

PART III.CONCLUSIONS.A. The necessity of destroying meercats  
and the value of studying their habits and warrens.

In general, as has been pointed out, the control of rabies consists in preventing the rabid animal from biting persons and animals.

Where the dog plays the principal rôle in the epizootology of the disease, the methods adopted to check dissemination of rabies is comparatively easy, as dogs can be placed under proper restraint by their owners, and ownerless dogs can be rounded up and destroyed. In addition prophylactic inoculation is employed in some countries with success, in spite of the fact, that this method may produce occult carriers.

When the disease is established in wild animals, as is the case in our viverrids, there can be but one way of eradicating the disease and that is by destruction of the vectors.

Before effective weapons can be devised, something must be known of the enemy, his habits, weaknesses and defences. This is why a study of the meercats was a sine qua non to any useful work. Not only have these studies shown, that the burrow is a place of refuge to which meercats run when disturbed and to which they owe their survival in settled areas, but they have revealed, that the burrow is a convenient place, not easily missed, in which these elusive animals can be "run to earth" and completely destroyed.

It is indeed fortunate, that the yellow mongoose, which is undoubtedly the ~~worst~~ most important vector of rabies in this country can so effectively be attacked and destroyed. If some other free roaming animal such as the jackal had been the principal carrier of the disease, then we would have had to face the same difficulties in the control of the disease

as for instance the sheepfarmer has in protecting his stock from this marauding beast.

B. Evolving the most effective and practical destruction methods.

(a) Of the various methods tried to destroy meercats, gassing of the burrows with calcium cyanide dust, followed up by trapping has proved to be the most effective.

The digging up of colonies subsequent to gassing revealed, that it was possible in many instances completely to destroy meercats in their burrows and where this was not possible the causes of failure were exposed and remedial measures to overcome them were devised.

Among the causes which may lead to failure or ineffective work must be mentioned;

(i) using a pump not in perfect working order resulting in bad distribution of calcium cyanide in burrows;

(ii) using poor quality, old or spent cyanide powder. Good fresh powder should have a very fine pulverulent texture and have a bluish slate colour.

(iii) gassing when the humidity, looseness and gas-absorbing properties of the soil are too high;

(iv) bad circulation of gas in the intricate tunnel maze of a colony, due to the pressure<sup>etc</sup> of obstructions and long cul-de-sacs;

(v) closing any openings before gas has emerged from them, and finally

(vi) failure to fumigate for a long enough period, namely until powder is seen emerging from all openings before these are closed.

Causes of failure due to equipment and technique can be avoided or remedied but those inherent to the burrow itself cannot be prevented. If the technique is perfect, therefore, and meercats still escape alive from a burrow it can be assumed, that the cause lies in the burrow and it would be sheer waste of time and money to fumigate such burrows

repeatedly since the results would probably be the same.

Where only one or two meercats per odd colony escape as seen from the reopened holes, it is therefore far more economic and more effective to set traps and so catch the last surviving animals.

The advantage of this method of gassing combined with trapping is that it is cheap, simple and with care safe to handle, eliminating many elaborate precautions

(b) This method of gassing combined with trapping has been successfully employed to destroy the meercats on several large areas. Although not considered feasible or necessary in so far as the particular method of rabies control adopted, an area so cleaned could if desired be maintained clean at a minimum cost by continuing trapping indefinitely in this fashion.

To ensure success attention should be paid to the following details:

(i) to locate all the colonies;

(ii) to comb the veld systematically to ensure that all the meercats are chased into the burrows prior to gassing;

(iii) to fumigate thoroughly - bearing in mind the pitfalls mentioned above;

(iv) to close all disused holes and colonies;

(v) systematically to revisit all colonies and set traps where required;

(vi) to continue trapping as long as any holes are being reopened while operations last in that area.

(i) Location of all colonies.

