

THREE *Acacia* INSECTS: A CHAIN OF DEPENDENCE

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Acacia karroo (Leguminosae), the Karoo thorn or Soetdoring, is one of the most widespread trees in South Africa. It has associated with it over its distributional range a considerable number and variety of insect species. Amongst these are beetle larvae which bore in the stems and branches, caterpillars of about fifty species of moths which mostly feed on the foliage, scale insects and related plant-sucking bugs which feed on the sap, wasps and bees which visit the yellow flowers for pollen and nectar and some bugs and beetles which feed on the ripe seeds.

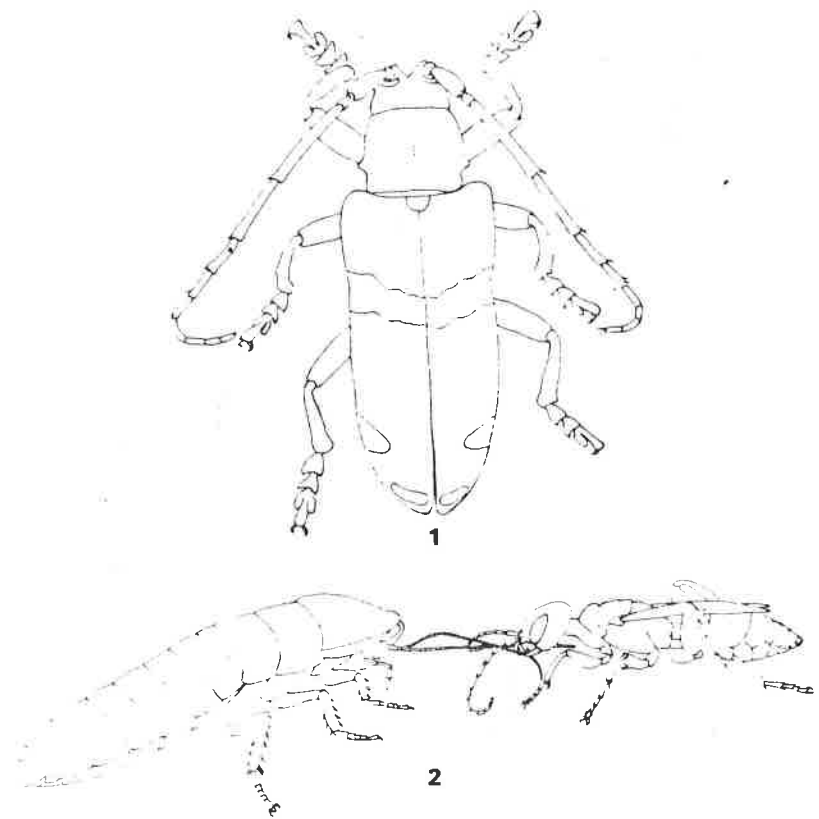
The present account, based on a study at Hilton, near Grahamstown, is concerned with three species of insects which form a chain of dependence. Each is a representative of a different insect group and each follows a way of life very different from that of the other two. All three, however, are restricted to *Acacia karroo*, the first directly, the second by virtue of the activities of the first, and the third by virtue both of the activities of the first and of the presence of the second.

The first species in the three-linked chain is a Long-Horned Beetle, *Ceropalesis hottentota* (Fabricius) (Fig. 1). Generally about 25mm long (excluding antennae), its head, prothorax, parts of its legs and the entire underside are a dull brownish red whereas the wing cases are a green-lustrous black with one complete and two interrupted transverse bands of red. The joints of its feet are expanded and modified for clinging to twigs so that breaking the beetle's hold may be quite difficult. It is, however, a good flier and may readily take to the wing when disturbed.

Adult *C. hottentota* appear in numbers on *Acacia karroo* in spring and are present on this tree throughout summer. However, it is the larval rather than the adult stage of the beetle which is of importance in our story. The larvae hatch from eggs laid in cracks in the bark and in the course of their feeding bore longitudinal galleries in finger-thick terminal branches. Towards the end of the winter the larvae are fully mature and within their galleries turn into pupae. These in turn change into adults which emerge into the open by chewing through the gallery wall.

