

Zoological Survey of the Union of South Africa. Tick Survey—Part IV.

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DISTRIBUTION OF RHIPICEPHALUS CAPENSIS, THE CAPE BROWN TICK.

General distribution.

Rhipicephalus capensis appears to occur most uniformly in the Cape Province, being very prevalent in the Western Province, extending along the west up into Little Namaqualand; extending along the southern coastal strip into the Eastern Province; and northwards into the Great Karroo and into the southern parts of the Orange Free State, where it is mainly found in the districts of Bethulie, Phillipolis and Fauresmith right up to the level of Bloemfontein; northwards from East London its occurrence in the eastern coastal strip is erratic, it extends through the Native Territories, Natal and Swaziland into the South East corner of the Transvaal, where it dies out at the level of Pilgrims Rest. Except for odd occurrences, it is absent from the northern parts of the Orange Free State, and from the whole of the Transvaal, it is likewise absent from the adjoining areas of Portuguese East Africa. It, however, shows a tendency to crop up again in the Northern Transvaal, and is also recorded from Southern Rhodesia. It is apparently absent in the districts of Hay, Gordonia Vryburg and Mafeking and the adjoining Protectorate of Bechuanaland, but crops up again, somewhat scarce and widely scattered, in South West Africa and across the border in Angola.

Distribution in the Vegetational Types.

The vegetation map shows *R. capensis* to be PRESENT:

I In all three types of forest.

- (a) *Evergreen deciduous bush and sub-tropical forest* fringing the East Coast from the Sunday's river northwards.
- (b) *Temperate Evergreen forest* of the George-Knysna-Zitzikama area, and of the other smaller isolated areas to the east of the Escarpment.
- (c) *Evergreen Sclerophyllous bush or Western Province vegetation*; it is solidly present in this type of vegetation even in the well cultivated areas.

II In one out of the three Grasslands.

- (a) It occurs very unevenly distributed in the *Tall Grass* of the Eastern Grasslands, being much more prevalent in some regions than in others; it does not seem to be influenced by

the nature of the grass appearing in sour as well as in sweet-veld; it seems to prefer open grass veld to veld with thorn trees, but the preference—if there is a preference at all—is not at all marked. In Swaziland, however, there seems to be a fairly definite association between the presence of the tick and the vegetational coverage. *R. capensis* is absent in the south which is mainly thorn veld, and is present in the north where there are but few thorn trees.

III In two out of the three *desert shrubs*.

- (a) It is prevalent throughout the *desert shrub* of the Karroo veld, more especially so in the eastern regions and in the broken veld of south west Orange Free State, shewing a tendency, however, to die out northwards towards the *Kalahari*, and occurring but very occasionally in the *Karroo veld* of S.W. Africa.
- (b) In the *desert succulent and desert grass* of little Namaqualand and of Bushmanland dying out, however, in the more arid regions of Great Namaqualand.

The vegetation map shews *R. capensis* to be ABSENT:

I From all three *Parklands*.

- (a) *Evergreen and deciduous tree and bush* of the Bankenveld and of the Limpopo Highlands, with three records, however, from the Louis Trichardt area and one from the Nylstroom area.
- (b) *Subtropical evergreen and deciduous tree and thorn forest* of the *lowveld* and of the Northern Transvaal; with occasional records however from Eshowe, Nongoma, Lebombo Range and from Louis Trichardt.
- (c) *Thorn Country or dry Bushveld*, with but one record on the Crocodile river in the north of Potgietersrust, and one on the Transvaal border of the Vryburg areas, and one at Rietfontein on the borders of S.W. Africa in the district of Gordonia.

II From two out of the three *Grasslands*.

- (a) *Short grass* of the Highveld. Further collections, however, are needed before a very definite statement can be made. For in the south it seems to be safely established on some farms in the Barkly East—Aliwal North—Dordrecht hills. North of Basutoland there are odd records from Vrede and Memel, and in the Transvaal it also seems well established at Waterval and in the Mauchsberg.
- (b) *Mixed Grass* of the *Middleveld* of the Northern Free State and of the Southern Transvaal, with odd records from Bloemfontein, Glen, Brandfort and Winburg in the O.F.S., and from the western boundary of Lichtenburg in the Transvaal, and two from the Eastern Transvaal in the district of Lydenburg.

III From one of the three *desert shrubs* areas.

- (a) *Thorn country and desert shrubs* of *Kuruman and Vryburg*. In these western areas it does not cross the Orange river at all.

The Influence of Dipping.

From the data available it is almost impossible to gauge what effect, if any, dipping has on the distribution picture of *R. capensis*. In the Transkei and in Natal, in those areas where dipping is conscientiously carried out, the tick may be partly dipped out. This cannot be assumed with much assurance however, for it is still present on some East Coast Fever farms where 5-5 dipping had been enforced recently.

The Influence of Temperature and of Altitude.

Altitude and low temperatures in themselves are not a limiting factor to the distribution of *R. capensis* (See Map, and Tables 1 to 5). It is present in the Roggeveld, Komsberg and Nieuweveld Mountain ranges in the Sutherland-Fraserburg areas with an average of 90-150 days of heavy frost; it is also present in the Barkly East district which experiences snow in winter; it is absent from the Witwatersrand which averages but 60-90 days of heavy frost. It is not recorded from Potgietersrust, Mafeking, Nongoma and Flagstaff with but light frosts or no frosts at all, and is present in the eastern coastal belt with no frosts at all. The temperature figures given on Tables I to V are taken from the records of the nearest representative meteorological station, and are thus frequently but approximate.

The Influence of "Rainfall", The Influence of Seasonal Variations in Relative Humidity and/or Aridity.

In the previous reviews on the three ticks, *Amblyomma hebraeum*, *Boophilus (palpoboophilus) decoloratus*, and *Rhipicephalus appendiculatus*, it was seen that, given adequate coverage, lack of precipitation and/or increasing aridity played a limiting role in the distribution of each species. In *R. capensis* it is almost impossible, from the data collected, to get a clear picture of the role played by humidity and/or aridity. (See also remarks on page 12.) The picture is further complicated by the fact that the adult ticks tend to shew seasonal variations in their feeding activities. S. G. Wilson* working in Nyasaland states that "*R. capensis* adults can only maintain themselves successfully during the hot dry months of September, October and November disappearing with the same suddenness at the end of November as they appeared at the end of August; three months when the average maximum temperature exceeds 80° F., and the average minimum temperature between 50° and 60° F. The optimum month is October, with an average maximum temperature of 84° F. and an average minimum of 53° F. and an R. H. ranging from 35 per cent. to 50 per cent. for 9 a.m. readings. During the months April to October there is virtually no rain; the November rainfall averages but 7.1", the main rainy season falls in the period December to March. Though dry, Sept. and Oct. seem to be decidedly warmer than August, July being the coldest month of the year." It would seem that in Nyasaland *R. capensis* behaves uniformly throughout the territory, it appears at the end of a long dry spell, climatic conditions in the various regions shewing but slight variations.

Since the *R. capensis* adult shews such a decided periodicity in its feeding activities in Nyasaland, it is permissible to postulate that in South Africa it may also shew similar variations in its appearances. It is in trying to establish

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these periods of activity that one finds that the data accumulated are not adequate, the collecting may have been very badly done; or our information, not so much in regard to actual rainfall figures, as in respect of relative humidity, is nil. The rainfall figures, given in Tables I to V, may be from the farm itself or from the next nearest representative farm. There is no published data relative to the mist belts, shewing altitudinal or seasonal distribution; nor are there any figures available as to the distribution and the periods of heavy or light night dews; it seems to be generally accepted that for day time the relative humidity on the central plateau is highest towards the end of February and the beginning of March i.e. during the rainy season, after which it falls rapidly to the middle of September; and then starts to rise again.

To try and establish (a) the factors limiting the distribution, and (b) the factors influencing the activities of *R. capensis*, it is perhaps best to select areas, representative of varying climatic conditions (humidity figures not available) from which adequate collections have been sent in, and to analyse these selected returns. (See Tables 1 to 5.)

Analysis of Returns from Selected Areas, as to Periods of Activity.

