DOI : 10.5958/2277-8934.2014.00017.4 *Vol 21 No 1, p 89-91*

SEA BUCKTHORN (*Hippophae rhamnoides*)- AN IMPORTANT FODDER FOR BACTRIAN CAMEL IN LADAKH REGION

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ABSTRACT

Hippophae rhamnoides, the sea-buckthorn or leh berry is a hardy, deciduous shrub with yellow or orange berries in the family Elaeagnaceae. It grows naturally in Ladakh region of Jammu and Kashmir and locally known as a *Tsermang or tasru*- wonder plant. It is mostly browsed by the bactrian camel in the Nubra valley of Ladakh. The nutritional, biochemical and anti-oxidant attributes of sea-buckthorn have been discussed.

Key words: Bactrian camel, *Hippophae rhamnoides*, Ladakh, sea-buckthorn

Hippophae rhamnoides, the sea-buckthorn is a hardy, deciduous shrub with yellow or orange berries in the family Elaeagnaceae. Sea-buckthorn grow naturally in Ladakh region (2300 to 5000 m above sea level) of Jammu and Kashmir and locally known as a *Tsermang or tasru*- wonder plant. It is also known as Leh-Berry. It grows on a wide range of soil conditions and is distributed wild over the four of the five valleys of Ladakh i.e. Nubra, Indus, Suru and Zanskar, in a large area. It can withstand temperatures from -40 to +40°C in Ladakh region (Bawa *et al,* 2002). It is usually spinescent, reaching 2 to 4 m in height. It has brown or black rough bark and a thick grayish-green crown. Leaves are alternate, narrow and lanceolate with a silver gray colour on the upper side. In ancient Greece, leaves of sea buckthorn added to horse fodder was well reputed to result in weight gain and shiny hairs, thus the latin name 'Hippophae' meaning shining horse (Lu, 1992). The plant is salt tolerant and can tolerate pH of 8.0 and salt spray (Bond, 1983). It is mostly browsed by the double humped or Bactrian camel (*Camelus bactrianus*) in the Nubra valley situated at 3000 to 3500 mtrs above sea level (Fig 1 and 2).

The biochemical and nutritional studies have revealed that fruit berries, seeds and leaves are important source of valuable nutrients and minerals (Jian-zhong and Xiao-feng, 2006 and Dhyani *et al,* 2007; Table 1 & 2). Sea buckthorn berries (Fig 2) are among the most nutritious and vitamin rich fruit known. The vitamin C and E contents are as high as 600 and 160 mg/ 100 g of fruits, respectively (Bernarth and Foldesi, 1992). Berries persist on the branches all winter due to the absence of an abscission layer and firm berry attachment to the fruiting branch (Li Thomas, 2002) and hence available to double hump camels in winter also. The sea buckthorn seeds extract was found to have antibacterial activity against *Bacillus cereus*, *Bacillus coagulans*, *Bacillus subtilis*, *Listeria monocytogenes, Yersinia enterocolitica* and reducing power and antioxidant activities suggesting the possible use of sea buckthorn seeds for medicinal uses and food preservation (Negi *et al,* 2005).

Exposure of organisms to hypoxia and cold stress, a situation which exists at high altitude, requires a higher rate of metabolism to cope up with increased energy demands.

Sea buckthorn is believed to be an important factor for the sustainability of double humped camel in high altitutde. Administration of sea buckthorn dry leaves aqueous lyophilised extract in single or five doses to rats was found to improve anaerobic generation of energy during C–H–R exposure (Trec 23°C) and post-stress recovery (Trec 37°C), enabling the organism to adapt successfully in such a severe stressful situation (Saggu and Kumar, 2007). Anti-oxidant potential of the sea buckthorn leaf extract was one of the factors observed for its adaptogenic activity (Saggu *et al,* 2007). Sea buckthorn leaves contain nutrients and bioactive substances. These include flavonoids 310 to 2100 mg/100 g air dried leaves (Chen *et al*, 1991), carotenoids, free and esterified

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sterols, triterpenols, and isoprenols (Goncharova and Glushenkova, 1996).

Alcoholic extracts of leaves and fruits of sea buckthorn at a concentration of 500 mg/ml were found to inhibit chromium-induced free radical production, apoptosis, DNA fragmentation and restored the anti-oxidant status to that of control lymphocyte cells. In addition, these extracts also were able to arrest the chromium-induced inhibition of lymphocyte proliferation. These observations suggest that the alcoholic extracts of leaves and fruits of sea buckthorn have marked cytoprotective properties, which could be attributed to the anti-oxidant activity (Geetha *et al,* 2002).

