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RESEARCH ARTICLE

Kalidudhi & Rohituka as probabilistic feed material

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Abstract

The nutritional constituents of the plants were determined using spectroscopic, calorimetric, flame photometric, chemical assay methods. Two lots of each plant in duplicate were evaluated for the parameters protein, fiber, fat, carbohydrate, vitamin C, energy value, calcium, phosphorus etc. *Ichnocarpus frutescens* (Kalidudhi) was found to contain protein content 4.0 – 6.42 %, fiber 49.19 – 62.99 %, carbohydrate 9.78 – 10.98 %, calcium 1.59 – 1.93 % & energy 3254.45 – 3386.21 Kcal/100g, whereas *Aphanamixis polystachya* (Rohituka) *has* the protein content 1.51 – 2.42 %, fiber 38.73 – 46.46 % , carbohydrate 10.76 – 14.18 % , calcium 2.33 – 3.62% & energy 3397.9 – 3553.5 Kcal/100g.

INTRODUCTION

Plants, the oldest friends of mankind, not only provide food and shelter but also serve humanity by preventing and curing different ailments. Apart from bioactive molecules they synthesize many compounds called primary metabolites that are critical to their existence. These include proteins, fats, and carbohydrates that serve a variety of purposes indispensable for sustenance and reproduction, not only for the plants themselves, but also for animals that feed on them. Most animals, including humans, have adapted over millions of years to a regular diet of plants which are used in animal feed as the nutritional supplements. Because of the global demand for grains which has exceeded the production and stiff competition between man and the livestock industry for existing food and feed materials which is primarily used to meet animals' needs, for example for energy, nutrients, minerals or dietary fibers, the interest in search for alternative/additional food and feed ingredients is of paramount importance.

There are a number of under-utilized plants adapted to local, harsh conditions available today that have tremendous potential as livestock feed. Pharmacological activity and phyto constituents of two medicinal plants i.e. *Ichnocarpus frutescens* (Kalidudhi) & *Aphanamixis polystachya* (Rohituka) persuaded us to evaluate their nutritional constituent which can possibly be used as feed material apart from imparting the medicinal values.

1. Ichnocarpus frutescens

English: Black creeper, Hindi: Kalidudhi, Sanskrit: Sariva, Syamalata, Family: Apocyanaceae

Botanical description – A large, evergreen, laticiferous, woody creeper with rusty red appearance, found almost throughout India, ascending upto an altitude of 4000 ft. Leaves are opposite, elliptic-oblong to broadly lanceolate, 1-4 in. x 0.5 – 2in., coriaceous, pubescent when young; flowers fragrant , greenish white or purplish, in axillary or terminal panicles of cymose clusters; follicles cylindrical, slender, usually two, divaricately placed; seeds 0.5 – 0.7 in. long slender, black , comose [1].

Distribution – Found throughout India usually up to an altitude of 4000 feet's also found in hedges in deciduous forests [2]

Parts used: stem, root.

Major chemical constituents: *α*-L-rhamnopyranosyl-(1→4)-*β*-D-glucopyranosyl-(1→3)-*α*-amyrin, 6, 8, 8-trimethylpentacosan-7-one, *α*-amyrin and its acetates, lupeol and its acetates, friedelin, epi-friedelinol and *β*-sitosterol from its stems. Its leaves mainly contain fla-vones and glycoflavones . ursolic acid acetate, kaemferol, kaemferol-3-galactoside (trifolin) and mannitol and its flowers contain quercetin and quercetin-3-*O*-*β*-D-glucopyranoside, where as *n*-butyl oleate, *n*-octyl tetracontane, tetratriacon-tadiene, *n*-nonadecanyl benzoate, benzocosanyl arachidate were reported from stems of the plant.

Plant is considered as a substitute for *Hemidesmus indicus* (Indian Sarsaparilla), this plant is used by tribes in atrophy, convulsions, cough, delirium, dysentery, measles, splenome-galy and tuberculosis. It is also used in abdominal and glandular tumors and its roots are used as alterative, anti-dysentric, antipyretic, demulcent, diaphoretic etc. [2].
Pharmacologically, various activities have been reported from this plant which include antiurolithiatic, hepatoprotective, anti-inflammatory, antipyretic, analgesic, antidiabetic, anticancer, antihyperlipidemic, and antioxidant [3]

2. Aphanamixis polystachya

English: Rohituka tree, Hindi: Harin hara, Sanskrit: Rohituka, Family: Maliaceae

Botanical description:
A large handsome evergreen tree, with a dense spreading crown and straight cylindrical bole up to 15 m in height and 1.5-1.8 m in grith, distributed in the sub himalayan track from Gonda (Uttar Pradesh) eastwards to Bengal, Sikkim and Assam west, in westerns ghats and the Andamans. Bark dark brown, rough, corky-cracked, cut reddish; leaves imparipinnated, 0.3-0.9 m long: leaflets 7.5-22.5 cm x 3.3-10.0 cm, elliptic or ovate; male flowers numerous, erect sub-globular in solitary axillary panicles; female in axillary or supra-axillary solitary spikes; fruits 2.5-3.8 cm in diam, globular, yellow when ripe; seeds oblong with scarlet aril, oily [4].