In dry Karroo regions (Table 1).

Present throughout the year in the Beaufort West flats and in the Prince Albert District north of the Zwartberg, having but a low average annual rainfall of 7-9", spread over but 20-30 days with no marked difference between summer and winter rainfall, winter only slightly less than summer. In Calvinia the tick is active most of the time except during the April-June winter period; in Sutherland this drop in activity in April-June is even more marked, with a tendency for another inactive period in October-December as well. As we go northwards and eastwards this all-the-year-round activity becomes further reduced. In Carnarvon and Van Wyksvlei the tick, if present, is active only in late summer, January to March, whereas in Williston its activity is confined to the July-Sept. period; this spring activity is also seen in the Philipstown collection, where the tick, however, stays on into the October-December period and in one or two instances even to the late summer, January-March.

Northwards and westwards in the Van Wyksvlei and Britstown regions *R. capensis* dies out being present on a few farms only. In the Free State it is liable to be present in the brokenveld of Fauresmith, and Phillipolis, the data here unfortunately are very incomplete, no collections having been sent in between April and September. In all probability the tick is inactive only during the winter period April-June, and as in the adjoining Philipstown area active in August-September.

In the Winter rainfall area. (Table 2.)

The tendency is for the tick to be absent during the early winter, April-June; it becomes active in the July-September period which is as wet as and even colder than the April-June period; it remains active throughout the warmer and drier summer months. Its appearance during the spring month of September would fit in with the data from other areas, but its appearance during the cold, wet and wintry July is most unexpected, especially as it is absent during the relatively warm and dry, late summer month of March.

The odd record for May from the Darling district may be interpreted as a very late summer record, wet wintry conditions usually set in after mid May.

In the Southern Coastal Areas. (Table 3.)

Stretching from Caledon to Grahamstown with the rainfall spread over the entire year, *R. capensis* shows the same period of inactivity during the April-June months (unfortunately only too frequently no collections were made at this time of year) with a shift forwards of this inactive period into the January-March months. Along the southern coastal strips as far as Port Elizabeth, the active period lasts from August till December-January. In these regions the picture is not disturbed by dipping practices. However, in the more eastern areas of Albany, Alexandria and Bathurst the active period is restricted to October-January, with no occurrence whatsoever in the July-September period; the picture here may be confused by dipping practices, but in all probability is not seriously disturbed, as in most instances the dipping is carried out very irregularly.

Eastern Grass Lands. (Table 4.)

The rainfall is somewhat heavy during the summer months, with lighter, though considerable falls as compared with the rest of South Africa, during the winter months. The picture in the Transkei and in Natal is very confused. The dipping periods are nominally 7-7 of 7-14, but apparently these periods are not always faithfully adhered to and the actual practices vary according to the conscientiousness of the individuals concerned. That the tick can maintain itself throughout the eastern grass lands is shown by its presence in various representative parts. Its extremely haphazard occurrence can, to a certain extent, be ascribed to the influence of the actual dipping practices.

The data available are inadequate, and it is almost impossible to establish periods of activity with any certainty whatsoever. In the hot dry *lowveld*, as for example in the Magut district, *R. capensis* seems to be active only during the January-March months. In the "*middleveld*", the Melmoth, Nkandhla and Babanango areas, on certain farms it may be active from August to March, occasional lone ticks may even be collected during April-June, but generally April-July can be considered as an inactive period. In the Highveld of Paulpietersburg it is confined to the September-December months.

In the Karroo areas of the Eastern Province. (Table 5.)

In Somerset East, Pearston and Middelburg, dipping as a limiting factor does not come into consideration, as most cattle may be sprayed or handdressed but occasionally, and small stock may be dipped but once or twice a year.

The tick appears to be most abundant during the six summer months October-March. In some instances, however, it may occur in August-September; and on one or two farms it is present the whole year round. In how far it is active during April-July it is difficult to judge, for once again the collections—otherwise excellent collections—were too frequently suspended during these months. The data available, however, seem to point to its being inactive during the four winter months.

DISCUSSION.

In Nyasaland *R. capensis* becomes active before the temperature has risen to any extent from its winter minimum (the coldest months are June-August) and before the rainy season has commenced; the first rains fall in November (1943 Reading: 3 days rain—2.1") after which the tick suddenly disappears, and the adults remain inactive for the rest of the year, i.e. during the rainy season which

ends in March as well as the winter months. Precipitation alone, or associated with a rising temperature, here seems to be the factor limiting the activity of the adult.

The Beaufort West results can be said to fall into line with the Nyasaland results, for, whereas there is an increase in temperature during December-January, there is no increase in rainfall and there is no cessation of activities and the adult is present throughout the year. Whereas the Beaufort West findings may be said to support the Nyasaland findings to a certain extent, those from the winter rainfall areas contradict them somewhat. Here the tick is absent during the wet winter months of April-June, as we would expect if rainfall is the factor limiting adult activity; but it occurs during the July-September period, a period which is as wet as and even colder than the previous three months period. *R. capensis* remains active with increasing temperature and decreasing rainfall, being present throughout the warm, relatively dry summer months and disappearing in April before the real winter rains have set in.

The Nyasaland findings are also contradicted by the Natal (Melmoth) findings where in some areas the adults are active during the hot rainy period and are absent during the drier (though relatively still moist) cooler winter months.

All in all, the data are still so incomplete and apparently so contradictory, that it is impossible at this stage to draw any conclusions as to the factors limiting the activity of the adult tick; all that can be said is that it tends to become inactive during the winter months April-May and June, independently of whether these months be dry, moist or wet. Of particular interest are the records from Government Veterinary Officer, Port Shepstone: here in the April-June 1939 collection the tick was present throughout, whereas in the April-June 1942 collection it was not represented at all. The local Government Veterinary Officer could offer no suggestion for this difference in behaviour in the 2 years.

In insect life, it is generally accepted that precipitation is an important factor in the emergence from hibernation. The findings for Nyasaland and those from the Union definitely shew that rainfall has nothing to do with the re-emergence of the adult *R. capensis*.

Factors Limiting the Distribution of R. capensis.

No clear-cut conclusions can be drawn as to the factors playing a limiting role. (A) In *Grasslands* the nature of the grass, however, seems to play a decisive part, *R. capensis* generally not being found in any but tall grassveld. (B) In *Karoo*, or in *mixed Karoo and Grass areas* or in *Thornveld*, increasing aridity undoubtedly exercises a certain influence on the survival of the tick. The amount of aridity tolerated, however, varies considerably in different regions; very dry Karoo areas, as judged by rainfall, may support the tick, whereas grassland areas with the same low precipitation cannot do so.

This postulated variation in aridity-tolerance varying with environmental conditions, could be paralleled in the insect world, where also there is every indication that (optimal) humidity for development and for survival may shift with temperature.

All the above conclusions relative to the seasonal activity and relative to the factors restricting the distribution of *R. capensis* are, however, but tentative, in that the data are frequently so incomplete as to be unreliable.

Disease.

A. capensis is capable of transmitting East Coast fever caused by *Theileria parva* in cattle.

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 I of this article.

Area 1—G.V.O., Johannesburg.

Only one odd summer record from the *middleveld*; undoubtedly a recent introduction which will not become established.

Area 3—G.V.O., Mafeking.

A few odd summer records from two farms in the Mafeking district, and one from a farm on the border of the Lichtenburg district. All in the *mixed grass veld* of the *middleveld*. Close to these four records is 54 C. in the Vryburg area, also a summer collection. No dipping.

It would seem that under certain favourable conditions the tick can become established in certain areas of the *middleveld*.

Area 4—G.V.O., Pietpotgietersrust.

Absent throughout the *middleveld*, *Bankenveld* and *Dry Bushveld*. Sent in in July, September and October from A. 2 in the Waterberg district and in July and January from C. 3 from the Crocodile river flats, with *Dry Bushveld*—or veld merging into *Sub-tropical evergreen and deciduous tree and thorn forest or Mopani bush* so characteristic of Southern Rhodesia; dipping irregular; the tick has undoubtedly become established on these two farms and not on the adjoining farms. The collections were made monthly. From the data available it is difficult to see why this A. 2 farm is more suitable than the others in the Limpopo Highlands on some of which no dipping is carried out at all. The presence on C. 4 could be explained as a farm having become infested from the north.

