Journal of Animal Husbandry and Dairy Science
Volume 3, Issue 1, 2019, PP 3-8
ISSN 2637-5354

The Potential Contribution of *Lantana Camara* to the Goat Nutrition: Review and Observation

GetachewWorku* and ZelekeTessema

Sirinka Agricultural Research Center (SARC), Amhara Regional Agricultural Research Institute (ARARI), Sirinka, Woldia, Ethiopia P.O.Box 74

***Corresponding Author:** GetachewWorku , Sirinka Agricultural Research Center (SARC), Amhara Regional Agricultural Research Institute (ARARI), Sirinka, Woldia, Ethiopia P.O.Box 74. Email: getaworkalebie@gmail.com*

ABSTRACT

Among African countries, Ethiopia takes the largest livestock population. Supplementary feeding is usually limited under smallholder livestock production systems due to their inaccessibility and high cost. To alleviate the difficulties related with the absence of dietary protein, there is a need to look for some alternative. One of such feed L. camarais a perennial small shrub which can grow up to around 2 m tall and can form dense thickets in a variety of environments. The aim of this review and observational study was to evaluate the nutritional composition of L. camaraleaf and grain as animal feed. The native range of L. camara is Central and South America; however it has become naturalized in around 60 tropical and sub-tropical countries worldwide. L. camara is known to be toxic to livestock. The active substances causing toxicity in grazing animals is pentacyclictriterpenoids which result in liver damage and photosensitive. Literatures recommend that further research is needed to determine the long term effects of L.camara on livestock. The leaf has crude protein (23.3%); Ash (15.7%), Dry matter (88%), crude fat (4.4%) and TDN (78.2%). The leaves are rich in nutrients such as the protein which can be used as a source of protein for animal diets. It is recommendable know the anti-nutritional factor and toxic level on different inclusion rate for different livestock species before feeding the animals. Standard feeding experiment is essential on the impact of L.camara leaves on body weight gain.

Keywords: *L. camara, feed, nutritional composition, leaves and grain, crude protein*

INTRODUCTION

Ethiopia has the leading livestock population among African countries and has diverse agro-ecological zones extending from semi-arid to arid environments (Gala, 2005).Shortage of feed and water in quality and quantity is among well-known production constraints along the value chain (Legese*et al.*, 2008). The production of feed covers requirements only in exceptional good years; the shortage reaching 35% in normal years and 70% in bad years (FAO, 2005).Animal feeding packages development can support the prevailing traditional production and the emerging private producers and exporter is the timely intervention to increase production and productivity, to achievement and live animal export market the demand (Asfaw*et al.*, 2011).Animal feeding shortage is aggravated throughout the dry season after natural pastures usually dry out and are overgrazed, resulting in low contents of protein and energy in the fodder. Consequence, huge flocks of productive livestock cannot be maintained on such low quality feeds to meet the basic maintenance requirements of the animals.

It is therefore important to supplement the major available fodder with some amount of concentrates in order to improve intake and digestibility of such poor quality feed resources. Nevertheless, the use of such supplementary feed is usually limited under smallholder livestock producer due to their inaccessibility and high cost. As a result, in order to mitigate the problems associated with the lack of dietary protein, there is a need to look for some alternative but cheap sources of protein. Previous works have reported that leaves of multipurpose trees growing in the backyards of the farmers can be used as a cheap source protein for supplementing livestock (Manaye *et al.*, 2009). Therefore, the aim of this review and observational study was to evaluate and assess the nutritional composition of *L. camara* leaf and grain as animal feed especially for goat due to the browsing feeding nature of the animal.

The Biology and Natural Habitat of L. Camara

*L. camara*is a perennial small shrub which can grow up to around 2 m tall and can form dense thickets in a variety of environments (Sharma, 1981). The native range of *L. camara* is Central and South America; however it has become naturalized in around 60 tropical and sub-tropical countries worldwide *(*Council, 2005; Sanders, 2012*)*. In East and South Africa it is found repeatedly where it happens at altitudes below 2000 m and often invades previously disturbed areas such as logged forests and areas cleared for agriculture (Gentle, 1974). In large areas of the Paleotropics *L.camara* is considered to be a weed where it has established itself. In agricultural areas or secondary forests it can become the dominant understory shrub, crowding out other native species and reducing biodiversity (Quentin*et al.*, 1995).

