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# Zoological Survey of the Union of South Africa: Tick Survey. Part II.—Distribution of *Boophilus (Palpoboophilus) decoloratus*, the Blue Tick.

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## General Distribution.

Roughly *B. decoloratus* occurs throughout the Transvaal; to the west it is present in the regions of Vryburg, Mafeking, Herbert and Bechuanaland, bordering on the Union; to the north it is found in Southern Rhodesia [Jack (1942). *Rhodesian Agric. Jnl. XXXIX*)]; to the east of the Transvaal it is absent in the Lowveld regions of the Districts of Lourenço Marques and Inhambane in Portuguese East Africa. (Actually it seems to be absent throughout Portuguese East, except in the Tete district: [Theiler (1943)]. From the eastern Transvaal it extends southwards through Swaziland, Zululand and Natal, east of the escarpment into the Eastern Province; from here it follows the coast line south of the mountain ranges, extending up the west coast till about the level of the Oliphants River mouth. To the south of the Transvaal it extends into the northern areas of the Orange Free State and into Basutoland. It is absent from the greater part of the Southern Free State, with, however, some isolated records from the Faure-smith-Luckhoff districts, from Zastron, and from Bethulie, and across the Orange River from Aliwal North and Norvals Pont and from Herschel and Venterstad.

It is absent from the Karroo, with the exception of an odd record from Schoombie and one from the Beaufort West flats. It is also absent from Bushmanland and Namaqualand; and from the southern regions of S. W. Africa; it occurs, however, in the northern regions of S. W. Africa to the north of a line drawn through Karibib and Okahandja, i.e. to the north of Latitude 22° S., extending into the Caprivi Zipfel, being absent, however, from the Namib coastal strip.

### *Distribution in the Vegetational Types.*

The vegetation map shows *B. decoloratus* to be *present*:

1. In all three types of *Forest*:
   (*a*) *Evergreen deciduous bush and sub-tropical forest* fringing the east coast from the Sundays River northward.
   (*b*) *Temperate evergreen forest* of the George-Kuysna-Zitzikama area, of the Katberg-Amatola range and of the other smaller isolated areas to the east of the Escarpment.

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(*c*) *Evergreen sclerophyllous bush*, or Western Province vegetation, to the south of the mountain ranges reaching from the Gamtoos River mouth in the south east, to Van Rhynsdorp and the Olifants River mouth in the west, with outliers along the Zwarteberg Range and the Kouga and Cockscomb mountains.

2. In all three types of *Parkland*:

(*a*) *Evergreen and deciduous tree and bush* of the *Bankenveld* and of the *Limpopo highlands*.

(*b*) *Sub-tropical evergreen and deciduous tree and thorn forest* with a tendency, however, for it to die out in the *Lowveld* towards Portuguese East Africa where it is entirely absent (no collections have been made in the Kruger National Park).

(*c*) *Thorn country*.—It is present in the *Bushveld* of the Transvaal and of the north-western corner of the Orange Free State and in the adjoining regions of the districts of Herbert, Vryburg and Mafeking and the Bechuanaland Protectorate; it already shows a tendency to peter out as we cross the Transvaal and Free State borders and soon dies out completely westwards, where there is but one record of it to the west of longitude 24°. In the Kalahari desert it would appear to be entirely absent, though actual collections have not yet been made to substantiate this surmise.

3. *In all* three types of *Grassland*:

(*a*) *Tall grass* of the eastern grasslands of the Eastern Transvaal, Swaziland, Natal, Native Territories and of the South Eastern Cape Province; in the South Eastern Cape Province it follows the Great Fish River and its tributaries into the *Karrooveld* of Somerset East and Pearston.

Its distribution throughout the *Tall grass* area, however, is most uneven. Unlike *A. hebraeum*, which does not occur on grassveld devoid of scrub or trees, *B. decoloratus* seems to thrive as readily on open grass veld as it does on veld with trees, so that one can but conclude that in those areas of the native territories, of Swaziland and of Natal, where it is absent and where dipping is carried out conscientiously and systematically the tick has been dipped out. Further one is tempted to conclude, that on farms in these same areas in which dipping is carried out conscientiously and systematically but where the tick is nevertheless still present, the arsenic resistant strain has become established. Further one can assume that the tick will be present on those farms where dipping is inadequate, whether it be the ordinary blue tick or the dip-resistant strain.

That *Boophilus* (*Palpoboophilus*) *decoloratus* can be dipped out is conclusively shewn by the returns for the farm 4.A.3. in the *Bankenveld* of the Limpopo Highlands in the Waterberg District. On this farm seven day dipping with handdressing is carried out and not a single Specimen of *B. decoloratus* has been sent in a series of monthly collections spread over 15 months· whereas on the neighbouring farms 4.A.1., A.2., and A.4., where there is no dipping and only occasional handdressing, *B decoloratus* is very abundant.

(*b*) *Short Grass* of the *Highveld*. It is present throughout the northern parts of the *Highveld*, but south of the Bloemfontein-Maseru line it peters out completely except for a few odd records from Zastron, Herschel, Aliwal North and Maclear. The rainfall of this southern section is less than that of the rest of the *Highveld*.

(*c*) *Mixed grass* of the *Middleveld*. It is present throughout.

The Vegetation Map shows *Boophilus* (*Palpoboophilus*) *decoloratus* to be *absent:*

1. From all three types of *Desert lands*:

(*a*) *Desert succulents and desert grass* of Bushmanland and of Little Namaqualand and from the Namib desert of South West Africa.

