A PARAPATRIC BOUNDARY BETWEEN TWO SPECIES OF REPTILE TICKS IN THE ALBANY AREA, WESTERN AUSTRALIA

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Summary

BULL, C. M. & KING, D. R. (1981) A parapatric boundary between two species of reptile ticks in the Albany area, Western Australia. *Trans. R. Soc. S. Aust.* **105** (4), 205-208, 11 December, 1981.

The distribution of populations of a tick morphologically similar to *Aponomma hydrosauri* was mapped near Albany in Western Australia. This taxon occupies an area of approximately 60 × 40 km. To the west its boundary appears to coincide with the edge of the jarrah forest belt. To the north and east its distribution abuts that of the more widespread reptile tick, *Amblyomma albolimbatum*. There is no obvious ecotone associated with this parapatric boundary. It is suggested that the boundary is maintained by an interaction between the two species. The stability of the boundary is not yet known, but one explanation of the present pattern of distribution is that *Amb. albolimbatum* is gradually expanding its range into areas previously occupied by *Ap. hydrosauri*.

Introduction

Smyth (1973) first described parapatry in the tick species, *Aponomma hydrosauri*, *Amblyomma limbatum* and *Amb. albolimbatum* in South Australia. All three species infest the same reptile hosts. In any one place only one of the three species is found, and their distributions abut at common boundaries. Investigations have failed to provide a satisfactory explanation of the mechanisms which prevent range overlap at the boundaries (Bull & Smyth 1973, Sharrad[1], Bull, Sharrad & Petney 1981). Smyth (1973) suggested two hypotheses. One hypothesis is that the boundaries follow environmental ecotones, and that at least one of the contacting species is poorly adapted for conditions across the boundary. This hypothesis was supported by the results of a detailed study near Mt Mary, South Australia, where the boundary between *Ap. hydrosauri* and *Amb. limbatum* coincides with the sharp vegetational change from mallee scrub to open woodland; however transplant experiments[1,2] have failed to demonstrate reduced fitness of either species across the ecotone (Bull *et al.* 1981). At other boundaries between pairs of these species environmental changes are less obvious (Smyth 1973, Bull *et al.* 1981).

The second hypothesis proposes that parapatric boundaries are maintained by ecological interactions between the tick species, resulting in the exclusion of one of them from the range of the other. The outcome of the interaction may be reversed where there is an environmental change, such as at an ecotone. Thus stable boundaries will form at ecotones, but boundaries will be established also wherever the ranges of two of the species contact, independently of the environmental conditions. A prediction is that where the ranges of two species meet in other areas parapatry would be expected also.

In southwestern Australia, *Amb. albolimbatum* is the common reptile tick but another species, morphologically similar to *Ap. hydrosauri*, was found by C.M.B. near Albany in southern Western Australia (Smyth 1973). The taxonomic status of this population is under investigation but here it will be referred to as "*Ap. hydrosauri*". Sharrad[1] and Sharrad & King (1981) confirmed its presence in at least four small isolated areas along the south coast of Western Australia. Their collections were sufficiently detailed to show that there was a parapatric boundary between *Amb. albolimbatum* and *Ap. hydrosauri* at Cape Naturaliste (Sharrad & King 1981), which may coincide with a vegetational ecotone (Bridgewater & Zammit 1979). We describe

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[1] Sharrad, R. D. (1980) Studies of the factors which determine the distributions of three species of South Australian ticks. Ph.D. Thesis, University of Adelaide, (unpublished).
[2] Petney, T. N. (1981) The interaction of two parapatric tick species with their off host environment. Ph.D. Thesis, Flinders University, (unpublished).