L. camara is rarely found in natural or semi-natural areas of forest as it is unable to compete with taller trees due to its lack of tolerance for shade (Quentine*et al.*, 1995).This weed is mainly disseminated by droppings of moving animal flocks/ birds, cutting and pollination (Ghazoul, 2002; Sharma *et al.*, 2007).There are many reasons why *L. camara* has remained so effective as an invasive species; though, the primary factors which have allowed it to establish itself are: Wide dispersal range made possible by birds and other animals which eat its drupes, less prone to being eaten by animals due to toxicity, tolerance of a wide range of environmental conditions (Quentin*et al*, 1995).

Habitat modification and increase in logging which has been helpful to *L.camara* as it prefers disturbed habitats. *L. camara* also excretes chemicals (allelopathic) which reduce the growth of surrounding plants by inhibiting germination and root elongation (Ahmed, 2007). *L. camara*have a potential to produce up to 12,000 seeds from a single plant per year (*"Weed Management Guide - Lantana").*One of the most important factor for the huge prevalence of this weed throughout world is it hasallelopathic or phytotoxic action which is due to the prevalence of lantadenes and phenolic compounds (methylcoumarin, umbelliferone, salicylic acid etc.) i.e. LA (lantadene A) and LB (lantadene B) (Ferguson and Rathinasabapathi, 2003).

Anti-Nutritional Factors of L. Camara

L.camara is known to be toxic to livestock such as cattle, sheep, horses, dogs and goats (Ross,1999,Burns,2001).The active substances causing toxicity in grazing animals is pentacyclictriterpenoids which result in liver damage and photosensitivy (Barceloux,2008). *L. camara* fruit poses no risk to humans and are in fact edible when ripe(Shaun*et al.*,2010).Toxic plants are of major concern to veterinarians because of their harmful effects to livestock in terms of causing mortality and reduction in productivity (Sharma *et al.*, 2007; Diaz, 2011).

Lantadenes are the most important toxic components present in this weedy plant. Lantadenes are pentacyclictriterpenes and often led to hepatotoxicity, photosensitization and jaundice. The lantadenes are mainly present in the leaves of this plant having varying toxic effects among different species and strains of mammals/livestock. The poisonous properties of this weed are manifest both in ruminants as well as in non-ruminants (Sharma*et al.*, 2007).

However, the severity of toxic effects caused by poisonous plants varies among species and depends upon the nature, part and amount of toxic component taken, environmental conditions, species, body condition, age and size of the animals (Sharma *et al.*, 2007). Among ruminants cattle, buffalo and sheep are highly susceptible, while goats are little resistant to lantadene toxicity (Sharma *et al.*, 1988; Sharma *et al.*, 2007). Male rats are often resistant to lantana toxicity because of the action of testosterones (Pass *et al.*, 1979; Pass *et al.*, 1985; Sharma *et al.*, 1992; Sharma *et al.*, 2007).

L. camara mostly attacks kidneys and liver of ruminant animals and leads to photo sensitization. In acute cases, the animals are died within 2-4 days. Lantadene toxicity study a dose dependent mortality was reported in sub-acute cases (Parimoo *etal.*, 2015). Lantadenes are also having effect on reproductive system, as found to interfere with the sperm count, daily sperm production, and sperm morphology (Sharma *et al.*, 2007).Along with the toxic effects to livestock, these invasive species are supposed to be the one of the major threat to biodiversity and ecosystem after habitat destruction (Zhang and Chen, 2011).

Literatures recommend that further research is needed to determine the long term effects of *L.camara* on livestock. The chemical constituent of the whole plant, essential oils and plant parts and are reported to be influenced by genetic, geographical, and seasonal factors as well as the developmental stages of the concerned plant, its parts/tissues (Haruna *et al.*, 2015) and the soil

type on which the plant grown. As long as the animal feed on *L.camara*leafs and grain and the plants avail as animal feed, it needs to be evaluated. Thus, the objectives of this study were to determine the nutritional composition of *L.camara* as animal feed.

Observation: Lantana Camara Leaf Hay Supplemented for Goat

The observation was conducted at Sirinka Agricultural Research Center, located in eastern Amhara region of Ethiopia (11˚45'00"N, 39˚36'36"E.) about 508 km north east of Addis Ababa at an altitude of 1850 m.a.s.l. *L. camara* leaves and grain were collected from the Sirinka Agricultural Research Center (SARC) from different plant stand. *L. camara* leaves and grains were harvested manually with hand, exposed for sun light to minimize its toxic effect and crushed to increase palatability and intake.