Area 6—G.V.O., Zoutpansberg.

Mostly absent throughout all three types of vegetation; present, however, in a few collections i.e. January at A. 5; February at A. 10; April at A. 26; all three farms in *Mopani bush*; dipping irregular. Present also in August, September in C. 1. 2. 3. in the Limpopo Highlands on farms having tall grass on the plateaux with wooded kloofs on the mountain sides; dipping 7-14; once again present on a few farms which in no obvious manner differ from those around them and from which no *R. capensis* were sent in.

Area 7—G.V.O., Barberton.

Three vegetational zones meet in this district, namely, the *sub-tropical evergreen and deciduous tree and thorn forest* of the *lowveld*, the *tall grass* of the *eastern grassland*, and the *short grass* of the *highveld*, with incursions of the *lowveld* along the rivers into the "middleveld" *tall grassland* with thorn trees onto the *highveld*.

Only two extensive collections were sent in, the one covering the period March-May the other October-December, the specific month in which the collections were made is not given. The tick is present on the Sabie Plateau lying in the *highveld* with sour veld, during both the March-May and the October-December collections; it is present in the "middleveld" of the *tall grasslands* on the White River plateau, on the Kaapsche Hoop plateau, in the Schoemanskloof area and in parts of the Houtboschloof area; occurring more frequently in October-December than in March-May; dipping 7-14. It is absent from the *lowveld* of Nelspruit, the Sabie and White River areas, Louw's Creek area, the Lebombo flats and from the *lowveld* of Barberton, from the "middleveld" of De Kaap Valley and of the highlands area; and from the *Highveld* of the Elands Valley and of part of the Schoemanskloof area; dipping 7-14. That is, with but few exceptions, it is present in the wetter highlands and absent from the drier *lowveld*; in the "middleveld" the critical rainfall seems to be at about 30", in areas below this the tick tends to be absent; in the Louw's Creek and Highlands areas it is, however, absent at much higher rainfalls and in the Lebombo flats it is present at 22-25". So that the distribution picture is anything but clear; and quite apparently other factors besides actual temperature and rainfall play a limiting role; dipping may be one of them.

Area 8—G.V.O., Piet Retief.

Present in the "middleveld" of the *Tall grasslands* to the South of Swaziland in February-March, absent during the rest of the year; its occurrence to the west of Swaziland in the Piet Retief area is somewhat irregular; here it may occur either in November or in June. This marked irregularity, however, may be due to the unevenness of the collections; of special note, however, is the fact, that it is absent across the border in Swaziland. Rainfall above 30"; dipping 7-14. It is also absent in the *Highveld* of Wakkerstroom, despite its high rainfall, above 35".

Area 9—G.V.O., Lydenburg.

These collections were very uneven; from most farms only one was sent in, an October collection. In October the tick is absent throughout—i.e., absent from the *lowveld*, the "middleveld" of the *tall grasslands*, from the *Bankenveld* as well as from the northern strip of *dry Bushveld*, rainfall below 30". It is recorded once from A. 7 in the "middleveld" of the Lydenburg and in late summer and early winter from the "middleveld" of the Bushbuckridge area. Though the absence of *R. capensis* from all these areas might be ascribed to the inadequacy of the collection, it yet fits in with the records from the adjoining G.V.O. Areas. Dipping 7-14.

Swaziland.

The major portion of the Territory lies in the "middleveld" of the *tall grasslands*, with but a narrow strip in the *lowveld*; dipping 7-day, in some E.C.F. areas 5-day. *R. capensis* is absent from the southern portion, but was sent in from most dipping tanks north of the Mhuluzi in the early summer i.e., August collections; at other times of the year it appears to be inactive. What the factor is that allows *R. capensis* to maintain itself in this northern strip, when it is absent everywhere else, is difficult to establish; There is no apparent difference in the dipping practices, one of these northern tanks being even on the five-day interval at the time the collections were made; the rainfall may be greater in the

north, but only slightly so; the mists in these northern areas are certainly more frequent and heavier than in the other parts, so that here the average humidity can be said to be greater.

Portuguese East Africa.

R. capensis is absent from the adjoining provinces of Lourenço Marques and of Inhambane which are essentially dry and hot regions.

Area 10—G.V.O., Ermelo.

Absent throughout in all four collections. One odd October record in the Carolina district from C. 2 on the edge of the *highveld* with incursions of *Thornveld*. This record fits in with the adjoining ones in Area 7. No dipping.

Area 14—G.V.O. Vryheid. (See Table 4.)

Dipping throughout 7-7. Distribution picture somewhat confused, *R. capensis* shews a tendency, however, to disappear in the *lowveld* e.g., Kataza and to be present in the mountains with their mist belts e.g., Babanango. Besides climatic factors, it would appear that the regular dipping also plays an important limiting role.

Area 15—G.V.O., Dundee. (See Table 4.)

R. capensis is mainly absent from the "middleveld" of Nqutu, Helpmekaar and Dundee, and crops up in the mountainous parts of Newcastle, Utrecht and Paulpietersburg; it is present only in the October-December collections (no July-September collections sent in). Dipping 7-7.

Area 16—G.V.O., Ladysmith.

The absence of *R. capensis* from this area may be more apparent than real as no July-September and no October-December collections were sent in. The only record is a May one from the mountainous regions of Olivier's Hoek Dipping 7-14.

Area 17—G.V.O., Estcourt.

Collections poor. *R. capensis* apparently absent throughout. Dipping 7-28.

Area 18—G.V.O., Pietermaritzburg.

Collections good. Distribution picture not clear. It would appear to be absent in the lower lying regions and to be present in the hilly regions with mist belts. Dipping 7-14.

Area 19—G.V.O., Greytown.

Collections poor. In all probability it will be found to be present in the hilly portions of New Hanover, Umvoti, Kranskop and Msinga, in as far as the collecting areas lie in the mist belt. *R. capensis* has been recorded from the neighbourhood of Seven Oaks and of Rietvlei in the Umvoti district. Dipping 7-7 or 7-14.

Area 20—G.V.O., Ixopo.

Apparently absent in the drier reaches along the Umzimkulu and present elsewhere; mainly present in the September collections. Dipping 7-14 or 14-14.

Area 21—G.V.O., Port Shepstone.

This area lies mostly in the warm-moist sugar belt. *R. capensis* is present throughout during the greater part of the year, with a tendency to disappear during January-March. Of particular interest is the fact that it was prevalent in the April-June collection in 1939, but entirely absent in the April-June collection in 1942. The G.V.O. could offer no suggestion as to this difference in behaviour; he could think of no single climatic factor that would account for it. Dipping 7-14.

Area 22—G.V.O., Eshowe. (See Table 4.)

R. capensis is present throughout, the area being warm and moist. Dipping 7-14. It is absent from A. 1. and D. 2. where the dipping is 7-7

Area 23—G.V.O., Nongoma.

Tick life in general in these lower lying drier *lowveld* regions is not very abundant. *R. capensis* is absent. Dipping 7-7 or 7-14. The record from B. 1. near Hluhluwe indicates that in all probability it is present in the moister parts of the district.

Area 24—G.V.O., Durban.

Having mostly sub-tropical conditions with a heavy annual rainfall. Dipping 7-7 or 7-14. *R. capensis* absent from all collections; except from C.4, the native location at Mapumulo, during the summer season.

Areas 26 and 27—Transkei.

Extending from the sea coast up to the Drakensberg. *R. capensis* seems to be restricted to two regions (a) in the Ngquellini and Libode districts between the Umtata and the Umzimvubu rivers in the coastal strip, reaching up through the grassveld regions to E. 2. in foothills at Tsolo. (b) in a block between Cofimvaba and Engcobo on the second rise from the coast.

It is absent from identical regions along the Drakensberg.

It would seem that the area is suitable and that the tick could maintain itself if it were not disturbed by the very strict dipping, which is 7-7 or 7-14. When present it is present during the early summer months.