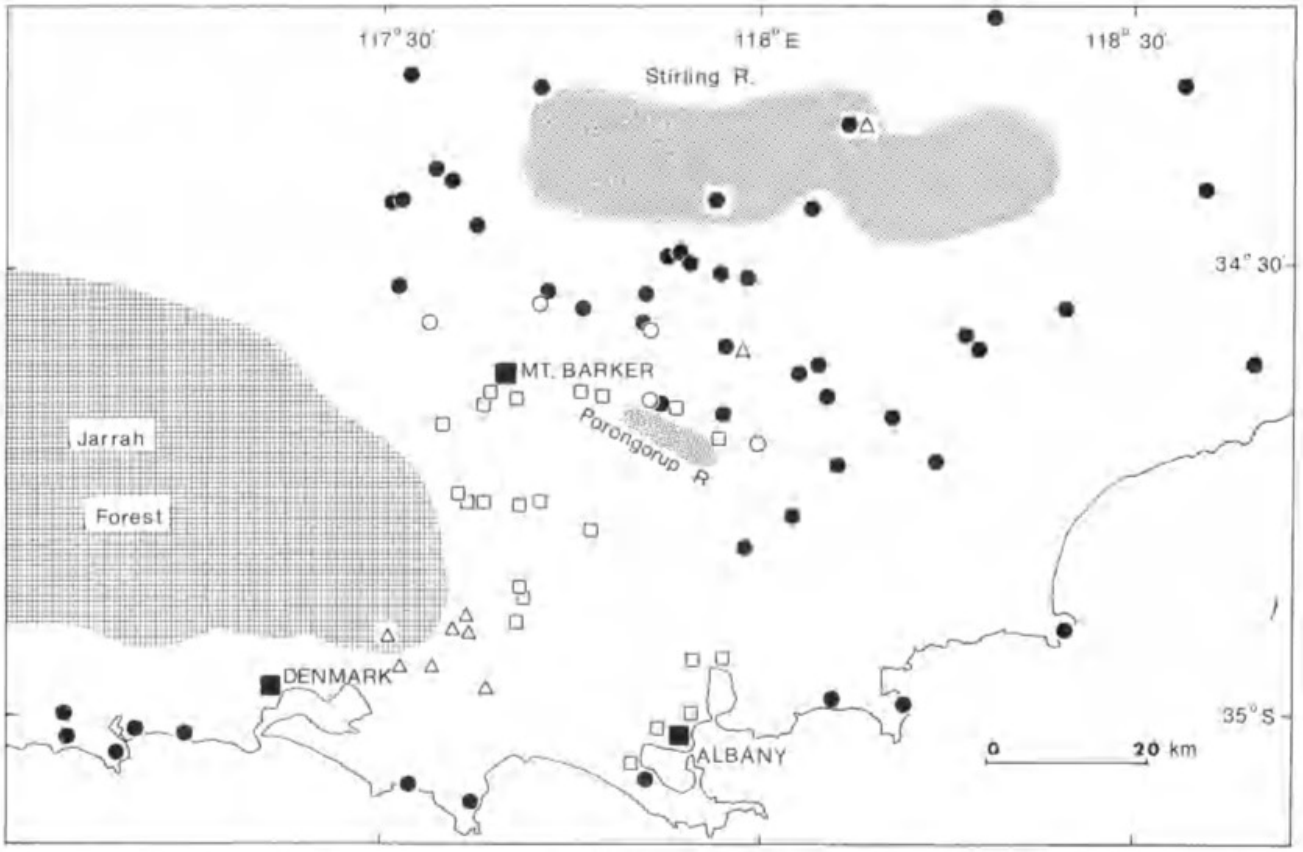

Fig. 1. Distribution of *Aponomma hydrosauri* (open squares and *Amblyomma albolimbatum* (closed circles) in the study area. Lizards with both species attached are shown with open circles, and those with no ticks attached, by open triangles.

investigations of the prediction that there is parapatry between the species near Albany.

Materials and Methods

Earlier records from a general survey of reptile ticks in Western Australia (Sharrad & King 1981) were supplemented with additional data collected in 1979 and 1980, and a detailed survey made in October 1980 of the area around Albany (Figure 1). Lizards, mainly *Trachydosaurus rugosus*, were captured as they crossed the roads or basked on the roadsides, and were examined for attached ticks.

Only *Ap. hydrosauri* and *Amb. albolimbatum* were found on *T. rugosus*. Adult ticks but not larvae and nymphs could be easily identified in the field and the immature stages were removed for later identification. A simple distinguishing feature is that *Amblyomma* species have eyes but *Aponomma* species lack them (Roberts 1970).

Other data came from road-killed hosts. Individuals of *T. rugosus* are commonly run over by vehicles, and some ticks remain attached to their dead host for several days (unpubl. observ.).

Other reptile species were examined when encountered. One blue tongue skink (*Tiliqua occipitalis*) and six freshly-killed brown snakes (*Pseudonaja nuchalis*) were examined, but had no ticks attached. Two snakes (no identification provided) and six goannas (all *Varanus rosenbergi*) from the area previously had been found infested by the tick species *Aponomma fimbriatum*.

