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Selectivity and Perceptiveness of Latex-Producing Plant Species as alternative forage for goats (*Capra hircus)* in Dong Community of Jos South, Jos, Plateau State

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Abstract

This study was carried out to ascertain the selectivity and perceptiveness of latex-producing plants as forage for goats in Dong community, Jos South. Purposive random sampling method was used to determine sites for data collection along settlement patterns targeting sub-locations. Quadrate size of 100 by 50 m(5000 m^2) was employed to determine plant species and goats were allowed to feed freely on these plants, 5 persons were assigned to monitor the bites, harmonized and submit data at the end of each expedition. Five (5) sites were habituated, species abundance was analysed using descriptive statistics such as Frequencies and percentages. Latex-producing plant samples were 15 out of 86 plant species collected from the five locations representing 17.4%. Latex producing plants eaten by goats were Ficus thonningii, Ficus trichopoda, Ficus elastic, Ficus sycomorus, Cascabela thevetia, Vitellaria paradoxa, Euphorbia hirta, Mangefera indica, Mannihot escalenta, Carica papaya, Carrisa edulis, Taraxacum officinale, Ipomoea batata, Cnidoscolus aconitifolius and Moriga oleiofera. Five (5) of the plants are more palatable as seen in the number of bites. Goats were noted to be very selective in their feeding habit by smelling the leave before they bite, if the leaves were novel, the goat might not bite the second time, but if it is unpalatable, the goat moves to the next plant, plant like Euphorbia hirta does not taste good to goats as a result, they eat little of it when the goats come across such plant. Some of the latex producing plants were eaten in small quantity as medicine, such as Cnidoscolius aconitifolius and Taraxacum officinale. Latex –producing plants are alternative to other forages of non latex-producing plants.

Key Words: Selectivity, Palatability, latex-producing plants, Forage, goats, Dong community, Jos South

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INTRODUCTION

Anthropogenic activities by humans are on the increase around settlements in Nigeria to bring food on the table of inhabitants (Papi and Onaji, 2019). So, plants are destroyed by large animals and construction work. The ruminants are not getting enough forages to feed on, as a result, there is the need to look inward for alternative resources that humans do not eat or compete with ruminants for it along food chain (Raghuvansi *et al*., 2007; Atiya *et al*., 2011).

Trees and shrubs forages form the integral part of ruminant feeds and use as components of diets in many countries. Forage trees, shrubs and weeds represent an enormous potential source of protein for ruminants in the tropics. Until recently, these feed resources have been generally ignored in the feeding systems for ruminants, mainly because of inadequate knowledge on various aspects of their potential use, as well as initiatives associated with the development of more innovative systems of feeding (Atiya *et al*., 2011).

Latex is not confined to plants with any one particular type of habit nor to plants from any particular type of habitat. It is to be found in herbs, including both xerophytic succulents and water plants, as well as in trees, shrubs, and lianas. Latex occurs in 12,500 species belonging to 900 genera. It is assumed that most of the lattices produced by this group of plants are poisonous to man, thus man detest touching and eating it as food (Walz *et al*., 2004; Konno, 2011).

Goats have the habit of selecting their feed carefully when eating and are considered to be agile feeders (Dumont *et al.,* 1995; Ngwa *et al.,* 2000). According to Steele (1996) goats are continuously searching for feed and are more satisfied when they have a whole range of different

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plants available including trees, shrubs and grasses. The anatomical characteristics of goats, small mouths and split upper lips, enable them to select even very small parts of a plant. Goats are characterized as generalized feeders since they adapt their choice according to what is available. However, goats are also considered to be very fastidious and even when having a very large selection to choose between, they will only consume the most nutritious feed available (Van Soest, 1991; Fajemisin *et al., 1996*).

Animal feeding behaviour has been the object of numerous studies and there are a number of explanatory theories regarding the principles of herbage selection by grazing animals (Dumont *et al., 1995*). Knowledge of feeding behaviour is of fundamental importance in management of pastures, especially with regard to the determination of opportune feeding strategies and the type and quantity of supplements to distribute (Fajemisin *et al., 1996*).