(*b*) *Thorn country and desert shrub* of Vryburg and of Kuruman.

(*c*) *Desert Shrub* of the *Karrooveld*, extending to latitude 22° S. in South West Africa. There is a tendency for it to become established in the " broken veld " of the Southern Free State, as is shewn by the records from Luckhoff, Fauresmith, Bethulie and Norvals Pont. The two very isolated records, the one from near Schoombie and the other from the Beaufort West flats, must be looked upon as recent introductions which will not survive more than one summer season.

*The Influence of Temperature and of Altitude.*

*B. decoloratus* is seen to occur at all altitudes from the sea coast into the high mountain ranges of the Drakensberg. It apparently is not influenced by temperature, for it is as safely established in the heavy frost areas of the *Highveld* with up to 120 days at 27° F., as it is in the frostless Western Province.

*The Influence of Humidity and of Rainfall.*

Unfortunately there are no data available as to the humidity of either the soil or of the air, the only figures available in this respect are those of rainfall. It must be remembered, however, that rainfall figures may be very misleading, e.g., average annual rainfall 15 in., may mean that each year approximately 15 in. of rain falls, or it may mean that in some years only 7-10 in. fall and in others 20-23 in. giving an average of 15 in.; or the interval between the rainy seasons may be six months or it may be nine months. Or again the soil and vegetative covering may be such as to retain most of the rainfall or alternatively a large proportion may flow off the land. Obviously the effect on the flora and more especially on the fauna will vary according to the various permutations and combinations of the above " 15 in. annual rainfall " possibilities.

That the " rainfall " (taken to represent humidity) plays an important rôle in limiting the distribution of *B. decoloratus* is undoubted. The critical level seems to be round about 15 in. per annum. Subject to other local conditions, which may act in a favourable or in an unfavourable manner, the tick may survive at a lower rainfall, as in the strip of arid country in the Northern Transvaal, along the Limpopo River, or it may not survive at 15 in. as in the southern strip of the *Highveld* in the Dordrecht, Elliot, and Barkly East areas. It would seem that a " low

rainfall " i.e. below 15 in. level is more easily tolerated in areas with bush than in open grass lands. This would account for its presence in the 10-15 in. belt in the Northern Transvaal and its tendency to absence in the 15-20 in. Dordrecht, Elliot and Barkly East areas.

What factors there are, if any, other than the control measures of dipping and handdressing, which may be the cause of the uneven distribution throughout the Native Territories, Natal and Swaziland, are difficult to establish. For here the rainfall is above the 15 in. level; nor is the absence of *B. decoloratus* definitely to be associated with the open grasslands as is *A. hebraeum* in these same areas. In Northern Zululand and in Portuguese East Africa the increasing aridity is undoubtedly, once again, the limiting factor.

In the Karroo, in Bushmanland and in Namaqualand the low rainfall is undoubtedly playing the major rôle in preventing the establishment of the tick in these areas.

*The Influence of Dipping.*

It is the experience of stockmen and of field veterinarians that *B. decoloratus* is one of the most easily controlled, if not *the* most easily controlled, of our South African ticks. That it can be dipped out is shewn most spectacularly by the returns from the farm 4.A.3., with a seven day dipping interval associated with handdressing. This farm was free of *B. decoloratus* and of *R. appendiculatus*, whereas both ticks were abundant on the neighbouring farms on which there was no dipping whatsoever. Other records from area 4, Government Veterinary Officer, Potgietersrust, show a decrease in returns from farms with " regular " 7 day dipping, i.e. *B. decoloratus* was not present in each of 15 collections received, whereas returns from " irregular " or " no " dipping areas show *B. decoloratus* present in each collection.

That the 7 day summer, 14 day winter dipping is adequate in the drier regions is shewn by the returns for Piet Retief, Lydenburg, Pietersburg, etc., where the rainfall, is still well above the critical 15 in.

In the eastern *grasslands* having a rainfall 20-70 in. with the data available at present, it is almost impossible to draw any definite conclusions as to which of the three factors, i.e. unconscientious dipping, the free movement or game, and the establishment of an arsenic-resistant strain, is mainly responsible for the continued presence of the blue tick in some areas, e.g. Pietermaritzburg. On the whole one is inclined to the view that controlled movement of stock associated with systematic dipping and handdressing would eradicate it from many areas where it is still prevalent.

Were dipping to be carried out equally effectively throughout the *tall grasslands* one could get a measure of the rôle played by game and by arsenic resistance in the maintenance of the tick in this large tract of land; in this tract of land, it may be pointed out, dipping is apparantly carried out rather more vigorously than in other parts of the Union.

*Disease.*

*Palpoboophilus decoloratus* transmits Redwater (*Piroplasma bigeminum*); Gallsickness (*Anaplasma marginale*) of Cattle; Spirochaetosis (*T. theileri*) in cattle, horses, etc.; and Tick Bite Fever (*Dermacentroxenus rickettsi var pijperi*) in man and various animals.

## Remarks on the Separate Government Veterinary Officer Control Areas.

These remarks must be read in conjunction with maps 1 and 2 of Part I; and with map 1 of this article. Areas from which *B. decoloratus* is entirely absent will not be commented upon individually.

