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FIRE ECOLOGY

AN OBSERVATION OF BABOON SPIDER MORTALITY RESULING FROM FIRE IN TEMBE ELEPHANT PARK, SOUTH AFRICA

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Introduction

Mesic savanna vegetation types are prone to combustion (Rutherford et al. 2005) and fire plays a significant ecological role as disturbance events within those environments by removing moribund vegetation, maintaining grazing pastures and preventing woody encroachment (Parr & Chown 2003, Masterson et al. 2008, Nimmo et al. 2012, Haddad et al. 2015, Douglas et al. 2016). Regular burning regimes are applied in protected areas across the grassland and savanna biomes of southern Africa (Masterson et al. 2008) yet very little is known about the relationship between burning and invertebrate ecology within a South African context (Haddad et al. 2015). Due to the ambiguous use of fire within and outside of conservation areas and the lack of knowledge surrounding the effects of such management policies on a wide range of animal taxa, there is a need to understand the implications for species, populations and communities resulting from burning practices (Parr & Chown 2003).

Habitat combustion, high temperatures, oxygen depletion and smoke inhalation caused by burning leads to the mortality, injury or displacement of animals (Engstrom 2010;\, Costa et al. 2013). The denaturing of proteins, thermal enzyme inactivation, temperature induced metabolic disruption, compromised cellular membrane structure and inadequate oxygen supply or a combination of these factors have been suggested as influences on the physiological causes of fire-induced faunal casualty and injury (Whelan 1995, Esque et al. 2003, Dickinson et al. 2016). Understanding the responses of faunal species to habitat combustion and burning regimes is essential for the ecologically sustainable and responsible management of fire prone habitats (Driscoll et al. 2010). Observations regarding southern Africa faunal responses to fire are not well understood (Parr & Chown 2003) but the effect of fire on the survivorship of mega fossorial fauna is generally considered to have minimal effects (Engstrom 2010). This may not always be the case as the severity of a fire is influenced by the fire type, intensity, season of burning, fire frequency (Bigalke & Willan 1982) and the available combustible material within the environment (Trollope 1999).

Baboon spiders are large, hairy spiders, most of which are fossorial, living in burrows in the soil or making retreats under rocks and other surface cover. They are long lived, taking several years to reach maturity. The females are iteroparous, reproducing annually for their adult lifetime, which may be 6–8 years in the larger species. Males are short lived after maturing, surviving only a few months, during which they wander in search of females to mate. Baboon spiders are protected by law in most provinces in South Africa as there is a significant demand for specimens for the exotic pet trade, both locally and internationally.

The Trapdoor Baboon Spider *Idiothele nigrofulva* is a common and widespread species in South Africa, occurring in the north-eastern parts of the country, through the Free State, and into the eastern parts of the Northern Cape. The diagnostic features of this species include a completely black underside without any banding on the abdomen, a rounded carapace profile, and a conical last segment of the spinnerets. It exhibits a remarkable behaviour for baboon spiders in that it constructs a trapdoor lid over its burrow, similar to those seen in the true trapdoor spiders of the families Ctenizidae, Cyrtaucheniidae, and Idiopidae. As with most other baboon spider species the burrow has a single entrance. The lid is camouflaged against the surrounding soil surface, providing a measure of protection from predators. It may provide additional protection from rainwater running into the burrow. Baboon spiders are sit and wait predators, and forage primarily after dark. Prey items, consisting mostly of other arthropods, which walk close to the burrow entrance are captured and quickly pulled back into the burrow to be consumed.

The impacts of fire mortality on invertebrates have not been studied directly. More often, community level changes in response to differing burning regimes are usually studied (e.g. Parr et al. 2002, 2004). Eastwood (1978) reported lowered densities of a scorpion, *Uroplectes lineatus*, on Table Mountain following fire, although quantitative data are not presented. Burbidge et al. (1999) in the interim recovery plan for the Minnivale Trapdoor spider, *Teyl* spp., from Australia assumed that the deep burrows which the species creates protect adults from direct fire effects such as mortality and injury. Indirect fire effects from habitat modification like a decrease in cover or reduced prey availability are considered to pose a greater threat to such species than the direct effect of fire itself (Tainton & Mentis 1982; Burbidge et al. 1999). Fire was shown to have a negative impact on ground dwelling spider taxa within South African grassland habitats after a spring fire (Haddad et al. 2015) while Uys & Hamer (2007) reported a positive influence on both invertebrate abundance and richness after autumn burns. Fire related mortality in baboon spiders has not been reported in the literature.

Study Site Description

Tembe Elephant Park (TEP) is situated within northern KwaZulu-Natal on the southern extent of the Mozambican coastal plain. It has an area of 30,013 ha and is managed by Ezemvelo KwaZulu-Natal Wildlife (EKZN). The area is dominated by unconsolidated sand of marine origin (Matthews et al. 2001).

