

## Zoological Survey of the Union of South Africa: Tick Survey. Part III.—Distribution of *Rhipi- cephalus appendiculatus*, the Brown Tick.

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### GENERAL DISTRIBUTION.

ROUGHLY *R. appendiculatus* occurs in the Transvaal, north of the Magaliesberg range, i.e. north of a line drawn through Zeerust-Pretoria-Belfast. To the west it has been collected off cattle sent to the Johannesburg abattoirs ex Bechuanaland from the various railway stations between Lobatsi and Palapye, although further south it is absent from the districts of Mafeking and Vryburg; to the north it is reported from Rhodesia (Jack, 1942. *Rhodesian Agric. Journal* (XXXIX)); to the east it occurs sporadically in Portuguese East Africa (Theiler 1943). From the Eastern Transvaal it extends southwards through Swaziland, Zululand, east of the Escarpment into the Eastern Province; from here it follows the coast line of the Southern Mountain ranges and dies out as it reaches the west coast at Table Bay. It is absent from the southern Transvaal, Orange Free State, Basutoland and from the Cape plateau, as also from South West Africa and from the Caprivi Zipfel. (Further collections from the Zipfel may yet shew it to be present in this strip.)

Records from some *Karoo* areas may represent recent introductions. The records from the Fauresmith district present some difficulty, either we are here dealing with a variety or a subspecies of *R. appendiculatus*, or *R. appendiculatus* has adapted itself to the Brokenveld of this area.

### *Distribution in the Vegetational types.*

The Vegetation map shows *R. appendiculatus* to be present:—

1. In all three types of Forest:
  - (a) *Evergreen deciduous bush and subtropical 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; it appears, however, to be *absent* from the Katberg-Amatola range.
  - (c) *Evergreen sclerophyllous bush*, or *Western Province vegetation* to the south of the Langeberg-Outeniqua Mountain ranges, extending to the Cape Peninsula; it is absent in

the *Western Province vegetation* to the west of the Drakenstein-Palmiet range, as also from the *Western Province vegetation* of the Groot Zwarte Berg.

As in other vegetational belts the limiting factor in the south-west Cape seems to be the presence of bush, the tick tending to be absent from the highly cultivated areas of Caledon, River-Zonder-Einde, Bonnievale and from the fruit orchards and wheatlands of the Boland and of the Swartland.

2. In all three types of *Parkland*.

- (a) *Evergreen and deciduous tree and bush* of the *Bankenveld* and of the *Limpopo Highlands* in the Transvaal.
- (b) *Subtropical and evergreen and deciduous tree and thorn forest or lowveld*, with a tendency, however, for it to die out eastwards in the more arid areas, and to the north in the arid Limpopo flats.
- (c) *Thorn country*.—It is present in the *Bushveld* of the Transvaal and in the Bechuanaland areas bordering immediately on the western boundary of the Transvaal. To the south of approximately latitude  $25^{\circ}5'$  it dies out in the Mafeking and Vryburg areas, and is also absent, except for one record, from small areas of *Bushveld* in the southern Transvaal and in the Free State. Westwards it dies out at approximately longitude  $25^{\circ}$ .

3. In only one of the three types of *Grassland*.

- (a) *Tall grass*.—Whereas *R. appendiculatus* is almost consistently present throughout the *Lowveld* and other *Parklands*, except where dipping and aridity play an important limiting role, its distribution in the *Tall grass veld* presents a very confused picture. The rain-fall in the strips of *Tall grass veld* seldom falls below 20" per annum, so that here increasing aridity does not play a role as a limiting factor; dipping in certain areas is very conscientiously carried out and undoubtedly plays quite an important part.

In Natal, roughly speaking, *R. appendiculatus* is found to the east of a line drawn through Port Shepstone-Ixopo-Howick-Estcourt-Ladysmith-Dundee up to Piet Retief. It is absent along the foot of the Drakensberg, with two exceptions near Bulwer; then it crops up again to the north along a line drawn from Bergville to slightly west of Newcastle, where it may survive at fairly high altitudes, up to 5,000 feet.

Upon careful scrutiny of the information given on the Survey forms, sent in by the collectors, it is seen that independently of other factors, the tick is present in all areas labelled acacia veld, bush and grass, thorn veld and grass, thorn-scrub; it may be present in areas labelled natural forest; it is absent, however, from dense forest. The nature of the grass mixed in with the trees or bushes does not seem to affect the tick in the least, it may be either present or absent in sweet-, sour-, or mixed sweet and sour-veld. In areas under cultivation it may be present or absent with wattle, sisal or sugar plantations.

The strip of country, running along the foot of the Drakensberg between the two lines Estcourt-Dundee-Piet Retief and Bergville-Newcastle is seen to be *open grass lands* and here *R. appendiculatus* is definitely absent, it is equally definitely present in the main blocks of bush country to the east of this line.

In the *Tall grass lands* of the south-east corner of the Transvaal the distribution picture is most confused, dipping practices are very uneven and tend to upset the picture; further confusion is introduced by the long established custom of trekking to Swaziland or to the "lowveld" for winter grazing, so that it is difficult to decide whether a record represents a recent introduction of the tick or whether it represents an area where the tick is well established.

The distribution picture for Swaziland is fairly clear-cut and shows the tick to be present throughout wherever bush is present and absent in the open grass lands, as is the case in Natal.

