BROWSE SELECTION OF BLACK RHINOCEROS (*DICEROS BICORNIS*) IN TWO VEGETATION TYPES OF THE EASTERN CAPE PROVINCE, SOUTH AFRICA, WITH PARTICULAR REFERENCE TO EUPHORBIACEAE

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1. INTRODUCTION

The black rhinoceros population in the Great Fish River Reserve (GFRR), Eastern Cape, South Africa, has increased steadily since re-introduction in 1986. This is a possibly a reflection of the habitat which comprises xeric succulent thicket with a variety of highly palatable species. The thicket is vulnerable to degradation under intensive herbivory (Evans *et al* 1997), and this necessitates an understanding of the impact of browsers and estimates of the carrying capacity of the vegetation for black rhinoceros.

The diet of the black rhinoceros has been studied in the thicket vegetation of the Eastern Cape Province by Ausland *et al* (2002) in the GFRR and Hall-Martin *et al* (1982) in the Addo National Park. This study aims to improve the understanding presented by Ausland *et al* (2002), specifically contributing towards an improved estimate of carrying capacity. Previous studies have indicated the importance of Euphorbiaceae in the diet of black rhinoceros (Joubert and Eloff 1971; Goddard 1968), but methods for studying these succulent latex-yielding browse species are poorly developed. Specifically, algorithms for relating diameter of browsed stems to browse volume and mass for typical woody species are deemed un-suitable for these succulents. Further, the growth rates and responses to browsing of succulent Euphorbiaceae are poorly understood. *Euphorbia bothae* is a typical example, with an irregular growth form. Thus, previously, intake of *E. bothae* by black rhinoceros and other browsers has not been quantified. Efforts to overcome this are currently receiving research attention.

2. METHODS

To determine the relationship between stem diameter and biomass, *E. bothae* clumps were selected randomly in a variety of areas in the GFRR in order to cover any possible growth differences in different habitats. Five stems from each plant were cut at 50mm and another five were cut at 100mm. The lengths were chosen to represent the possible bite lengths by black rhinoceros. The lengths of cut stems were frozen until analysis. Calipers were used to measure stem diameter between flanges. Thereafter, the stems were weighed, and mass and stem diameter were regressed.

Data on diet composition of black rhinoceros were obtained using the backtracking technique, in which animals were located in the early morning whilst foraging. The foraging path of the animal was followed and at each feeding station we recorded: species eaten, bite diameter classes, feeding height and associated species. A bite was regarded as the number of twigs browsed on the same plane within a circumference of 10cm (Hall-Martin *et al* 1982). Backtracks were stratified and analysed per vegetation community. For the purpose of this paper, only the two communities in which the majority of the backtracking has been conducted were analysed. These were medium *Portulacaria* thicket (MPT) dominated by *Portulacaria afra* (Figure 1), and short *Euphorbia* thicket (SET) dominated by *Euphorbia bothae* (Figure 2). Ten backtracks were conducted in SET and 13 in MPT. The data were collected from July to November, 2001.

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Figure 1. Medium *Portulacaria* Thicket

Figure 2. Short *Euphorbia* Thicket

3. RESULTS

Cutting sections of stems of *E. bothae* in order to simulate browsing by rhinoceros revealed a highly significant positive relationship. Of the lengths cut at 100mm, the correlation coefficient is 0.67 (DF = 57; $P \leq 0.01$), whilst that of the lengths cut at 50mm is 0.85 (DF = 61; $P \leq 0.01$). These correlations are however, applicable only to known lengths of stem. The data for the 50mm lengths are presented (Figure 3).