The importance of locating all the colonies need hardly be stressed, as success of eradicating the meercats in a given area depends largely on the thoroughness with which this is done. Even disused ones should be located and closed. The best method to ensure that all the colonies are located,

is for the members of the gassing gang, consisting of from six to eight persons, to walk in extended rank formation. The space between the men should not be more than fifty to a hundred yards, depending on the denseness of the vegetation. A good procedure to follow to avoid overlapping of areas, or which is more important of skipping portions, is for the flank member to stake or erect temporary beacons at least at the ends of his beat and at such other points along his patch as may be necessary. These beacons indicate on the return journey, the strip of land previously traversed. Instead of carrying flags etc., it is convenient and just as effective where there are trees and fences to place tufts of grass on them for beacons. In open country, where antheaps are plentiful, the top of an antheap may be removed and by placing it with the inner side upwards, an easily recognisable mark is made. (see photo)

Both the inhabited and uninhabited colonies should be marked and if possible numbered in such a way, that they can be easily relocated and identified at subsequent visits. A suitable method to mark these colonies is by driving a light metal fencing dropper with a numbered tag on it into the ground near the colony.

(ii) Ensuring that all meercats are chased into the burrows.

The system of combing the veld as described above serves also the very important purpose of ensuring that the meercats are chased into their burrows, where they are to be gassed.

Meercats invariably run to their burrows when disturbed in the veld, unless hard pressed or closely chased, when they may seek refuge in any convenient hole. On the Sannahspost area, where extensive mealie fields existed, neglect to comb these fields, where meercats hunted for food, resulted in many of them being missed at the gassing of their burrows,

and had to be trapped afterwards.

(iii) Fumigating thoroughly.

Gassing is the quickest and easiest way to kill the meercats, when they are in their burrows. Success in doing so depends on the thoroughness with which this is done. The pitfalls mentioned above should therefore always be borne in mind, and the necessary steps should be taken to eliminate these when possible.

Before a colony is gassed, one or two strokes of the pump should be given to see, that the correct amount of dust is forced out. Regular attention should be given to the pump to lubricate and keep it in perfect working order. The procedure in gassing as described before should be closely followed.

(iv) Closure of all disused holes and colonies.

On the farms Beestekraal and Philip, where a careful record of all the colonies was kept, it was found, that six out of thirty-five and two out of thirteen colonies respectively, which were unoccupied and deserted at the time of the general survey of the farms, became occupied at a later date. Unless such colonies are closed and revisited later and treated as if they were inhabited, they become the abode of meercats, which would otherwise escape destruction.

(v) and (vi) Systematic revisiting of all colonies and the setting of traps.

White (1932) gave up all hopes of exterminating meercats on a large scale on account of the rapid reinfestation taking place on a farm even before the gassing operations on that farm were completed.

Thornton (1935) also described the lack of success in

destroying veld rodents in connection with plague due to neglect to treat deserted and spare warrens.

From the observations made on the farms Beestekraal, Middagson, Philip, Sannahspost etc. it was concluded, that colonies were reopened by (a) meercats, which had escaped contact with gas in the burrow and succeeded in digging themselves out, (b) by meercats, that were away at the time of gassing and returned to dig themselves in, (c) by meercats migrating from adjoining untreated ground, finding in their new hunting ground, convenient shelter by merely opening up and cleaning out existing burrows, (d) by meercats visiting colony after colony opening a few holes, (e) by marauding animals like the skunk digging after prey, and (f) by anteating chats, which nestle in burrows.

It stands to reason therefore, that if one wishes to exterminate meercats in a given area, one will have to pay very close attention to this most important supplementary method of destruction namely trapping. Not only is it the cheapest method of destroying these animals but it is very effective and can well be used without gassing, when the time factor is not very important.

The following procedure gives the best results.

The area gassed should be revisited the following day and sufficient traps provided to place at all reopened holes. In practice fifty traps are found sufficient. The person incharge of the trapping is given the numbers allocated to the colonies gassed the day before to serve as a check to himself to ensure, that every colony is found, as cattle may sometimes push the droppers over and they can also not be seen easily from a distance.

At all holes and warrens found reopened traps are set. These are inspected the following day and any not sprung may be removed and the holes closed, since many burrows

are reopened but do not become occupied. The same applies when an animal or bird has been caught, unless there are other holes, which have been reopened again.

It is essential that the person with the traps follow closely on the heels of the gassing gang.

Since many colonies are reopened and become reoccupied as many as three times or more by meercats, which are continually filtering into the area from the untreated adjoining ground, a second and if necessary a third person should be detailed to pay repeated visits at regular intervals to the area treated already to trap any animals, that may continue to reopen burrows.