Throughout the tropics and especially in the humid regions, there exist a variety of feed resources. These include a variety of forages and abundant supplies of crop residues, agro-industrial by-products and also non-conventional feed resources. Among these, approximately 50 to 60% of the feeds produced are dry bulky roughages, mainly cereal straws and stovers. In Asia, the volume of production is increasing at about 3% annually. However, not all these feeds are put to maximum and efficient use. Inefficient utilization is identified with low levels of animal production in which the contribution from ruminants (buffaloes, cattle, goats and sheep) compared to non-ruminants is especially low (Devendra, 1990).

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The focus is on the latex plants that are consumed by herbivores animals, especially goats. In the traditional feeding systems in tropical countries, the native grasses, legumes and some foliages are the main feed resources for ruminants. Foliages from trees and shrubs are important feeds for grazing and browsing animals and often contain appreciable amounts of nutrients that are deficient in other feed resources (Komwihangilo *et al.,* 2001).

LITERATURE REVIEW

THE CONCEPT OF LATEX-PRODUCING PLANTS

Latex, a sticky substance that flows out of some plants upon injury, can be found in more than 20,000 species from some 40 families (Lewinsoln, 1991; Hunter, 1994; Bauer *et al*., 2014). It is stored in laticifers (specialized) cells or chains of cells containing latex (Fahn, 1979) and seals wounds as it coagulates when discharged. Besides the simple sealing of the wound, latex functions range from a plant defense system to the restoration of the mechanical properties of injured plants (Agrawal, 2009; Bauer & Speck, 2012). Not only the latices differ inter-specifically, in their colour and chemical composition (Agrawal, 2009), but also different types of laticifers can be found. Some species like *Hevea brasiliensis* are equipped with articulated laticifers that are composed of chains of cells joined together. Such chains can be unbranched (non-anastomosing) or laterally connected, thus forming a net-like structure (anastomosing).

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The laticifers of other plants like *Ficus benjamina* consist of only one single cell that forms elongated tubes (non-articulated laticifers) that are often branched (Dussourd & Denno, 1991). Thereby, the laticifers in the stems of most latex-bearing plants are most numerous close to the surface (e.g. the cortex), which is in accordance with the functions of the latex earlier, as this arrangement allows for an effective release of latex from injured plants. When considering these functions, also the time until the latex is completely coagulated (most latices then turn transparent) plays an important role. Whereas latex droplets of typical volume (about 10µl) of most latex-bearing plants coagulate within about 20–30 minutes, others (e.g. *Campanula glomerata*) may coagulate within less than two seconds (Bauer *et al*., 2010).

Most of the research on latex and latex-bearing plants has been conducted with regards to its use for the rubber processing industry. That is why mainly the latex of the Pará rubber tree (*Hevea brasiliensis*) has been examined in detail so far (D'Auzac *et al*., 1995). Other latex-bearing plants have mainly been examined because of their potential replacement of *Hevea brasiliensis* as a source of natural latex or to exploit new latex sources in regions where *Hevea brasiliensis* cannot be cultivated (Ulmann, 1951; Lewinsoln, 1991; Hunter, 1994; Bauer *et al.*, 2014).

However, there are many latex producing plants in Jos and its environs as observed by the researchers but the focus of this study is on the latex producing plants that are eaten by herbivores especially the goats. To this point, some latex-producing plants such as *Ficus* species

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(of different species), *Cascabela Thevetia, Mangifera Indica*, *Manihot eculatum*, *Euphorbia hirta,* (Papi and Mbaekwe, 2016).

Secondary Metabolites of latex-producing Plants

Rubber (*cis*-1, 4-polyisoprene) is a terpenoid found in the latex of many plant species, across some 300 genera and 8 plant families (Bushman *et al*., 2006; Mooibroek and Cornish, 2000).