### *Area 1, G.V.O., Johannesburg.*

*B. decoloratus* was not sent in from three farms, which in no way differed from any of the neighbouring collecting areas. As only one collection was sent in from these areas this absence cannot be taken as a true one, the assumption, therefore, is that *B. decoloratus* is present throughout area 1.

### *Area 2, G.V.O., Potchefstroom.*

*B. decoloratus* is present throughout the *Middleveld* areas where it is firmly established. Westwards, where more arid conditions creep in and where there are incursions of the dry *Bushveld* into the mixed grass of the *Middleveld*, there is a tendency for it to disappear. Thus in the western regions of Christiana, Wolmaransstad and of Schweizer Reineke it leads but a precarious existence.

### *Area 3, G.V.O., Mafeking.*

*B. decoloratus* is present throughout the *Middleveld* of Lichtenburg. and the *Bankenveld* and *Bushveld* of Marico. In Mafeking it is present in the eastern portions but peters out westwards with the increasing aridity of the *Kalahari*. It also tends to die out in the incursion of the *Bushveld* into the south of Lichtenburg. The critical rainfall in this area lies between 10 in. and 15 in. apparently.

### *Area 4, G.V.O., Potgietersrust.*

*B. decoloratus* is present throughout, even in Block C situated in the dry belt along the Limpopo River with a rainfall of 3-8 in.

That dipping influences the numbers of ticks present can be clearly seen in the returns sent in over a period of fifteen months, from the Waterberg and Potgietersrust areas. The ticks were plentiful and some were sent in with each collection from areas with " no " or " irregular " dipping; where " regular " 7 day dipping is carried out blue ticks were not sent in at each collection and showed a decided decrease in numbers. The records for collecting area 4 A 3 are spectacular and are of particular interest. On this farm regular seven day dipping and handdressing is carried out and not a single blue tick was sent in over the period of 15 months, whereas it was sent in regularly from the other three collecting farms of Block A on which no dipping was carried out at all. On this farm 4 A 3, *R. appendiculatus* was also dipped out; *R. evertsi* though not completely dipped out was, however, scarce. *A. hebraeum* and the two bont-legged ticks *H. impressum rufipes* and *H. impressum transiens* hardly seemed to be affected at all.



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*Area 5, G.V.O., Pietersburg.*

The real value of the returns from this area are difficult to assess, as in the majority of cases only one collection was sent in. The finding for G.V.O. Area 4 *that the tick can be dipped out* is supported by the findings for this region, for ticks were sent in from most farms with irregular dipping; and no ticks were sent in from most farms with " regular " dipping with rainfall ranging from 18 in. to 80 in., though in some instances, e.g. the dry region round about Bochem lying to the south of the Zoutpansberg, to the west of Zoekmekaar and to the north of Pietersburg, and some of the drier regions of the *Lowveld*, the lower rainfall rather than the dipping is undoubtedly the limiting factor. In the drier areas a 14-14 dipping practice seems to be quite adequate.

*Area 6, G.V.O., Zoutpansberg.*

*B. decoloratus* is present in the moister regions; it is present, though apparently not firmly established, in the drier regions, i.e. the Limpopo flats, and the flats lying to the south of the Zoutpansberg, to the north of Pietersburg and to the west of Zoekmekaar; it also tends to disappear in some of the *Lowveld* areas.

*Area 7, G.V.O., Barberton.*

The distribution picture for this area is most confused. The rainfall is adequate ranging from 20 to 60 in.; the altitude ranges from 500 to 5,500 ft.; the vegetation ranges from *lowveld* forest, through the *tall grasslands* of the " middleveld " to the short grass of the *Highveld;* the dipping practices are given as 7 to 14 days (i.e. 7 days summer, 14 days winter) throughout. *B. decoloratus* is present or absent haphazardly and quite independently of any one factor or of a combination of any two factors; it does, however, show a tendency to peter out in the *Lowveld* regions towards the Portuguese border. Given the data available one is perhaps justified in concluding that the climatic and physiographical conditions are favourable and that if there were no dipping the tick would be present throughout the district; conversely one might be justified in concluding that if the dipping were carried out equally conscientiously by all, the results would be the same, and the tick would be dipped out and would be absent from all the collecting areas and not from some only. The local practice of trekking annually may confuse the picture somewhat.

*Area 8, G.V.O., Piet Retief.*

Rainfall 20 to 35 in.; altitude 2,000 to 6,000 ft.; dipping 7-14-28 day intervals. Veld burning is extensively practised in this area which is mostly occupied with sheep farming, so that one of the primary concerns is young grass for the sheep with the resultant degeneration of the veld. Despite this, conditions have remained favourable for *B. decoloratus* which is present throughout, except on a few farms where possibly more conscientious dipping accounts for its absence. The even distribution of the tick is possibly also partly to be attributed to the frequent local trekking of stock.

*Area 9, G.V.O., Lydenburg.*

Rainfall 20 to 75 in.; altitude 1,000 to 5,000 ft.; dipping 7-14-28 or 0, or irregular; vegetation ranging from the *Lowveld*, through the three types of *grasslands*, through the *Bankenveld* to the thorn country or *Bushveld;* winter temperatures ranging from areas of very light frosts to areas in the *Highveld* with very heavy frosts—up to 120 days at 27° F. As in Area 7 the distribution picture is very confused, and the absence of the tick from some areas and not from others can be written down to the inequalities of the dipping. As in 7 and 8 there is a tendency for *B. decoloratus* to peter out eastwards in the *Lowveld* areas.

