousands of natives enter the colony every year from north of the Zambezi and are temporarily absorbed into its economic life. The effect of this in regard to measures against the fly is to preclude on a practicable basis all operations which are mainly dependent upon a really large supply of labour, and, even were it possible to collect the labour needed, the cost tends to be prohibitive.

Furthermore it is not possible to offer the land to natives as a reward for unpaid effort in driving back or checking the fly, except in native reserves, where in fact it belongs to them communally at present. Land outside the reserves is, generally speaking, destined for European occupation and the whole question is decided by legislation with which the entomologist certainly cannot attempt to interfere.

Native occupation is also distributed in accordance with tribal affinities which are the heritage of the past and at present there is ample room for all. The densest areas of native population are mostly remote from fly areas and are, in many cases, outside the potential fly areas. The natives cannot be moved about like pawns in a game with a view to creating barriers against encroachment of tsetse fly or to reclaiming infested areas. Here and there it is possible to offer them certain inducements to change the locality of their kraals, but the conditions attached do not involve anything in the nature of manual labour. It need hardly be said that the usual form of native occupation does not of itself constitute an effective barrier against the fly.

Finally it may be pointed out that tribal discipline has lapsed to such an extent that it is rarely possible to obtain substantial help from the native chiefs for purposes connected with operations against the fly.

Realization of the above conditions may lead to a better understanding of the difficulties involved and of the reasons why a certain line of action is, in the main, being pursued.

Practical operations against *morsitans* and other species of *Glossina* favouring savannah forest appear, in the light of present knowledge, to be confined to a very few alternatives. Amongst these may be mentioned (1) Organized Grass Fires, (2) Solid Clearance of Forest, (3) Destruction of Essential Retreats and (4) Game Reduction.

(1) With regard to *organized grass fires* it may be stated briefly that much of the country involved in Rhodesia does not appear to lend itself to successful employment of this measure and that experiments conducted have given discouraging results. Moreover, it is exceedingly difficult to conserve the grass over extensive areas to a sufficiently late date and in actual practice to carry out a successful burn. To rely upon putting this measure into practice year after year, unless a very elaborate and expensive guard system were maintained, would be to gamble against odds. The decisive factor, presuming the measure to be effective in heavily grassed areas, lies, however, in the large proportion of scantily grassed areas in the Southern Rhodesian fly country.

(2) *Solid Clearance of Forest*.—This has apparently been utilized to a considerable extent in Tanganyika Territory, but under conditions which are not paralleled in Southern Rhodesia. Preceding remarks concerning native labour and the native population generally have a powerful bearing in this connection. Complete clearing as a means of reclaiming infested country appears out of the question in reference to any aspect of the problem at present apparent in Southern Rhodesia, and is in any case generally undesirable.

It may be noted, however, that forest clearance by plain chopping was apparently the final factor in eliminating *morsitans* from a small isolated fly belt between Hartley and Gatooma some fifteen years ago. This cost the Government nothing, being carried out in connection with the supply of wood to a large mine, the Government stipulating, however, that the forest was to be levelled completely. Such economic opportunities are rare, and unfortunately at the present day none of the fly areas are isolated, so that reinvasion of the chopped area as soon as the trees grew up again would be the natural event.

Solid clearing of forest in belts with a view to creating a *barrier* to the fly's advance is a measure which has been freely suggested and has in fact received very careful consideration.

The fundamental drawback to arriving at any conclusion as to the practicability of this measure lies in the fact that reliable data appear to be lacking as to the width of the clearing necessary to accomplish the object in view. Certainly, as a direct Government operation, and this is the only procedure possible in most instances, the cost would be great. An attempt at chopping a mile wide barrier was made in 1918 in one district. Although over 300 natives were employed for several months only about one and three-quarter

miles were chopped. The influenza epidemic interfered, however, with the work. Chopping is of course a very temporary expedient. The cost of stumping is prohibitive, and ring barking has the drawback, fatal in many instances, of requiring several years before its effect is apparent.

Attempts to create barriers of the nature suggested appear almost a measure of desperation. Such barriers are inelastic and the prospect of the interminable maintenance and patrol involved in their effective employment is not far short of appalling.

Experimental determination of the necessary width appears also to involve difficulties which are almost insuperable unless unlimited funds and time are available.

(3) *Destruction of Essential Retreats.*—Under this heading is included clearance of forest which remains evergreen during the latter part of the dry season.