Migration of meercats takes place soon after an area has been treated, but as the number available in the neighbourhood is gradually reduced by gassing and trapping, the rate of migration steadily decreases, until finally a stage is reached, when the infiltration becomes negligible. It is essential therefore, that trapping should be continued until all holes, that are being reopened by meercats, remain closed.

The reopening of holes by the anteating Chat sometimes causes a lot of trouble, as in many instances it is not easy to distinguish whether the hole has been reopened by one of these birds or by a meercat. In such cases traps have to be set and rarely fail to show, which of the two is responsible for the reopening of the holes. As many as eight birds have been trapped in one day.

After the extermination of meercats in any locality by the methods outlined above, it should be a comparatively easy matter if so desired to maintain effective control and keep such an area clean with very little expenditure of time and money, by making frequent periodic inspections and setting traps at any warrens that have become reopened. Especially

would this be the case with Cynictis, the most important carrier of the disease. This animal unlike Geosciurus, when occupying an old (closed) colony, only opens and uses a few warrens on the periphery, thus the purchase of a large number of traps by the farm owner, who may wish to keep his farm free from Cynictis, would be unnecessary.

### C. Labour, equipment and working cost.

(1) For continuous and large scale extermination of meercats the <sup>operations</sup> observations can be carried out to advantage by units or groups of eight natives under the supervision of a trained European. The supervisor should be selected for his energy and reliability, as the whole scheme depends on the thoroughness with which the work is executed.

All the equipment necessary for such a unit comprises two gassing pumps, a supply of cyanide dust, a few spades and about two hundred three-inch gin traps. Such a unit must of course be self-contained and mobile, i.e. provided with its own camping outfit and transport, so as to be on the spot the whole time and not to waste time going to and from their homes.

Naturally in all undertakings of this nature the cost involved should not be out of proportion to results obtained

From the ~~sumar~~ summary of the work performed on the five infected farms, and the expenditure to eradicate the meercats, it is estimated that a party consisting of eight natives under the supervision of a trained European can clean an area of 1,000 morgen in four days at an approximate cost of a little over £9.

For small scale operations, e.g. for the farmer, who wishes to clean up his farm, the only equipment necessary would be one pump at £2 15 - say 2 dozen traps at 1/6 each, and a small amount of Cyanogas. If the eradication is undertaken on a cooperative basis - several neighbouring farmers



pooling together their equipment and labour, the cost can be brought down, well within the reach of every one.

D. Destruction of meercats with a view  
to the eradication of Rabies.

Eradication of rabies in South Africa depends on the possibility of destroying the wild carnivora, which disseminate and propagate the disease amongst themselves.

It is fortunate perhaps, that the viverrids and particularly Cynictis penicillata seem to play the major rôle and that the infection discovered in other animals, until proved otherwise, may well be regarded as accidental.

Consequently a campaign of this sort must be directed against the yellow mongoose mainly. With this species should be included the suricate and ground-squirrel on account of their close association, commensal habits and on account of the damage to crops done by the latter.

Against these three species generalized extermination over the large area in which rabies occurs represents a formidable task. Even if the work was undertaken voluntary and co-operatively or even under compulsion by land owners. It is doubtful, whether anything more than a temporary reduction in the numbers of meercats would result from such an effort. The tremendous cost of organising, supervising and maintaining such a scheme of total eradication whether done by landowners, themselves or by the State would be prohibitive and out of all proportion to the losses due to the disease.

Before total eradication is resorted to its effects on other animals, birds and insects would have to be very carefully considered. It is possible, that the "balance of nature" might be upset resulting in a "plague" more harmful than rabies.

In a previous communication (Snyman and Thomas - 1939) it was shown that although rabies occurs over a large part of the Union, yet it is restricted to more or less well defined centres and localities, where it seems to smoulder for long periods and thence spread slowly.

This hypothesis is supported by the following observations:-

(a) In glancing at the incidence map of rabies, it will be noticed, that outbreaks are bunched together within a restricted area. The history of the outbreaks in these areas further supports this presumption.

(b) In many centres the history of the outbreak shows, that the disease had been smouldering for several years, e.g. on Trompsburg, Edenburg and Vryburg town commonages.

(c) On the farms Beestekraal and Philip in the Hoopstad district and Sunnyside in the Bloemfontein district rabid Cynictis were found in the same locality on the farm several months after the original outbreaks were reported.