The stickiness of latex may be caused by at least three factors:

(*a*) Elasticity of *cis*-polyisoprene,

(*b*) Coagulation of rubber particles, and

(*c*) Adhesiveness of rubber particles to the surfaces of insects.

The chemical compositions of latex are:

Alkaloids are basic natural products containing nitrogen, many of which are toxic and typically do not have a primary function in plants. Alkaloids are produced by a variety of animals, microorganisms and plants and have been reported from the latex of many species, sporadically distributed among angiosperm families, including Papaveraceae and Moraceae (Samanani *et al*., 2006 and Weid *et al*., 2004).

Latex of many plants in the Apocynaceae contains cardenolides and this range from trace amounts up to 30% dry mass of latex (Malcolm, 1991). Cardenolides have also convergently evolved in a few other plant families (e.g., Brassicaceae, Celastraceae, Fabaceae), but in these cases they are not associated with latex (Groeneveld, 1999).

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Terpenoids are extremely diverse group of carbon-based compounds that are derived from five-carbon isoprene units. Terpenoids are likely to have many functions in plants, including pollinator attraction, defense, and roles in primary metabolisms (Mazoir *et al*., 2008).

Phenolics are huge group of multifunctional carbon-based secondary metabolites produced by the Shikimate pathway that includes tannins, lignins and flavonoids. Latex of the sweet potato, *Ipomoea batatas* (Convolvulaceae) contains high concentrations of hexadecyl, octadecyl, and eicosyl esters of *p*-coumaric acids (Snook, 1994).

Proteases are enzymes that cleave protein and are found in all living organisms. Various types of proteases are found from latex of plants belonging to diverse phylogenetic clades. The latex-like resin exudates of mango, *Mangifera indica* (Anacardiaceae), contain both serine and cysteine proteases (Pechan *et al*., 2000).

Protease inhibitors are thought to function as anti-nutritive secondary metabolites by binding to proteases and preventing the digestion of protein. Trypsin (serine protease) inhibitors are found in latex of *Carica papaya* (Azarkan *et al*., 2004; Zhu-Salzman *et al*., 2008).

Lectins are carbohydrate-binding proteins that have affinity with specific sugar moieties, which often have toxic activities against animals including insects. Several types of lectins have been found in latex from Euphorbiaceae, Moraceae, Apocynaceae, and phloem sap from Cucurbitaceae. Chitin-binding proteins with hevein-like domains, such as the wheat germ lectin, are toxic and inhibit the synthesis of the insect gut peritrophic membrane (Hopkins and Harper, 2001).

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Chitinases, these are enzymes that degrade chitin (important components of insects' gut peritrophic membrane) widely found in plant latex from several plant families including Caricaceae, Moraceae, and Euphorbiaceae. Because chitin is the major constituent of the cell wall of fungi, so the enzyme is destructive to fungi, as a result, it is reasonable to assume that chitinases protect the leaves from infection by pathogenic fungi as well (Azarkan *et al*., 2004; Kabir *et al*., 2006; Lawrence and Novak, 2006).

Polyphenol oxidase (PPO) and peroxidase (POD) are common plant oxidases reported from Euphorbiaceae, Moraceae, and Anacardiaceae (Saby *et al*., 2003). PPOs and some PODs are regarded as plant anti-herbivore defense proteins, because they oxidize mono- or di-hydroxyphenolics that are ultimately converted in *o*-quinones, which then covalently bind to amino acids such as cysteine and lysine, making them inaccessible, and decrease the nutritive value of leaf protein (Walz *et al*., 2004).

In addition some latex, proteins are confined to specific plant taxa and have been suggested to be involved in plant defense. These compounds include phosphatase in Euphorbiaceae. Lipase in Caricaceae, Euphorbiaceae, Apocynaceae, glutaminyl cyclase in Caricaceae (Papaya) (Azarkan *et al*., 2004) and gum arabic glycoprotein, a high-molecular-weight, hydroxyproline-rich arabinogalactan-protein found from exudates of *Acacia senegal* (Fabaceae) (Goodrum *et al*., 2000).