This measure is clearly not everywhere applicable, but in certain regions of comparatively low rainfall and shallow soil and where mopane forest is the dominant savannah type, it may be possible to carry it out at a cost which stops short of being prohibitive. The practicability of rendering country altogether uninhabitable by *morsitans* by this measure has, however, yet to be proved. Operations were commenced last year with the object of creating a ten-mile zone of country, lacking these presumably essential retreats, as a barrier to the renewed advance of the fly to the Gwaai River. Progress was, however, slow, the destruction of the timber involved was considered undesirable, and local opinion strongly favoured a renewal of operations against the game which had had a satisfactory sequel in 1922. The operations were, therefore, closed down in favour of an alternative scheme.

There is no doubt that destruction of the class of forest involved in this measure is highly objectionable. The aim is to deprive the country of all shade during the hottest part of the year. The trees are amongst the most beautiful constituents of our natural flora and many are valuable timber trees of great growth. No opposition has ever been offered to game reduction by the farming community in an affected area, but great reluctance in the matter of destroying streambank forest has been frequently manifested.

(4) *Game Reduction.*—There can be no question concerning the close approach to unanimity amongst students of the bionomics of *morsitans* concerning the ultimate dependence of this species on the game. Any difference of opinion which exists appears to be confined to the question of the practicability of reducing the game sufficiently to eliminate the fly. This would appear to be largely a question of local conditions and whilst a considerable European population introduces factors which are inimical to large-scale operations against forest, its influence in regard to the practicability of game reduction would appear to be directly the reverse. In any case there is no point in asserting that the measure is everywhere impracticable, unless far better arguments than any so far put forward can be adduced. The obvious procedure is to try the measure out on a practical scale.

Intensive operations in limited areas appear to afford the best prospect of success and in Southern Rhodesia the measure is being tried out in various districts and under varying conditions. With a

view to protection of European settlement, game fences are being employed on an extensive scale, whilst operations without fences are proceeding in native reserves and in other localities.

Indications to date are that it is practicable to check the fly and cause some retrogression by the measure, but no claim can be made that it affords a fully satisfactory solution of the problem. It has in fact been necessary to resort to it in the apparent absence of practicable alternatives.

The advantages of operations against game compared with operations against forest include its comparatively low cost, which in some areas is reduced almost to nil, its apparent elasticity, the small amount of labour required and the fact that, broadly speaking, it is less objectionable from an economic standpoint. The disadvantages lie in the tardiness of results and the fact that unless intended to proceed progressively and be followed up by settlement, it is almost as temporary a measure as chopping down the savannah forest. Maintenance of a zone cleared of fly by game reduction would seem as interminable as maintenance of a barrier of cleared forest. Such maintenance can, however, be effected in certain areas with a sufficient native population at very low cost.

Sentiment counts for much in human affairs and there is hardly need to state that to any naturalist and lover of wild life large scale destruction of the natural fauna is extremely abhorrent. Unfortunately the position appears to be expressed by the proverb that "one cannot make omelettes without breaking eggs" and as Dr. Lloyd has aptly expressed it "a tsetse infested country which preserves its game can only retrogress." The aim in Southern Rhodesia is the reverse of retrogression, but such retrogression is imminent unless the spread of *Glossina* can be stayed.

European settlement has long been regarded as exerting an influence which for some vague reason *morsitans* at least cannot withstand. The view is presumably based upon experience in the Transvaal and adjoining territories during the past century. I have pointed out elsewhere that the pioneers in the Transvaal were apparently in a large degree professional hunters, and it would appear that if European settlement was definitely responsible for driving back the fly the influence could only have been exerted through the game. Otherwise we would seem to be dealing with a series of coincidences.

It has not infrequently been urged that European settlement should be utilized to create a barrier against the fly's advance or even to reclaim infested country. It has also been stipulated that the settlement must be of an agricultural type and, apparently ignoring economic factors, that it should consist of small holdings.

Experience in Southern Rhodesia is that where European settlement of a markedly agricultural type and *Glossina* are in contact, and natural and economic tendencies are allowed free sway, the victory of *Glossina* is practically assured. Not only is there no indication that such settlement is by itself instrumental in driving back the fly, but it is clear that it does not even protect itself against the fly's encroachment. We have definite record of fly advancing as far as and beyond the borders of solid blocks of farms which had been occupied for five years and more without loss of

cattle. On these farms extensive clearing of from 300 to 1,000 acres per farm had taken place and this certainly far exceeds anything likely to have occurred in the case of the pioneers in the Transvaal during the past century.