TEP reserve management utilises regular burning to combat woody encroachment in open- and sparse woodland. A study is currently underway to determine mortality rates in reptiles as a direct result of fire. Surveys were conducted in the morning following fires by walking transects in burnt areas to document directly observable fire induced reptile mortality (Jordaan in prep.). During one such survey incidental baboon spider mortalities were recorded.

Observation

The study site was burned on 14 October 2015. The fire was set in sparse woodland between 10h00 and 11h00 in the morning with an ambient temperature of 43°C. Surveys were conducted the morning after burning at 06h00. Transects were a total length of 2000 m and encompassed a total area of 8000 m^2. Two adults and three juvenile *I. nigrofulva* were collected, dead on the surface, during these surveys. The two adult females had carapace lengths of 17.7 mm and 16.6 mm whilst the juvenile specimens had carapace lengths of 4.8 mm; 5.5 mm and 6.0 mm. All five specimens were found on the surface in open habitat amongst burned grass with some burnt leaf litter (Figure 1). One of the adult female specimens exhibited burn damage on the anterior appendages (Figure 2). Surveys were also conducted following two previous fires which were set in mid-August 2015 under lower ambient temperatures. No baboon spider mortalities were recorded during those surveys.

***Figure 1** Examples of trapdoor baboon spiders,* Idiothele nigrofulva*, found dead on the surface following a planned fire at Tembe Elephant Park, South Africa. Left: adult female; right: juvenile.*

***Figure 2** Antero-ventral (left) and ventro-lateral (right) views of the extent of burn damage exhibited in one of the specimens of* Idiothele nigrofulva *found during the study.*

Discussion and Conclusions

This observation of mortality in baboon spiders resulting from fire is noteworthy as it is typically assumed that the burrows of these animals provide sufficient protection against the effects of fire. The cause of death in the specimens is uncertain. Heat shock is a possibility, as evidenced by the notable burn wounds observed on one of the adult female specimens. However, the physical burning on the appendages of this specimen may have occurred on emergence onto the surface. Mortality resulting from smoke or toxic gas inhalation is another possibility, but needs to be ascertained with histological investigation of freshly burned specimens. Baboon spiders breathe by means of book lungs, and have a relatively low oxygen demand due to their low metabolic rates (Foelix 2010), which presumably makes them less prone to these mortality agents than vertebrates with higher metabolic requirements.

The exact circumstances that led to the deaths of the spiders observed in this study can only be speculated about. For the juvenile spiders, it is quite possible that the specimens were in short burrows, or making use of logs on the surface for cover, as is occasionally observed in this species. The circumstances that led to mortality of the larger females is puzzling. Large *I. nigrofulva* specimens typically occupy deep, permanent burrows, extending up to 30 cm below the soil surface. The spiders would presumably seek shelter at the bottom of the burrow in the event of fire. Heat from fires typically only impacts the organic and shallow soil layers, so a deep burrow should provide sufficient protection (Tainton & Mentis, 1982). Determining the mode of mortality of baboon spiders resulting from fire will require further investigation.

We postulate three possibilities to explain the mortality of the adult spiders. Firstly, they may have been specimens that had recently moved from their burrows, and had made use of surface cover for temporary protection, or occupied short temporary burrows at the time of the fire, which would expose them to the heat of the fire. However, this would seem unlikely for the adult specimens, as large adult female baboon spiders seldom, if ever, move from their burrows. Despite the high temperature conductivity of sand the burrows of adult baboon spiders are assumed to be sufficiently deep to provide protection from fire.

Secondly, it may be possible that the heat of the fire was drawn into the burrow to a greater depth than typically occurs in the soil surface by some mechanism. The soil itself provides a buffer through which heat must travel, therefore limiting the depth to which the heat can extend, but hot air could theoretically extend all the way through an

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open tube in the soil without the protection of soil cover. It is unlikely that the trapdoor lid on the burrow would provide any protection, as this is constructed with a mixture of silk and soil, and the silk would break down on exposure to extreme temperatures. An alternative possibility is that heat is drawn into the burrow as a result of partial air pressure change caused by the consumption of oxygen by the fire.

Thirdly, fires produce a range of toxic gases, including carbon monoxide, which may have entered the burrows and induced the spiders to exit the burrow despite the fire, exposing them to heat shock on the surface or at the top of the burrow. Lawrence (1966) states that small mammals utilising burrows with a single entrance were more likely to die from suffocation than animals sheltering in multi-entrance burrows with better ventilation.

The impact of fire on baboon spider populations is difficult to ascertain with the available data. Importantly, the observation of mortality resulting from fire dispels the perception that fossorial burrowing invertebrates are unaffected by fires. Determining the extent and significance of mortality within a baboon spider population would be difficult as it is possible that specimens die within their burrows, and that the specimens observed dead on the surface represent a small proportion that emerge before dying. Alternatively, if deaths within the burrow do not occur frequently, and the greater proportion of burnt specimens do emerge from their burrows, there would be a lower impact on the population from burning. In order to determine this impact quantitative estimates of population density within the burnt area would be required, as well as an estimate of the extent of mortality following fire, neither of which is trivial to acquire. Alternatively, long term, large scale burning experiments could provide some insight by comparing population densities between replicates.

