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A preliminary study of the ants of the Wildcliff Nature Reserve

with special attention to the invasive Argentine ant

(*Linepithema humile* Mayr)

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Picture: *Linepithema humile* Mayr (Alex Wild)

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1 Introduction

This study will investigate the diversity of the local ant populations in the Wildcliff Nature Reserve and the possible presence of invasive ants. Besides native ants, it is known that an introduced ant species is invading the Cape Floral Region (in which the reserve is situated), namely the Argentine ant (*Linepithema humile* Mayr.). The presence of this species has a number of negative consequences, on native ants, other arthropods, native plants, and more. From a nature conservation point of view, it is important to find out if the Argentine ant is present at Wildcliff. But first, the native ant populations should be studied. I will try to make a species list of the captured ants and investigate the presence of *L. humile*.

1.1 The Cape Floral Region (CFR)

The Wildcliff Nature Reserve is located in the Cape Floral Kingdom (South Africa, Western Cape). The world can be divided in six florisitic kingdoms: the Boreal Kingdom, the Neotropical Kingdom, Paleotropical Kingdom, Australian Kingdom, Antarctic Kingdom and the South African Kingdom (aka Cape Floral Kingdom) (Figure 1.1).

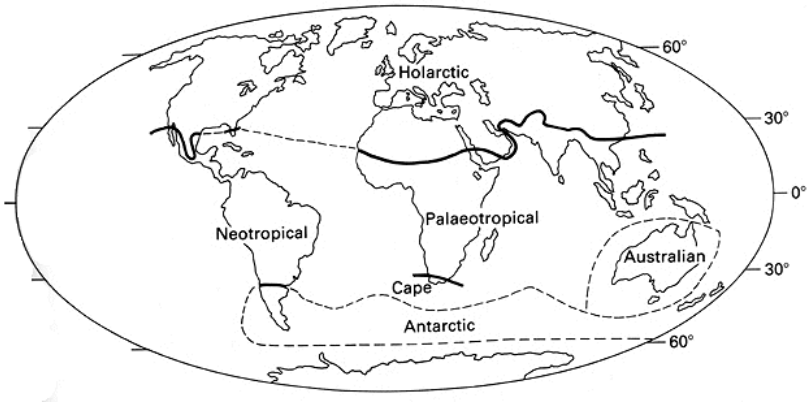

Figure 1-1: The world's six floristic kingdoms

Floristic kingdoms are characterized by a high degree of family endemism. The kingdoms can be divided in different floristic regions which are characterized by a high degree of generic endemism. Each floristic region, in its turn, can consist of floristic provinces with a high degree of species endemism.

The South African Floristic Kingdom, better known as the Cape Floristic Kingdom, has only one floristic region (the Cape Floristic Region) and includes only one floristic province (the Cape Floristic Province). The Cape Floral Kingdom (CFK) is the smallest of the world's six floral kingdoms and the only one to be found entirely within one country. It is one of the

world's 18 biodiversity hot spots and is home to more types of indigenous plants than any similar sized area on Earth (UNESCO World Heritage). What makes it even more special is that approximately 70% of its 9600 plant species are found nowhere else on Earth.

The Cape Floral Region includes five biomes: Nama- and Succulent Karoo, Thicket, Forest and Fynbos (Low & Rebelo, 1996).

Fynbos is its most dominant and most characteristic biome. The area experiences a Mediterranean-type climate with warm, dry summers and cool, wet winters. Fynbos is dominated by diverse evergreen shrubs and perennial graminoids restricted to low-nutrient soils. It must burn at between 6 and 45 years of age to sustain its plant species. Many species store their fruit in fire-safe cones for release after a fire, and ants are tempted to bury fruit where they are safe from rodents and fire. This very specific form of mutualism between plants and ants is called myrmecochory (from the Greek "ant" (*myrmex*) and "dispersal" (*kore*)). Up to 30% of the fynbos of the Southern African scrubland plant species rely on this kind of seed dispersal.