*Area 10, G.V.O., Ermelo.*

Rainfall 20 to 40 in.; altitude 3,500 to 5,900 ft.; dipping 0, sometimes 7-14; winter temperatures ranging from light frosts to areas in the *Highveld* with heavy frost up to 90 days at 27° F. *B. decoloratus* present throughout, even on farms with (supposedly) 7-14 days dipping practices, some local trekking.

*Swaziland.*

Rainfall 20 to 55 in.; altitude 750 to 4,000 ft.; vegetation *Lowveld* to open *grasslands* of the "middleveld"; i.e., conditions are favourable throughout, the dipping varies from 5 day to 7 day to 7-28 day; in certain areas game is plentiful. The distribution of the tick is somewhat haphazard indicating that the dipping is not always carried out as systematically and as conscientiously as it might be. *B. decoloratus* is sometimes present even in East Coast fever areas. It is just possible that the arsenic-resistant strain is becoming established in Swaziland.

*Portuguese East Africa.*

*B. decoloratus* tends to peter out eastwards in those areas of the Transvaal and of Swaziland which border on Portuguese East Africa. Thus far no specimens have been sent in in collections from the southern portions of this territory. It would seem that the prevailing sandy *lowveld* conditions are not suitable.

*Area 11, G.V.O., Pretoria.*

Present throughout; dipping irregular or not at all.

*Area 12, G.V.O., Rustenburg.*

Rainfall 15 to 30 in. Present throughout; dipping irregular or not at all.

*Area 14, G.V.O., Vryheid.*

Rainfall 15 to 30 in.; dipping 7-7 day intervals. Conditions are favourable for *B. decoloratus* to maintain itself, and generally speaking it is present throughout except on some farms where it has obviously been dipped out (recent East Coast fever areas) and on some farms in the *Lowveld;* there seems to be a tendency for it to die out below 20 in.

*Area 15, G.V.O., Dundee.*

Conditions favourable, and *B. decoloratus* present throughout. Only dipped out on two of the farms from which collections were sent in.

*Area 16, G.V.O., Ladysmith.*

Conditions favourable, dipping 7-14 day intervals; *B. decoloratus* present throughout except for a few farms where it apparently has been dipped out (arsenic-resistant strain present?).

*Area 17, G.V.O., Estcourt.*

Conditions favourable; dipping 7-14 day intervals; *B. decoloratus* present throughout except on a few farms where dipping apparently is carried out more conscientiously. (Arsenic-resistant strain present?).

*Area 18, G.V.O., Pietermaritzburg.*

Conditions favourable; dipping 7-14 day intervals; *B. decoloratus* present throughout. It must, however, be pointed out that *A. habraeum* is absent from many farms in this district where conditions for its maintenance are favourable. The absence of *A. hebraeum* in this instance has been ascribed to the 7-14 day dipping; *R. appendiculatus*, though not eradicated, also shows a definite decrease. It is these rather inconsistent results, i.e. the absence of *A. hebraeum* and the reduction in numbers of *R. appendiculatus*, associated with the but slight or non-interference with the otherwise easily eradicated *B. decoloratus*, that lead one to the conclusion that the arsenic-resistant strain has become established in the " middleveld " tall grass areas of Natal and that both the normal and the arsenic-resistant strain are living side by side.

*Area 19, G.V.O., Greytown.*

Conditions favourable; collections poor; *B. decoloratus* present even on farms with regular dipping and handdressing. (Arsenic-resistant strain present?).

*Area 20, G.V.O., Ixopo.*

Conditions favourable; dipping 7-14, or 14-0 day intervals; *B. decoloratus* is present or absent quite haphazardly and independently of dipping practices. (Arsenic-resistant strain present?).

*Area 21, G.V.O., Port Shepstone.*

Conditions favourable; dipping 7-14 day intervals; *B. decoloratus* is present throughout; there are no signs of it having been dipped out.

*Area 22, G.V.O., Eshowe.*

Conditions favourable; dipping 7-14 or 7-7 day intervals; *B. decoloratus* present throughout except on one collecting farm from which it was absent from each of six collections and from which, one can assume it has been dipped out. The eradication of the tick in this instance, as in other instances in other G.V.O. areas, helps to stress the point that, though the arsenic-resistant strain may be present in Natal, it is by no means present on all

the farms. In all probability its distribution is still somewhat limited and many more farms could be cleared of blue ticks by systematic and conscientious dipping, especially those farms where game is not abundant.

*Area 23, G.V.O., Nongoma.*

Conditions favourable; dipping 7-7 or 7-14 day intervals; *B. decoloratus* is absent throughout these Native Tank areas, except at one Tank 23, B.1. Once again these returns show that *B. decoloratus* can be dipped out and that the dip-resistant strain is by no means established everywhere in the *tall grasslands.*

*Area 24, G.V.O., Durban.*

Conditions favourable; dipping 7-7 or 7-14 day intervals; *B. decoloratus* is present or absent quite haphazardly and quite independently of dipping practices. This inconsistency may be due either to unconscientious dipping or to the presence on some farms of the arsenic-resistant strain.