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References

Abu-Humdeh NH, Reeder RC 2000. Soil thermal conductivity: Effects of density, moisture, salt concentration, and organic matter. Soil Science Society of America Journal. 64: 1285–1290

Anderson AN, Woinarski JCZ, Parr CL 2012. Savanna burning for biodiversity: Fire management for faunal conservation in Australian tropical savannas. Austral Ecology, 37: 658–667

Burbidge AA, Harvey M, Main BY 1999. Minnivale Trapdoor Spider Interim Recovery Plan: 1998–2000. Department of Conservation and Land Management Western Australian Threatened Species and Communities Unit.

Driscoll DA, Lindenmayer DB, Bennett AF, Bode M, Bradstock RA, Cary GFJ, Clarke MF, Dexter N, Fensham R, Friend G, Gill M, James S, Kay G, Keith DA, MacGregor C, Russell-Smith J, Salt D, Watson JEM, Williams RJ, York A 2010. Fire management for biodiversity conservation: Key research questions and our capacity to answer them. Biological Conservation. doi:10.106/j.biocon.2010.05.026.

Eastwood EB 1978. Notes on the scorpion fauna of the Cape. Part 3. Some observations on the distribution and biology of scorpions on Table Mountain. Annals of the South African Museum 74: 229–248.

Engstrom RT 2010. First-order fire effects on animals: Review and recommendations. Fire Ecology 6: 115–131.

Foelix R 2010. The biology of spiders. Oxford University Press, Oxford.

Haddad CR, Foord SH, Fourie R, Dippenaar-Schoeman AS 2015. Effects of a fast-burning spring fire on the ground-dwelling spider assemblages (Arachnida: Araneae) in a central South African grassland habitat. Journal of African Zoology 50: 281–292.

Lawrence GE 1966. Ecology of vertebrate animals in relation to chaparral fire in the Sierra Nevada foothills. Ecology 47: 278–291.

Masterson GPR, Maritz B, Alexander GJ 2008. Effect of fire history and vegetation structure on herpetofauna in a South African grassland. Applied Herpetology 5: 129–143.

Matthews WS, Van Wyk AE, Van Rooyen N, Botha GA 2001. Vegetation of the Tembe Elephant Park, Maputaland, South Africa. South African Journal of Botany 67: 573–593.

Nimmo DG, Kelly LT, Spence-Bailey LM, Watson SJ, Taylor RS, Clarke MF, Bennett AF 2012. Fire mosaics and reptile conservation in a fire-prone region. Conservation Biology 27: 345–353.

Panzer R 2002. Compatibility of prescribed burning with the conservation of insects in small, isolated prairie reserves. Conservation Biology 16: 1296–1307.

Parr CL, Chown SL 2003. Burning issues for conservation: A critique of faunal fire research in southern Africa. Austral Ecology 28: 384–395.

Parr CL, Bond WJ, Robertson HG 2002. A preliminary study of the effect of fire on ants (Formicidae) in a South African savanna, African Entomology 10: 101–111.

Parr CL, Robertson HG, Biggs HC, Chown SL 2004. Response of African savanna ants to long-term fire regimes. Journal of Applied Ecology 41: 630−642.

Rutherford MC, Mucina L, Lötter MC, Bredenkamp GJ, Smit JHL, Scott-Shaw CR, Hoare DB, Goodman PS, Bezuidenhout H, Scott L, Ellis F, Powrie LW, Siebert F, Mostert TH, Henning BJ, Venter CE, Camp KGT, Siebert SJ, Matthews WS, Burrows JE, Dobson L, van Rooyen N, Schmidt E, Winter PJD, du Preez PJ, Waed RA, Williamson S, Hurter PJH 2006. Chapter 9: Savanna Biome. In: Mucina L, Rutherford MC (ed). The vegetation of South Africa, Lesotho and Swaziland. South African National Biodiversity Institute, Strelitzia 19. Pretoria.

Tainton NM, Mentis MT 1982. Fire in grassland. In: Booysen P de V, Tainton NM (eds.) Ecological effects of fire in South African ecosystems. Springer-Verlag, Berlin.

Trollope WSW 1999. Veld burning. In: Tainton N (ed.) Veld management in South Africa. University of Natal Press, Pietermaritzburg.

Uys C, Hamer M 2007. The effects of long-term fire treatment on invertebrates: Results from experimental plats at Cathedral Peak South Africa. African Journal of Range and Forage Science 24: 1–7.

Whelan RJ 1995. The ecology of fire. Cambridge University Press, Cambridge.