To the south of Natal, in the Native territories, the picture is not as clear-cut as it is in Natal and in Swaziland, but perhaps more instructive. Dipping in these areas is carried out systematically, and its influence on the prevalence of ticks is very marked. *R. appendiculatus* here enjoys but a restricted distribution, being found mainly in the valleys of the larger rivers and on some isolated farms at the higher altitudes in the more mountainous areas. It is just possible that an incorrect conclusion is being drawn, and that the limiting factor here, is after all not the dipping, but the overgrazed and somewhat treeless state of the veld. So that although the plant species are still the same as in Natal, yet the veld conditions, from the tick survival point of view, have been so altered as to resemble the *short-grass-veld* treeless aspect of the Orange Free State more closely, rather than the "tall grass with bush" of the typical *Eastern grass lands*.

The fact, that the ticks survive in the river-valleys and in the more isolated areas, tends to point to overgrazing as the limiting factor affecting the survival of *R. appendiculatus*. At the same time it must be remembered that it is also in these areas of thicket covered kloof that an ox or two may be overlooked at dipping time.

In the Eastern Province *R. appendiculatus* is very abundant in the bush country but dies out in the mountain areas of the Zuurberg and the Katberg and of the Great Winterberg where the bush country becomes replaced by the more open grass lands. In the bush country it is liable to be present if the rainfall is above 15"-20" and if no dipping is carried out; if the dipping is done conscientiously the tick tends to disappear. The bush country in the Eastern Province may be represented by *Thornveld* such as obtains in Natal and in the Native Territories or it may be the karrooid "Fish River Bush". It may be noted that *R. appendiculatus* does not follow up along the Fish River-bush-rivers nearly as far as does *Amblyomma hebraeum*.

The Vegetation map shows *R. appendiculatus* to be *absent*:—

1. From two of the three *grass lands*:—

(a) *Short grass* of the *Highveld*; the odd border-line records in the Bergville, Newcastle and Paulpietersburg districts

represent extensions of the eastern *grass lands* into the *Highveld*. The records from the *Highveld* in the Barberton, Belfast and Lydenberg districts represent, once again, incursions of the *Tall grass lands* into the *Highveld*, or they represent ticks recently introduced from the *tall grass lands* whither the stock is sent for winter grazing.

(b) *Mixed grass* of the *Middleveld*. Most of the records plotted as being on *mixed grass* on the vegetation map are border-line cases, a few are undoubtedly recent introductions which will not be able to maintain themselves.

2. From all three types of *desert shrub*.

(a) The general statement can safely be made that *R. appendiculatus* does not occur in the *desert shrub* of the *Karoo*. The eastern strip, however, merits special mention; here there is an intermingling of *grass veld* and *Karoo veld* associated with a definite type of soil (subdivision 42 on the official soil map of the Division of Chemical Services No. 94, 1929) stretching from Somerset East to beyond Fauresmith, and in this broken-veld-type of vegetation we find a brown tick safely established. This brown tick has provisionally been classed as *R. appendiculatus*, but breeding studies need to be carried out to confirm the provisional identification. Among rhipicephalids the specific characters may show such a great range of variations that it is frequently difficult to know whether a species represents one species or whether it should not be subdivided into sub-species. The ticks from this area do show minor taxonomic differences from those from say the Eastern Province. These minor taxonomic differences associated with the physiological adaptation, which allows the tick to maintain itself in a totally different environment from its normal one, may justify, upon future study, the erection of a definite sub-species. East Coast fever transmission work has not yet been carried out with brown ticks from the Fauresmith area. It is of interest to point out that *B. decoloratus* which also does not survive when introduced into the *Karoo areas* is likewise showing a tendency to establish itself in this *Brokenveld* strip.

(b) *Thorn country and desert shrub* of the Hay and Kuruman district.

(c) *Desert succulents and desert grass* of Namaqualand and South West Africa.

*The influence of dipping.*

That *R. appendiculatus* can be dipped out, given good farm management associated with the restriction of movement of Wild life and conscientious dipping associated with hand dressing of the ears, is shown most spectacularly by the returns from the farm 4.A.3. with a 7 day dipping interval associated with hand dressing. This farm is quite free of *R. appendiculatus* as well as of *B. decoloratus*, whereas the neighbouring farms in the same block with no dipping whatsoever are heavily infested. In Natal and in the Transkei Native territories the tick has undoubtedly been dipped out in many tank areas, more especially so in those areas where East Coast fever dipping has been in force recently.

*The Influence of Temperature and of Altitude.*

In how far altitude and frost influence the distribution of *R. appendiculatus*, independently of vegetation, is difficult to gauge. In the Limpopo Highlands the tick is found up to the top of the mountains at 4,000 feet; here, however, there are no heavy frosts, and there is no change in vegetation. Further south along the escarpment of the Drakensberg ranging from the Eastern Transvaal to the Eastern Province, associated with a rise in altitude, there is always a marked decrease in the density of the bush, the bushveld of the "lowveld" gradually giving place to the "middleveld" with its scattered bush and this in turn to the open grass plains of the "highveld" in the foot-hills of the mountain ranges. This decrease in the density of bush is paralleled by the temperature curves. If temperature alone is considered it is seen that *R. appendiculatus* seldom, if ever, occurs in areas having more than 30 days of heavy frost. In the Fauresmith area the "Fauresmith strain" lies in the heavy frost belt having frost for 90-120 days.