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MATERIALS AND METHODS

Description of the Study Area

The study took place in Dong community in Jos North LGA. The area covers about 927m X 891m (825,957m^2), the area in Jos Metropolis bordered with Kabong to the North, Wild Life Park to the East, Jos South LGA to the South, and Bassa LGA to the West. The area is 1,238 metres above sea level.

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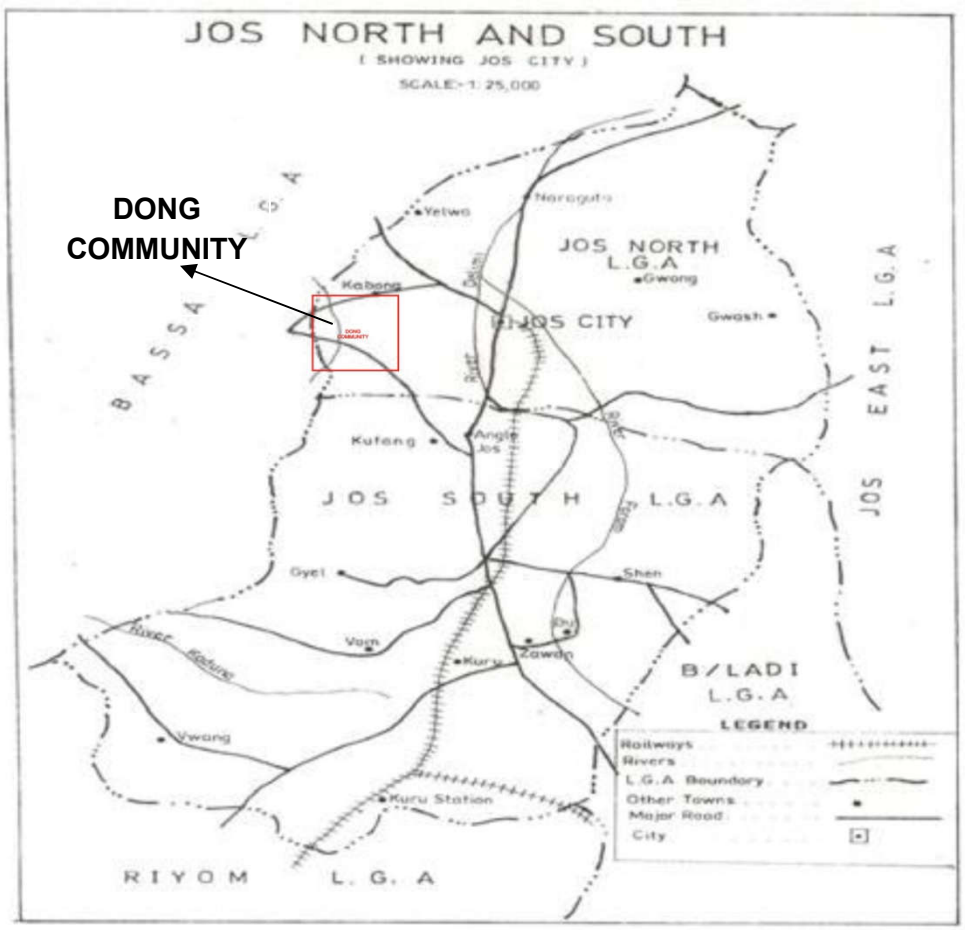

Figure 1 Map of Dong Community in Jos Metropolis

Source: www.researchgate.net, accessed November 2021

Sampling Method and Procedure

Purposive random sampling method was used to determine sites for data collection along settlement patterns targeting sub-locations in Dong community. Samples were collected from five locations for the study namely the Northern, Eastern, Western, Central and Southern parts of

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Dong community to cover various sites and to obtain a dependable data. Five (5) goats were took out the goats for 1 hour for 5 days to feed on plant parts for data collection, that is we visited each quadrate five times. Records of bites were taken by 5 research assistants. After the 1 hour of being on the field, the goats are allowed to feed freely on any plant parts they come across.