*Areas 26 and 27 G.V.O., Umtata.*

Conditions favourable; dipping 5-7, or 7-7 day intervals. *B. decoloratus* is present throughout, except for six farms from which it is absent. As regards *A. hebraeum* it was concluded that, though the open grassy plains were unsuitable for its maintenance the thicket-covered kloofs and river banks offered sufficient shelter for breeding purposes and that the absence of the tick could be ascribed partly, if not entirely, to the dipping practices; attention was drawn, however, to the possibility of stray cattle in the kloof being overlooked. This finding, that the distribution of *A. hebraeum* is influenced to a considerable extent by the dipping, is not consistent with the returns for *B. decoloratus* which is even recorded from 5 day dipping areas. Hence one must conclude that the absence of *A. hebraeum* is to be ascribed to the unfavourable open grassy plains, rather than to the dipping and that the dipping was not as conscientiously carried out as was assumed, which would allow for the presence of *B. decoloratus;* or one must conclude that the dipping was carried out conscientiously and that the arsenic-resistant strain has become established in some of the tank areas, and that *A. hebraeum* has been effected by the dipping.

*Area 28, G.V.O., Butterworth.*

Conditions favourable on the whole; dipping 7-14 or 14-28 day intervals. There is a tendency for *B. decoloratus* to be dipped out in the drier areas below 25 in., and in the sandy areas. *A. hebraeum* also is present in those areas suitable for its maintenance, showing that the dipping interval 14-28 is inadequate.

*Area 29, G.V.O., Flagstaff.*

Conditions favourable; dipping 7-14 day intervals. Only one batch was sent in from most collecting areas so that the recorded absences are not necessarily true absences; *B. decoloratus* is present wherever more than one collection was sent in as well as in quite a few one-times collections. For *A. hebraeum* the conclusion was drawn that dipping undoubtedly assisted in the disappearance of the tick from the above region. This conclusion is not substantiated by the findings for the presence of *B.decoloratus*, and the absence of *A. hebraeum* must be ascribed to the lack of bush cover in the open grasslands rather than to the 7-14 day dipping.

*Area 30, G.V.O., Kokstad.*

Conditions favourable; dipping 7-14, or 14-0 day intervals; some areas are subject to severe frost. Once again *B. decoloratus* is absent or present independently of temperature conditions. It is recorded as absent from some 7-14 day interval areas and from some 14-0 day interval areas, but generally it is present throughout, showing that in all probability the dipping is inadequate or that the arsenic-resistant strain is fairly widespread.

*Area 31, G.V.O., Aliwal North.*

No dipping. Conditions are apparently favourable in Lady Grey, Herschel and Barkly East, where the annual rainfall averages about 20 in; rainfall conditions are inadequate in the rest of the G.V.O.'s district. The number of batches from each collecting area was 3 to 4. *B. decoloratus* was only sent in from one farm in the Herschel district. This absence of *B. decoloratus* from areas with rainfall above 20 in. may be accounted for by the exceptionally heavy drought of the year before.

*Area 32, G.V.O., Queenstown.*

*B. decoloratus* is present in the *grasslands* of Cathcart, Queenstown, Indwe, Elliott and Maclear with a rainfall of 20 to 40 in. and dipping intervals of 14-28 or 14-0 days. It is absent on one or two collecting farms in the Cathcart and Queenstown districts with a rainfall below 20 in. It is absent from the *Karrooveld* of Tarkastad and Sterkstroom with a rainfall of 12 to 20 in.; no dipping.

*Area 33, G.V.O., East London.*

Conditions favourable; dipping 7-7 or 7-14 day intervals. *B. decoloratus* was sent in from all collecting farms; except from C2 in the northern corner of Stutterheim with a rainfall of 20 in. and where severe drought conditions prevailed during the preceding year.

From the data available it is difficult to decide on which farms the presence of *B. decoloratus* can be ascribed to inadequate dipping and on which farms to the establishment of the arsenic-resistant strain. It is on the West Bank that the arsenic resistant strain was first recognised in 1940.

*Area 35, G.V.O., Worcester.*

It is absent from the Ceres *Karrooveld* and from the *Karroo* incursions in the Worcester district. No dipping. As in other areas *B. decoloratus* is present througout on the *sourveld* of the *Western Province vegetation*. It is also present on the farms belonging to the big Bonnievale irrigation scheme even though these are on *Karrooveld* with a rainfall of 4 to 13 in.

*Area 36, G.V.O., Swellendam.*

No dipping. *B. decoloratus* is present throughout the sourveld of the *Western Province vegetation* and where the rainfall is more than 15 in. It is absent from the *Karrooveld* or wherever the rainfall is below 15 in. In this area once again it is clearly seen that the limiting factors are *Karrooveld* and dry conditions.

*Area 37, G.V.O., Oudtshoorn.*

It is present in areas with *Western Province vegetation* even though in some areas the rainfall is below 15 in. It is absent from the *Karrooveld*, unless irrigation schemes are present, e.g. the lucerne fields watered by the Kamanassie scheme.

*Area 39, G.V.O., Port Elizabeth.*

*B. decoloratus* is absent from the *Karrooveld* proper of Jansenville, but present in the coastal belt of the sourveld of the *Western Province vegetation*.

From the data available it is difficult to decide whether it can maintain itself in the so-called *Middlebush Karroo* or *Noorsveld* of the northern part of Humansdorp and of the southern part of Uitenhage; the indications are that it probably cannot do so as the rainfall is 15 in. or just below; it is absent from the *Noorsveld* in Somerset East.

