

Case Study Report

Fodder Plants Of Mithun *Bos Frontalis* Lambert, 1804: A Case Study Of West Siang, Arunachal Pradesh

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Abstract: The present study was carried out with purpose to document the fodder plants of Mithun *Bos frontalis* and to understand its foraging habit and habitat requirements. During the study 42 species of plants belongs to 16 families were documented. Analysis of data showed that out of the 42 species, 17 species were trees, 11 species were shrubs, 8 species were herbs, 4 species were climbers and 2 species were creepers. Mithun *Bos frontalis* always browses around to locate a specific fodder plants than grazing at one site for longer time to forage and consumed fresh and tender leaves. Heavy rain with humidity, hilly terrain with elevation ranging between 200-2000 msl with dense tropical and semi tropical evergreen rainforest forest enriched with perennial fresh water sources like lakes, spring, streams and small rivers have been considered as major attributing factors in mithun habitat requirement.

Key words: *Bos frontalis*, Fodder, Wild plant, Browsing, Habitat requirements

Introduction

Mithun, *Bos frontalis*, is a massive and semi-wild ruminant found in Bangladesh, Bhutan, China, India, Malaysia and Myanmar. The largest population are found in India, which is restricted to Arunachal Pradesh, Manipur, Mizoram and Nagaland. The Indian stock consists of four distinct strains, namely Arunachal strain, Manipur strain, Mizoram strain and Nagaland strain (Gupta *et al.*, 1996; Tamang and Perkins, 2000; Rajkhowa *et al.*, 2004; Prakash *et al.*, 2006). Mithun is considered as descendent of wild guar or cross between *B. gaurus* and domestic cattle (Simons, 1984; Borang, 2001; Choudhury, 2003; Rajkhowa *et al.*, 2004; Prakash *et al.*, 2006).

Arunachal Pradesh hosts the largest population of Mithun and it is deeply integrated to socio-economic practice of local tribal people of Arunachal Pradesh. In spite of immense socio-religious value, Mithun is partially domesticated by the

tribal people and is reared in the wild under traditional free range condition in which Mithun thrives in the forest and depend wholly on the natural vegetation for their fodder need.

These forest based fodder resources for Mithun is poorly documented and any exclusive information on wild foddors of mithun is not available. The documentation of wild fodder would prove supportive in the domestication effort, wide scale farming and captive breeding in future to propagate the population in *vis-a-vis* socio-economic practice which alarmingly reduces the Mithun population in Arunachal Pradesh. Documentation of the wild foddors will also be valuable information to understand the food habit of Mithun and knowledge of fodder would be important for domestication of the Mithun. Therefore, in the present study, the preliminary survey has been carried out to identify and document the wild plants relish by Mithun *B. frontalis*.

Materials and methods

Study periods

The field survey was conducted from October 2006 to April 2008 in West Siang district of Arunachal Pradesh to document the fodder plant and feeding habit of Mithun. The survey was conducted during morning and evening time because to avoid the scorching heat of mid day mithun forage in morning and evening time of the day.

Study sites

The survey was carried out in West Siang district of Arunachal Pradesh and the sampling was done at three places, namely at Aalo (28°10'07.62''N & 94°48'05.40''E), Basar (28°01'36.57''N & 94°34'29.30''E) and Likabali (27°35'41.39''N & 94°43'19.01''). West Siang having geographical area of 8,325 km² is located at coordinate 28°10'07.62'' North latitude and 94°48'05.40'' East longitude with altitude ranges from 600 m to 3000m above sea level. Study area West Siang is cover up with twelve kind of natural vegetation viz., Tropical evergreen forest, Tropical semi-evergreen forest, Mixed moist deciduous forest Subtropical evergreen forest, Temperate broad-leaved forest, Coniferous forest, Alpine scrubs, Alpine pastures, Pine forest, Rhododendron scrub, Riverain forest, Bamboo mixed forest. Some of the dominant trees are *Altingia excelsa*, *Anthocephallus chinensis*, *Ficus drupacea* and *Premna bengalensis*, *Terminalia myriocarpa*, *A. excelsa* and

Albizia procera, *Terminalia myriocarpa*, *Duabanga grandiflora* and *Albizia lebbek*, *Saurauia roxburghii*, *Trevasia palmate*, *Q. lemellosa*, *A. excelsa*, *Bischofia javanica*, *Lagerstroemia speciosa*, *Olea dioica*,

T. myriocarpa, *Shorea assamica* and *Mangifera sylvatica*, *Castanopsis indica*, *Phoebe cooperiana*, *Q. lemellosa*, *Castanopsis hystiix*, *Rhododendron grande* and *Syzygium tetragona* trees, *Pinus kesiya*, *P. roxburghii*, *Quercus* spp.

