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SHORT COMMUNICATION

FOOD OF SAMBAR DEER (*CERVUS UNICOLOR*) IN A MANAWATU (NEW ZEALAND) FLAX SWAMP

Summary: The diet of sambar deer in a *Phormium tenax* wetland is examined. Proportions of forage species were assessed from cuticle fragments in faeces and the nutrient quality of the food determined chemically. The deer feed selectively although at times the principal forages ingested are of poor nutritional value.

Keywords: Sambar deer; cuticle analysis; forage quality; selective feeding.

Introduction

Sambar deer *(Cervus unicolor* Kerr, 1792) were first introduced to New Zealand when a pair from Sri Lanka were liberated on the Carnarvon estate, Rangitikei River, in June 1875 (Donne, 1924). The present Manawatu herd of fewer than 500 animals, diffusely distributed through a mosaic of habitat types, is probably derived solely from these two animals.

The study area of 74.6 ha at Moutoa (NZMS 1, N149, grid ref. 136825) comprised about 50% dense flax *(Phormium tenax),* a remnant of the once extensive plantations which supported the flaxmilling industry, and about 50% ungrazed pasture. About one-third of the area is under water for most of the winter. The perimeter is formed by the Manawatu River, a tree *(Populus)* nursery, and developed beef cattle pasture. Deer were occasionally seen on the adjacent land; they travelled to maize crops several kilometres away and spoor indicated some movement to and from a plantation of *Pinus radiata* 8 kilometres to the west.

The study aimed to identify and measure the animal's diet and to analyse its nutrient quality.

Methods

The only feasible way to identify forage consumed was faecal analysis. Direct observation of grazing animals was precluded by the density of the vegetation, it was impossible to quantify deer feeding sign because it could not be reliably separated from that of possums *(Trichosurus vulpecula)* and occasional stray cattle, and examination of rumen contents was not possible because the animals were protected.

Our procedure follows with some refinements that described by Stewart (1967). At the beginning of each month, 5 pellets were taken from each of 10 randomly selected fresh faecal deposits then bulked and oven dried at 80ºC for 48 hours. This material was ground in a Wiley mill with a I mm screen and shaken in a 200 mesh sieve. Fragment size was thereby rendered more uniform (Malechek, 1966), an advantage when determining cover values in microscope slide preparations (Stewart, 1967). Faecal material was chemically macerated using the chromic acid/nitric acid method (Zyznar and Urness, 1969) and the mixture agitated before making semi-permanent preparations. These involved 5 pipetted drops on each of 5 microscope slides and on each one, 20 fields were examined. Therefore in 100 fields for each case, all plant cuticles present were identified and measured in arbitrary units using a squared micrometer eyepiece. This was a time consuming task (8-10 hours per 100 fields) but one likely to reduce the variance encountered by Stewart, who measured only the areas of the first 100 cuticle fragments.

The 12 plant species eaten were all analysed for nutrient quality although seven of them, none of which were especially nutrient rich, never amounted to more than 10% of the total. Therefore this account is restricted to flax, floating sweetgrass *(Glyceria fluitans),* tall fescue *(Festuca arundinacea),* reed canary grass *(Phalaris arundinacea),* and chickweed *(Stellaria media)*. For each of these, five random samples of the plant portion normally taken by deer were gathered, bulked, oven dried (80 ºC for 48 hours) and ground in a Wiley mill fitted with a I mm mesh screen; they were then analysed repeatedly for crude protein, gross energy and lignocellulose (Horwitz *et al.,* 1970) until duplicates varied by less than one percent. Protein was calculated from Macro-Kjeldahl nitrogen values (Meeker & Wagner, 1933; Hiller *et al.,* 1948) using the correction factor of 6.25 (Dietz, 1970; Hobbs *et al.,* 1981). Energy values were determined using bomb calorimetry and lignocellulose by the acid detergent fibre (ADF) method of van Soest (1963, 1966). Moisture content was also evaluated.

Differences in chemical content between collection dates were analysed using t-tests (Hobbs *et al.,* 1981).

Visual estimates were made of relative plant biomass in the field.