In the opinion of the local G.V.O. the controlled weekly dipping carried out in these native areas plays a very important role in the disappearance of tick life in general.

Area 28—G.V.O., Butterworth.

As in the adjoining regions of the Transkei the tick is absent, although conditions would appear to be favourable throughout. Possibly here too the tick has been dipped out? Dipping 7-14 or 14-28.

Area 29—G.V.O., Flagstaff.

Collections from this area were poor, so that the absence of the tick may be more apparent than real. Its absence here, however, agrees with the records from the immediately adjoining areas in 26; in all probability the regular dipping practices are responsible for its non-appearance.

Area 30—G.V.O., Kokstad.

Absent from the higher lying areas in Mount Fletcher, Matatiele, Mount Currie and Umzimkulu; in this it agrees with the adjoining areas of Elliot, Maclear and Quembu. Present in the lower areas of Mount Currie and Umzimkulu; in this the records agree with those from the adjoining regions of Ixopo (21), and Harding (20). When present, present in the October-December collections. No July-September collections sent in.

Area 31—G.V.O., Aliwal North.

Collections inadequate. As in Elliot (32) Maclear and Mount Fletcher (30), *R. capensis* appears to be absent from the mountainous regions of Barkly East, Herschel and Lady Grey. It has, however, been sent in from the Wartrail area, collected in October, and where it is stated to occur regularly every year. 41" of rain and average maximum 67° F. average minimum 37° F., over 90 days of severe frost, heavy snow in winter. Generally speaking it is also absent from the Grassveld of Aliwal North, Wodehouse and Albert, and crops up in the mixed veld of the more mountainous parts of Molteno; it is present in the *Karoo veld* of Venterstad. Practically no dipping is carried out in any of these districts.

Area 32—G.V.O., Queenstown.

Absent in the Stormberg, Great Winterberg, Katberg and Amatolas, crops up, however, in the *Karoo veld* of Tarkastad. The odd midsummer record from Cathcart is difficult to explain except as an accidental introduction.

Area 33—G.V.O., East London.

No collections in October-December, which may account for the absence of the tick from this area; for according to the records from area 40 G.V.O., Grahamstown, an area in which the collecting was carried out very conscientiously, one could expect *R. capensis* to be present in the adjoining regions of East London; the absence of *R. capensis* from area 33, however, would fall in with the records from area 28, where the collections were considered adequate.

Area 35—G.V.O., Worcester. (See Table 3).

Lying in the belt of *Western Province vegetation* with an incursion of *Karoo veld*. *R. capensis* is liable to be present all the year round throughout the area. The area is relatively dry, with rain all the year round, slightly heavier in winter than in summer. No dipping.

Area 36—G.V.O., Swellendam. (See Table 3).

In this area the vegetation and climate vary considerably. There is a coastal strip of *temperate evergreen forest*, including the Knysna-Tzitzikama forest, followed by a band of *Western-Province flora*, and beyond the Langeberg

and the Outeniqua range a strip of *Karoo veld*, bordered on the north by the *Western Province flora* of the Groot Swartberg range. *R. capensis* is present throughout, ranging from the wet region of George to the dry regions of the Little Karroo and crossing the Swartberg into the Karroo proper. Dipping is usually not carried out, spraying and handdressing may be carried out on some farms, when tick life becomes abundant. It seems to be active from September onwards dying out in late summer; in one or two instances it was present all the year round.

Area 38—*G.V.O., De Aar. (Table 1).*

Including De Aar, Philipstown, Britstown, Hopetown and Prieska all in typical *Karoo veld*. Absent throughout except in the eastern parts of Phillipstown adjoining Phillipolis and Fauresmith, where there is a certain amount of Grass mixed in with the Karroo bushes. Here it is mainly active during the summer months, but has also been collected during the April-June period. An odd March lot was sent in from the Marydale (N.W. Prieska) area, this record fits in with the somewhat scattered and uneven records from the Kenhardt district. Tick life throughout these areas is generally very scarce during the winter months.

Area 39—*G.V.O., Port Elizabeth. (Table 3).*

In this area the coastal strip of *sub-tropical forest* peters out and there is a general meeting and intermingling of *tall grass veld*, *Karoo veld* and of *Western Province flora*, with *Karroid scrub* or *Fish River Bush* along most of the rivers. The rainfall is fairly evenly distributed over the year.

R. capensis is present in the coastal belt of *Western Province vegetation*; it is unexpectedly absent from the *middle-bush Karroo* of Uitenhage and Humansdorp; its occurrence in the dry *Karoo* of Jansenville and Steytlerville is uncertain, it was only sent in from two collecting areas. The collections, however, might be considered inadequate, and in all probability the tick will be found to be present throughout and will shew the usual falling off in activity during the April-June period.

Area 40—*G.V.O., Grahamstown. (Table 3).*

R. capensis is virtually present throughout the whole area right up into the Amatola Mountains, and onto the Hogsback. It seems, however, to shew a tendency to die out along the coastal strip of *sub-tropical vegetation*; this absence, however, may be more apparent than real. The collections were good, though suffering slightly from the lack of April-June collections.

As in the adjoining district of East London *R. capensis* is apparently absent from the native reserve in the Peddie district; better collections will in all probability, however, shew it to be present.

The absence of the tick from certain farms, differing in no way from adjacent areas where it is present, may possibly be due to the more conscientious manner in which dipping is carried out on these farms.

Area 41—*G.V.O., Middelburg.*

As in the other *Karoo* districts of the Eastern Province present throughout, and almost all the year round, with the usual tendency however, to become

inactive during the April-June period, with the period of greatest activity after September; there were but few late summer collections so that it is difficult to say when its activity begins to fall off.

Area 42—G.V.O., Calvinia. (Table 1).

This area is mainly covered by dry grass or drier *Karoo veld*; in the north-western corner it gradually changes to the *grassveld* of *Bushman land* and in the very south east corner of Ceres there is an incursion of *Western Province Flora*. *R. capensis* is present throughout the *Karoo veld*, but dies out in *Bushman land*. The coldest regions of South Africa lie in this area in the Sutherland district, which experiences more than 150 days of severe frost annually. *R. capensis* is generally absent during April-June, but becomes active during the equally cold August; in one or two instances it is active all the year round. The records are not conclusive, but it would appear that the tick is absent from the very dry *Ceres-Sutherland Karoo*.

Area 43— G.V.O. Beaufort West. (Table 1.)

Present throughout the *typical Karoo veld*, absent, however, in the very *dry Karoo areas* so typical of Laingsburg and its surroundings. It shews a tendency to disappearance in Carnarvon as also in the adjoining Kenhardt (44) and Prieska (38).

Area 44—G.V.O. Gordonia.

Present, though apparently not securely established, unless it is that the picture is confused due to the nomadic habits of the Trekboers. It appears to be definitely absent from the triangle Kenhardt—Buchuberg—Upington; in this it agrees with the adjoining portion of Prieska. The explanation lies possibly in a change of vegetation, not shewn on the map, for these areas lie close on the borders of the *Kalahari* type of Bushveld; *R. capensis* is absent from the *Kalahari*.

Area 45—G.V.O. Cape Town. (Table 2.)

Western Province vegetation, winter rainfall, the climate generally is mild. *R. capensis* is present throughout; absent during April-June, it becomes active in July, which is as cold and as wet as May-June, and remains active throughout the summer months. No dipping; dairies may spray or handdress when ticks are abundant.

Area 46—G.V.O., Stellenbosch. (Table 2.)

Winter rainfall area stretching from the wet mountainous Stellenbosch-Franschoek regions to the drier open flats of Malmesbury-Piquetberg. In between the cultivated fields there may be stretches of natural vegetation, often with permanent vleis. The distribution picture is not quite clear, the tick being present or absent quite haphazardly; this unevenness may be either due to inadequate collections, or due to the fact that cultivation of the fields has disturbed the environment to such an extent that it ceases to be suitable for the maintenance of *R. capensis*. On the whole it would be safe to conclude that it is potentially present throughout the district.

Area 47—G.V.O., Bedford. (Table 5.)