Average Temperature during summer is 35° C and during winter it is 15° C. Area is extremely humid with average 2500 mm rainfall annually and humidity is as high as 90% during June and July.

Survey

Mithun was followed and observed with 16X40 DPSI Olympus binocular while it grazes upon plants in the forest to find out the plant eaten. Plant grazed upon by the Mithun was located and recorded along with part eaten and habit of the plant. Then plant was photographically documented by using Canon EOS 50D with 18-55 mm zoom lens. Specimen of recorded plant was collected mostly leaves and twigs.

Identification and Classification

Fodder plants recorded were identified using herbarium maintain in Higher Plant Unit, Centre of Biodiversity, Rajiv Gandhi University. For classification of the plants, we followed the classification of Chase and Reveal, 2009 and Christenhusz, 2011.

Results

In the present study, total 42 species of plant belong to 16 families commonly relished by Mithun *Bos frontalis* (Fig. 2) were recorded and identified at West Siang district of Arunachal Pradesh as listed in Table 1 and Fig. 3.

Family Poaceae was dominant with eleven species, followed by Moraceae with seven species, Euphorbiaceae, Utricaceae and Fabaceae each with four species, Arecaceae with two species and rest Sterculiaceae, Cannabaceae, Verbenaceae, Rosaceae, Rubiaceae, Stomaetceae, Cryperraceae, Polygonaceae, Zingiberaceae and Convolvaceae each with one species. Out of the 42 species

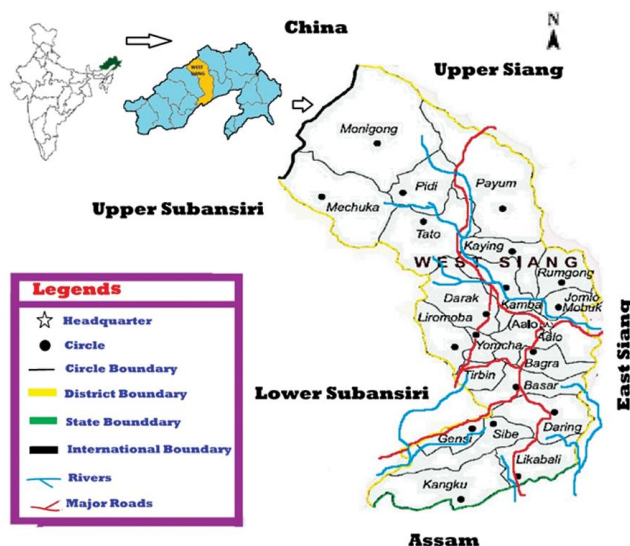


Fig.1. Map of study area, West Siang District, Arunachal Pradesh.

documented, 17 species were trees, 11 species were shrubs, 8 species were herbs, 4 species were climber and 2 species were creepers. Majority of the fodder plants recorded were trees followed by shrubs, herbs, climbers and creepers as in the table no. 1.

Table 1. List of plants eaten by *Bos frontalis*, which was identified and documented during the survey in west Siang district of Arunachal Pradesh