Sample Size

Quadrate size of 100 by 50 meters was determined and the goats were allowed to feed and 5 persons were detailed to monitor the bites and at the end of the exercise, the data were harmonized. Records were taken five times in each plot or quadrate.

Methods for Data Collection

The 5 goats were reared within the plots or quadrate sites demarcated to collect data of bites on the different plant species. The bites actually differ with plant species and the number of the bite depends on how hungry the goats are and palatability of the plant species. Goats are very selective in their bites by smelling the plant parts before the biting, so that they do not bite the plant parts could be harmful to them immediately or later.

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Data Analysis

Species abundance was analysed using descriptive statistics such as frequencies and percentages, Cross tabulations were used to summarize categorized data and creation of contingency tables.

RESULTS

Latex plants were collected and documented in Dong community, Jos South Local Government Area. The options are presented on simple percentage tabulation for proper understanding and accompanied with interpretation and narration therein. A total of 15 latex producing plant species were collected and documented.

A sample of 15 out of 86 species from the five locations were used in representing 17.4%

Table 1: Distribution of sample Plant species in the study area

Location	Total Number of plant Species	Number of latex producing plant species
1	16	2
2	13	3
3	22	2
4	18	2
5	17	5
Total	86	15

Table 1; depicts the total number of plant species in the quadrates determined and the number of latex producing plants recorded during the survey.

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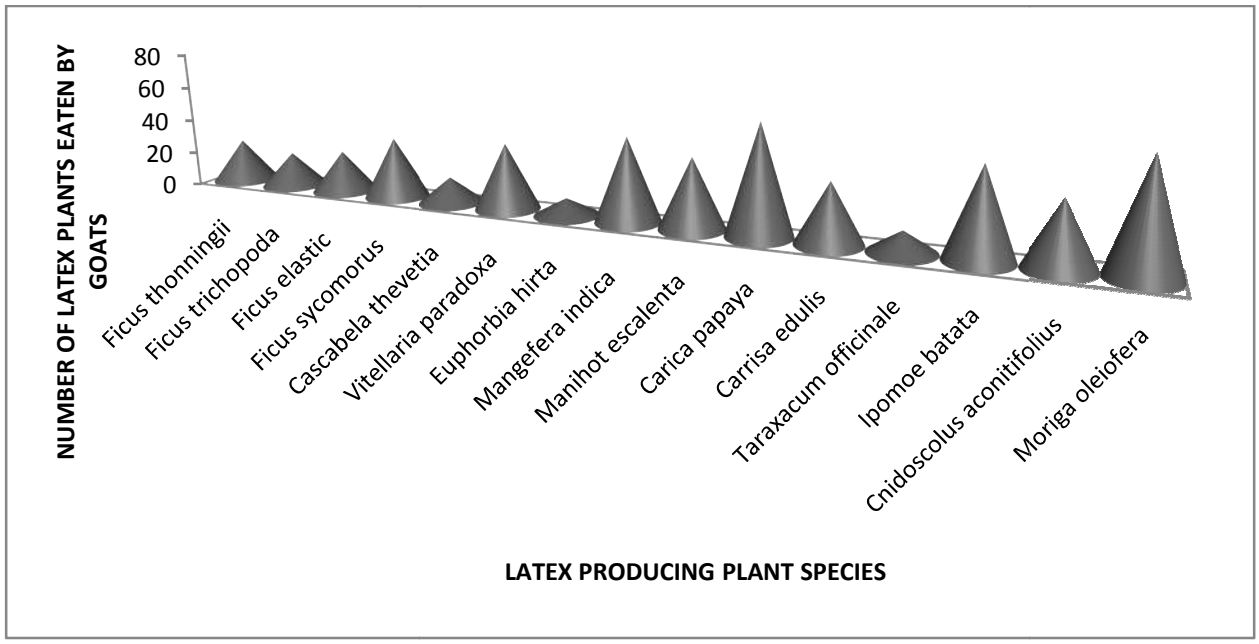

Figure 1 shows the habits of the plants and the number of bites by the goats in 5 days that the goats were taken out to feed on latex producing plants.