Results

Over a 12-month period 79% of the diet consisted of only three species: flax (32%), floating sweetgrass (29%) and tall fescue (18%) (Fig. 1). Much smaller amounts of reed canary grass (5%) and chickweed (4%) were present in most samples. Because the data on monthly (seasonal) variation in cuticle area for these five major dietary species consisted of only one replicate, analysis of variance could not be used in the conventional manner to test the main factors "month" and "food species". The factor "month" (unlike "food", of which there are five nominal

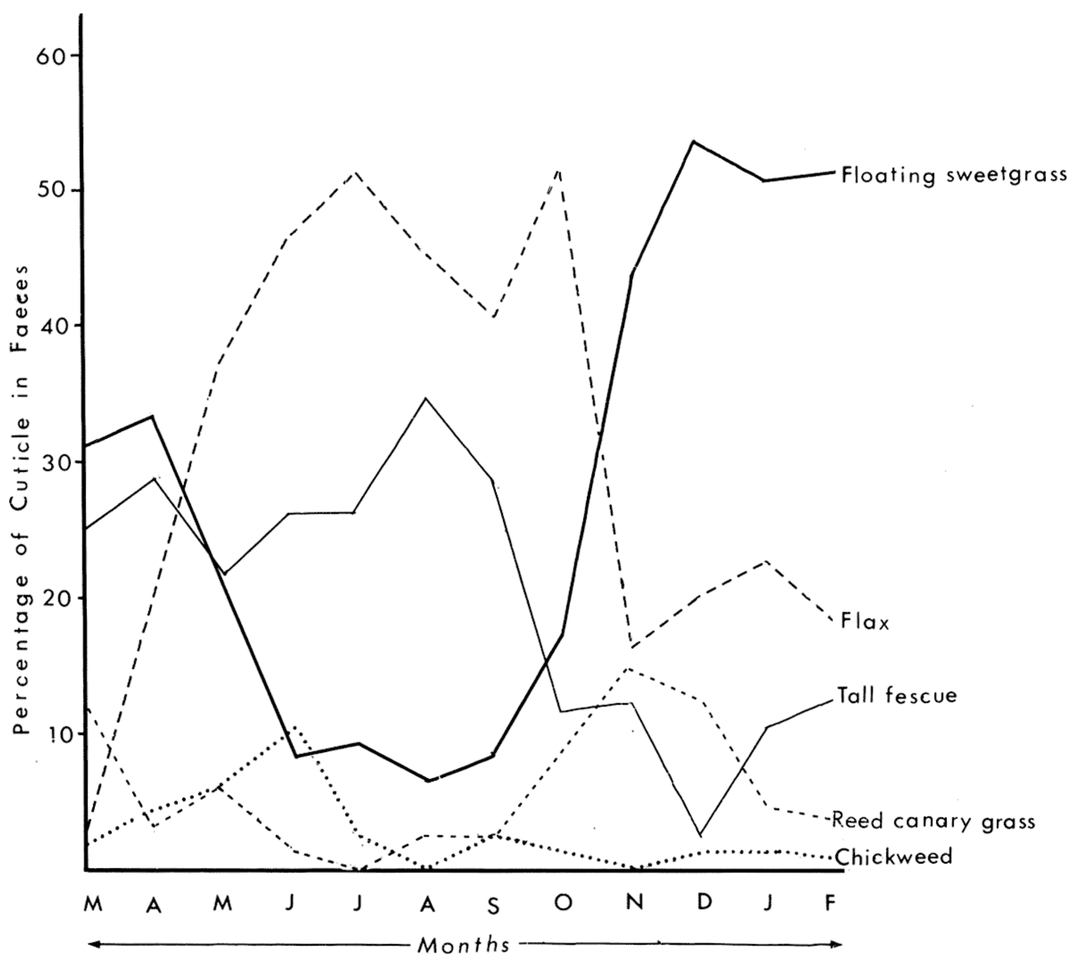

Figure 1: *Monthly variation* in *percentage of the five species occurring most frequently as cuticle fragments* in *faeces* (= *100* x *total cuticle area of species/total cuticle area of all species).*

categories) formed part of a repeated sequence. One might also expect the variable "cuticle" to cycle sinusoidally with "month". Therefore the interaction of the first order harmonic for "month" with the factor "food" was examined to determine whether each food showed the same seasonal pattern. Remaining deviations were assigned to the error stratum of the analysis. That is, we tested whether the diet composition of the animal changed significantly with season and the analysis indicated that it did ($F_{s.36}$= 8.00, $p < 0.001$).

Among the five plant species all continuously present in the area, flax and taIl fescue were favoured in the wetter months (March-October) and floating sweetgrass and reed canary grass in the drier months (November-February) (Fig. 1). The winter proportion of floating sweet grass in faeces was approximately 10% and it was flax and tall fescue which comprised the bulk of the sample.