Species	Preferred part	Habit
Family: Moraceae		
1. Fig tree <i>Ficus hirta</i> Vahl.	Leaves	Tree
2. Hairy fig <i>Ficus hispida</i> L.f.	Leaves	Tree
3. Drooping fig <i>Ficus semicaudata</i> Bush.-Ham. Ex Sm	Leaves	Tree
4. Rocky fig <i>Ficus palmeri</i> S. Watson	Leaves	Tree
5. Dimoru <i>Ficus lamponga</i> Miq.	Leaves	Tree
6. Jack fruits tree <i>Artocarpus heterophyllus</i> Lam.	Leaves	Tree
7. Red fig <i>Ficus insipida</i> Willd.	Leaves	Tree
Family: Euphorbiaceae		
8. Blistry macaranga <i>Macaranga denticulate</i> Blume	Leaves	Tree
9. Kamala tree <i>Mallotus philippensis</i> (Lam.) Mull. Arg.	Twings	Tree
10. Rusty kamala <i>Mallotus tetracoccus</i> (Roxb.) Kurz.	Leaves	Tree
11. Bishop wood <i>Bischofia javanica</i> Blume	Leaves	Tree
Family: Utricaceae		
12. Ombe tree <i>Sarcochlamys pulcherrima</i> Gaudich	Twings	Shrub
13. Nilgiri nettle <i>Debregeasia valutina</i> Gaudich	Leaves	Shrub
14. Orange wild rhea <i>Debregeasia longifolia</i> (Burm.f.) Wedd.	Leaves	Shrub
15. Pouzolzia <i>Pouzolzia guatemalana</i> Wedd.	Leaves/Shoot part	Creepers
Family: Sterculiaceae		
16. Sterculia shrubs <i>Sterculia coccinea</i> L.	Leaves	Tree
Family: Arecaceae		
17. Took-patta <i>Livistona jenkinsiana</i> Griff.	Leaves	Tree
18. Wallich's Dwarf Fishtail palm <i>Wallichia densiflora</i> Mart.	Leaves	Shrub
Family: Cannabaceae		
19. Charcoal tree <i>Trema orientalis</i> (L.) Blume	Leaves	Tree
Family: Fabaceae		
20. Hawwaiin orchid tree <i>Bauhinia purpurea</i> L.	Leaves	Tree
21. Indian kudzu <i>Pueraria tuberosa</i> (Wild.) DC	Whole plant	Climber
22. Japanese arrowroot <i>Pueraria thunbergiana</i> Benth.	Whole plant	Climber
23. Kudzu <i>Pueraria wallichii</i> DC.	Whole plant	Climber
Family: Verbenaceae		
24. Beauty berry <i>Callicarpa arborea</i> Roxb.	Leaves	Tree
Family: Rosaceae		
25. Cane-fruit tree <i>Rubus hexagynus</i> Roxb.	Shoot part	Climber
Family: Poaceae		
26. Tiger grass <i>Thysanachaena maxima</i> Kuntze.	Leaves	Shrub
27. Grader grass <i>Themada caudata</i> A. Camus.	Leaves	Shrub
28. Palm grass <i>Seteria palmifolia</i> J. Koenig	Leaves	Herb
29. Blady grass <i>Imperata cylendrica</i> P. Beauv.	Leaves	Herb
30. Wild sugar cane <i>Saccharum spontaneum</i> L.	Whole plant	Shrub
31. Sugar cane <i>Saccharum officinarum</i> L.	Whole plant	Shrub
32. Maize <i>Zea mays</i> L.	Whole plant	Shrub
33. Mahal bamboo <i>Bambusa longispiculata</i> Gamble	Leaves/Shoot	Tree
34. Buffal grass <i>Brachiaria mutica</i> (Forssk.) Stapf.	Whole plant	Herb
35. Paddy plant <i>Oryza sativa</i> L.	Whole plant	Herb
36. Bermuda grass <i>Cynodon dactylon</i> L.	Whole plant	Herb
Family: Rubiaceae		

37. Himalayan mussaenda <i>Mussaenda roxburghii</i> Hook.f.	Leaves	Shrub
Family: Stomaetceae		
38. Nepal osbeckia <i>Osbeckia nepalensis</i> Hook.f.	Leaves	Shrub
Family: Cryperaceae		
39. Sedge grass <i>Carex cruciata</i> Wahlenb.	Leaves	Herb
Family: Polygonaceae		
40. Pink head knotweed <i>Polygonum capitatum</i> Buch.-Ham.	Whole plant	Herb
Family: Zingiberaceae		
41. Spiked ginger lily <i>Hedychium spicatum</i> Buch.-Ham.	Whole plant	Herb
Family: Convolvulaceae		
42. Sweet potato <i>Ipomoea batatas</i> (L.) Lam	Whole plant	Creepers



Fig 2: Mithun *Bos frontalis*, semi-domesticated bovine species of North East India



Fig. 3. Photograph of some wild plants eats by mithun. (a) *Debregeasia valutina*, (b) *Pueraria thunbergiana*, (c) *Mallotus tetracoccus*, (d) *Ficus hispida*, (e) *Thysanachaena maxima*, (f) *Sterculia coccinea*, (g) *Ficus hirta*, (h) *Sarcochlamys pulcherrima*, (i) *Saccharum spontaneum*.