Present in the *Karrooveld* of Cradock, Somerset East and Pearston. In is of interest to note that it is very common in the Pearston district, whereas it was apparently absent from the adjoining districts of Jansenville and of Steytlerville, further collections are needed from these latter areas to verify this absence. The collections from Bedford, Adelaide, Beaufort and Stockenroom were quite inadequate, so that it is impossible to ascertain whether or not the tick climbs the Great Winterberg. According to the Queenstown (32) records it apparently does not, but these records also need to be confirmed. *R. capensis* is active mainly between October-March, although it may start earlier or stop later. Dipping or spraying occur but seldom, so are not likely to disturb the ticks' activities.

Area 49—G.V.O., Bethlehem.

Collections irregular, often only made during April-September and none in the summer months, so that in all probability they do not reflect the distribution of *R. capensis* correctly. The tick, thus far, is recorded as present in the *Vrede*, and as absent in the *Highveld* areas of the districts of Frankfort, Reitz, Harrismith, Bethlehem, Fouriesburg, Ficksburg, Clocolan and Lady Brand bordering on Basutoland; it is in all probability more widespread than the present records indicate. Further collections are also needed from Basutoland, where the tick in all probability is present though but precariously established.

Area 50— G.V.O., Kroonstad.

Absent throughout, except for one record from the *middleveld* of Winburg, where it appears to be firmly established having been collected in January of 1939 and in March of 1941.

Area 51—G.V.O., Kimberley. (Table I.)

Collections poor. *R. capensis* has been sent in from the majority of the collecting areas in Fauresmith and Phillipolis and from a few odd *Karoo* farms in the adjoining Jacobsdal and Herbert. It would seem to be a safe assumption that it is present in the *Karoo* regions in this G.V.O. area. It is absent, however, from the collections from the adjoining *thorn veld* of Kimberley, Barkly West, Herbert and Hay districts.

Area 52— G.V.O., Bloemfontein.

Collections inadequate. Specimens have been sent in from the *Sandveld--middleveld* of Bloemfontein, one from Brandfort and one from Thabanchu [one record from the adjoining Winburg (50)]. One odd record has been noted from the *Karoo veld* of Bethulie, none from Trompsburg, and one from Edenburg. No specimens have been sent in from the *Highveld* areas of Zastron, Rouxville, Wepener, Dewetsdorp, Reddersburg and Thabanchu. Further collections may shew the tick to be more widespread than the present records indicate.

The tick apparently is but precariously established in this area, and is liable to be active during the summer months; no winter collections were made.

Area 53—G.V.O., Hoopstad.

No specimens sent in from either the *Middleveld* or the *Thornveld* of this area.

Area 54—G.V.O. Vryburg.

One record from the *Bushveld* of the north eastern corner of Vryburg. This odd record links up with the few stray records in Mafeking.

Area 55—G.V.O. Namaqualand.

Present throughout. No specimens sent in from Pella; this absence is apparently due to the fact that only one collection was made and that during winter.

Area 57—G.V.O., Graaff-Reinet.

As in the adjoining *Karoo* districts of Jansenville and Steytlerville. *R. capensis* does not seem to be firmly established in these areas. Its presence or absence seems to be peculiarly haphazard. Occasional handrearing is practised on some of the farms.

Areas 58 and 59—G.V.O. Van Rynsdorp and Clanwilliam.

R. capensis present throughout on both the *Western Province* and the *Karoo* type of Vegetation, and is liable to be active during all months of the year.

South West Africa.

According to the data available present, but insecurely established; specimens have been sent in from Keetmanshoop, Windhoek, Omaruru-Kalkveld, Erundu-Otjiwarongo and from the Okavango territory. As yet none have been received from Warmbad, Bethanie, Aroab, Gibeon, Maltahöhe Okahandja, Gobabis, Outjo and Ovamboland.

Sigwart 1914 does not list it from Outjo nor from Otjiwarongo.

Warburton 1922 lists *R. sanguineus* as present in S.W. Africa and states "The specimens from Teufelsbach, Okahandja and partially those from Swakopmund are not characteristic. Possibly they belong to *R. Sulcatus* which I consider a variety of *R. sanguineus*". *R. sulcatus* is now considered to be a synonym of *R. capensis*, giving Outjo as another district in which *R. capensis* is recorded as present.

Dönitz 1906 does not list it as present in South West Africa, but records it from Steinkopf in Little Namaqualand (55).

Bechuanaland and Caprivi Zipfel.

As yet *R. capensis* has not been recorded from the Caprivi Zipfel or from Bechuanaland. The tick survey thus far has but one record from Ngamiland collected in February.

SUMMARY.

(1) The distribution of *R. capensis* has been given in terms of political Divisions, as well as in terms of vegetational coverage.

(2) *R. capensis* shews a tendency to become inactive during the April-June period, independently of whether this is the coldest, the wettest or the driest time of the year. From the data available, it is impossible to establish a behaviour pattern for this species.

(3) The factors limiting the distribution of *R. capensis* are difficult to establish. Extreme heat and extreme cold do not affect it. Humidity, in terms of precipitation, alone, does not play an important role—but it would seem that humidity associated with plant coverages does influence the distribution. In scrub country i.e., *Karoooveld* it would appear that *R. capensis* can support much greater aridity than it can in *grass veld*. It is seldom, if ever, present in the *open veld* of *short- or mixed-grasslands*; in the tall *grass lands* it occurs only, apparently, in the moister areas. In these eastern *tall grass lands* the disturbances in the distribution picture may be ascribed to the dipping practices.

UNION OF SOUTH AFRICA

Provincial Boundaries
 District Veterinary Officers' Boundaries

VEGETATION — FOREST

Evergreen and deciduous rain and sub-tropical forest.
 Temperate evergreen forest.
 Evergreen sclerophyllous bush.

PRAIRIELAND

Evergreen and deciduous tree and bush.
 Sub-tropical evergreen and deciduous tree and shrub forest.

THORN COUNTRY

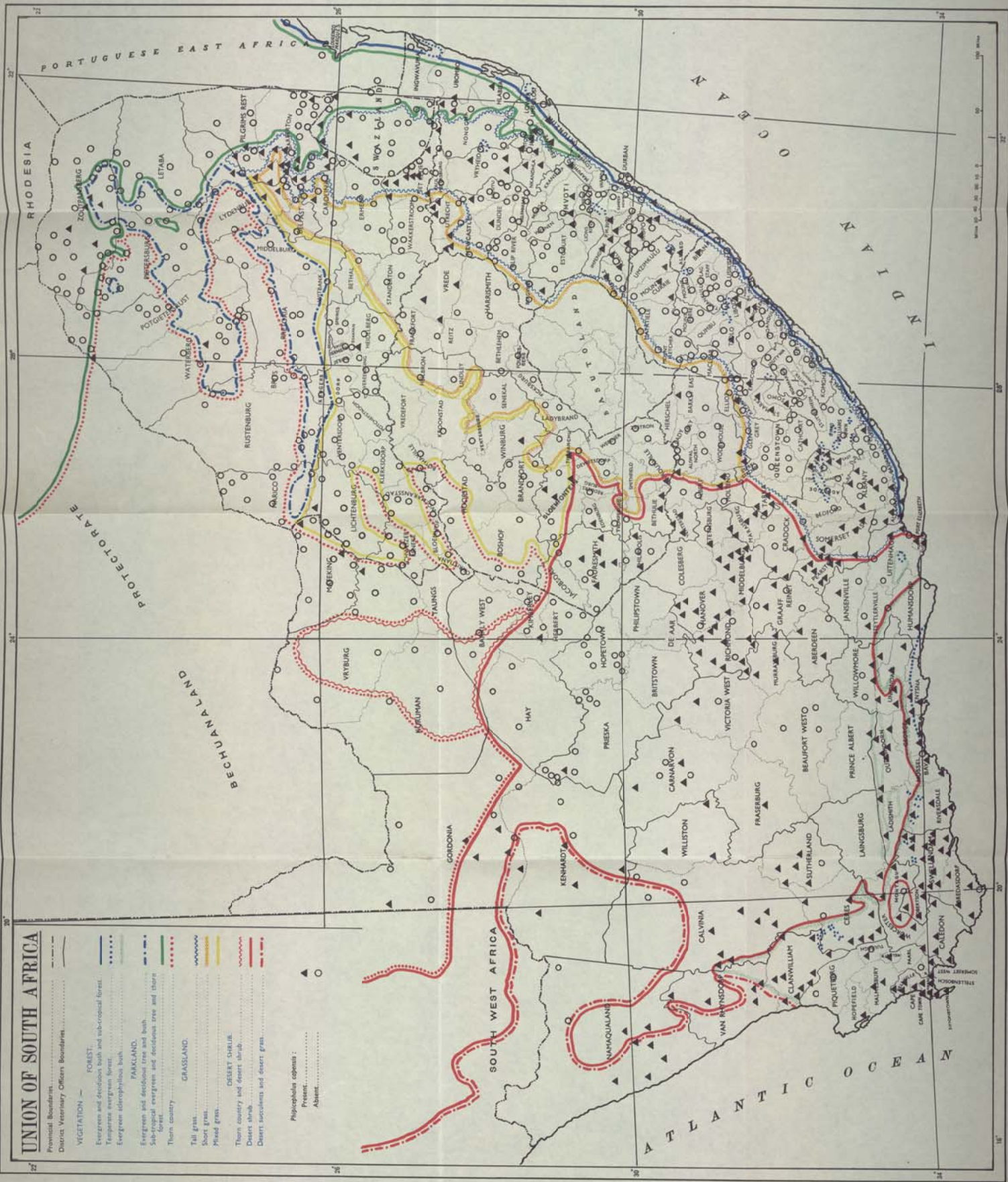
Tall grass.
 Short grass.
 Mixed grass.