*The Influence of Rainfall.*

That "rainfall" may act as a limiting factor is shown by the tendency for *R. appendiculatus* to disappear with increasing aridity in the *lowveld* of Zululand and in the adjoining provinces of Portuguese East Africa; as also in the Zoutpansberg *lowveld* along the Limpopo river. The same tendency to disappearance with increasing aridity is seen in the strip of *Bushveld* extending southwards through Vryburg to Barkly West with incursions into S.W. Transvaal and N.W. Free State. Isolated records exist for this strip of *Bushveld* but it would seem that, though present, *R. appendiculatus* is but precariously established. In South West Africa, in those regions with an average annual rainfall above 15", the absence of *R. appendiculatus* is to be ascribed to the severe droughts which occur intermittently (see Table I).

Given a good coverage *R. appendiculatus* appears to be able to maintain itself quite easily in areas of 15" rainfall; below this it experiences increasing difficulty. In the Fauresmith area, the local strain of *R. appendiculatus* is managing to survive with very poor coverage at 10" rainfall.

*Comparison with Findings in East Africa.*

Lewis 1939 (Empire Jnl. Exp. Agric. VII) working in Kenya comes to somewhat the same conclusions. He states that "the plains are usually free of this tick, and it is not often found on the high plateaux or in the desert areas. It is usually found in greatest abundance at elevations between 4,600 feet and 7,000 feet, but it extends to higher country, where the vegetational cover reduces the more severe conditions of exposed pastures. It penetrates into lower country also, where the general environment is modified by the vegetation and local climate".

Hornby (1934) working in Tanganyika, describes the *Amblyomma* species as hardier than the *Rhipicephalus* species. (This statement also holds for *A. hebraeum* and for *R. appendiculatus* in S. Africa). *R. appendiculatus* in Tanganyika is found all the year round only in comparatively moist cool areas. Dry open thorn thicket, he states, is unsuited to the tick at almost any season. Between these extremes of moist, cool areas and dry, open, thorn thickets occur areas which are suitable or unsuitable according to season. He also states that the natural grass country of Usukuma with its

TABLE I.

Annual Rainfall Figures (expressed in millimeters) of a few Selected Localities in the Northern portions of South West Africa to show erratic rainfall, taken from the records of the Meteorological Office, Windhoek. [15 inches = 381 mm.; 20 inches = 508 mm.]

	1923-24	1924 25	1925-26	1926-27	1927-28	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34	1934-35	1935-36	1936-37	1937-38	1938-39	1939-40	Yearly Average.
Ovamboland:																		
Yearly Average.	—	689	383	764	439	184	210	502	204	216	919	404	490	799	776	479	527	504
Ovamboland:																		
Ondangua.....	476	819	281	327	374	198	—	489	225	—	920	400	—	—	—	458	524	458
Okavanga: Kuring																		
Kura.....	353	997	432	417	577	277	414	493	—	—	768	—	533	511	499	558	842	552
Caprivi: Andara..	338	976	624	526	—	425	513	356	480	251	792	391	708	506	614	843	499	553
Grootfontein.....	348	881	290	487	709	341	431	496	353	200	893	393	778	400	482	455	690	507
Otiwarongo:																		
Otiwarongo.....	319	495	—	482	440	—	—	—	—	—	673	446	603	469	499	—	498	492
Otiwarongo:																		
Waterberg.....	346	603	276	509	—	323	430	493	—	162	1,130	720	—	447	—	—	—	493
Outojo: Outojo.....	274	652	287	312	168	296	228	424	96	231	1,018	287	342	446	661	332	439	388
Omaruru.....	189	512	—	273	210	223	91	241	104	117	858	255	180	291	372	104	320	271
Gobabis.....	297	482	270	299	372	193	221	251	—	194	1,040	—	—	279	327	518	334	363

fair rainfall would be suitable if the grass were allowed to grow, but a dense population has produced a cultivation steppe as inhospitable to the East Coast fever tick, as the semi-desert of say the Ruaka valley lying south of Dodoma. In view of the findings in South Africa, that, even given suitably humid conditions in open grass lands, *R. appendiculatus* does not survive unless adequate tree-bush or shrub coverage is also present, one questions this surmise of Hornby's, unless it be that the more tropical East African grasses give much heavier and denser tufts and thus offer more efficient coverage than does the South African grass of our *tall grass lands*.

The findings of Lewis in Kenya, of Hornby in Tanganyika and of Wilson in Nyasaland all point to suitable coverage associated with adequate moisture as being the main factor controlling the spread of *R. appendiculatus*.

*Disease.*—*R. appendiculatus* is the chief vector of East Coast fever caused by *Theileria parva*; it is also a transmitter of Redwater in cattle caused by *Piroplasma bigeminum*; of *Theileria mutans*; and of the two virus diseases of sheep, Nairobi sheep disease and Louping ill; and of tick bite fever in man caused by *Dermacentor venus rickettsi* var *pyperi*.

#### 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. Areas from which *R. appendiculatus* is entirely absent will not be commented upon individually.

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

*R. appendiculatus* is present in the *Bankenveld* of the N.W. corner of Krugersdorp, absent from the *Middleveld* and from the *Highveld* of the rest of the district.

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

*R. appendiculatus* is absent throughout the *Middleveld* areas except for two records which probably represent two recent introductions. It is but precariously established in the dry *Bushveld* of Southern Bloemhof and of Southern Christiana.

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

*R. appendiculatus* is absent from the dry *Camel-thorn veld* of Mafeking and from the chalky sourveld of Lichtenberg. It is present in the *Bankenveld* and in the *thornveld* of Zeerust and Marico. The odd record from the Lichtenberg *Middleveld* probably represents a recent introduction which will not be able to maintain itself.