Results

The distributions in the study area of the tick species, *Amb. albolimbatum* and *Ap. hydrosauri*, attached to *T. rugosus* are shown in Figure 1. The range of *Ap. hydrosauri* is 60 km (north-south) × 40 km (east-west). To the north and east its distribution abuts that

of *Amb. albolimbatum* which is widely distributed in southern Western Australia (Sharrad & King 1981). *Amb. albolimbatum* was not found within the distribution of *Ap. hydrosauri*, except in a narrow boundary zone (Figure 1), where both species were found together. Five host individuals collected in the boundary zone had both tick species attached to them. The width of the overlap zone is not known, but at the northern boundary there were less than 10 km separating hosts with only *Ap. hydrosauri* from hosts with only *Amb. albolimbatum*.

To the west, the distribution of *Ap. hydrosauri* abuts with the edge of the uncleared jarrah forest (*Eucalyptus marginata*). Road-killed *T. rugosus* were found regularly over most of the study area, but on the roads through the jarrah forest neither live nor dead *T. rugosus* were seen. Seven live *T. rugosus*, captured on the southeastern edge of the jarrah belt in country still containing extensive uncleared areas of forest, had no ticks attached to them. In the rest of the study area only two other uninfested *T. rugosus* were found (Figure 1).

Amb. albolimbatum is distributed along the south coast to the east and west of Albany (Figure 1), and abuts with, and may just overlap, *Ap. hydrosauri* about 6 km west and about 3 km east of Albany.

Discussion

It is not clear which factors prevent *Ap. hydrosauri* from spreading beyond its very narrow range around Albany. The morphologically similar species in South Australia occupies a wide range of environmental conditions (Smyth 1973). One environmental change which seems to have an important influence on the distribution of *Ap. hydrosauri* near Albany is the jarrah forest to the west. The density of *T. rugosus* appears to be lower there, and those found on the margins of the forest had no ticks on them. This suggests that some characteristic of the forest makes it unsuitable for occupancy by ticks.

The northern and eastern boundaries do not follow macroclimatic clines as does the boundary between *Ap. hydrosauri* and *Amb. limbatum* in South Australia (Smyth 1973). Near Albany the tick boundary crosses rainfall isoclines (Sharrad & King 1981). Moreover, *Ap. hydrosauri* is found in Western Australia in areas receiving higher rainfall, such as south of Cape Naturaliste, and in areas receiving lower rainfall, such as Bremer Bay (Sharrad & King 1981).

There are no obvious vegetational changes at the northern and eastern boundaries. Much of the area has been cleared for farming, but wide roadside verges still maintain native vegetation classified as mallee heath (Beard 1976). There may be a subtle change, but if so it is not significant enough to show on the vegetation maps of the area (Beard 1976). In fact, *Ap. hydrosauri* does survive in the distinctly different and less mesic coastal scrub on drift sand dunes at Bremer Bay. (The Cape Riche and Bremer systems of Beard (1976).)

Topographic barriers are also unlikely to be important in maintaining the boundary. The area is dominated by two mountain ranges, the small Porongorup Ranges starting about 35 km north of Albany, and the more extensive Stirling Ranges starting about 65 km north of Albany (Figure 1). These ranges rise abruptly from the plains and there is a flat intermontane area, about 20 km wide, between them. At one point the boundary is located on this plain. The Woogenellup Road runs northeast from Mt Barker and along the southern edge of the Stirling Ranges; only *Amb. albolimbatum* is found along it. The Porongorup Road runs east from Mt Barker along the northern edge of the Porongorup Ranges; most lizards found along this road carried *Ap. hydrosauri*. Thus the boundary region must occur on the plain in between these roads; and the mountain ranges are not barriers to the extension of the range of either species. There are no topographic features of any significance along the eastern boundary of *Ap. hydrosauri*.

An alternative explanation is that the position of the boundary is independent of environmental gradients, but is maintained by an interaction between the species. The strength of this hypothesis is the lack of any other obvious options, although attempts to demonstrate interactions of ticks at other parapatric boundaries have not been successful (Bull *et al.* 1981). Nevertheless, the frequent occurrence of parapatric boundaries within this group of ticks (Bull *et al.* 1981) is circumstantial evidence in favour of the interaction hypothesis.

Perhaps *Ap. hydrosauri* was once distributed continuously from South Australia to southern Western Australia, but *Amb. albolimbatum* has subsequently spread and displaced it, to leave geographically isolated populations in eastern South Australia, in the southern part of Eyre Peninsula, and in a number of locations along the southern coast of Western Australia.

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