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Examination of Faeces for the Identification of Plant Species in the Diet of Cattle

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SUMMARY

A technique was previously developed for microscopic examination of plant material (Storr, G.M., 1961; Griffiths, M. and Barker, R. 1966) but has now been tested on plant species partly digested by the bovine digestive tract under Central Australian conditions. The analysis enables a basic identification of the major plant genera eaten by the particular animal. It is however difficult to distinguish between species within the genera of both grasses and forbs (dicotyledons). For a broad identification of plant material, a key differentiating the characteristics of the various species is essential.

INTRODUCTION

Identification of plants in the diet of both healthy animals and those apparently affected by their diets is not always readily obtained in the live animal. A method to determine the plant species consumed and an indication of the relative proportions therein may be advantageous on occasions for diagnostic purposes. Storr, (1961) reported a microscopic analysis of faeces as a technique for ascertaining components of the diet of herbivorous mammals. Later Talbot, and Talbot, (1963) described a successful method used for identification of plants in stomachs from wildebeest in western Masailand, East Africa. More recently Griffiths, M. and Barker, R. (1966) used a similar technique to determine the plants eaten by sheep and kangaroos grazing together in a paddock in south Western Queensland.

Occasionally veterinarians are called upon to diagnose cases of possible plant poisoning. As a diagnostic aid, an accurate determination of plant species eaten as seen by an examination of the affected animals faeces would be a valuable asset. This will include the identification of plant species that are not normally thought to be eaten by stock.

AIM OF THE PROJECT

The aim of this project was to evaluate microscopic examination of faecal plant material as a technique for identification of the major components of the diet of cattle in Central Australia.

PROCEDURE

The method is based on identification of patterns on the cuticle remaining after treatment of the plant faecal material with nitric acid, followed by hydrogen peroxide. The hydrogen peroxide is used to remove the discolouration of the sample. A stain of safranin and analine blue is used to highlight the important plant tissues. The procedure requires that no part of the plant is destroyed by the chemical agents since this will alter the microscopic characteristics including cuticle pattern, hairs, asters, silica cells and spines.

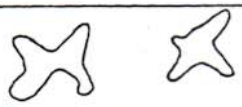
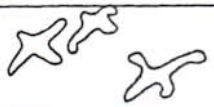
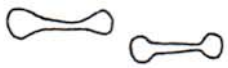
Chemical treatment. A known quantity (2) gm of faecal material is dissolved in (4) ml of concentrated nitric acid (HNO_3) in a water bath for two minutes. The residue plus 100 mls of distilled water is placed in a beaker and boiled. The suspension is then strained through a Gooch sintered crucible and placed in a 100 ml beaker with 25 mls of hydrogen peroxide (H_2O_2) 34% W/W and boiled to discolour the sample. The residue is then washed with distilled water and placed in a storage liquid. This storage liquid (formalin acetic alcohol) consists of:

85 parts - 70% ethyl alcohol
10 parts - 40% formaldehyde
5 parts glacial acetic acid

A safranin and analine blue stain is used to highlight the plant species characteristics (Gurr, E. 1965).

The descriptive terms used for the types of silica bodies and the associated plant species recognised are as follows.

(This identification or descriptive system does not imply that the characters have any taxanomic significance. They simply distinguish one plant from another).

DESCRIPTIVE TERM	ACTUAL SHAPE	PLANT SPECIES INCLUDED
Intermediate between cross and dumb-bell shaped		Enneapogan Panicum
Cross shaped		Dichanthium Panicum
Elongated dumb-bell shaped		Trioda Digitaria Themeda
Intermediate between cross and dumb-bell shaped		Digitaria Iseilema Triodia
Acutely angled		Digitaria Brachiaria
Dumb-bell shaped		Aristida
Saddle Shaped		Astrebla
Shortly dumb-bell shaped		Dichanthium Iseilema
Intermediate between cross and dumb-bell shaped		Eragostis Sporobolus
Star fish shape		Sida Abutilon Hibiscus
Nodular		Chrysopogan
Oryzoid (distinct from saddle shape)		Oryza
Honeycomb		Cucumis

These follow those summarised by Prat, H. (1948) and Clifford, H.T. and Watson, L. (1977).

Apart from these short cells and silica bodies, the presence of macro-hairs (which vary in length, frequency, thickness of cell wall, rigidity and straightness) and micro-hairs (smaller, one or two celled and often distorted or missing) enable the identification of the plant species.

RESULTS

The following plants were readily recognised according to the particular features of the silica bodies in the residue of the epidermis of each plant.

Aristida latifolia	-	distinctly dumb-bell shaped
Astrebla pectinata	-	saddle-shaped
Chrysopogan fallax	-	nodular
Cucumis mello var agrestis	-	honeycomb
Dactyloctenium radulans	-	saddle and cross
Dichanthium sericeum	-	cross
Digitaria ciliensis	-	cross and dumb-bell & inbetween
Enteropogan acicularis	-	saddle
Eriachne armittii	-	saddle
Enneapogan pollyphyus	-	cross and dumb-bell & inbetween
Eragrostis barrellieri	-	saddle
Eragrostis ciliaris	-	saddle
Iseilema vaginiflorum	-	inbetween cross & dumb-bell
Oryza australiense	-	oryzoid to shortly dumb-bell
Paspalum jubiflorum	-	distinct micro-hair - cross or dumb-bell or nodular
Panicum whitei	-	cross - dumb-bell or nodular
Rhyncosia minima	-	long thin hairs with two basal cells
Sida fibulifera	-	stars
Sporobolus australasicus	-	cross to dumb-bell
Themeda australis	-	cross to dumb-bell
Triodia pungens	-	cross to dumb-bell to nodular

DISCUSSION AND CONCLUSION

Monocotyledons are readily distinguished from the dicotyledons. The main criteria used in identification of dicotyledons are hairs, stomates and guard cell shape. With an understanding of both macro and micro hairs and the subsidiary cells, the various genera of grasses can be differentiated. A major failing of the system is the difficulty in distinguishing between species of grasses and species of dicotyledons within their genera.

However this procedure enables the identification of many of the grass and dicotyledonous genera being grazed by the bovine.

The technique can also be used for the examination of rumen content. This is easier than examining faeces and yields information also as to the relative amounts of the various plants eaten by the animal.

REFERENCES

Clifford, H.T. and Watson, L. (1977). Identifying Grasses. University of Queensland Press. St Lucia, Qld

Griffiths, M. and Barker, R. (1966). The Plants eaten by Sheep and by Kangaroos grazing together in a Paddock in South Western Queensland. CSIRO Wildl Res 1966 11 145-167

Gurr, E. (1965). The Rational Use of Dyes in Biology. Leonard Hill - London

Metcalfe, C.R. (1960). Anatomy of the Monocotyledons. The Claredon Press. Oxford

Prat, H. (1948). General Features of the epidermis in Zea Mays Ann Mo Bot Gdn 35 : 341-351

Storr, G.M. (1961). Microscopic analysis of Faeces, A Technique for ascertaining the diet of herbivorous Mammals. Aust J of Biol Sci 14 : 1 : Feb 1961 157-165

Talbot, L. and Talbot, M.H. (1963). The Wildebeest in Western Masailand, East Africa. Wildl Monogr Chestertown 12