*Area 40, G.V.O., Grahamstown.*

Conditions favourable; dipping mostly irregular. *B. decoloratus* is present throughout the district; it is even present in the hot and arid valleys covered with *Fish-River-Bush* and having a rainfall of 14 to 16 in. It is to be noted that, like *A. hebraeum*, it follows the Fish River into the *Karrooveld* of Somerset East and of Pearston. It is also present throughout the neighbouring native territory of Peddie. No ticks from this area have, as yet, been proved to be arsenic-resistant. One farm in the Alexandria district is free of the tick,—this absence is undoubtedly due to the more conscientious manner in which dipping is carried out.

*Area 41, G.V.O., Middelburg.*

It is absent throughout the district which is *Karrooveld*. It was sent in from one farm in Aberdeen with an annual rainfall of 15 in. This record in all probability represents a recent introduction which will not maintain itself.

*Area 42, G.V.O., Calvinia.*

It is absent throughout the Cold Bokkeveld and throughout the *Karroo*, but present on one farm in the Warm Bokkeveld with a rainfall of 25 in.

*Area 43, G.V.O., Beaufort West.*

Conditions unfavourable; *Karrooveld*. One record was received from a farm on the Beaufort West flats with rainfall 9 in.; this in all probability represents a recent record which will not be able to maintain itself.

*Area 45, G.V.O., Cape Town.*

Present throughout; *Western Province vegetation;* no dipping; rainfall 12 to 17 in.; many permanent vleis present.

*Area 46, G.V.O., Wellington.*

Present throughout; *Western Province vegetation;* no dipping; rainfall 16 to 18 in.; many permanent vleis present.

*Area 47, G.V.O., Bedford.*

It is present throughout the *tall grassland areas*, traversed by the *Fish-River-Bush* of Bedford, Adelaide, Fort Beaufort, Stockenstroom, Victoria East and Somerset East. Some of these areas have a rainfall below 15 in. It is absent from the typical *Karrooveld* of Cradock and from the *Noorsveld* of Somerset East. Its presence in *Karroo* and *Grassveld* of the Pearston district is inexplicable for the rainfall is low, between 9 to 12 in. and normally the tick cannot maintain itself at these levels.

*Area 49, G.V.O., Harrismith.*

Conditions favourable; rainfall above 20 in; no dipping; *short grasslands* of the *Highveld.*

*Area 50, G.V.O., Kroonstad.*

Conditions favourable; rainfall above 20 in.; no dipping; *short grasslands* of the *Highveld*, passing westwards into the *mixed grasslands* of the *Middleveld.*

*Area 51, G.V.O., Kimberley.*

On the vegetation map Philippolis, Fauresmith, Jacobsdal and Hay and Herbert are given as being *Karrooveld;* Barkly West and the major portion of Kimberley fall into the *Bushveld.* The greater portion of the region falls within the 10 to 15 in. rainfall belt, some stretches, however, are in the 15 to 20 in. strips. *B. decoloratus* is mainly absent throughout. It has, however, established itself on one or two farms in the *Brokenveld*, e.g. E.3 and E.15 of Fauresmith, with a rainfall of about 15 in. It is recorded from the northern part of Barkly West with a rainfall of just over 15 in.

*Area 52, G.V.O., Bloemfontein.*

The rainfall decreases from the east westwards, e.g. Thaba 'Nchu, 20 to 25 in., Bloemfontein 15 to 20 in., Petrusberg 10 to 15 in. To the north of a line Thaba 'Nchu-Bloemfontein-Petrusberg, the vegetation is given as *mixed grasslands* of the*Middleveld*, to the south as *Karrooveld;* the east and south east portions are mainly *short grass lands* of the *Highveld* as in Area 31, G.V.O. Barkly East. *B. decoloratus* is unexpectedly absent from the *Highveld* of Rouxville, Zastron, Smithfield, Wepener and Dewetsdorp, where the rainfall would appear to be adequate; it has, however, been recorded from the *Highveld* of Thaba 'Nchu and once from Zastron. It is absent from the *Karroo* to the south of Bloemfontein; since, however, the *Brokenveld* reaches to within 20 to 30 miles of Bloemfontein, it is possible that if introduced into these regions *B. decoloratus* may establish itself as it has done at Fauresmith. To the north of Bloemfontein in the Sandveld areas of *mixed grasslands* its foothold does not seem to be secure. According to the collections sent in it may be present on one farm and apparently absent on a neighbouring farm. The collections, however, were mainly only one-times collectons, so that probably the real explanation of the somewhat haphazard appearance of *B. decoloratus* in the " sandveld " of the *mixed grassveld*, is that it is present but never in great numbers, and that hence, if the collections are neither numerous nor well done, the tick may be overlooked and be recorded as absent.

*Area 53, G.V.O., Hoopstad.*

The collections were very widely spaced, only four farms being selected for the districts of Hoopstad, Boshof and Brandfort. According to these *B. decoloratus* is present in the *mixed grassveld*, but is absent from the stretches of *Bushveld* in the north-west of Hoopstad and Boshof, which absence agrees with the findings for the adjoining districts Christiana and Bloemhof on the other side of the Orange River.

*Area 54, G.V.O., Vryburg.*

*B. decoloratus* is present in those regions where the rainfall averages over 15 in. i.e. Taungs, S.E. Vryburg and the Kaap Plateau and E. Kuruman. It is absent in stretches with a rainfall below 15 in. It is entirely absent in the S.W. corner of Kuruman, that is, it peters out as we approach the *Kalahari desert* conditions.