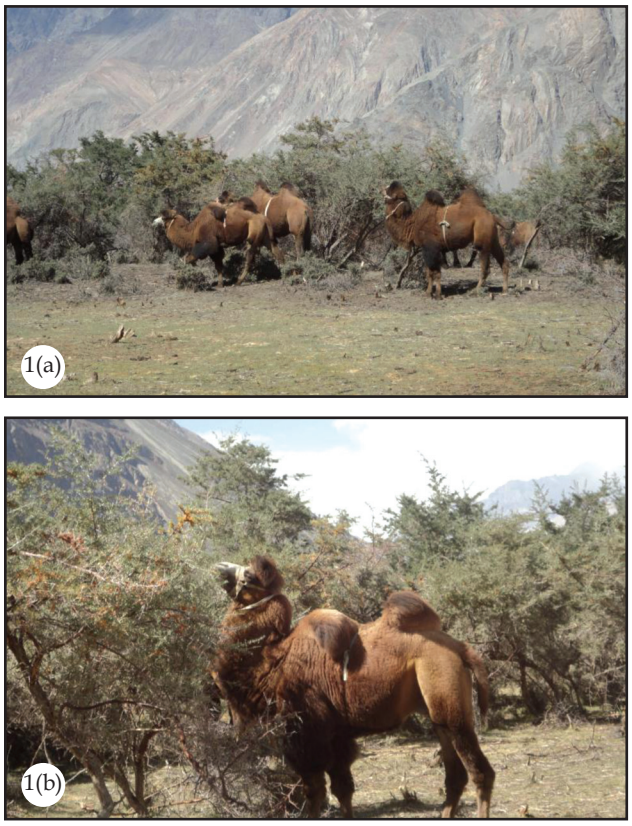

Fig 1. (a) and (b) Double humped camels browsing the Sea buckthorn (*Hippophae rhamnoides*) in Nubra valley.

The leaves of sea buckthorn contain many nutrients and bioactive substances such as *urtica diocia, vaccinium mytrilis* and *berberis vulgaris*, which are suitable for animal feed (Morar *et al,* 1990). Sea buckthorn leaves are rich source of proteins (20%), fat (4-5%) and other micronutrients comparable to Beri-pala (*Zizyphus nummularia* leaves), an important fodder of cattle and small ruminants in hot arid region (Table 1 & 2) and hence has potential of becoming nutritive fodder for cattle and sheep/goats of Ladakh region.

Sea buckthorn develops an extensive root system rapidly and is therefore an ideal plant for preventing soil erosion (Yao and Tigerstedt, 1994). It has been used in land reclamation for its ability to fix nitrogen and conserve other essential nutrients (Dobritsa and Novik, 1992). The plant spreads rapidly by rhizomatous roots and quickly colonises adjacent areas (Li Thomas and Schroeder, 1996). This can be an ideal plant for greenification of the Ladakh region.

Acknowledgement

The authors are thankful to Dr N.V. Patil, Director, National Research Centre on Camel for

Fig 2. Sea buckthorn (*Hippophae rhamnoides*) with berries in Nubra valley.

Table 1. The nutritional values of Sea buckthorn, green alfalfa and Beri-pala.

Fodder type	Fat (%)	Crude protein (%)	Crude Fibre (%)	P (%)	N (%)	Ca (%)	Ref
Sea buckthorn Fruit pulp	10.33	7.13	14.0	0.63	1.14		1
Sea buckthorn seeds	Nd	Nd	Nd	0.69	4.53		1
Sea buckthorn leaves	4.1	20.7	15.6	0.18		1.18	2
Sea buckthorn seeds	10.2	26.4	12.3	0.34		0.31	2
Sea buckthorn Fruit residues	11.6	18.3	12.7	0.15		0.19	2
Green alfalfa (*Medicago sativa*)		5.3	10.7	0.09		0.49	2
Beri-pala (*Zizyphus nummularia* leaves)		14	17	0.04		2.8	3

[1]Dhyani *et al,* 2007. [2]Jian-Zhong and Xiao-Feng, 2006. [3]Nath *et al*, 1969

Table 2. Biochemical evaluation of Sea buckthorn.

Fodder type	Reducing sugar (%)	Starch (%)	Lignin (%)	Fe (ppm)	Mg (ppm)	Zn (ppm)	Cu (ppm)	Na (%)	K (%)	Lysine	Methionine +Cystine	Ref.
Fruit pulp	6.0	29.42	21.33	0.81	1.92	2.74	0.10	0.53	14.84	Nd	Nd	[1]
seeds	Nd	Nd	Nd	0.65	2.84	1.94	0.04	0.05	13.42	Nd	Nd	[1]
Sea buckthorn leaves	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd	0.73	0.13	[2]
Sea buckthorn seeds	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd	0.42	0.59	[2]
Sea buckthorn Fruit residues	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd	Nd	0.84	0.06	[2]

[1]Dhyani *et al,* 2007. [2]Jian-zhong and Xiao-feng, 2006.

providing financial and administrative support for the visit to Ladakh under Tribal Sub- Plan (2013-14).

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