Samples were analyzed for DM by drying at 105 °C for 24 hour , ash by ignition in a muffle furnace at 600 °C for 6 h, CP by the Kjeldahl procedure (AOAC, 2006), and neutral detergent fiber (NDF) and acid detergent fiber (ADF) according to procedures of (Decruyenaere*et al.*, 2009).

Figure1. *L.camara leaf preparation for goat feed*

Two yearlings' intact male Central Highland goats were selected with 25 kg and 27 kg initial weight. Goats were allowed to graze/browse on natural pasture for 6:00 hours during the day time. During the night and when returned from grazing goats kept within the individual pen and supplemented 400 g/day. Goats randomly assigned to two levels of treatments and fed for 60 days: T1= Grazing/browsing+ 100% commercial concentrate and T2= Grazing/browsing+ 75% commercial concentrate + 25% *Lantana Camara* leaf hay.

Results of Observation

The results of the laboratory analysis of *L. camera* leaf and grain are shown on table 1. The leaf has crude protein (23.3%), Ash (15.7%), moisture (12%) and crude fat (4.4%). while grain also has crude protein (9.3%), Ash (7.8%) and moisture (11%).

Table1. *Nutritional composition of concentrate, L. camara leaf and grain*

Proximate indices	Leaf	Grain
Dry Matter	88	89
Ash (Mineral content)	15.7	7.8
Organic matter	84.3	92.2
Crud protein	23.3	9.3
Total digestible nutrient	78.2	45.3
Ether extract (crude fat)	4.4	*Nd*
Neutral detergent fiber(Cell wall constituents)	23.3	53.3
Acid detergent fiber	15.7	44.4
Acid detergent lignin	5.56	20

Nd: not detected,

Feed Intake and Growth Rate

Feed intake of goat supplemented with commercial concentrate only was 367.5g/day and intake for goat supplemented with *Lantana camara* hay and the commercial concentrate was 311.8 g/day (233.8 g concentrate and 77.95g lantana leaf hay). The growth rate of goat supplemented with concentrate and *Lantana camara* leaf hay was 130g/day whereas for goat fed with concentrate mix only ADG was 100g/day.

Carcass Characteristics and Organoleptic Test

The carcass weight was 14.2 and 14.8 kg for

goats supplemented with concentrate only and concentrate + *Lantna Camara* leaf hay respectively. The organoleptic test for some organs; liver and spleen was found to be normal for both groups. However, Necrosis in the kidney and inflammation of lung observed in goat fed with concentrate and *Lantana Camara* leaf hay.

DISCUSSION

The results of the present study indicated that a high level of protein in the leaf of L. camara and it could be used as a source of protein in animal diets and it can replace the conventional animal feed types. Today animal feed is becoming too expensive due to the limitation posed by protein source. This is because the conventional soybeans and groundnut are over-competed for man and his animals (Muhammad *et al.*, 2010).Therefore, this study revealed the level of protein in the leaf of L. camaraand compare favorably well with some proteinous plants such as cowpeas reported by (Agza*et al.*, 2012, Etana *et al.*,2013) who found that CP contents of cow pea samples were (20.33) and (23.9%), respectively. Pigeon pea (22.8 %), Sasbania (22.6 %) and Leucaena (22.2 %) (Devendra, 1992).

The proximate compositions of the *L.camara* leaf were compared with other research work with the same species. The result was comparable with (Haruna*et al.*, 2015) in moisture content, crude protein, crude fat,and ash content. Their result were(10.15 %), (24.84 %), (16.41 %), (2.99 %) and (10.77 %) respectively. And incomparable results were observed in CP with (*Chimsaet al., 2013) their result were 12.43% this is due to* the soils type difference and other environmental factors like rainfall. Their work was conducted in sandy-dry-loam with some alluvial nature. However,in this study, Sirinka has clay dominant vertisol. On the hand, there were comparable results in other parameters like DM (88.82%), Ash (12.63%), OM (89.60%) and ADL (6.0%) (*Chimsa1et al.,2013).*

Proximate compositions of the grain were lower than the leaves in moisture content (11%) and crude protein (9.3%). Conclude that feeding the leaves more nutritional than grain.The ash content is a reflection of the mineral contents preserved in the leaf; the crude fat will help provide energy while the moisture content will reflect shelf-life of the plant (Haruna *et al.*, 2015).The ether extract is an indicator of the energy measure of the feed.

