

SECONDARY METABOLITES FROM PLANTS: A GROWING BENEFIT FOR LIVESTOCK

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ABSTRACT

Plants are being used for their therapeutic potential throughout history. This use has mostly concentrated on human health, but in ethnoveterinary practice and animal health management, plants have also been, and have always been, employed. The use of synthetic chemicals is becoming widespread in recent times. Public knowledge of the possible risks to the environment and health associated with heavy chemical use has also increased incredibly. This has placed pressure on regulatory bodies to reduce the agricultural use of chemicals. The most striking example is the European Union's 2006 ban on antibiotics for animal feed. Moves like this have accelerated the push to find alternatives to synthetic chemicals, and research has once again turned to the use of secondary metabolites from plants (SMP) as a way of enhancing animal health. Recent studies propose that there is major potential in the use of these SMP to enhance livestock health especially that of ruminants (sheep, cow, deer, etc) in particular. Some of these SMP include polyphenols, saponin, and tannin, which help in improving meat quality, milk and foam production, bloat control, reproductive efficiency, and methane production. Microbial and nematode control are also a major area of research and the evidence indicates that a much wider variety of SMP. This brief review gives a summary of SMP's importance of animal health and production.

Keywords: SMP, animal health, agriculture, polyphenols, and synthetic chemicals

INTRODUCTION

With tremendous structural diversity, plants contain an impressive array of organic constituents. Many of these secondary metabolites from plants (SMPs) are essential for the growth and development of plants and are primary sources of food for livestock. These SMPs are quite important both for the plants that produce them and for humans and animals who manipulated them in different ways (Breilmann *et al.*, 2006; Greathead, 2003). SMPs have, for decades, been used in human and animal medicine in different ways. Ethnopharmacognosy is an example of how indigenous peoples use plants for cures, and scientific knowledge has confirmed the remedies in many cases (e.g. artemisia for malaria, willow bark for fever (aspirin) (Bello *et al.*, 2017; 2018; 2018b; 2019; 2019b; 2019c). Nowadays, the animal production industries are heavily dependent on the use of pharmaceutical drugs and synthetic medicines. Many of these pharmaceuticals are been produced majorly for human health through intense research and development. SMPs are a new and recent source for new drugs and maybe new templates for pharmaceutical industries. Most of the antinematocidal, anticoccidial, antimicrobial, feed additive antibacterial, and endectocide drugs popularly employed in the livestock industries and market are SMPs or synthetics based on SMPs (Ruddock, 2000; Niderkorn *et al.*, 2021; Greathead, 2003). The bulk of the medicines made from SMPs have been authenticated in animal models, mostly rodents but ruminant animals have subsequently taken up many, e.g. the β -lactam antibiotics. Plants are vital for the nutrition of ruminants and their health, though they offer benefits beyond basic nutrition. For almost every aspect of ruminant production, the judicious use of these SMPs has great and untapped potential especially in developing nations like Nigeria; this is the core burden of this review.

Some SMPs for Animal Importance

Tannins

There are wrong and harmful generalizations about tannins that, are harmful or toxic to livestock especially ruminant animals. This is at variance with the fact that humans have relished this SMPs-type for many years in

drinks and foods (Caygill and Mueller-Harvey, 1999; Santos-Buelga and Scalbert, 2000; Mueller-Harvey, 2004). Many livestock feeds i.e. browse leaves, fruits, and fodder legumes contain tannins. Many of these feed i.e. species of *Acacia*, *Dichrostachys*, *Dorycnium*, *Hedysarum*, *Leucaena*, *Lotus*, *Onobrychis*, *Populus*, *Rumex*, and *Salix*, do give valuable benefits to ruminants, such as better animal health through inhibition of bloat and lower worm burdens (Foo *et al.*, 1996; 1997; McNeil *et al.*, 1998; Hedqvist *et al.*, 2000; Min *et al.*, 2003; Waghorn and McNabb, 2003; McWilliam *et al.*, 2004). The structural diversity of tannins is chemically varied and diverse, they have one unique and significant character; tannins bind easily to proteins. Tannins i.e. procyanidins (A, B2, B3, B5) (Figure 1) and prodelphinidins (Figure 1) are condensed tannin-types, they can be found in some species of *Calliandra* *Onobrychis* and *Lotus* and the ellagitannins (Figure 1) are hydrolyzable tannins which are usually found in the chestnut wood extract (*Castanea sativa* Mill.) are highly important and helpful as demonstrated by higher live weight gains or milk yields (Murdiati *et al.*, 1990; Sliwiansli *et al.*, 2002; Tuwei *et al.*, 2003)

Phenolics

Phenolics are an enormous community of over 8,000 complex compounds that are secondary metabolism products of plants. Both phenolic compounds include an aromatic ring in their chemical structure, with one or even more hydroxyl groups. Names such as flavonoids, tannins, oligomeric proanthocyanidins, and lignans are widely recognized phenolics. A fundamental characteristic of phenolics is their essential antioxidant function. Catechin, quercetin, epicatechin (Figure 1), and many others in this class of SMPs are known for animal gut health, such as anti-inflammatory or antimicrobial activity. The bioavailability of polyphenols has been verified in various reproductive organs, including brain reproductive centers (hypothalamus and hypophysis), testis, ovaries, uterus placenta, and fetus, confirming the capacity of polyphenols to move through the reproductive organs' various blood barriers and thus presumptively affect their physiological functions (Ly *et al.*, 2015; Woclawek-Potocka *et al.*, 2013; Sieniawska, 2015; Gessner *et al.*, 2017; Milojevic *et al.*, 2020).