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

*R. appendiculatus* is present throughout with but few exceptions, thus at 4.A.3 it, as well as *B. decoloratus*, has been completely dipped out. Its absence from B<sub>3</sub> and B<sub>1</sub> on the *Bankenveld* is difficult to explain; the rainfall and the coverage are adequate and no dipping is carried out, unless it is that overgrazing and veld burning play a role in this instance. *R. appendiculatus* is present in the more arid belt along the Limpopo but does not seem too happy.

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

The picture for the distribution in the Pietersburg area is confused, in all probability due to the fact that only one collection was sent in from most areas. It appears, however, to be present throughout the *Lowveld* areas with irregular or 14-14 dipping, and a rainfall of 15"-18" upwards; it is absent from *Mopani veld* with 14-14 or irregular dipping; on one farm with *thornveld* and 25" rainfall it has been dipped out. Its distribution in the *Bankenveld* appears to be most haphazard and quite independent of dipping practices—though with a 7-14 dipping interval it appears to become dipped out. Probably further collections will show it to be present throughout the *Bankenveld*. In the *Bushveld* areas it tends to disappear in the arid flats of Bochem.

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

The picture is somewhat confused, probably due to the fact that from many areas only one collection has been sent in. *R. appendiculatus* is undoubtedly safely established in the moist regions of the Blouberg, the Zoutpansberg and of the *lowveld*; it shows a tendency to die out in the drier areas of the *lowveld* and of the Limpopo flats. In the moister areas, 18" rainfall and upwards, and 7-14 dipping practices as carried out seem to be inadequate.

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

Three vegetation zones meet in this district, the *lowveld* the *Tall grass lands* and the *Highveld*, with a tendency for the vegetation picture to be somewhat disturbed, due to the fact that the one type of veld runs into another along the river valleys and kloofs. *R. appendiculatus* is present throughout the *lowveld* which has a rainfall of 21" and upwards with a tendency to die out in the drier areas. The dipping intervals of 7-14 is undoubtedly responsible for the absence of the tick from I 1.2&3; H.1.2&4; F3; C1 and C2 where all the other factors appear suitable for tick survival. *R. appendiculatus* is present throughout the "middleveld" with scattered bush, and 7-14 dipping interval. It is absent from the "middleveld" areas labelled *open grassveld*. *R. appendiculatus* follows the "middleveld" incursions into the *short grass* of the *highveld*. On the *Highveld* proper it may occur as a recent introduction. The local and long distance trekking, as practised in this region, undoubtedly helps further to confuse the already somewhat disturbed picture.

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

*R. appendiculatus* is present throughout the *tall grass lands*: even in the more *open grass lands* with but scattered bush to the west of the Swaziland border, a sheep farming region, from which *A. hebraicum* is absent; dipping intervals 7-14, rainfall 20"-40". It is absent from the *highveld* of Wakkerstroom except for one farm where the cattle trek to Swaziland for the winter months.

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

Nearly all types of vegetational zones are represented, ranging from the *lowveld* of Pilgrimsrest to the *Highveld* of Belfast and the *Bushveld* of Middelburg.



*R. appendiculatus* is unexpectedly present on one *lowveld* farm with but 10" rainfall; it appears to have been eradicated from 2 farms, 20" rainfall, 7-7 dipping associated with hand-dressing. It is present throughout the *tall grassveld* areas throughout which a fair amount of trekking takes place. Its occurrence at 9.A.7. in the *mixed grass* of the *Middleveld* is undoubtedly due to the annual trek to the *Bushveld*, otherwise it is absent from *Middleveld* farms. It is present in the *Bankenveld* and in the *Bushveld* area, dipping 7-0 or 14-0; it is absent on one *Bushveld* farm with 5" rainfall, dipping 0. It occurs on two farms on the *Highveld* of Belfast, the stock from both farms leaving the *Highveld* for winter grazing.

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

*R. appendiculatus* is present throughout the *tall grass lands*, even on farms with but little bush and from which *A. hebraeum* is absent; dipping 7-14, irregular, or 0. It is absent from 10.C.1. which was an East Coast fever contact farm, dipping 7-14. It is absent from the *highveld* of both Carolina and Ermelo. 10 C.2 situated on the *highveld* still has kloofs of "middleveld" vegetation and these undoubtedly account for the presence of the tick in this area.

*Swaziland.*

The vegetation ranges from dry *lowveld* conditions, rainfall 15"-20" in the west to the moister *tall grass lands* in the mountains in the east, rainfall up to 55".

As in other *Tall grass land* areas *R. appendiculatus* shows a tendency to die out in the *open grass lands*, but does not die out as soon as does *A. hebraeum*; it also shows a tendency to die out in the dry *lowveld* tank areas. In this territory there are no fences and game is abundant in the more heavily bushed areas, so that dipping may be negated by movement of game. In the more *open grass lands* game is absent, and the absence of *R. appendiculatus* may be ascribed to the ecological factor, absence of bush, alone, or to this factor associated with dipping.

*Portuguese East Africa.*

*R. appendiculatus* is present in the Lourenço Marques territory up to the tropic of Capricorn, though not prevalent throughout. Its absence from some areas may be due to dryness or due to dryness associated with dipping.

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

Present in the *Bankenveld*, absent in the *Middleveld*, no records from the *Bushveld*.

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

Further collections from this area are needed to clarify the distribution picture. *R. appendiculatus* is absent from the *Middleveld* to the S.W. of Koster; it is present in the Waterberg to the east of Thaba Zimbi; elsewhere, in the *Bankenveld* and in the *Bushveld*, its occurrence is haphazard and apparently independent of any one factor. In the *Bushveld*, however, it seems to die out as the *Acacia giraffae* and the *Rosyntjebos* etc., so characteristic of Bechuanaland, make their appearance, i.e. as the climate becomes drier and the trees more widely spaced.