The seeds of ant-dispersed plants have highly attractive, oilrich coverings or appendages, known as elaiosomes (*elaios* - oil, *some* - body) (Van der Pijl, 1972 uit ecology 85). When such seeds fall to the ground, the ants rapidly move them to nest chambers below the ground. The ants consume the elaiosomes and (in many cases) leave the seeds unharmed.

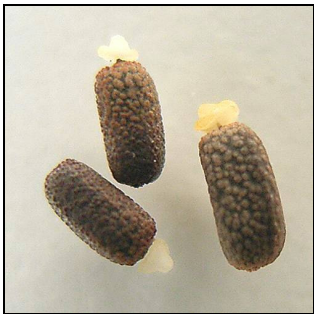

Figure 1-2: seeds with elaiosomes

1.2 Ants

Living ants (Family Formicidae) are currently classified into 21 subfamilies and 283 genera (after Bolton 2003). Ants dominate most ecosystems, and form 15–20% of the terrestrial animal biomass. They are social insects and form colonies. Most individuals in this colony are sterile females (workers, soldiers, etc.) The colony also has one or a few fertile females (queens) and some fertile males (drones).

Ants play a very important role in the ecosystem, in particular because of their relationschip with other organisms (other arthropods, plants, and fungi), called symbiosis. Furthermore they are important as a prey for other animals and/or as a predator (pest control). Ants have also an influence on the surrounding vegetation (seed dispersal, soil aeration, etc.).

1.2.1 Native South African ants

A total of 515 ant species are described from South Africa, representing 11 subfamilies (Antbase (*Distribution Database*) & Taylor (*The Ants of Africa*)).

Some local ant species have a special function in the Fynbos biome, namely seed dispersal. Many Fynbos plant species (1300) are dependent on myrmecochory for their survival. A total of 29 families and 78 genera of Fynbos plants have been identified as containing species that are ant dispersed (Botes *et al*. 2006). This form of mutualism is threatened by the invasive Argentine ants, because they displace the native ants and do not bury seeds.

Myrmecochorous ants belong to four subfamilies: Dolichoderinae, Formicinae, Myrmicinae and Ponerinae (Gómez & Espadaler, 1998 uit Cederberg). In the CFR the most dominant myrmecochorous ant species are *Pheidole capensis, Anoplolepis* sp. *(cf. steinergroeveri*), *Anoplolepis* sp. (cf. *custodiens*) *Tetramorium quadric spinosum* and *Camponotus niveosetosus* (Bond & Slingsby, 1983, 1984).

1.2.2 *Linepithema humile* Mayr.

The Argentine ant (*Linepithema humile*) is considered one of the world's most destructive invasive species (IUCN, 2000). *L. humile* belongs to the subfamily Dolichoderinae and is commonly referred to as the sugar ant because of its preference for sweet substances.

1.2.2.1 Description

The Argentine ant is a small brown ant, about 2-3mm long and relatively hairless. All *Linepithema* species share a distinct pattern of teeth on their mandibles and an unusual shape to the clypeus. *Linepithema* species have a clypeus that is broadly concave in the center and mandibulair teeth that are arranged as a series of small denticles interspersed with larger single teeth. Only one *Linepithema* species is known in South Africa: *Linepithema humile* (Taylor, 2008).

1.2.2.2 Geographical range

The Argentine ant (*L. humile*) is native to mesic subtropical or mesic mild-temperate regions of northern Argentina (Tsutsu *et al*., 2001) (Figure 1.3).

Argentine ants now occur throughout the world, with at least 28 separate introductions known from six continents and many oceanic islands (Figure 1.3). Although new records continue to accumulate, many populations were established before the 1950s (Suarez Holway & Case, 2001).