The feeding activities of the beetle larvae result initially in exudation of gum from wounds in live wood. Later the bored branches die resulting in the separation of the bark from the wood. Following the emergence of the adult beetles the then open and abandoned larval galleries are accessible to other insects.

The second species is a cockroach, *Bantua dispar* (Burmeister) (Fig. 2). Like all cockroaches this species has an incomplete metamorphosis; there are no distinct larval and pupal stages. The young, called nymphs, resemble the adults in appearance and gradually grow larger by a series of moults. Male and female nymphs look very similar until the final moult which changes them into adults. Whereas the adult female retains the appearance of the mature nymph and is therefore wingless, the adult male differs from the mature nymph and from the female in the possession of two pairs of functional wings. Adults of both sexes reach a length of about 23mm although in the male this is the measurement to the ends of the folded wings, the body length being less. Females are a very dark brown and males, especially their wings, are lighter coloured.



Figs 1-2. Fig. 1, *Ceroplesis hottentota* (x 2,5) Fig. 2, *Bantua dispar* (left) and *Ampulex* sp. (near *cyanura*) (right) (x 2,5).

B. dispar occurs on *Acacia karroo* throughout the year, maturing to adulthood, mating and ovipositing in the summer months. For its shelter and food it is dependent upon the results of the activities of *C. hottentota* and is consequently found only in association with those trees infested by the boring larvae of the beetle. *B. dispar* is a shy, retiring, nocturnal species which spends the day in hiding under loose bark of branches killed by the beetle. Its dorso-ventrally flattened form is eminently suitable for this low-ceilinged retreat. Less frequently it also shelters in the old galleries of the beetle. At dusk it emerges from its hiding places to feed upon gum exuding from beetle-wounded live wood.

The third species is a wasp, *Ampulex* sp. (near *cyanura* Kohl) (Family Sphecidae) (Fig. 2). Females of this wasp reach a length of a little over 13mm and males a little over 11mm. Both sexes are very strikingly and beautifully coloured for, with the exception of their jaws which are red, they are a shining dark metallic blue. Their wings are clear with, in places, some black clouding.

Like the vast majority of solitary wasps *Ampulex* sp. provisions its young with paralysed prey. Unlike some wasps which may hunt a range of prey species of suitable size this wasp is restricted to a single prey species — the cockroach *B. dispar*. It follows therefore that as *B. dispar* is found only on *C. hottentota* bored acacias the *Ampulex* is similarly restricted to such trees as it is only there that its hunting will meet with success. There is furthermore another way in which *Ampulex* is linked to the activities of *C. hottentota*: it does not excavate or hollow out nests or galleries of its own but nests in pre-existing cavities — the abandoned galleries of the beetle larvae.