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

Present in the *lowveld* with bush; absent on two farms A2 and A3 given as *grassveld*, rainfall 26", dipping 7-7. Present throughout the "middleveld" with bush, as also in the more open "highveld" grass lands with but sparse bush. Rainfall 20"-40", dipping 7-7. There are large tracts from which no ticks were sent in.

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

Mainly in the *tall grass* areas of the "middleveld" rising to true *Highveld* in the Utrecht and Newcastle districts; *R. appendiculatus* is absent in the *Highveld* and in the more open grass lands at the base of the Drakensberg; present in the *thornveld* areas of the *tall grass lands*. Its occurrence in the *Highveld* at M1, 2 and 3 can only be explained as due to recent introductions.

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

*R. appendiculatus* absent from the true *Highveld*; absent also in the "highveld" grasslands at the base of the Drakensberg; present in the "middleveld" *thornveld*; rainfall 20"-32"; dipping 7-7 or 7-14.

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

Collecting areas few and far apart, but once again *R. appendiculatus* appears to be present in the *thornveld* of the "middleveld" (dipped out in B.1.) and absent from the more open grass lands; rainfall 20"-33", dipping 7-14. It is absent from the true *Highveld*.

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

Vegetation ranging from the *thornveld* of the "middleveld" to true *Highveld* at Impendhle. *R. appendiculatus* present in the *thornveld* of the "middleveld", rainfall 20"-47"; absent from the more open grass lands, rainfall 30"-32". The 7-14 day dipping, which undoubtedly plays a rôle in the elimination of *A. hebraeum* in this district, hardly seems to affect the distribution of *R. appendiculatus*; were handdressing of the ears also practised dipping might be more effective.

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

Collections inadequate, so that the recorded absence of *R. appendiculatus* from any one area cannot be taken to be a true absence. Rainfall 21"-56"; dipping 7-7 or 7-14. The absence of the tick from 14.A2 in the *thornveld*, an East Coast fever farm, may be a true absence; as also from D1 and D2, on which farms dipping and handdressing are practised.

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

The vegetation ranges from the lower lying *thornveld* through the higher "middleveld" more open grass lands of Polela to the *Highveld* of Underberg. *R. appendiculatus* is absent from the *Highveld* and from the open grass lands of the higher "middleveld", whether sweet or sour; present on the *thornveld* of the "middleveld"; dipping 7-7, 7-14, 14-28 or 14-0 according to locality. The 7-7 or 7-14 dipping has not killed out the tick on any one *thornveld* farm.

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

*R. appendiculatus* is present throughout, both in the coastal sugar-cane belt and in the *thornveld* of the "middleveld"; dipping 7-14, rainfall 30"-36".

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

Vegetation ranges from the *coastal subtropical belt* through *lowveld* to *tall grass lands*.

*R. appendiculatus* is present throughout, even in the more *open grasslands* of the "middleveld", dipping 7-7; rainfall 25"-60".

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

Vegetation ranging from the *subtropical coastal strip*, through the true *lowveld* to the *thornveld* of the *tall grass lands*. *R. appendiculatus* was not sent in from the one tank area in the coastal strip; rainfall 30"; dipping 7-7; nor from the *lowveld* tank areas 27A.2 and B.2. stated to be Savannah and Ilala palm; rainfall 30"; dipping 7-7. It is present on the *thornveld* tank areas; rainfall 27"-32", dipping 7-14; but absent from 27.C.2 which is *open thornveld*, dipping 7-14. The returning officer states that the 7-7 dipping is carried out most conscientiously, the absence of *R. appendiculatus* from the *lowveld* areas can thus be ascribed to the dipping.

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

Narrow strip of *coastal subtropical forest*, for the rest, the vegetation falls in the *tall grass* zone. *R. appendiculatus* is absent from the coastal strip (though *A. hebraeum* is present in some parts), dipping 5-7, rainfall 30"-35". It is present throughout the *tall grass areas*, dipping 7-7.

Areas 26-27, G.V.O., Umtata.

The vegetation ranges from coastal strip of *subtropical forest* through the various aspects of the *tall grasslands*. The district consists mostly of grassy plains, often overgrazed, in some cases with thornbush, intersected by rivers running from the escarpment to the sea. The banks of these rivers are usually covered with thickets. *R. appendiculatus* is present at nearly all tank areas which according to the returning officer are in *thornveld* areas; it is absent from all areas described as *grassveld*, even though some of these latter are described as having well-wooded gorges or gullies; dipping 7-7 rainfall 25"-30".

Whereas *A. hebraeum* was undoubtedly affected by the dipping, it seems questionable whether dipping has influenced *R. appendiculatus* at all, except perhaps in the coastal strip which is mainly grass veld with scrub in the valleys; the dipping here, however, is only 7-14 instead of the more vigorous 7-7 practised elsewhere.

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

Vegetation mainly *tall grass lands* with a narrow coastal strip of *subtropical forest*.

*R. appendiculatus* was not sent in from the coastal strip which in this G.V.O. area is described as grass with scrub in valleys, rainfall 32"-44"; dipping 7-14. It was also not sent in from most collecting areas the majority

of which are described either as grass, or as grass with shrub, rainfall 20"-30", dipping either 7-14 or 14-28. It was sent in from three farms, one along the Bashee River, one described as scrub and one as thornveld. It would seem that the dipping practise 7-14 conscientiously carried out has influenced the distribution of the tick in the scrub areas.

