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Acacia tree exudates: their composition and use as a food source by baboons

Many plants of the genus *Acacia* exude viscous gummy liquids through cuts in their bark. These exudates form clear or translucent masses when exposed to air and function to seal off the injured part of the plant thereby preventing moisture loss and entrance of plant pests or pathogens. Man has capitalized on several unique physical and rheological properties of acacia tree exudates. Gum arabica, for example, is an acacia tree exudate widely used in the food and drug industries. The chemical composition and physical properties of such commercially important acacia gums have been intensively studied (Glicksman, 1969). This note summarizes chemical analyses of the exudates of *Acacia xanthophloea* Benth. and *A. tortilis* (Forsk.) Hayne, two of the more common East African acacia trees.

Our interest in acacia tree exudates originated in the course of field studies of yellow baboons (*Papio cynocephalus* L.) in the Amboseli National Park, Kenya (Hausfater, 1975). Two acacia tree species predominate in the central portion of the Park: *A. xanthophloea*, the yellow-barked acacia or fever tree, is found around swamps and waterholes, *A. tortilis*, the umbrella tree, is found in drier areas and at slightly higher elevations. Baboons spent long periods of time feeding on the exudate of *A. xanthophloea*; in contrast, only a few instances of baboons feeding on the exudate of *A. tortilis* were recorded. Thus, analyses were undertaken to determine if some basic nutritional difference between exudates of these two species accounted for the pattern of selective feeding shown by Amboseli baboons.

A. xanthophloea exudes large quantities of a gum from cuts and holes in its bark. The gum is stored in a 2- to 6-cm broad band of tubules immediately beneath the outer photosynthetic layer of bark and is readily visible in cross-section in felled trees. The exudate is tasteless and odourless to humans and varies in colour from crystal clear through amber to a deep translucent reddish-brown; colour is determined by impurities or extraneous substances washed into the exudate, exposure to fire, and tannin incorporated from tissues of the parent tree (Glicksman, 1969). Exudate occurs as droplets, strands, dense nodules up to 15 cm in diameter, or as a broad layer coating the trunk.

Exudate of *A. tortilis* is usually found in much smaller quantities than that of *A. xanthophloea*. The colour is always a deep reddish brown, darkening with age. Exudate usually appears as a narrow longitudinal streak on trunk or branches, about $\frac{1}{2}$–1 m long and usually less than $\frac{1}{2}$ m wide; exudate also often builds up in the litter beneath the tree. To humans, *A. tortilis* exudate is odourless, but has a somewhat unpleasant taste. This fact, together with its low carbohydrate content (see below), suggests that it is a resin and may contain toxic compounds.

Exudate was collected from one or more positions on several trees of both species. Material from trees of the same species was then combined for analysis, including determination of moisture content, ash content, ash composition, and water and benzene solubility. Additionally, the water-soluble fraction from each species was

Table 1. Composition of the exudates of *Acacia xanthophloea* and *A. tortilis*. Figures given are percent by weight of original sample. The chromatography technique had a sensitivity of greater than 0·5 μg in a one cm diameter spot for the six constituent sugars investigated

					Constituent sugars					
Species	Water solubility	Benzene solubility	Ash	Total carbohydrates	D-galactose	D-arabinose	D-glucuronic acid	L-rhamnose	D-glucose	D-xylose
Acacia xanthophloea	77·4	< 1·0	1·6	> 50·0	20·0	25·0	present	present	not detected	not detected
Acacia tortilis	46·2	< 1·0	10·7	< 1·0	< 0·3	< 0·3	not detected	not detected	not detected	not detected

subjected to acid hydrolysis and the quantities of the resulting monosaccharides estimated by paper chromatography. Table 1 summarizes the results of these analyses.

Exudate from these two tree species showed the following important differences. *A. xanthophloea* exudate was substantially more water soluble than that of *A. tortilis* and contained over 50% (by weight) carbohydrates compared to less than 1% carbohydrates in *A. tortilis* exudate. *A. xanthophloea* exudate also had a much lower ash content than did *A. tortilis*. In both species the ash contained mostly inorganic sodium and potassium with traces of inorganic iron and aluminium as determined by simple qualitative analytical procedures. The exudate of *A. xanthophloea* is most likely a complex polysaccharide of variable structure containing at least four sugar constituents. It is potentially nutritious for baboons and other animals. The exact composition of *A. tortilis* exudate is still unknown, but the low solubility and apparently low carbohydrate content suggest that it is probably of little nutritional value to animals. Thus, the significant nutritional differences between the exudates of these two tree species probably explains the fact that Amboseli baboons fed almost exclusively on the exudate of *A. xanthophloea* and avoided the exudate of *A. tortilis*. The high carbohydrate content of *A. xanthophloea* exudate and the copious supply of gum stored just beneath the outer layer of bark may also explain selective feeding on this tree species by elephants at Tsavo National Park, Kenya, and in other areas of East Africa (Croze, 1974).

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