DESERT SHALIB

Thorn country and desert shrub.
 Desert shrub.
 Desert succulents and desert grass.

Philosophical opinions:

Present
 Absent



Scale: 1:1,000,000
 0 100 200 Miles

18°

TABLE 1.
Dry Western Areas and Nyasaland.

Locality.	Average Rainfall.	Days.	Absolute Maximum.	Absolute Minimum.	October-December.			January-March.			April-June.			July-September.			Dipping Practices.	Environmental Notes.
					Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.		
Brandvlei.....	42	14	—	—	0.92	84.34	51.4	1.91	88.8	58.8	1.01	71.4	41.4	0.51	69.0	35.9	—	Karoo, Trek. Karoo and Bushman grass. Trek. Heideveld and Karoo. Trek. Heideveld and Karoo. Trek.
	A1	—	—	—	†	†	†	†	†	†	†	†	†	†	†	†	—	
	2	—	—	—	†	†	†	†	†	†	†	†	†	†	†	†	—	
	3	—	—	—	†	†	†	†	†	†	†	†	†	†	†	†	—	
4	—	—	—	—	†	†	†	†	†	†	†	†	†	†	†	†	—	
Van Wyksvlei.....	43	17	106	12	1.14	86.4	54.3	2.21	90.5	61.0	1.0	71.6	45.7	0.13	69.3	38.0	—	Irrigation Scheme—dunes and pans—Karoo.
	L1	—	—	—	†	†	†	†	†	†	†	†	†	†	†	†	—	
Williston.....	42	17	102	20	1.07	83.0	52.7	2.53	88.1	59.6	1.32	69.4	41.5	0.62	67.6	36.9	—	Karoo—Yearly trekking. Karoo—Yearly trekking. Karoo—Yearly trekking.
	E1	—	—	—	†	†	†	†	†	†	†	†	†	†	†	†	—	
	2	—	—	—	†	†	†	†	†	†	†	†	†	†	†	†	—	
	3	—	—	—	†	†	†	†	†	†	†	†	†	†	†	†	—	
Calvinia.....	42	31	111	21	0.81	80.9	48.5	1.62	86.2	49.6	1.81	70.1	42.0	0.88	66.5	38.4	—	Karoo—No trekking. Karoo and Rhenoster bos. Heideveld and Karoo.
	C1	—	—	—	*	*	*	*	*	*	†	†	†	*	*	*	—	
	2	—	—	—	*	*	*	*	*	*	†	†	†	*	*	*	—	
	3	—	—	—	2.62	—	—	2.72	—	—	4.17	*	*	5.0	†	†	—	
10	—	—	—	*	—	—	*	—	—	*	—	—	*	†	†	—		
Sutherland.....	42	12	98.0	11	0.76	74.4	49.3	1.31	80.6	49.9	2.61	62.9	35.3	4.12	59.1	31.8	—	Karoo typical—Trekking. Karoo typical—Trekking. Karoo typical—Trekking. Karoo typical—Trekking.
	F2	—	—	—	†	†	†	*	*	*	†	†	†	*	*	*	—	
	F3	—	—	—	†	†	†	*	*	*	†	†	†	*	*	*	—	
	F1	—	—	—	2.21	—	—	2.04	—	—	3.10	†	†	5.01	†	†	—	
Carnarvon.....	43	25	103	24	2.63	82.6	52.2	3.18	86.8	57.8	1.78	68.2	39.2	0.23	65.9	35.8	—	Karoo typical—Trekking. Karoo typical—Trekking. Karoo typical—Trekking.
	J1	—	—	—	†	†	†	*	*	*	†	†	†	†	†	†	—	
	2	—	—	—	†	†	†	*	*	*	†	†	†	†	†	†	—	
	5.88	20	—	—	0.87	—	—	3.08	—	—	1.33	—	—	0.62	—	—	—	

Table continues on p23-24b

Carnarvon.....	43	7-82	25	103	24	2-63	82-6	52-2	3-18	86-8	57-8	1-78	68-2	39-2	0-23	65-9	35-8	Krie veld and Kriedoring. Krie veld and Kriedoring. Mixed Karoo and pans. Mixed Karoo and pans. Mixed Karoo and pans.
		J1	—	—	—	†	†	†	*	*	*	†	†	†	†	†	†	—
	2	5-88	20	—	—	0-87	—	—	3-08	—	—	1-33	—	—	0-62	—	—	—
		K1	—	—	—	†	†	†	*	*	*	†	†	†	†	†	†	—
	3	—	—	—	—	†	†	†	†	†	†	†	†	†	†	†	†	—
Britstown.....	38	9-06	25	111	17	2-36	85-1	54-2	3-96	88-6	58-3	2-01	69-4	45-7	0-73	66-8	37-0	Karoo.
F1, 2, 3, 4	G1, 2, 3, 4	—	—	—	—	†	†	†	†	†	†	†	†	†	†	†	†	—
Phillipstown.....	B1	9-03	22	—	—	2-23	—	—	3-80	—	—	1-85	—	—	1-15	—	—	Mixed Karoo and grassveld.
	2	—	—	—	—	*	*	*	†	†	†	†	†	†	*	*	*	Hilly and vleiveld; Ganna and Karoo.
	3	—	—	—	—	†	†	†	†	†	†	†	†	†	*	*	*	Karoo.
	4	—	—	—	—	†	†	†	†	†	†	†	†	†	*	*	*	Karoo.
	16	16	—	—	—	†	†	†	†	†	†	†	†	†	*	*	*	grass—Steek.
	2	16	—	—	—	†	†	†	†	†	†	†	†	†	*	*	*	River veld—Brak—Typical Karoo.
	3	16	—	—	—	†	†	†	†	†	†	†	†	†	*	*	*	Karoo.
Phillipolis.....	51	16-62	43	99-5	16-8	3-90	80-4	51-1	8-21	81-8	56-2	2-92	64-4	38-9	1-61	64-9	36-5	Mixed veld, mountains and vlaktes
F1	—	—	—	—	—	†	†	†	†	†	†	†	†	†	†	†	†	Hilly.
	2	—	—	—	—	*	*	*	*	*	*	*	*	*	*	*	*	Vlaktes.
	3	—	—	—	—	*	*	*	*	*	*	*	*	*	*	*	*	—
Fauresmith.....	E1	14-53	45	99-5	13-9	4-88	81-9	53	5-91	83-7	57-2	2-10	66-6	37-8	1-64	68-6	38-3	Mixed farming; Brokenveld.
	2	—	—	—	—	*	*	*	*	*	*	*	*	*	*	*	*	Mixed farming; Brokenveld.
	3	—	—	—	—	*	*	*	*	*	*	*	*	*	*	*	*	Mixed farming; Brokenveld.
Beaufort West Flats...	43	7-43	22	104	17	2-01	81	52-1	3-16	84	57-0	1-44	68-5	43-2	0-82	66-6	39-2	Short Karoo—mixed—Good coverage.
C1	—	—	—	—	—	*	*	*	*	*	*	*	*	*	*	*	*	Short Karoo—Mixed—Good coverage.
C2	—	—	—	—	—	*	*	*	*	*	*	*	*	*	*	*	*	Short Karoo—mixed—Good coverage.
C3	—	—	—	—	—	*	*	*	*	*	*	*	*	*	*	*	*	—
Prince Albert.....	A1	8-74	—	—	—	2-01	—	—	1-74	—	—	2-49	—	—	1-50	—	—	Cultivated lands, mountain slopes, Karoo bushes.
Zwartberg.....	2	—	—	—	—	*	*	*	*	*	*	*	*	*	*	*	*	Cultivated lands, mountain slopes, Karoo bushes.
	3	—	—	—	—	*	*	*	*	*	*	*	*	*	*	*	*	Cultivated lands, mountain slopes, Karoo bushes.
Nyasaland.....	—	33-4	84	—	—	10-9	83-7	59-3	20-4	80-1	62-1	1-8	78-6	49-5	0-3	78-7	43-9	—
	—	—	—	—	—	*	*	*	†	†	†	†	†	†	*	*	*	—