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

Vegetation mainly *tall grass lands* with a narrow coastal strip of *subtropical forest*, the majority of the collecting areas are given as *open grass lands*.

*R. appendiculatus* is absent throughout from the *open grass lands*, and present on *thornveld farms*. The records from this area are not as reliable as those from most areas, in that only one batch was sent in from each collecting area.

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

Vegetation mainly of the more *open grass veld* of the "middleveld" of the *tall grass lands* rising to the *Highveld*, mainly above 3,500 feet; some areas subject to severe frost; rainfall 25"-30"; dipping 7-14, in the colder regions 14.0.

*R. appendiculatus* is absent throughout. It was sent in from two collecting areas situated in the *open grass lands*, both these two records are in all probability recent introductions which will not be able to maintain themselves.

Area 31, G.V.O., Alval North.

Vegetation is mainly *Highveld*, with *Karoo veld* in Venterstad and in the western portions of Albert and of Molteno.

*R. appendiculatus* was sent in from A.1. in the *Highveld*, 20" rainfall, and this undoubtedly represents a recent introduction. The record from E.3. in the *Karoo* is also probably a recent introduction. In both instances the tick was sent in but once.

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

Lying mostly above 3,500 feet; the vegetation varying from the *tall grassveld* of Cathcart, through the hilly regions to the *Highveld* of the Stormberg, and to the *Karoo* areas in the Tarkastad district.

*R. appendiculatus* is absent from the *Highveld* and from the *Karoo*. In the *tall grass lands* it is liable to be present in *thornveld* with rainfall of 20" or more if no dipping is carried out; with dipping it tends to disappear.

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

Mainly *tall grass lands*, and some large rivers with thickets along their banks; a narrow strip of *subtropical forest*.

No *R. appendiculatus* was sent in from the *subtropical* strip, dipping 7-7. *R. appendiculatus* was sent in from *thornveld farms* with 14-0 dipping, but tended to be absent from *thornveld farms* with dipping 7-14; as also from the *open grassveld* areas, rainfall 22"-28".

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

Mainly *Western Province* vegetation in the districts of Caledon, Worcester, Robertson and Montagu, with incursions of *Karoo* into Worcester and Robertson along the Great Robertson Fault. Laingsburg and the western portion of Montagu are in the *Karoo* proper.

The distribution picture is very confused partly due to the incursion of *Karoo veld* along the Robertson fault, partly due to the large Bonnievale irrigation scheme which cuts right across the Robertson fault, and partly due to the intensive cultivation carried out in the wheatlands in the Caledon district. The rainfall varies from 30" in the Caledon area down to 6-8" in the Robertson *Karoo*.

*R. appendiculatus* may be present in the moist areas of *Western Province* vegetation in spite of the intensive wheat farming; it is absent from the *Karoo* areas; it may be absent or present on the *Karoo* farms of the Bonnievale irrigation scheme, although these lie in a very low rainfall area.

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

Vegetation of the *Western Province* type ranging from the more open sourveld of the dunes to bush-covered hills, and in one or two areas with incursions of *Karoo*.

*R. appendiculatus* is absent from the *Karoo* or *semi-Karoo* areas. It was sent in from most areas of strand-veld, duneveld or grass and bush, mostly with a rainfall over 15", it was unexpectedly absent from a few grass and bush farms also with a rainfall about 15". More conscientious collecting will undoubtedly show the tick to be present wherever there is *Western Province* vegetation.

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

The vegetation varies considerably. A coastal strip of *temperate evergreen forest*, including the Knysna and Zitzikama forests, 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 Swarteberg range.

*R. appendiculatus* is present throughout the *temperate evergreen forest* stretching from George to Cape St. Francis. It is present throughout the southern strip of *Western Province vegetation*, but is unexpectedly absent from the Groot Swarteberg, in one or two of which areas its absence can be explained by the rather low rainfall of 10"-15". It is absent from the *Little Karoo*, except at 37.B.2 which has irrigated lucerne lands, rainfall 8".

Area 38, G.V.O., de Aar.

Vegetation *Karoo*veld.

*R. appendiculatus* was sent in from 38.U.2. at the northern-most extremity of Philipstown. The vegetation here is a mixture of *grass* and *Karoo*veld, approaching very much the *brokenveld* so typical of Fauresmith. No dipping, handdressing once a week; rainfall 10"-15".

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

In this area the coastal strip of *subtropical* forest peters out and there is a general meeting and intermingling of *tall grass veld*, *Karoo veld* and of *Western Province flora*. The *Karoooid scrub* or *Fish River bush* is to be found along most of the rivers in this area, where it often extends far inland into *Karooveld* e.g. up the Sundays river well beyond Lake Mentz in the Jansenville district.

The collections from this area were somewhat poor. *R. appendiculatus* however can be said to be present in the Sourveld of the *Western Province vegetation* and to be absent from the *Karooveld*.

It was sent in from one farm B.4. which according to the plotting on the map is on the *Karoo*, but which according to the returning officer has a mixed-bushveld-flora. No *R. appendiculatus* was sent in from B.1. in the *Tall grass lands*, rainfall 22"; this farm, however, suffered from a severe drought during the previous year. (See remarks on South West Africa.)

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

A narrow coastal strip of *subtropical* forest; mainly *tall grassveld*. The area is broken up by numerous rivers whose banks are clothed with thickets of *Fish River Bush*, these rivers reach far back into the surrounding mountainous regions taking their *Karoooid vegetation* with them.