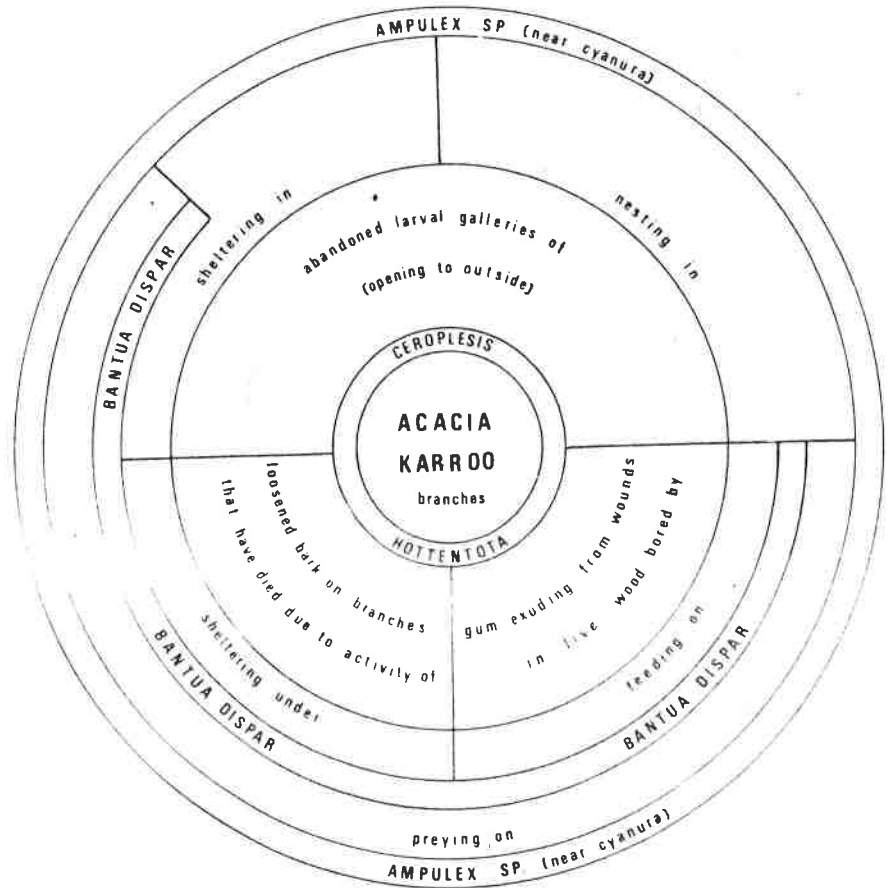


Fig. 3, Diagram showing the structure of a complex of three insect species, *Ceropalesis hottentota* (Cerambycidae), *Bantua dispar* (Blattidae) and *Ampulex sp* (near *cyanura*) (Sphecidae) associated with and restricted to *Acacia karroo*. The diagram is best read from the outer edge inwards.

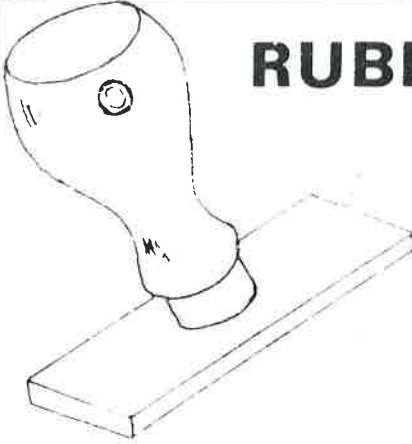
Ampulex sp. hunts during the day. On foot and with quivering antennae it explores the trunk and branches of the *Acacia*. Large cockroaches, mature nymphs or adult females, are sought as each nest, consisting of a single cell, is provisioned with only one prey which must supply all the needs of the wasp larva which will develop upon it. Having flushed a suitable cockroach from its hiding place the wasp advances upon it with widely separated jaws, lunges forward, grasps it and, holding it, flexes her abdomen beneath its body and stings it one or more times.

The effect of the sting on the cockroach is not so much to paralyse it but to render it incapable of independent action. This is of great importance to the wasp for were the prey totally inert its superior size and weight might well render it very difficult to transport along branches to the wasp's chosen nesting cavity. As it is, the cockroach, if left to itself, will not move from the spot where it has been attacked but quite readily walks when led by its captor. This is done by the wasp holding one of the cockroach's antennae with its jaws and walking backwards, drawing the cockroach along. Often transport is preceded by imbibing of a small amount of the prey's blood from the severed end of one of its antennae.


On arrival at the chosen beetle gallery the prey is drawn into it head first. The wasp then lays a single egg on the cockroach which the wasp then seals into its tomb by plugging the cavity entrance with bits of detritus. Depending upon how advanced the summer is at the time of oviposition the young adult wasp may emerge from its cell after only six weeks or it may not emerge until the following summer.

The chain of dependence exhibited by the three species of insects is unidirectional and is portrayed in Fig. 3 in the form of concentric circles which, followed inwards, lead to a central hub, the tree.

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