According to (Haruna *et al.*, 2015), Anti-nutrient content of *lantana camara* leaf were identified inconsiderable amount of Phytate, Tannins and Oxalate. The existence of the anti-nutrients which are known to have various deleterious effects, ranging from reduction in feed intake, reduction in bioavailability of minerals to causing death of animals (Butler, 1989; Butler, 1992;Giner-Chavez, 1996; Reed, 1995;Osagie and Eka, 1998) is an indication of the limitation of the use of the leaf as protein source in animal diets. Hence, for *L. camara* to be used as a source of protein and minerals in animal diets, it may therefore be necessary that the plant be subjected to processing techniques. This will either reduce or eliminate its anti-nutritional factors (Haruna *et al.*, 2015).

CONCLUSION

The result of the current study indicates that *L.camara* leaf is rich in nutrients such as a protein which can be used as a source of protein for animal diets. *L. camara*leaf has more feed value than its grain. However, due to its invasiveness and allelopathic effect on potential indigenous forage and forest species resources in addition to crop land, the devastation of *L. camara*is our first and must option. Using as animal feed especially for goat (as their nature of feeding is browsing) is the way to eradicate *L. camara*. It is recommendable know the anti-nutritional factor andtoxic level on different inclusion rate for different livestock species before feeding the animals. Standard feeding trial is essential on the impact on body weight gain.

ACKNOWLEDGMENT

We are thankful to Sirinka Agriculture Research Center for the successful completion of this research work. We would like to express our appreciation to the Livestock research directorate for the facilities provided during this investigation. The animal nutrition laboratory workers of DebreBirhan Agricultural Research Center are also acknowledged for their support in the chemical analysis of the feed samples.

REFERENCE

[1] Agza B, Kasa B, Zewdu S, Aklilu E, Alemu F. Animal feed potential and adaptability of some cowpea (Vignaunguiculata) varieties in North West lowlands of Ethiopia. Wudpecker J. Agri. Res. 2012;1(11):478-83.

[2] Ahmed R, Uddin MB, Khan MA, Mukul SA, Hossain MK. Allelopathic effects of Lantana camara on germination and growth behavior of

some agricultural crops in Bangladesh. Journal of Forestry Research. 2007 Dec 1;18(4):301-4.

[3] AOAC, 1990. In Official Methods of Analysis. Association of Official Analytical Chemists.15th edition. Washington, D.C; 22-45

[4] Asfaw N, Shahidur R, Berhanu G. Livestock production and marketing. Development Strategy and Governance Division, International Food Policy Research Institute–Ethiopia Strategy Support Program II, Working. 2011;26:40.

[5] Barceloux DG, 2008. Medical Toxicology of Natural Substances: Foods, Fungi, Medicinal Herbs, Plants, and Venomous Animals. Wiley. pp. 867–8. ISBN 978-0-471-72761-3.

[6] Burns D, editor. Storey's Horse-lover's Encyclopedia: An English & Western A-to-Z Guide. Storey Books; 2001.

[7] Butler LG. Effects of condensed tannin on animal nutrition. InChemistry and significance of condensed tannins 1989 (pp. 391-402). Springer, Boston, MA.

[8] Butler LG. Antinutritional effects of condensed and hydrolyzable tannins. InPlant polyphenols 1992 (pp. 693-698). Springer, Boston, MA.

[9] Carstairs SD, Luk JY, Tomaszewski CA, Cantrell FL. Ingestion of Lantana camara is not associated with significant effects in children. Pediatrics. 2010 Oct 26:peds-2010.

[10] Chimsa MB, Mummed YY, Kurtu MY, Leta MU, Hassen A, Gemeda BS. Forage preference of camel calves (Camelusdromedarius) in easten Ethiopia. Pakistan Agricultural Scientists Forum.

[11] Council FE. Florida Exotic Pest Plant Council: Lantana camanara. Florida Exotic Pest Plant Council. 2005.

[12] Devendra C. Nutritional potential of fodder trees and shrubs as protein sources in ruminant nutrition. Legume trees and other fodder trees as protein sources for livestock. 1992;100:95-113.

[13] Diaz GJ. Toxic plants of veterinary and agricultural interest in Colombia. International Journal of Poisonous Plants Research. 2011;1:1-9.

[14] Etana A, Tadesse E, Mengistu A, Hassen A. Advanced evaluation of cowpea (Vignaunguiculata) accessions for fodder production in the central rift valley of Ethiopia. Journal of Agricultural Extension and Rural Development. 2013 Mar 31;5(3):55-61.

[15] FAO, 2005. Legume trees and other Fodder Trees as protein sources for Livestock. Food and Agriculture of the United Nations Animal Production Health. pp. 95-108.