*R. appendiculatus* is present throughout the coastal strip of *subtropical forest*, and throughout the *tall grass lands* carrying *bush* as well as throughout the *Karoooid Fish-river-bush*. It dies out however in the more open rolling plains of the Katberg and of the Hogsback. Unlike *A. hebraeum* and *B. decoloratus* it does not follow the Fish River into the *Karoo veld* of Somerset East and of Pearston. Rainfall 12"-30"; dipping 14, is usually not conscientiously carried out. In one or two areas where conditions are suitable the tick was absent, this absence may be due to more conscientious dipping and hand-dressing.

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

*R. appendiculatus* is absent throughout the district which is *Karooveld*, rainfall 10"-15".

The two records 41.D.2 and 41.N.1 probably represent *R. appendiculatus* which have been introduced but recently, (the mares being sent away to the stallions) and which will not be able to maintain itself.

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

*Western Province vegetation*; rainfall 12" in the flats to 40" in the Table Mountain range.

The collections were mainly sent in from dairies or from agricultural farms on the flats, the assumption being that the grazing for cattle is somewhat limited in this more densely populated region.

*R. appendiculatus* was sent in from some areas 12"-17" rainfall, but not from others. It would seem that the climatic and vegetational conditions are favourable, the permanent vleis providing adequate moisture to carry the tick through the dry summer season, but that the daily handling relative to the hygiene of a milking cow is sufficient to eliminate the tick.

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

Partly in the *tall grass lands*, rising to the highlands of the Great Winterberg to the north and merging into *Karoo plateau* of Pearston and Cradock to the west, with incursions of *Karoooid scrub* along the Fish River and its tributaries well up into the mountains and way back into the Karoo plateau.

The collections sent in from the *tall grass lands* were mainly from the dry region between the great Winterberg to the north and the Zuurberg to the south with an average rainfall 10"-15": *R. appendiculatus* was absent from these collections, with one exception from a mixed grass-veld farm at the foot of the Zuurberg with a rainfall of 11½"; it is entirely absent from the *Karooveld* of the west of Somerset East, Pearston and Cradock. Once again, unlike *A. hebraeum* it does not follow the *Fish River scrub* along the river up into the mountains or into the *Karoo* plateau.

Dipping practices vary from once a fortnight to once a year for cattle; sheep on the same farms are dipped but once a year. Thus, except in one or two instances where dipping is carried out conscientiously, the absence of *R. appendiculatus* can be ascribed to the arid conditions (or possibly to the poor collections sent in).

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

Vegetation mainly *mixed grass lands* of the *Middleveld*, with a strip of *short grass land* of the *Highveld* to the east and a very narrow strip of *Bushveld* along the extreme western boundary of Bothaville.

There is one record from this *Bushveld* strip, rainfall 20"; no dipping. This may represent an area in which the tick has become permanently established, although it is absent in the neighbouring *Bushveld* areas. There is one record from near Winburg in the *Middleveld* area, the farm, however, carrying *thorn-trees*; whether this is a recent introduction, or whether the tick has already become established, it is difficult to say, for just across the border in the Brandfort district there is another similar occurrence.

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

The districts of Phillipolis, Fauresmith, Jacobsdal, Hay and Herbert are mainly *Karooveld*; Barkly West and the major portion of Kimberley fall into the *Bushveld*. The rainfall for the greater portion is 10"-15", in some stretches however it is 15"-20".

*R. appendiculatus* is absent throughout the *Bushveld* area and throughout the *scrub areas* of the *Karoo*. It is present, however, on several farms where the *Karoo scrub* is intermingled with grass, e.g. in Phillipolis, E. 1. 3. 4.8. 15 in the neighbourhood of Fauresmith and Luckhoff (to this cluster of farms may be added 38 C. 2 across the border in the Phillipstown district). The rainfall in this "brokenveld" of the Fauresmith district ranges from 6" to 17", so that the presence of *R. appendiculatus* is unexpected.

The question hence arises as to whether the tick is a true *R. appendiculatus*, or whether it is a strain of *R. appendiculatus* which has become adapted to the arid conditions obtaining in the Fauresmith "brokenveld" (there are indications that *B. decoloratus* is becoming established in these areas) or whether it is not a new species or subspecies. A further more

detailed study will have to be made before a considered opinion can be expressed. In the meanwhile the indications all point to the fact that the tick present is not the usual *R. appendiculatus* but a brown tick with different environmental potentialities.

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

Vegetation mainly *mixed grassveld* of the *Middleveld*, with a small corner of Brandfort in the *Highveld*, and a narrow strip of Boshof in the *Bushveld*.

*R. appendiculatus* is absent throughout the *Middleveld*. It is recorded as present once from the Boshof *Bushveld*, where it is just possible that it is permanently established; and once from the Brandfort *Highveld*; this latter is in all probability a recent introduction (compare 50.E1. across the border in Winburg).

*Areas 60-67, South West Africa.*

The annual rainfall of 15"-27" obtaining in the northern portion of S.W. Africa, i.e. to the north of a line drawn through Karibib-Okahandja, associated with the *Bushveld* type of vegetation would lead one to expect to find *R. appendiculatus* in this region. Thus far only one batch has been recorded, a male and a female off a cheetah shot by the G.V.O., Grootfontein in Okavanga territory.

The explanation for this absence of *R. appendiculatus* from these otherwise apparently suitable regions is to be looked for not in the average rainfall figures but rather in the actual annual figures (Table 1).