Saponins

This is another important class of SMPs that display huge structural diversity. Saponins are an important class of terpene glycosides that have a composition of which can vary both in the core terpenoid (sterol derivatives to triterpenes) and also the number, type, and substitution pattern of the glycoside residues (Figure 1). They have numerous biological effects and some can demonstrate highly selective and potent biological activities. Pen *et al.*, (2006) carry out *in vitro* fermentation studied employing the fluid from the ruminal Holstein cows, the study shows saponin from *Yucca schidigera* extract (YSE) (**Figure 1**) reduced the methane production although saponin from *Quillaja saponaria* extract (QSE) (**Figure 1**) did not. Various studies have shown that this class of compound has various activities i.e. anthelmintic, nematocides, and others (Patra *et al.*, 2006; Pen *et al.*, 2006;

Githiori *et al.*, 2006).

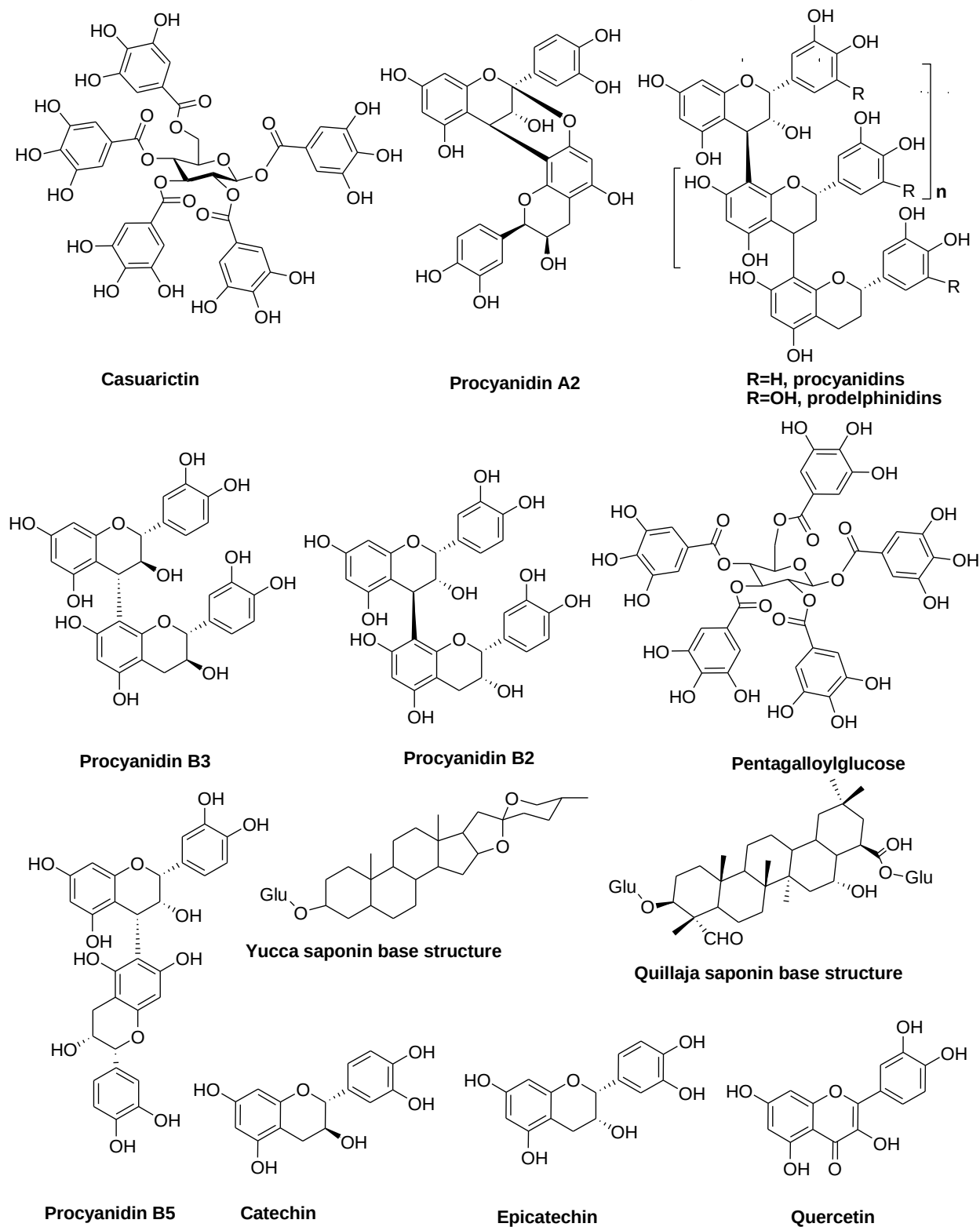


Figure 1: Some secondary metabolites from Plants (SMPs) of Animal Importance

CONCLUSION

The use of secondary metabolites from plants (SMPs) for animal health is a field of growing research interest and significance. Many of the researches done in this area especially on ruminant animals to date have targeted specific classes of these SMPs i.e. tannins, phenolics, and saponins. There have been many studies targeted towards ruminant animals, exploring the use of SMPs as nematocides. Though the focus has been on the effects of phenolic and its compounds, there have been SMPs of a different chemical class that has exhibited nematocidal and antibacterial activity signifying that this could be a lust field for research in the future. This review recommends that plants may indeed be beneficial for animal health as they contain SMPs of great health importance. Though, the review further highlights the need for more *in vivo* studies to validate these plants and their SMPs bioactivity.

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