(d) The number of meercats' carcasses found on the infected farms, on which eradication is in progress, also, would seem to indicate the presence of an epizootic amongst them.

If the hypothesis of the localized nature of the disease is correct, then eradication of rabies can be undertaken on a much reduced scale, involving the actual centres of infection only. For if all the infected animals, as well as all susceptible ones, which might have been bitten, are destroyed, the disease at that point must die out, since it cannot persist outside the live animal. Should the area so cleansed of meercats become repopulated again, it would be of no consequence provided the newcomers are not infected.

Success obviously depends in defining the area in which the destruction is to be carried out and secondly on the

thoroughness with which the destruction takes place.

The area in which such restricted destruction of meercats is to be carried out, depends on the extent to which the disease is believed to have spread in that locality.

A preliminary survey of the locality, therefore, becomes necessary, and when taken in conjunction with the history of the outbreak, the topography of the ground and a sound knowledge of the habits and habitation of meercats, one is enabled to determine the area in which the meercats have to be eradicated. In practice one can also judge the probable extent of the infection from the position and number of colonies and the ease of contact between them. Such other portions of the adjoining ground are then also included according to local circumstances so that as wide a margin of safety is allowed consistent with the purpose in view, namely to destroy all meercats likely to have been infected. On the other hand one should bear in mind not to make the area unnecessarily large, as the increased cost may have an unfavourable effect on the issue.

Of great assistance, is the occurrence of carcasses of meercats, which have presumably died of rabies. The evidence of these constitute a valuable guide in defining the centre of the infected area. When combing the area adjoining that regarded as infected, a keen lookout should be kept for the occurrence of such carcasses, and if they are found, the area to be treated should be extended accordingly.

Control measures should not only be directed towards the isolated outbreaks, but the ultimate aim should be the total eradication of the disease from the country.

Such an ambitious aim is not entirely out of the question. For if it is possible to eradicate or greatly to reduce the meercats, it follows that the disease will find it more and more difficult to persist and spread. Thus by systematically destroying the carriers in the

infected centres, starting in the sparsely infected areas and gradually closing in on the central areas, the incidence of the disease will, it is hoped, be greatly reduced and in time even eradicated.

This is the scheme as envisaged and as now being carried out with a view to reduction and eventual eradication of rabies in the Union.

This does not mean however, that other isolated or concerted efforts toward general destruction of meercats should not be contemplated or should be abandoned if already started.

On the contrary if farmers in a given district can be persuaded voluntarily to exterminate the meercats so much the better as obviously rabies would have very little chance of persisting in such a district.

By every means at our disposal the general reduction of meercats should be encouraged provided, it is done in an economical way. There is for instance the system of premiums offered for captured vermin, which is worth a trial at any rate.

The Provincial Administration of the Orange Free State has as from the 1st April 1939, added Cynictis penicillata to the list of vermin, for whose destruction a reward is paid, on account of its pernicious habit of attacking newly born lambs. The reward of three pence per tail should be sufficient encouragement to reduce the number of these animals, as they are easily trapped. The response for the first three months has been very disappointing. Altogether rewards for only 2720 tails, i.e. a total of £34 was claimed in the whole of the Province. Where as at the price, trapping could be made quite a profitable line!

It does not seem therefore, that at this rate the encouragement given by the Provincial Administration would reduce the meercat numbers to such an extent as to

have any noticeable effect on the incidence of rabies, because the eradication may be spasmodic on farms, and only undertaken, where these animals have acquired the pernicious habit, and secondly no intensive campaign would be undertaken, unless farmers form clubs on the lines similar to those of the Jackal Clubs. Isolated undertakings on a small area will of course only have a very transient effect on the meercat population at that point.

There are however weaknesses in the scheme outlined above to which consideration will have to be given.

In the first place outbreaks are not always noticed or even reported, when they are known. One of the primary conditions on which the success of the scheme depends is thus rather uncertain but susceptible to improvement by suitable propaganda.

Secondly this scheme depends on the assumption, that the yellow mongoose is the only source of infection. In the Vryburg district, where a large proportion of the outbreaks occurred in the genet, infection in them can hardly be regarded as accidental. Thus even if the infection in meercats is completely destroyed, the genet may still be a source of reinfection for meercats. Hereagain it is hoped, that it will be possible to combat the disease in genets as well.