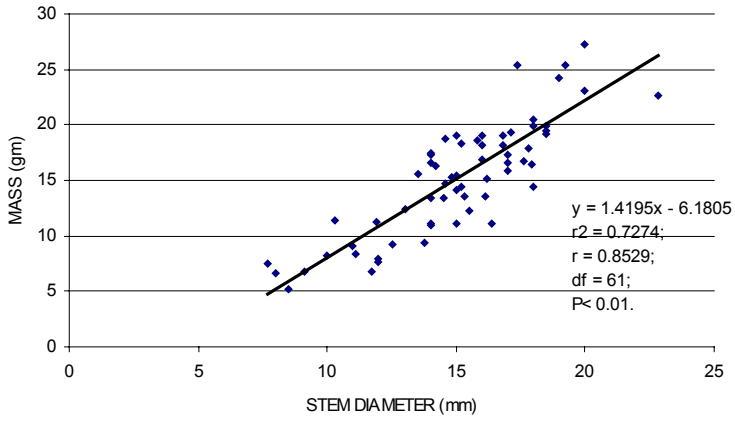

Figure 3. The relationship between stem diameter and mass for sections of *Euphorbia bothae* of known length of 50mm.

In terms of bites, the diet of the rhinoceros in the SET is presented (Figure 4). The diet was dominated by *E. bothae* (644 bites out of 1605 – 41%). *Grewia robusta* (264 bites out of 1605 - 16%) and *Euclea undulata* (123 bites out of 1605 - 8%) were the next most frequently represented species. All other species contributed less than 100 bites each.

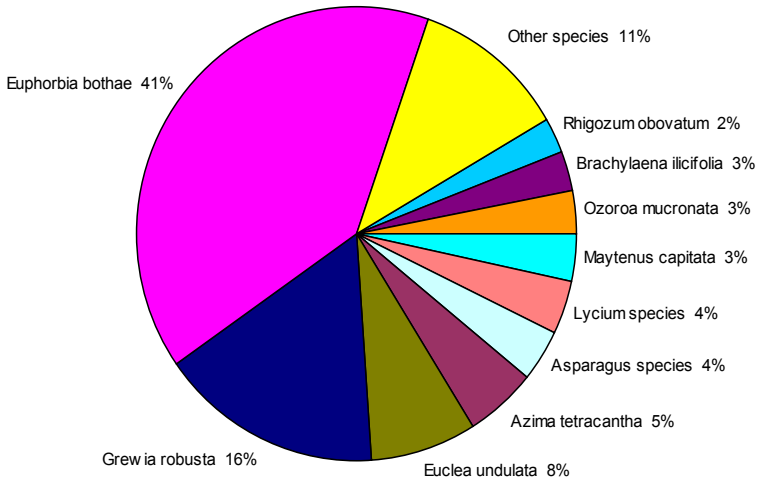

Figure 4. The ten tree and shrubs species most frequently browsed by black rhinoceros in Short *Euphorbia* Thicket in the GFRR, expressed as the percentage of bites recorded throughout the year.

In the MPT, the diet of the rhinoceros was dominated by *Rhigozum obovatum* (22%), *Grewia robusta* (13%), *Euclea undulata* (12%) *Ozoroa mucronata* (8%), and *Lycium* spp. (7%) (Figure 5). These five species comprised 62% of all bites. *Portulacaria afra*, the species characterizing this vegetation community, only contributed 34 bites (3%) while succulent mesembryanthemums (*Phylobolus* spp.) comprised only 3% of bites.

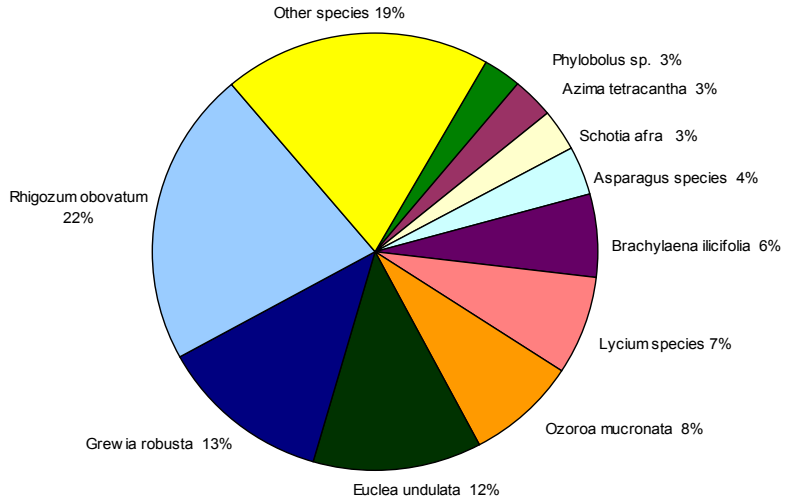

Figure 5. The ten most frequently browsed tree and shrub species in Medium *Portulacaria* Thicket in the GFRR expressed as the percentage of bites recorded throughout the year.