Explanations : * = Ticks present. † = No collections sent in. ‡ = Ticks absent.

TABLE 2.

Winter Rainfall Area.

Locality.	Average Rainfall.	Days.	Absolute Maximum.	Absolute Minimum.	October-December.			January-March.			April-June.			July-September.			Dipping Practices.	Environmental Notes.
					Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.		
Peninsula.....	45	—	97	30	64.5	56.0	68.6	59.5	64.1	54.5	—	60.1	51.5	—	—	—	—	Port Jackson wattle. Port Jackson wattle. Port Jackson wattle.
D1	27.38	89	—	—	4.19	*	2.83	*	10.77	†	†	9.59	*	*	—	—	—	—
D2	—	—	—	—	*	*	*	*	†	†	†	*	*	*	—	—	—	—
D3	—	—	—	—	*	*	†	†	†	†	†	*	*	*	—	—	—	—
Wynberg.....	45	—	108	47	75.1	55.9	79.9	63.2	69.4	50.9	—	65.8	48.1	—	—	—	—	Sandy—Grazing and Agric. and Port Jackson. Sandy—Grazing and Agric. and Port Jackson.
A2	33.11	87	—	—	3.94	*	1.56	*	13.46	†	†	14.15	*	*	—	—	—	—
A3	—	—	—	—	*	*	*	*	†	†	†	*	*	*	—	—	—	—
Wellington.....	41	—	104	31	79.9	57.2	86.2	62.3	70.4	49.9	—	69.1	46.6	—	—	—	—	—
A3	26.49	73	—	—	3.87	*	2.15	†	11.09	†	†	9.38	*	*	—	—	—	—
Gonda.....	46	—	105	34	81.8	48.2	87.9	59.9	72.4	47.1	—	66.6	43.7	—	—	—	—	Cultivated Vines and Cereals.
C1	20.43	43	—	—	2.61	*	1.68	†	8.07	†	†	8.1	*	*	—	—	—	—
	—	—	—	—	*	*	†	†	†	†	†	*	*	*	—	—	—	—
Darling.....	46	—	107	34	76.8	55.1	82.7	60.4	70.4	50.9	—	64.6	46.8	—	—	—	—	—
D1	19.43	90	—	—	2.46	†	1.58	†	6.81	*	*	6.72	*	*	—	—	—	—
	—	—	—	—	†	†	†	†	*	*	*	*	*	*	—	—	—	—
Piquetberg.....	41	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
B3	19.97	57	—	—	3.18	†	1.50	*	7.50	†	†	7.52	†	†	—	—	—	—
	—	—	—	—	†	†	*	*	†	†	†	†	†	†	—	—	—	—

Explanations: * = Ticks present. † = No collections sent in. ‡ = Ticks absent.

TABLE 3.
No Marked Rainy Season.

Locality.	Average Rainfall.	Days.	Absolute Maximum.	Absolute Minimum.	October-December.			January-March.			April-June.			July-September.			Dipping Practices.	Environmenta. Notes.
					Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.		
Caledon.....	35	—	102	31	74.8	53.0	3.24	78.6	56.2	4.29	69.5	47.9	4.39	63.9	44.1	—	—	
	C3	26	—	—	*	*	*	*	*	†	†	†	*	*	*	—	—	
Heidelberg.....	36	—	114	23	78.8	52.6	12.38	83.3	57.6	8.95	76.7	44.8	8.93	70.2	40.7	—	—	
	C1	89	—	—	*	*	†	†	†	†	†	†	†	†	†	—	—	
	2	—	—	—	*	*	†	†	†	†	†	†	†	†	†	—	—	
	3	—	—	—	†	†	†	†	†	†	†	†	†	†	†	—	—	
Strandveld.....	—	55	—	—	—	—	3.05	—	—	3.47	—	—	5.41	—	—	—	—	
	D1	—	—	—	*	*	†	†	†	*	*	*	*	*	*	—	—	
	D2	—	—	—	†	†	†	†	†	*	*	*	*	*	*	—	—	
	D3	—	—	—	*	*	†	†	†	*	*	*	*	*	*	—	—	
Riversdale.....	37	—	114	17	77.7	53.6	3.39	82.6	58.6	3.12	71.7	45.9	4.02	69.5	42.3	—	—	
	D3	62	—	—	*	*	†	†	†	†	†	†	*	*	*	—	—	
Mosselbay.....	—	49	104	35	71.0	59.5	2.43	74.6	60.1	2.23	69.1	55.8	3.42	65.8	52.3	—	—	
	E1	—	—	—	*	*	*	*	*	†	†	†	*	*	*	14-14	Grass, Rhenoster bush.	
George.....	—	121	107.2	36.2	71.1	54.0	9.88	74.3	59.1	7.24	69.1	51.0	7.47	69.2	48.5	—	—	
	T1	—	—	—	*	*	*	*	*	*	*	*	*	*	*	—	—	

Table 3 continues from p27-28a

George.....	34.12	121	107.2	36.2	9.53	71.1	54.0	9.88	74.3	59.1	7.24	69.1	51.0	—	48.5	—	Sour veld; Wattles.
	34.22	105	—	—	10.33	*	*	9.37	†	†	6.46	†	†	0-0	†	—	Sour mountain veld; Bush.
	—	—	—	—	*	*	*	*	†	†	†	†	†	—	†	—	Mixed grass, mostly sweet.
	45.56	120	—	—	13.04	—	—	11.95	—	—	10.11	—	—	—	—	—	Bush (on Knysna Avontuur road).
	34.28	111	—	—	10.32	*	*	9.16	†	†	7.0	†	†	—	—	—	Sour grass veld.
	—	—	—	—	*	*	*	*	†	†	†	†	†	—	—	—	Occasionally, 1 in 28 summer, 1 in 54 winter.
Knysna.....	31.70	130	104.8	33.8	6.15	73.1	55.7	7.59	76.2	60.1	7.43	70.0	50.4	—	46.2	—	Mixed grass, mostly sweet.
	—	—	—	—	*	*	*	*	*	*	*	†	†	—	†	14-28.	—
Assegaaibosh.....	39	114	103.5	35.9	6.68	71.8	55.8	5.48	76.2	60.3	9.26	69.4	53.7	—	49.9	—	Coastal mt.—Sour veld abuts Tzi- tzikama forest.
	B2	—	—	—	*	*	*	†	†	†	†	†	†	—	*	—	—
Gamtoos Ferry.....	B3	17.54	—	—	4.84	—	—	4.30	—	*	3.4	—	—	—	—	—	Mixed bush veld.
	—	—	—	—	*	*	*	*	—	—	—	—	—	—	—	14-14.	—
Port Elizabeth.....	B4	22.73	103	32	6.00	72.5	55.9	4.36	77.3	60.9	5.94	70.5	49.7	—	46.6	—	Commonage mixed.
	B1	25.87	99	—	8.55	*	*	4.08	†	†	8.63	†	†	—	†	—	Bushed, sour-sweet veld.
Bathurst.....	40	25.96	104.0	37.0	6.99	74	56.4	6.40	78.6	61.8	6.15	71.9	53.8	—	50.7	—	Plateau, mixed grass—Dense scrub and dry bush in valleys.
	A1	—	—	—	†	†	†	†	†	†	†	†	†	—	†	—	Supposedly 14 day.
Alexandria.....	2	—	—	—	*	*	*	†	†	†	†	†	†	—	†	—	Most stock owners dip irregularly.
	3	—	—	—	*	*	*	†	†	†	†	†	†	—	*	—	Dense scrub. Dense bush with patches open sweet grass veld.
	4	—	—	—	*	*	*	†	†	†	†	†	†	—	†	—	Rolling open grass veld with thorn