Apart from the obvious weaknesses above mentioned, it is fully realized, that the scheme is by no means foolproof and could easily go wrong at several points. This is why it has been insisted upon all along, that the eradication of meercats in rabies centres should not be left to the haphazard whim and fancy of landowners, but should be undertaken by the State, and the work entrusted to a reliable staff specially trained for the purpose.

E. Other control measures against  
rabies in the Union.

Although constituting the main attack in so far as the rabies problem in the Union, the proposed campaign against the carriers of this disease should not be regarded as the only weapon to be used. There are other measures of more general nature, which should not be overlooked, e.g.

(a) Prevention of fresh importation of rabies

(b) Quarantine and other State Veterinary measures against spread of the disease by domestic and other animals, especially dogs and cats.

(c) And above all nation wide propaganda,

(i) enlightenment of the public.

(ii) to report all suspicious cases.

(iii) to help destroy and keep down meercats,

(iv) to collaborate with the State in all its measures to eradicate rabies.

(a) Prevention of fresh importation of rabies.

Although rabies is wide spread and firmly established in some of our wild carnivora it has the peculiarity, mentioned already, of not spreading in dogs. The outbreaks, that have occurred in dogs during the past twelve years have been isolated cases, and in a few instances only did the infected dogs communicate the disease to members of their own species or to other animals. It is therefore of the greatest importance, that the regulations imposed on the importation of dogs from neighbouring territories and from overseas should be rigidly enforced to prevent the introduction of a virus, which might behave differently when effecting dogs.

The provisions of the Stock Disease Act, No. 14 of 1911 aim mainly at total prohibition of the importation of dogs and cats from countries, where the disease is enzootic; and

prescribe a period of six months quarantine of canines at Ports of Entry from other countries.

(b) Quarantine and other State Veterinary measures against spread of the disease by domestic and other animals.

In 1936 the author described the legislation dealing with rabies and the lines to be followed when outbreaks occur. Stress was laid on the special precautions to be taken when outbreaks even in wild animals, occur near towns and villages, on account of the large dog population, to which the disease may be communicated in such places.

The usual precautions of restraining movements of dogs, isolating all suspected animals and destruction of all stray animals and those, that have been bitten or have been in contact with infected animals, should be enforced.

These precautions, no matter how rigidly they be enforced, would not have the desired effect unless the source of the infection, which is usually the yellow mongoose, is not eradicated. On the contrary if dogs and cats are confined or destroyed, vermin and rodents will increase, thereby enhance the propagation of rabies and possibly of bubonic plague also.

(c) Nation wide propoganda.

One of the first and most important steps to take with a disease of which the existance has been known for a short time only, and of which the epizootology is not understood by the public, is to enlighten them by all possible means as to the dangers they run, how to protect themselves and the duties they have to perform.

This can be done by public lectures, addresses to farmers at association meetings, natural history lessons to school children by teachers, cinematographic representations,

and by giving prominence to outbreaks in the press.

Two points should particularly be stressed, firstly to avoid being bitten by small wild carnivora. Special attention being drawn to the fact, that a great many of the fatal cases in human beings have occurred in children, as a result of catching, what appeared to them, tame meercats, but which were semiparalysed animals in the last stages of rabies.

Secondly people should be encouraged to report suspected cases of the disease as success in eradicating by the methods at present at our disposal depends on an early recognition of all or as many centres of infection as possible.

It should further be impressed on the public that it is their duty to destroy and help keep down meercats and to collaborate with the State in all its measures to eradicate the disease.

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#### S U M M A R Y.

A. The study of the habits of meercats and their burrows, has shown, (a) that the burrow is the most convenient place to destroy meercats and (b) that those meercats, which escape contact with the gas in the burrows together with those, that filter into an area, on which destruction of meercats takes place, may easily be destroyed by trapping.

B. It is a practical proposition to exterminate Cynictis penicillata, the principal carrier of rabies, together with Suricata suricatta and Geosciurus capensis on an area, up to 10,000 morgen in extent, infected with rabies.

C. A scheme has been evolved, which aims at total eradication of rabies in the Union, by destroying the meercatson infected centres, starting in the sparcely