DISCUSSION

Latex-producing plants eaten by goats in Dong community were *Ficus thonningii, Ficus trichopoda, Ficus elastic, Ficus sycomorus, Cascabela thevetia, Vitellaria paradoxa, Euphorbia hirta, Mangefera indica, Manihot escalenta, Carica papaya, Carrisa edulis, Taraxacum officinale, Ipomoea batata, Cnidoscolus aconitifolius and Moriga oleiofera.* These are the plants that were available at the time of the research. These plants were common in residential areas and not seen at all in the wild due to anthropogenic activities of man, which is true that man have

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ravaged the vegetation of Nigeria by its activities (Papi and Onaji, 2019). These ones are more palatable and seen in the number of bites like *Carrica papaya, Moriga oleiofera, Ipomoea batata Moriga oleiofera.and Cnidoscolus aconitifolius*

Latex-producing plants exude latex that could be poisonous or harmful to man, animals and other plants in the habitants, but goats are highly selective in eating leaves from the clustered of plant parts. They select and cut the leaves with their incisors, then chew later because goats chew curd. They are capable of regurgitating the leaves they have eaten previously and chew properly again. It was observed that the goats do not eat much of latex producing plants at a particular time or to be stratify but they eat little as medicine to heal the several ailments, which is true of (Nasira *et al.,* 2011) who said that the chemical metabolites in latex producing plants are for defense

Apart from the latex producing plants mentioned earlier that are eaten by the goats, there are others latex-producing plants that exist in Dong community like Cactus, Pencil Plant, Candle plant, Opuntia and Cashew plant that are not eaten by goats even if they are hungry because they are poisonous and their morphological features are inundated with thorns and spines. The latex, thorns and spines are features that make eating or chewing the plant parts a problem for the goats.

Appetites of goats are controlled by the following factors namely;

1. Palatability of the plant parts. If plant parts or leaves is sweet, mint or aromatic in nature, the goats eat it or bites in large number.

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2. The health condition of the goats determine the number of bites, healthy ones eat more than the sick ones.

3. Hunger determines the bites a goat takes at a particular time, when they are brought out from the cage or dweller place, for example, If it is in the evening they are brought, they take many bites especially the latex producing plant that is more palatable e.g. *Moriga oleiofera*

4. Competition plays a vital role especially when the plant is palatable, the individual goat would want to eat much before the shepherd would want to chase them to their dwelling place. As a result, plants like *Moriga oleiofera* and *Cnidoscolus aconitifolius* are palatable and goats eat them in quantum.

5. Scarce food, when the goats are in number and the palatable plant parts are few in number, they rushed to the sites and eat it fast so that they are not left out or go hungry for some times before another meal will be provided.

Goats are very selective in their feeding by smelling the leave before they bite, if the leaves is novel, the goat might not bite again but move to the next plant and smell it too before it commences biting the plant like *Euphorbia hirta* is not palatable to goats because they eat little of it when the goats come across the plant.

Some of the latex-producing plants are eaten in small quantity as medicine for the goats, these plants are beneficially to the goats like *Cnidoscolius aconitifolius* and *Taraxacum officinale*. This

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is the reason why goats hardly fall sick. As a result, we should grow latex producing plants in homes and sometimes given to goats as alternative and advantage to non latex producing plants.

CONCLUSION

Goats do not eat latex-producing plants at the same rate they eat non latex-producing plants in large quantity, the reason is the poisonous nature of latex that comes out of the plants when injured. Some are eaten as medicine and the chemical metabolites in latex help to defend goats against ailments.

Selectivity and palatability of latex producing plants depend on the taste of the plant to the goats, hunger, and scarcity of the plants in the community, competition among the goats and the time the goats were taken out from their dwelling place to eat grasses for the day.

Let's feed our goats with latex-producing plants because of it's beneficiary aspect and it is alternative to other forages of non latex-producing plants.

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