In terms of plant biomass in the area, that of flax probably exceeds that of the second most prominent species, tall fescue, by several orders of magnitude, and there is a much smaller amount still of floating sweet grass, especially in winter.

Nutritive values determined are presented in Table 1. In grasses, protein content was highest in autumn (April) and winter (August) and declined through spring and summer. ADF increased over summer while moisture content peaked in spring. In flax, protein content did not change appreciably throughout the year, whereas ADF peaked in autumn, was lowest in winter and increased over spring and summer. Energy content peaked in winter.

Table 1: *Seasonal Forage Quality. .**Quantity very small, no value determined.*

	April	August	November	February
Crude Protein Content (%) of Forage Species				
flax	5.8	6.4	6.7	6.5
Floating sweet grass	23.1	23.2	17.9	13.1
Reed canary grass	6.6	21.8	22.3	12.1
Tall fescue	13.9	17.1	15.2	12.6
Chickweed	19.4	25.3	19.6	**
Energy Content (Joules/g) of Forage Species				
flax	17982	18812	17769	17832
Floating sweet grass	18819	19437	19756	18945
Reed canary grass	17932	19060	19588	18289
Tall fescue	18719	18646	18958	18442
Chickweed	15892	17541	**	**
Acid Detergent Fibre Content (%) of Forage Species				
flax	34.7	21.9	23.9	26.2
floating sweet grass	21.8	22.1	32.1	33.8
Reed canary grass	33.3	20.7	27.3	32.8
Tall fescue	28.9	29.0	36.6	35.4
Chickweed	21.9	20.7	**	**
Water Content (%) of Forage Species				
flax	85.5	84.9	86.5	84.9
floating sweet grass	81.8	81.1	81.1	65.1
Reed canary grass	61.1	79.2	80.5	66.3
Tall fescue	74.5	76.7	79.1	65.5
Chickweed	92.9	92.6	90.0	**

Discussion

Analysis of cuticle remnants in faeces suggests that although proportions of forage species fluctuate seasonally, the same four consistently account for at least 95% of the diet of sambar at Moutoa.

There are unusual features about this deer population. It is smaIl yet is influenced neither by predators nor interspecific competitors and is only lightly hunted. It also exists in the midst of edible vegetation which is constantly present in superabundance. Whilst it is therefore inconceivable that there can ever be any shortage of forage in a quantitative sense, forage quality, generally regarded as better when fibre is low and protein and energy levels are high, is a different question. Comparing the values obtained in the study with those published for a variety of stock feeds for domestic cattle (Holmes and Wilson, 1984), it seems clear that the forage consumed in summer is of good quality. However, crude protein values for flax consistently rank among the lowest recorded by Holmes and Wilson yet this species may comprise up to 50% of the winter diet. It cannot be assumed that protein intake in winter is adequate simply because the animals are surrounded by ingestible forages, especially as floating sweet grass, potentially the best protein source, is barely available at this time of year. This species is known to be actively sought after by cattle (Hubbard, 1954), and although its biomass is still low in summer there is sufficient for deer to selectively graze it, to the extent that it forms half of the cuticular material in faeces.

A well documented response of East Africanherbivores to fluctuations in abundance or quality of forage, is to follow the most favourable feeding situation by migrating (Bell, 1971; Jarman and Sinclair, 1979). There is no evidence that Moutoa sam bar do this and we speculate that the dense cover is a powerful attraction. The strong affinity of the species for cover is well known (e.g. Brander, 1923; Donne, 1924; Cahalane, 1939) and this is confirmed locally by farmers (L. & R. Rowe, pers. comm. and D. McNeile, pers. comm.). More than 100 years ago

Powerscourt (1884) attributed the demise of his herd in Ireland to 'chilling' because the animals would not come out of the 'thickets' during the warmth of day time.

In conclusion, inadequacies in seasonal food quality have been reported as contributing to population limitation in grazing herbivores (e.g. Sinclair, 1977). It is possible that this constraint applies to Moutoa sambar, through the seasonal loss of high quality forage species and a resulting shift in diet to more abundant but lower quality vegetation.

Acknowledgements

For permission to work at Moutoa we thank Crown Lands officers particularly Mick Hunter, and for comments on drafts of the manuscript, especially on statistical approaches, assistance from Ed Minot and Martin Cleland has been much appreciated.

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