4. DISCUSSION

The significant relationship between the stem diameter and biomass of *E. bothae* still requires further testing. The fact that the correlation is true only if the length is known means that the average bite size on *E. bothae* by black rhinoceros

must be determined by another method (e.g. fixed point photography). The diameter of the branch where browsed cannot be used to determine the length of branch removed in browsing. Direct observation may also help to determine the average length of branch removed by browsing.

The preliminary results presented in this paper indicate the importance of analyzing browse data on the basis of vegetation types. The bites constituted by the various species differed markedly between the SET and the MPT plant communities. It is likely that further research will reveal that *Rhigozum obovatum* is over-represented in this initial assessment of diet in MPT since much of the data was obtained in an accessible area where *R. obovatum* is especially abundant.

Ausland *et al* (2002) found that *E. bothae*, *Grewia robusta*, *Jatropha capensis*, *Plumbago auriculata* and *Azima tetracantha* were amongst the ten most frequently selected plants in all three seasons during which data were collected. Although the analyses were based on the number of times that an individual plant of a particular species was selected rather than the number of bites, comparisons can be made. *J. capensis* does not feature in the ten most frequently browsed species in either MPT or SET only contributing to 1% of bites in SST. *P. auriculata* contributed 4% of all bites in all habitats, but did not feature in the ten most frequently browsed species in either MPT or SET. It is a species that can be locally abundant and browsed heavily at times. Such a species is likely to distort the results if sampling is inadequate or if backtracking is not conducted in as wide a variety of habitats as is possible. *G. robusta*, *E. bothae* and *A. tetracantha* were found to be frequently browsed. However, *E. bothae* is restricted to a small portion of the reserve and does not feature as an important species in the MPT.

Seasonal changes in the importance of certain species in the diet of black rhinoceros are not revealed in these preliminary results. Both *Lycium* species and *Rhigozum obovatum* appear to be preferred after rain-induced flushing, but rejected during most of the rest of the year. Ausland *et al* (2002) did not find evidence of the importance of these two species, although Hall-Martin *et al* (1982) found *R. obovatum* to be favored after rainfall events. It is therefore possible that these species could be very important since they provide black rhinoceros with highly palatable browse soon after the end of the dry season, a time when body condition is likely to be at its lowest.

Annuals and succulent forbs are thought to be under-represented in the data presented. This is partly due to their inconspicuous nature but also due to the fact that these plants are frequently uprooted and entirely consumed. One such succulent forb, a *Mesembryanthemum* spp, is highly sought after. These forbs may well be seasonally more important than is generally recognised.

In agreement with Ausland *et al* (2002), *Acacia karroo* and *Portulacaria afra* were not important browse species. Other species that were also not apparently preferred by the black rhinoceros were *Phyllanthus verrucosus* and *Ehretia rigida*, both of which were relatively widespread in the different plant communities. *Ozoroa mucronata*, unpalatable to other browsers, was browsed in significant quantities (3% in SET and 8% in MPT).

These preliminary results indicate that *Grewia robusta* and *Euclea undulata* were the most frequent species in the diet of the black rhinoceros based on number of bites. This is by virtue of their wide distribution in the GFRR and in thicket vegetation in general where *Grewia robusta* in particular, is often a dominant species. *Euphorbia bothae* dominates the diet of black rhinoceros in the limited area where it occurs. *Lycium* spp. and *Rhigozum obovatum* are seasonally very important. Further research is continuing to assess the importance of this species and other succulent-stemmed *Euphorbia* spp. by developing techniques for estimation of 'browse volume' and mass intake per bite.

5. REFERENCES

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