The effect of the clearing of lands is so often adduced as an explanation of the inimical effect of settlement on the fly, that it is necessary to point out that such clearing of savannah forest in the class of country involved is almost always insignificant in comparison with the area of forest left standing and cannot be expected to have any more effect on the fly than the existence of natural open spaces in the forest.

As already mentioned it is the protection of agricultural settlement which constitutes the most urgent aspect of the problem in Southern Rhodesia to-day. Suggestions as to utilizing it as the spearhead of a thrust against or as a barrier to the advance of the fly appear about as logical as suggestions that helpless women and children should be employed in a similar way against an enemy in war.

It is to be realized that even agricultural settlement, when reasonably compact and solid, has the effect of driving out the game more or less from the area actually occupied. The factor which appears to be ignored by some is that the effect of a fly area extends for a considerable distance beyond the borders of the definitely infested country and that settlement can only protect itself if its inimical influence on the fly extends to a sufficient distance beyond its boundaries to place the occupied area outside the limit of normal fly incursion. This limit appears, in some instances, to extend as much as twenty miles from the edge of the definitely infested country. In this indefinite area, which appears to surround all definite fly areas, cattle may contract Trypanosomiasis comparatively freely, but no definite fly centres can be located, and weeks of close search are commonly necessary before even an odd fly can be found. In actual practice we have never yet succeeded in finding fly over the whole area in which cattle have been liable to contract infection, although Europeans and natives with bait cattle have been employed for months on end. Approximate elimination of game and agricultural clearing does not protect country from such incursion.

Our aim has been, therefore, to create and maintain approximately game free zones extending for ten miles and more beyond the farm boundaries, with a view to causing sufficient retrogression of the limits of the definitely infested country. The effect of such operations, as have been carried out, has been slow, even where the reduction of the game has been pushed to a point approaching elimination in the case of the larger species, but progress has been appreciable after a certain period.

Experience in the Transvaal and adjoining territories during the past century appears to suggest that less drastic reduction might achieve the object in view, but we are naturally anxious to accelerate the process as much as possible. Moreover, it must be borne in mind that in the Transvaal the fly seems to have been near the limit of its climatic range and introduction of any adverse factor might be expected to have a quicker and possibly more complete effect than in warmer climates. The apparent effect of the Rinderpest epizootic appears indeed to have decreased in the direction of the equator.

A broad statement of the immediate policy in Southern Rhodesia to-day is that effort is being concentrated on reducing the game as much as possible all along the edge of the fly infested country in the hope of arresting or retarding the extension of the infested country. Such action is logical and inevitable in face of the very serious threat to the welfare of the colony created by the steady encroachment of the fly and lack of known practicable alternatives.

*Control of Traffic.*—Increased use of motor vehicles for prospecting and hunting purposes has rendered control of such traffic highly desirable in some localities and during the last Session of the Legislative Assembly at Salisbury an Act was passed giving the Government powers in this connection. This Act is to be utilized at once.

*Research.*—Definite action against the fly has been, and will, in all probability, continue to be unavoidable. It must, without doubt, have first call on the Treasury on considerations of urgency. It would seem, however, equally necessary that facilities for research into the bionomics of the fly should be provided and that the effect of such operations as are in progress should be followed on a more scientific basis than has been possible hitherto. Such research has not been altogether neglected in the colony and is in fact proceeding along several lines at the present time. It has, however, been a case of endeavouring to make the most of available opportunities and to fit this research work in with the other duties of the Division.

It appears highly desirable that a more or less permanent field station should be established in an undisturbed fly area, where pure bionomical research can be made the main feature of the work, whilst facilities for experimental and *ad hoc* research also exist in the neighbourhood. An increase in the technical establishment would, of course, be involved, and collaboration between veterinary officers, proto-zoologists, entomologists, etc., is indicated.

The vital menace to the colony created by the fly's continued spread certainly justifies a substantial effort in the direction of supplementing our present knowledge and finding more satisfactory methods of dealing with this complex problem than are known at the present time.

The question of establishing a suitable research station in the fly country is, I may say, receiving the very serious consideration of my Government at the present time.

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*Paper No. 4.*

ESSAY ON THE ECONOMIC POSSIBILITIES OF THE TREATMENT OF TRYPANOSOMIASIS IN CATTLE (BOVINES) WORKING WITHIN AREAS AFFECTED BY GLOSSINA.

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ONE of the most serious problems confronting agricultural development in the northern part of the Portuguese Colony of Mozambique is, without doubt, the dissemination of the tsetse fly, whose ravages militate against the breeding of domesticated animals for employment in ploughing and tilling the land, and in the transport of its products.