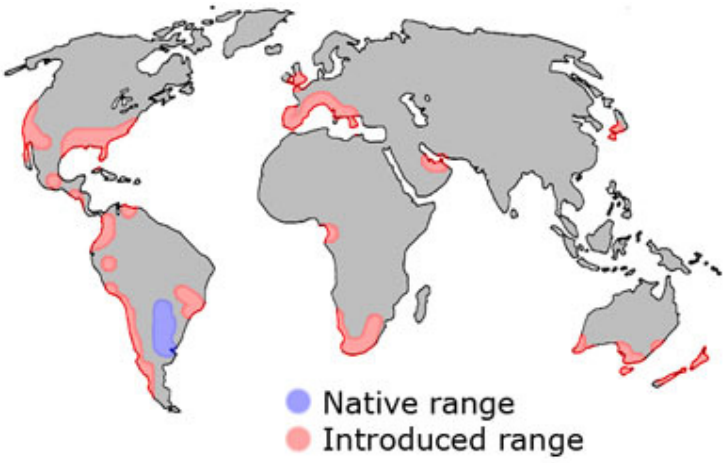

Figure 1-3: blue: native range of the Argentine ant, red: the introduced range

Argentine ants were first recorded in South Africa in the late 1800s (Skaife, 1955) and have become established in much of the Western Cape Province (de Kock & Giliomee, 1989), including the heath-like Fynbos communities of the Cape Floral Region.

1.2.2.3 Introduction pathways to new locations

Because winged dispersal of female reproductive forms (queens) is rare or absent, natural dispersal mostly takes place by 'budding'. Budding occurs when one or more queens leave the nest accompanied by workers who aid in establishing and caring for the new colony. Colony dispersal by budding alone greatly limits rates of spread (15 – 270 m/yr for *L. humile* in Northern California (Suarez *et al.*, 2001)). Because rates of spread by budding are so low, species that undergo colony reproduction solely by budding depend largely on human-mediated dispersal to colonize new and distant locations (Suarez *et al.*, 2001).

Argentine ants often relocate their nests in response to changes in physical environment (Gordon et al., 2001) and the distribution of food resources (Holway & Case, 2000).

Although workers of all invasive ants are sterile, in species such as *L. humile,* workers can rear eggs and early instar larvae into sexuals in the absence of queens. Consequently, propagules of *L. humile* need not even contain queens to establish successfully (Aron, 2001). Dequeened propagules that contain eggs and larvae are able to produce both female and male sexuals. This makes it even easier to start a new colony.

1.2.2.4 General impacts

L. humile is a dominant and aggressive ant. As with other invasive ants, invasion by Argentine ants is often associated with displacement of native ants and other ground dwelling arthropods (Holway *et al.*, 2002). They have a negative influence on ant-mediated seed dispersal and plant pollination. Research has shown that in South Africa, the Argentine ant can collect up to 42% of the available nectar before bees can forage (Holway *et al.*, 2002).

2 Objectives

Investigation of the ant population with special attention to the invasive Argentine ant.

- Which ant species are living at Wildcliff?
- Is the Argentine ant present or absent?
- If present, what is its range? And what is its impact on the ecosystem of the Wildcliff Nature Reserve?
- What are the possibilities for management of the Argentine ant on a reserve such as Wildcliff?

3 Method and Materials

3.1 Location

Wildcliff is 17km north-east of Heidelberg, Western Cape. It is centered at about 33º57'S, 21º2'E with elevations from 290m to 1130m. The boundaries lie between 20º58.9'E on the west to 21º3.0' on the eastern side, and 33º58.5'S on the south to 33º55.9' at the northernmost point.