Table 3 continues on p27-28c

TABLE 4.
Natal and Piet Retief.

Locality.	Average Rainfall.	Days.	Absolute Maximum.	Absolute Minimum.	October-December.			January-March.		
					Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.
Magut..... 14	..	—	112	33	—	84·5	62·6	—	86·2	63·4
A1	19·69	51	—	—	7·67	+++	+++	8·36	*	*
A2	—	—	—	—	+++	+++	+++	*	*	*
A4	—	—	—	—	†	†	†	†	†	†
Sulphur Springs..... 8	—	—	104	26	—	78·5	58·7	—	79·7	58·1
A1	34·36	107	—	—	13·69	++	+++	14·56	*	*
A2	—	—	—	—	+++	+++	+++	*	*	*
Paulpietersburg..... 15	—	—	104	17	—	85·4	56·6	—	82·2	58·8
J1	28·80	54	—	—	11·37	*	*	12·16	†	†
J2	—	—	—	—	*	*	*	†	†	†
Luneburg..... 14	—	—	104	26	—	78·5	58·7	—	79·7	58·1
B2	39·74	89	—	—	17·73	†	†	15·31	†	†
15	—	—	104	17	—	85·4	56·6	—	82·2	58·8
H2	23·72	42	—	—	12·27	*	*	11·47	†	†
L3	33·70	83	—	—	12·70	*	*	16·34	†	†
M1	—	—	—	—	*	*	*	†	†	†
2	—	—	—	—	*	*	*	†	†	†
Piet Retief..... 8	—	—	96·4	23	—	76·1	55·6	—	77·1	57·9
B4	31·23	68	—	—	14·38	*	*	12·06	†	†
5	—	—	—	—	†	†	†	†	†	†
6	—	—	—	—	†	†	†	†	†	†
11	—	—	—	—	*	*	*	†	†	†
Melmoth..... 22	—	—	107	37	—	79·1	58·1	—	80·08	61·6
B1	31·47	116	—	—	11·86	*	*	13·12	*	*
2	—	—	—	—	*	*	*	*	*	*
3	—	—	—	—	*	*	*	*	*	*
Nkandhla..... Cl	31·59	—	—	—	12·59	—	—	12·96	—	—
2	—	—	—	—	*	*	*	*	*	*
Kataza..... 14 D1	38·5	119	—	—	13·99	—	—	16·61	—	—
D2	—	—	—	—	†	†	†	*	*	*
D3	—	—	—	—	†	†	†	†	†	†
Babanango..... C1	40·39	68	—	—	15·48	—	—	17·72	—	—
C2	—	—	—	—	*	*	*	†	†	†

Explanations: * = Ticks present. † = No collections seen.



TABLE 4.
Natal and Piet Relief.

April-June.			July-September.			Dipping Practices.	Environmental Notes.
Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.		
— 1·78 † † †	78·6 † † †	51·7 † † †	— 1·88 † † *	77·1 † † *	50·3 † † *	— 7-7. 7-7. —	Lowveld bushveld. Boreholes. Grassveld and Bushveld. Very warm. Grassveld and Bushveld. Very warm.
— 2·93 † † †	72·4 † † †	45·0 † † †	— 3·18 † †	71·9 † †	43·3 † †	— 7-14. 7-14.	Thornveld, High grass, Lowveld. Thornveld, High grass, Lowveld.
— 2·29 † † †	72·8 † † †	42·1 † † †	— 2·98 † †	69·7 † †	42·0 † †	— — —	Highveld, Grassveld. Highveld, Sourveld.
— 3·56 † — 2·22 † 2·34 † † † † †	72·4 † † 72·8 † — † † † † †	45·0 † † 42·1 † — † † † † †	— 3·14 * — 1·36 † 2·22 † † † † †	71·9 * * 69·7 † — † † † † †	43·3 * * 42·0 † — † † † † †	— 7-7. — — — — — — — — —	Redgrass and wattle plantations. Mountains. Grassveld. Grassveld. Sourveld. Sourveld.
— 2·26 † * * †	70·3 † * * †	48·6 † * * †	— 2·53 † † † †	69·9 † † † †	43·4 † † † †	— 7-14. 14-28. 7-14. 7-14.	Short grass, Sourveld and Wattle plantations. Wattle plantations, Sourgrass. Wattle plantations, Sourgrass.
— 2·94 † † † *	73·8 † † † *	53·2 † † † *	— 3·01 † * *	73·0 † * *	50·6 † * *	— 7-14. 7-14. 7-14.	Wattle and grassveld. Wattle and grassveld. Wattle and grassveld.
3·11 † † †	— † † †	— † † †	2·93 † † †	— † † †	— † † †	— 7-14. 7-14.	Grassveld. Grassveld.
4·36 † † †	— † † †	— † † †	3·54 † † †	— † † †	— † † †	— 7-7. Handdress ears. 5-7 or 7-7. Handdress ears 7-7.	Lowveld, grass and wattle very warm. Grass—Very warm. Thornveld.
3·05 * †	— * †	— * †	4·14 † Also *	— † A4; *	— † B2; E. *	— 7-7. 7-7.	Grass—Mist belt. Grass—Mist belt.

†=No collections sent in. ‡=Ticks absent.

TABLE 5.
Eastern Province.

Locality.	Average Rainfall.	Days.	Absolute Maximum.	Absolute Minimum.	October-December.			January-March.			April-June.			July-September.			Dipping Practices.	Environmental Notes.
					Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.	Rainfall.	Average Maximum.	Average Minimum.		
Somerset East.....	47 10-46	— 29	108	23-1	— 2-79	78-9 *	52-8 *	— 3-45	82-3 —	57-6 —	— 2-35	71-2 †	47-1 †	— 1-87	68-9 †	44-5 †	—	Zuurberg Mt. Veld thick—bushes Sourveld.
Wilgerfontein.....	F 9	—	—	—	* *	* *	* *	— *	— *	— *	† †	† †	† †	† †	† †	† †	14-14.	Noorsveld, bush and Karroo.
Volksrust.....	F 9	—	—	—	* *	* *	* *	* *	* *	* *	† †	† †	† †	* *	* *	* *	Cattle sprayed, small stock twice yearly.	Karroo and Bushveld.
Kruidfontain.....	F 8	—	—	—	* *	* *	* *	* *	* *	* *	† †	† †	† †	* *	* *	* *	Cattle sprayed, small stock twice yearly.	Karroo and Bushveld.
Kommadagga.....	A 11-56	29	—	—	3-32 *	— *	— *	4-40 —	— †	— †	1-47 †	— †	— †	2-37 *	— *	— *	—	Karroo and Bushveld.
Lyndhurst.....	B —	—	—	—	† †	† †	† †	* *	* *	* *	† †	† †	† †	† †	† †	† †	Handdress occ.	Lucerne, river and Karroo.

Table 5 continues on p31-32b