*Area 58, G.V.O., Van Rynsdorp.*

*B. decoloratus* is absent in the *Karroo* and in the *desert grass regions*. It is present wherever the *Western Province vegetation* obtains; and it has followed along the Olifants River irrigation scheme which traverses the the arid coastal desert strip below Klaver.

*Area 59, G. V. O., Clanwilliam.*

*B. decoloratus* is present throughout; the entire district lies in the zone of *Western Province vegetation.*

*Areas 60 to 67, South West Africa.*

It is absent in the southern dry regions of Namaqualand (Warmbad 4 in., Keetmanshoop 5·56 in.) where the vegetation is mainly *Karrooveld* and consists of a sparse growth of grass and of low edible bushes, and absent from the coastal strip of the Namib Desert in the West (Luderitz 0·7 in.) as also in the east from the Kalahari and Sandveld areas of Gibeon (6·4 in.) Windhoek (14·9 in.) and Gobabis (? no collections from Gobabis); it is also absent from the thorntree steppes with low undergrowth and thick grass of the northern areas of Namaqualand and from the Bastardland highlands (Rehoboth 10·1 in.). It occurs in the *thornveld* of Damaraland, to the north of a line drawn through Karibib-Okahandja, i.e. roughly to the north of latitude 22° S. Otjivarongo 16·1, Grootfontein 23, Tsumeb 24 reaching into Ovambo-land and into Okavanga territory and into the Caprivi Zipfel, and towards the north-east into the hills of the Kaokoveld (? no collections from the Kaokoveld).

The rainfall increases from the south and from the west north-eastwards; in the south it ranges from 4 to 10 in.; in Damaraland from 12 to 24 in. and in the northern regions from 16 to 24 in. However, even in the north, the rainfall may be very irregular with frequent delays in the rainy season and consequently long dry periods.

In how far these occasional delays in the rainy seasons affect tick life is difficult to judge from the data available, possibly the numbers of *B. decoloratus* may be lessened appreciably during severe droughts, the species, however, never being entirely killed off.



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In South West Africa *B. decoloratus*, as in the Union, appears to be limited in its distribution by the amount of the annual rainfall; here again it does not seem to tolerate conditions represented by an annual rainfall below the 12 to 15 in. level.

## Comments on Previous Collections.

It is of interest to note that Sigwart (Z. Infk. XVI) collecting during the period September, 1912 to May 1914 in his area of control in the district of Outjo, in the adjoining corner of Omaruru and in the northern portion of the Waterberg (Otjiwarongo) failed to find specimens of *B. decoloratus*. It is difficult to account for the absence of *B. decoloratus* from Sigwart's collection. If it had been present, even if only in small numbers, one would expect it to have been encountered in the collections spread over two summer seasons. On the other hand, in view of the suitability of the country and of the free movement of wild life and in view of the preseut day incidence of the Blue Tick, one cannot conclude that it was entirely absent when Sigwart's collections were made. Hence one can but assume that *B. decoloratus* was present, but in only small numbers and that some local climatic disturbance had reduced its incidence considerably at the time.

Neumann (1901) records it from Walvisbay (probably on introduced cattle?) and in 1911 from Damaraland. Warburton, 1922 (Warburton, 1922, Michaelsen Land and Süsswasser Fauna Deutsch Süd West-Afrika Bd. P.91) does not list it for South West Africa. It is difficult to make out from Dönitz' publications whether or not he met it in South West Africa.

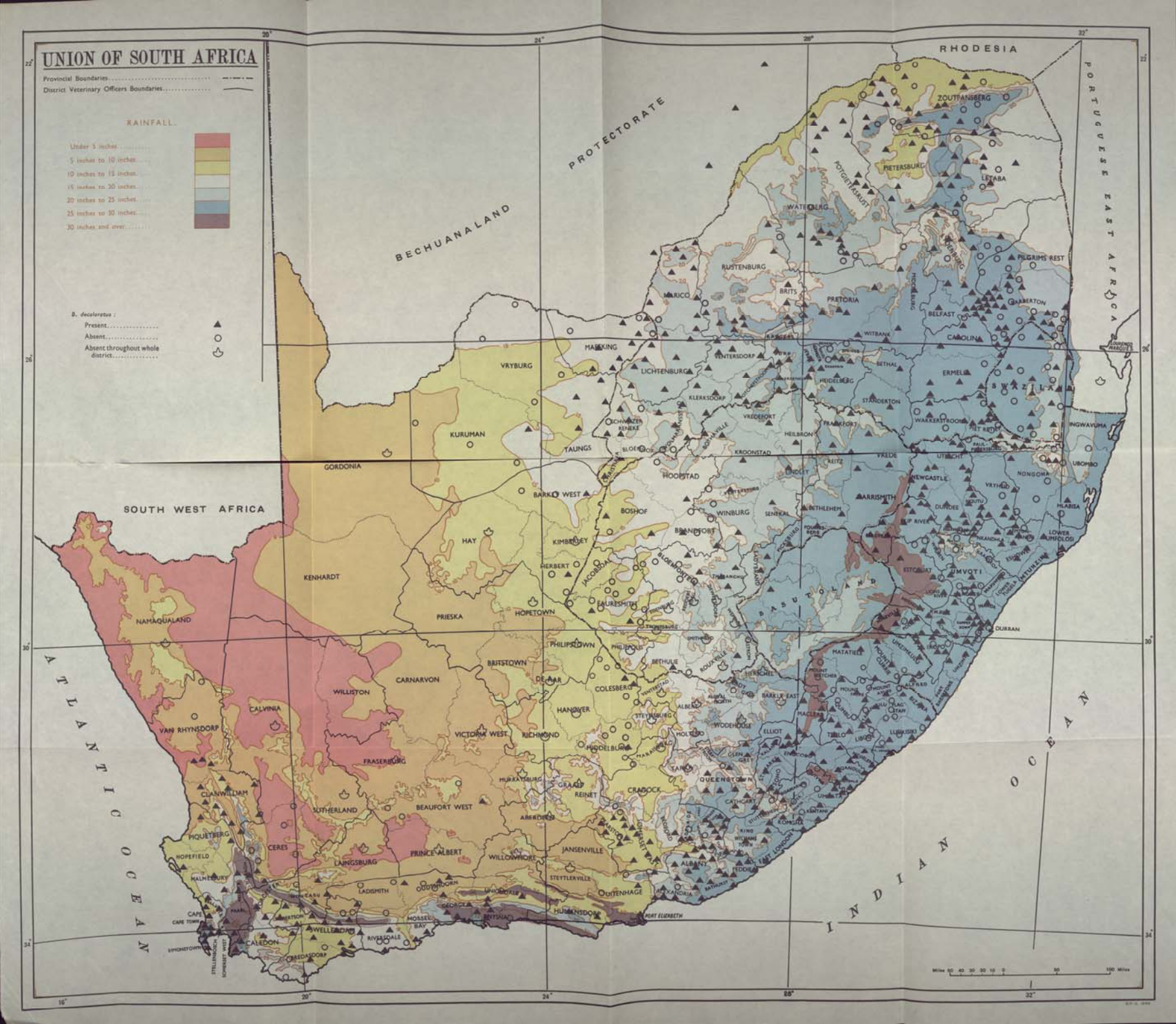
## Summary.