Distribution – A large evergreen tree, found up to 1200 m altitude, in the hilly regions almost throughout India, except the North and Northwestern parts.

Part used- Stem bark

Major chemical constituents: Amooranin, aphanamixinin, aphanamixin, aphanamixolin, aphanamixolide, aphananin, aphanamixol, amoorinin, prieurianin, β-sitosterol, stigmasterol,
dammer-(20:21)-ene-(24:25)-epoxy-3β-O-α-Lrhamnopyranosl-(1→4)-b-D-xylopyranoside, 1,5-dihydroxy-6,7,8-trimethoxy-2-methyl-3-O-β-Dxylopyranoside, naringenin 7,4'-dimethylether-5-O-α-Lrhamnopyranoside, poriferastrol-3-rhamnoside, betulin-3b-O-β-D-xylopyranoside, 8-C-methyl-5,7,3',4'-tetrahydroxyflavone-3-*O*-β-D-xylopyranoside, fatty acids, tannins, aphanamixin, tetra nortriterpene,aphanamixinin, aphanamixol, rohitukin, polystachin etc. [5]

The plant was studied in most of the world because of its high potential medicinal value. It is widely used in traditional medicine for the variety of ailments like anthelmentic, hepatoprotective, antimicrobial, antirheumatism and spleen diseases.

The nutrient contents of the plants were evaluated and are summarized in Table 1.

MATERIAL AND METHOD:

Apparatus: Kjeldahl assembly was used for the estimation of proteins, UV absorbance was taken on SHIMADZU-1700 UV VIS spectrophotometer, and sodium was evaluated on Harrison's flame photometer.

Reagents & material: Chemicals and reagents used were of analytical reagent grade. Petroleum ether, chloroform, HPLC water and ammonia solution, sodium hydroxide, potassium hydroxide & potassium thiocyanate were from RANKEM. Sulphuric acid, citric acid & hydrochloric acid were of SD fine chemicals**.** Ferrous sulphate was from

HIMEDIA, potassium persulphate was from JT Baker, sodium diethyldithiocarbamte was from Sigma Aldrich. Other chemicals used were of AR grade and procured from authentic sources.

Methodology for the estimation of Fat:
Defat the sample with petroleum ether (60-80°**C**), Transfer the filtrate to a tared petridish portion wise and evaporate to dryness on a boiling water bath. Cool the petridish in desiccator and weigh. The extractive value is calculated as a percentage [6].

$$\text{Crude fat (\% w/w)} = \frac{\text{Weight of residue in g}}{\text{Weight of sample in g}} \times 100$$

Methodology for the estimation of Crude fibre:
Defat the sample with petroleum ether (60-80° C), reflux the marc sequentially in 0.255 N H_2SO_4 and 0.313 M NaOH. Washwith 1.25 % H_2SO_4, Water and ethyl alcohol. Dry and ignite the residue in silica crucible at 600 °C for 30 minutes .Cool the crucible in a dessicator and weigh for a constant weight and carry out the calculations [7].

$$\text{Crude fibre (\% w/w)} = \frac{(W2 - W1) - (W3 - W1)}{\text{Weight of sample in g}} \times 100$$

Methodology for the estimation of Protein:
Digest the sample with potassium sulphate and copper sulphate in 9:1 ratio in a digestion tube using concentrated H_2SO_4 at 400 °C for 35 minutes. Adjust the digestion tube on VELP-scientifica, UDK-152 automatic protein analyzer and select the previously designed method . Instrument takes up the known volume of NaOH solution in digestion tube, boric acid solution with indicators methyl red & bromocresol green in titration vessel and starts distilling the free ammonia which it titrates against 0.1N hydrochloric acid solution.
% age of Nitrogen & Protein – gets displayed on VELP machine display board after the completion of analysis.

Methodology for the estimation of Ash:
Ignite a known amount of sample placed in silica crucible in a muffle furnace at 750 °C for 5 hours and cool. Weigh the crucible till constant weight and calculate the % age ash [8].

Methodology for the estimation of Carbohydrate:
Digest the sample with 2.5 N HCl. Develop the color using anthrone reagent and take absorbance at 630 nm using glucose as standard. Calculate the result using linear regression curve plot [9].