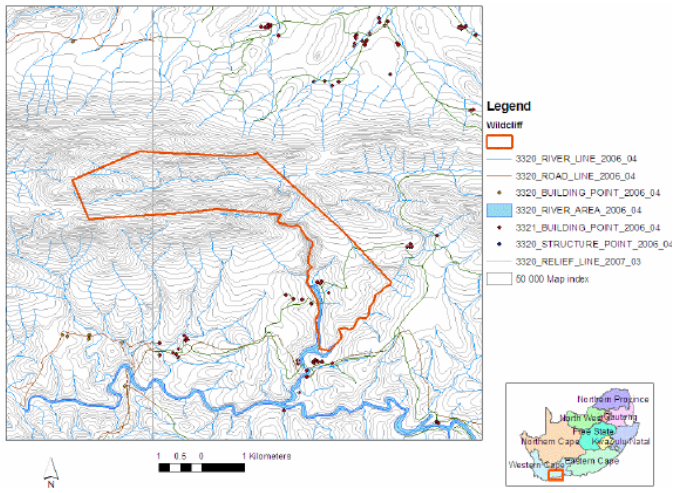

Figure 3-1: Map of Wildcliff Nature Reserve

Wildcliff is a mountain wilderness reserve consisting of 955 hectares, deep kloofs with afro-montane forest, rocky mountaintops and high meadows of fynbos.

3.2 Sampling methods

To collect as wide a range as species possible, several methods must be used. These include hand collecting, ground litter sampling, using bait as attractant, and the use of pitfall traps. The best way to capture *L. humile* is by tuna bait trapping. The combination of these four sampling methods should make it possible to get an overview of the diversity of the native ants in the reserve and the degree of presence of *L. humile*. Each method is described more in detail here below.

(Some details such as the placement of the traps will be discussed in Cape Town with Hamish Robertson, an ant specialist of the Iziko Museums of Cape Town, and are not yet integrated into this proposal.)

3.2.1 Hand collecting

Hand collecting consists of searching for ants everywhere they are likely to occur. This includes on the ground, under rocks, on tree trunks, in vegetation, etc.

3.2.2 Leaf litter sampling

Many ants are small and forage primarily in the layer of leaves and other debris on the ground. Hand collecting these species can be difficult. One of the most successful ways to locate these ants is to collect the leaf litter in which they are foraging and extract the ants from it.

The extraction is done with a double-net system, comprised of two net bags, the inner one of which contains the accumulated leaf-litter. The outer bag stands off from the inner approximately 2 inches and is drawn into a funnel shape below the inner bag. The end of this funnel of net is connected to a largish (2lb jam jar sized) bottle containing a preservative (e.g. ethylene glycol). The whole mechanism, once the inner bag has been filled with the collected substrate, is hung in an airy situation, but out of any direct sunlight, such as a garage. The substrate will slowly dry and the invertebrate animals will leave its confines and fall into the net funnel below the inner bag. From this position they will either slide or move down and fall into the jar containing the preservative. The slow action of this method results in a much greater percentage of the available invertebrates leaving the substrate and being collected for further examination and identification.

3.2.3 Tuna bait trapping

Baits can be used to attract and concentrate foragers. This often increases the number of individuals collected and will sometimes attract species that would be difficult to locate otherwise. Because of the dominant nature of the Argentine ant, tuna bait is a good method to catch this species. Anderson (1992) showed that L. humile occurred at a large proportion of tuna baits; they dominated and monopolized most (>85%) of the baits at which they occurred and they were far more abundant at baits than expected from their representation in pitfall catches. The bait (one teaspoon of tuna) is placed on laminated white cards, this makes it easier to spot ants and to capture them before they can escape into the surrounding leaf litter. Thirty minutes later every ant on the card is sampled during three minutes.

3.2.4 Pitfall trapping

The pitfall trap is another commonly used tool for collecting ants. A pitfall trap can be seen as any small container placed in the ground with the top level with the surrounding surface and filled with a preservative. Ants are collected when they fall into the trap while foraging.
(Sample number / sample placement / sampling coverage and intensity will be discussed with Hamish Robertson)

3.3 Identification

Sorting and counting of trap contents will be carried out in the laboratory of Wildcliff. The identification of the ants will occur with the identification key: “Identification Guide to the Ant Genera of the World” by Barry Bolton (1994). Furthermore, Dr. Hamish G. Robertson is willing to help with the identification of difficult specimens.

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