[16] Ferguson JJ, Rathinasabapathi B. Allelopathy: How plants suppress other plants. University of Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, EDIS; 2003.

[17] Gala S, 2005. Biodiversity in goats. *Small ruminant Research*, 60, 75–81.

[18] Gentle CB, Duggin JA. Lantana camara L. invasions in dry rainforest-open forest ecotones: The role of disturbances associated with fire and cattle grazing. Australian Journal of Ecology. 1997 Sep;22(3):298-306.

[19] Ghazoul J. Flowers at the front line of invasion?. Ecological entomology. 2002 Oct;27(5):638-40.

[20] Giner-Chavez BI 1996. Condensed tannins in tropical forages. Ph.D Thesis, Cornell University, Ithaca, NY, USA; 24-35.

[21] Haruna SS, Ahmed O, Titilayo JO. Nutritional and anti-nutritional composition of Lantana camara leaf. J. Investig. Biochem. 2015;4:58-60.

[22] Legese G, Teklewold H, Alemu D, Negassa A. Live animal and meat export value chains for selected areas in Ethiopia: Constraints and opportunities for enhancing meat exports.

[23] Manaye T, Tolera A, Zewdu T. Feed intake, digestibility and body weight gain of sheep fed Napier grass mixed with different levels of Sesbaniasesban. Livestock Science. 2009 May 1;122(1):24-9.

[24] Muhammad NO, Jimoh FO, Nafiu MO, Oloyede OB, Salawu MO. Nutrients and antinutrients analysis of Albizialebbeck seed. Bioresource Bulletin. 2010;4:161-5.

[25] Osagie A U, and Eka OU, 1998. Nutritional quality of plant foods.

[26] Parimoo HA, Sharma R, Patil RD, Patial V. Sub-acute toxicity of lantadenes isolated from Lantana camara leaves in Guinea pig animal model. Comparative Clinical Pathology. 2015 Nov 1;24(6):1541-52.

[27] Pass MA, Findlay L, Pugh MW, Seawright AA. Toxicity of reduced lantadene A (22β-angeloyloxyoleanolic acid) in the rat. Toxicology and applied pharmacology. 1979 Dec 1;51(3):515-21.

[28] Pass MA, Pollitt S, Goosem MW, McSweeney CS. The pathogenesis of lantana poisoning. Queensland poisonous plants committee, Yeerongpilly, Australia. Plant Toxicol. 1985:487-94.

[29] Quentin CB, Cronkand Janice LF, 1995. Plant Invaders: The Threat to Natural Ecosystems. Royal Botanic Gardens, Kew: Springer. ISBN 0-412-48380-7.

[30] Reed JD. Nutritional toxicology of tannins and related polyphenols in forage legumes. Journal of animal science. 1995 May 1;73(5):1516-28.

[31] Ross IA, 1999. Medicinal plants of the world (PDF). Humana Press. p. 187.

[32] Sanders RW. Taxonomy of lantana sect. Lantana (verbenaceae): ii. Taxonomic revision. Journal of the Botanical Research Institute of Texas. 2012 Nov 23:403-41.

[33] Sharma IN, Singh AK, Singh SP. Allelopathic potential of some plant substances as anti-feedant against insect pests of jute. InProceedings. First National Symposium. Allelopathy in agroecosystems (agriculture & forestry), February 12-14, 1992, held at CCS Haryana Agricultural University, Hisar-125 004, India. 1992 (pp. 166-168). Indian Society of Allelopathy, CCS Haryana Agricultural University.

[34] Sharma OP, Makkar HP, Dawra RK. A review of the noxious plant Lantana camara. Toxicon. 1988 Jan 1;26(11):975-87.

[35] Sharma OP, Sharma S, Pattabhi V, Mahato SB, Sharma PD, 2007. A review of the hepatotoxic plant Lantana camara. Critical reviews in toxicology. 1;37(4):313-52.

[36] Sharma OP, 1981. A Review of the Toxicity of Lantana camara (Linn) in Animals. Clinical Toxicology. **18** (9): 1077–1094. doi:10.3109/15563658108990337.

[37] Zhang W, Chen B. Environment patterns and influential factors of biological invasions: a worldwide survey. Proceedings of the International Academy of Ecology and Environmental Sciences. 2011 May 1;1(1):1.

Citation: *GetachewWorku and ZelekeTessema." The Potential Contribution of Lantana Camara to the Goat Nutrition: Review and Observation" Journal of Animal Husbandry and Dairy Science, 3(1), pp 3-8.*