Methodology for the estimation of Calcium:
Digest the ash of accurately weighed sample with conc. HCL for 10 minutes and prepare the sample in HPLC grade water. Carry out the complexometric titration with EDTA using hydroxy naphthol blue indicator with color point pink to blue [10]

Methodology for the estimation of Phosphorus:
Digest the sample with sulphuric acid. Cool and add nitric acid, boil till colorless solution is obtained. Develop the color with molybdovanadate reagent and take optical densities. Calculate the result using linear regression curve plot [11].

Methodology for the estimation of Sodium:
Prepare the sample by dissolving it in HPLC grade water, filter the solution before subjecting to Flame photometer. Use analytical grade sodium chloride as standard. Calculate the result using linear regression curve plot [12]

Methodology for the estimation of Iron:
Iron in the herb is determined by converting the iron to ferric form using oxidizing agents like potassium persulphate and treating thereafter with potassium thiocyanate to form the red ferric thiocyanate which is measured cororimetrically at 480 nm [13].

Methodology for the estimation of Copper:
Copper is isolated and determined colorimetrically as copper diethyldithiocarbamate at pH 8.5 in the presence of EDTA as chelating agent. Copper reacts with sodium diethyldithiocarbamate in alkaline solution producing a yellow

to brown color depending on the amount of metal present. The color is soluble in organic solvents and is extracted from the aqueous solution using carbon tetrachloride and is measured colorimetrically [13].

Methodology for the estimation of Vitamin C:
Weigh accurately about 0.1 g of sample and dissolve in a mixture of 100 ml of freshly boiled and cooled water and 25 ml of 1 M sulphuric acid. Immediately titrate with 0.05 M iodine, using starch solution as indicator until persistent blue violet color is obtained [14].

Methodology for the estimation of Calorific value by bomb calorimeter:
Weigh accurately about 1.0 g of sample pellet in crucible. Place a Nichrome wire across the electrodes and tie a thread touching with sample pellet. Introduce 2 ml of water and charge he bomb with oxygen gas. Place the bomb in calorimeter vessel and make all the connections. Pour the measured quantity of water into the calorimeter and start the mixer. After 10 minutes of mixing, adjust the digital temperature meter to zero. Press the ignition button. Wait till the temperature raise to a constant value, record it.

$$CV = \frac{T \times W - (CVT + CV_W)}{M}$$

Where:
CV = calorific value of sample, T = temperature rise, W = water equivalent, CV_T = calorifica value of thread, CV_W = calorific value of ignition wire

RESULT & DISCUSSION:

Ichnocarpus frutescens & *Aphanamixis polystachya* are the plants known for their hepatoprotective, antiinflammtory, antipyretic, analgesic, antimicrobial, anthelmintics etc. activity. The nutritional contents of the two lots each of stem & stem bark of respective plant in duplicate were evaluated for the parameters protein, fiber, fat, carbohydrate, vitamin C, energy value, calcium, phosphorus etc. (Table 1).
Ichnocarpus frutescens has the protein content 4.0 – 6.42 %, fiber 49.19 – 62.99 %, carbohydrate 9.78 – 10.98 %, calcium 1.59 – 1.93 % & energy 3254.45 – 3386.21 Kcal/100g, whereas *Aphanamixis polystachya* has the protein content 1.51 – 2.42 %, fiber 38.73 – 46.46 % , carbohydrate 10.76 – 14.18 % , calcium 2.33 – 3.62 & energy 3397.9 – 3553.5 Kcal/100g

FIG. 1. *Ichnocarpus frutescens*

FIG. 2. *Aphanamixis polystachya*

TABLE 1: NUTRITIONAL CONSTITUENTS OF *ICHNOCARPUS FRUTESCENS* & *APHANAMIXIS POLYSTACHYA.*

CONSTITUENT	% (PERCENTAGE)	
	Ichnocarpus frutescens	***Aphanamixis polystachya***
Ash	4.03 – 4.76	5.78 – 7.21
Crude fibre	49.19 – 62.99	38.73 – 46.46
Protein	4.0 – 6.42	1.51 – 2.42
Fat	0.77 – 1.19	0.12 – 0.20
Carbohydrate	9.78 - 10.98	10.76 – 14.18
Food energy (Kcal/100g)	3254.45 – 3386.21	3397.9 – 3553.5
Calcium	1.59 – 1.93	2.33 – 3.62
Phosphorus	0.02 – 0.03	0.081 – 0.058
Sodium	0.09 – 0.13	0.045 - 0.060
Iron	0.0507 – 0.0593	0.015 - 0.0328
Copper	0.0186 – 0.0215	0.0154 – 0.0193
Vitamin C	0.076 – 0.089	0.085 – 0.096

CONCLUSION:

Both the plants have reasonable nutritional value in addition to the pharmacological efficacy. Further study in livestock as feed material in mixing with the regular fodder is needed to prove their nutritional efficacies and economical benefits.

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