From these figures it will be seen that such severe drought years as 1923-24, 1925-26, 1928-29, 1931-32, 1932-33 will play an undoubted role in eliminating any but the most drought resistant species.

#### SUMMARY.

1. The distribution of *R. appendiculatus* has been given in terms of political divisions as well as in terms of vegetational coverage.
2. *R. appendiculatus* is seen to be present in areas with a rainfall above 15" per annum, provided the bush or scrub coverage is adequate; in areas above 15" without bush the tick is absent.
3. The brown tick present in the "brokenveld" of Fauresmith is either not a true *R. appendiculatus*, or it is a strain of *R. appendiculatus* which has become drought resistant.
4. It is concluded that where farming conditions are favourable, associated with the restriction of movement of wild life, *R. appendiculatus* can be eradicated.



# UNION OF SOUTH AFRICA

Provincial Boundaries.....

District Veterinary Officers Boundaries.....

## VEGETATION —

**FOREST.**  
Evergreen and deciduous bush and sub-tropical forest.....

Temperate evergreen forest.....

Evergreen sclerophyllous bush.....

## PARKLAND.

Evergreen and deciduous tree and bush.....

Sub-tropical evergreen and deciduous tree and thorn forest.....

Thorn country.....

## GRASSLAND.

Tall grass.....

Short grass.....

Mixed grass.....

## DESERT SHRUB.

Thorn country and desert shrub.....

Desert shrub.....

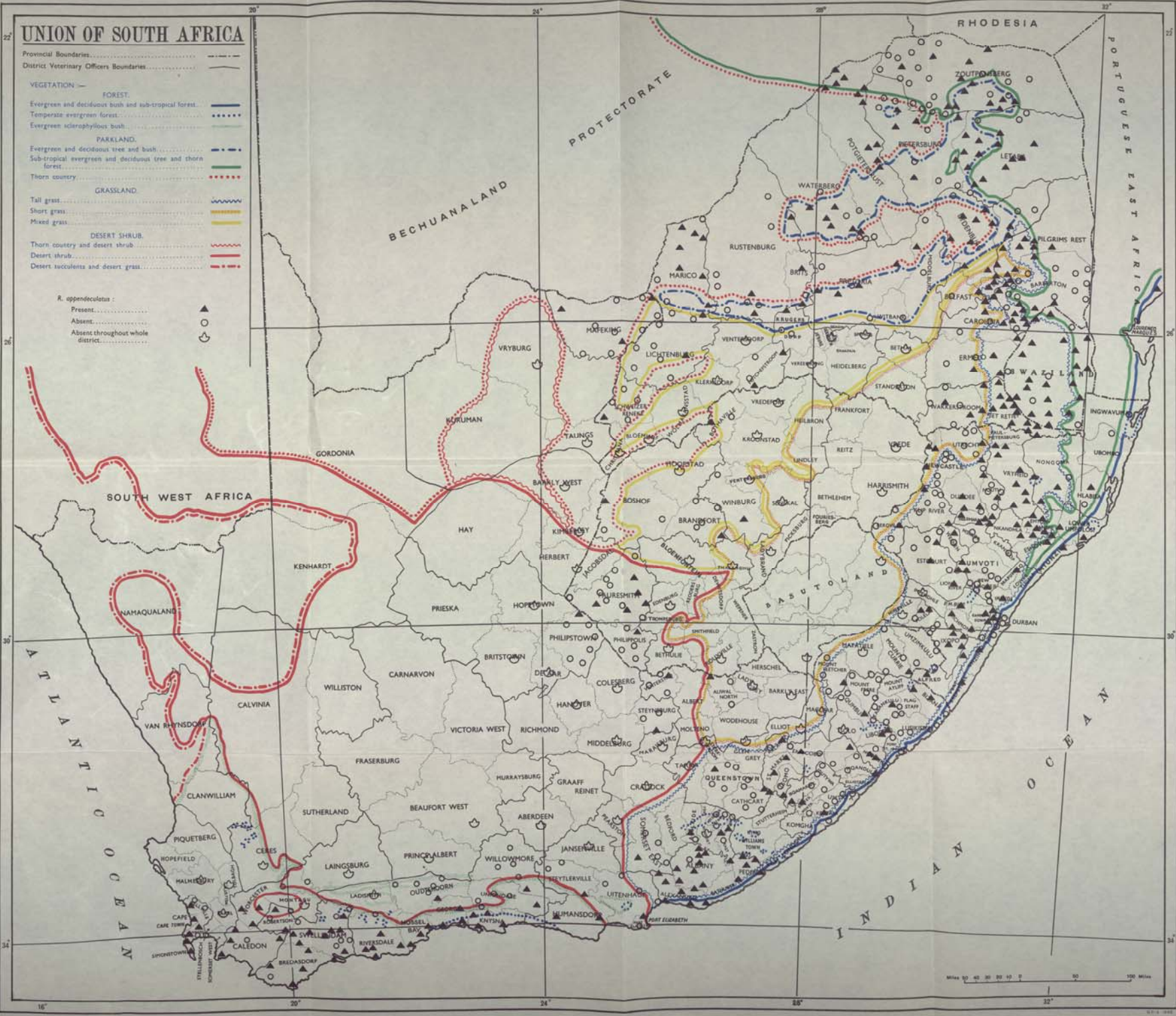
Desert succulents and desert grass.....

## R. appendiculatus :

Present.....

Absent.....

Absent throughout whole district.....



Miles 0 20 40 60 80 100 120 140 160 180 200

16° 20° 24° 28° 32° 36°