1. The distribution of *B. decoloratus* has been given in terms of political divisions as well as in terms of vegetational coverage.

2. The factor playing the most important rôle in limiting the spread of *B. decoloratus* is seen to be increasing aridity. In most parts of the Union the critical level is represented by an annual rainfall of 15 in.

3. It is concluded that where farming conditions are favourable the tick can be controlled by dipping.

4. From the nature of the data available one is perhaps not justified in drawing any definite conclusions as to the distribution of the arsenic-resistant strain; one can but draw attention to the fact that it apparently occurs on scattered farms throughout the *tall grassland* areas extending as far north as Swaziland.


UNION OF SOUTH AFRICA
Provincial Boundaries
District Veterinary Officers Boundaries
RAINFALL
Under 5 inches
5 inches to 10 inches
10 inches to 15 inches
15 inches to 20 inches
20 inches to 25 inches
25 inches to 30 inches
30 inches and over
B. decolorstus :
Present
Absent
Absent throughout whole district
RHODESIA
PROTECTORATE
BECHUANALAND
PORTUGUESE EAST AFRICA
SOUTH WEST AFRICA
ATLANTIC OCEAN
INDIAN OCEAN
ZOUTPANSBERG
PIETERSBURG
LETABA
POTGIETERSRUST
WATERBERG
RUSTENBURG
MARICO
BRITS
PRETORIA
PILGRIMS REST
BELFAST
WITBANK
CAROLINA
MAFEKING
VRYBURG
LICHTENBURG
WINTERSDORP
BETHAL
ERMELO
SWAZILAND
KLERKSDORP
HEIDELBERG
STANDERTON
VREDEFORT
WAKKERSTROOM
PIET RETIEF
FRANKFORT
HEILBRON
KURUMAN
TAUNGS
KROONSTAD
INGWAVUMA
UTRECHT
VREDE
UBOMBO
GORDONIA
HOOPSTAD
NEWCASTLE
NONGOMA
BARKLY WEST
LINDLEY
KEITZ
VRYHEID
HLABISA
BOSHOF
WINBURG
SENEKAL
BETHLEHEM
HARRISMITH
DUNDEE
HAY
KIMBERLEY
BRANDFORT
BLOEMFONTEIN
LOWER UMFOLOSI
HERBERT
JACOBSDAL
THABANCHU
ESTCOURT
UMVOTI
KENHARDT
FAURESMITH
BASUTOLAND
PRIESKA
HOPETOWN
NAMAQUALAND
DURBAN
PHILIPSTOWN
MATATIELE
BRITSTOWN
DE AAR
BETHULE
CARNARVON
WILLISTON
COLESBERG
BARKLY EAST
CALVINIA
HANOVER
ELLIOT
VAN RHYNSDORP
VICTORIA WEST
RICHMOND
WODEHOUSE
MIDDELBURG
FRASERBURG
QUEENSTOWN
HURRAYSBURG
GRAAF REINET
CRADOCK
CLANWILLIAM
SUTHERLAND
BEAUFORT WEST
ABERDEEN
CATHCART
PIQUETBERG
CERES
PRINCE ALBERT
WILLOWMORE
JANSENVILLE
HOPEFIELD
LAINGSBURG
STEYTLERVILLE
MALMESBURY
LADISMITH
OUTENIQUA
CAPE TOWN
PAARL
GEORGE
HUMANSDORP
MOSSEL BAY
PORT ELIZABETH
WELLINGTON
RIVERSDALE
CALEDON
SWELLENDAM
CALEDONSDORP
STELLENBOSCH
SOMERSET WEST
Miles 60 40 30 20 10 0 50 100 Miles