Discussion

Mithun *Bos frontalis* is socio-economically and socio-religiously important animal for the tribal people of Arunachal Pradesh. In spite of immense value Mithun is partially domesticated by the tribal people. As a result, peoples commonly adopted traditional free range rearing system under which Mithun is allowed to roam freely in the forest (Arora, 1998). Though full domestication of Mithun *Bos frontalis* is not yet achieved but Mithun *Bos frontalis* is over use for the socio-religious or culture practice of the local tribal people. So, in absence of scientific rearing system, Mithun *Bos frontalis* population is plummeting due to socio-religious or culture practice (Heli, 2002). Not only the animal, but also natural habitats as well as the natural fodder resources are under threat due to shifting/jhum cultivation, tea plantation, rubber plantation, orange plantation, timber operation and other anthropocentric activities which synergize the decline of population. With the background, seeing the absolute necessity, the fodder plants, foraging habit and habitat requirement of Mithun *Bos frontalis* was studied to draw baseline information to boost future conservation action particularly *ex situ* conservation or domestication effort of the people.

Our study showed that among the forty two fodder plants documented, thirty seven were wild plants which constitute the 88.09% of the total documented fodders which evidence that Mithun *Bos Frontalis* mostly relish wild plants as fodder and almost total dependency on natural vegetation or wild plants to fulfil their requirements of fodders, this substantiate others earlier finding of Arora, 1998. The dependent on wild plants as fodder might be due to traditional free range rearing system as wild plants available more easily in the free range areas.

Finding in feeding habit, showed that Mithun *Bos frontalis* do not graze at one site for long time rather they browse around for fodders and consequently covers considerable distance in search of specific fodder plant. Browsing habit of Mithun may be attributed to selective food habit as well as habit of consuming only tender, fresh, and healthy and green leaves and avoidance of dried, wilted, unhealthy and rotting leaves.

Habitat requirement analysis showed that Mithun *Bos frontalis* required humid and moderate climate with heavy rainfall and 80-90 % humidity; dense tropical and semi tropical evergreen rainforest forest vegetation with numerous perennial water sources like freshwater lakes, spring, streams and small rivers and need hilly terrain which altitude range between 200 to 2000 m above sea surface as their habitat condition. Mithun's body surface has very scare hair to insulate the body and as a result there is rapid evaporation from the body surface so Mithun always preferred aforesaid habitat condition. Therefore, animals are always found around the vicinity of the water bodies to replenished water loss and found in humid climate to minimize the water loss from the body to avoid dehydration. Also, this is the reason that Mithun *Bos frontalis* avoid hot sun and mostly venture out in the open only during night, dawn and dusk or during rainy day. All these habit and preferences always confines the Mithun *Bos frontalis* mostly in the deep forest which is a gigantic hindrance for domestication of the animal and compel local tribal people to adopt traditional free range rearing system so far which is economically less beneficial.

The findings of the present study presented in this paper is a significant contribution for domestication effort by local tribal people, conservation of Mithun and their habitat. It will facilitate further research on nutrient composition of fodder and strategy to natural fodder propagation. Intensive survey will be required to document all the fodders relished by Mithun *Bos frontalis* to conserve this rare and endemic bovine species of north-east India.

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References

Arora, C. L. 1998. Less used animal: Yak and Mithun- an overview. Indian Journal of Animal Science. 68 (8) 735-742.

- Borang, A. 2001.** Mammalian fauna of Arunachal Pradesh (Checklist and distribution in protected areas). Arunachal Forest News. 19 (182): 43-82.
- Chase, M.W, and Reveal, J.L.2009.** A phylogenetic classification of the land plants to accompany APG III. Botanical Journal of the Linnean Society. 161: 122-127
- Choudhury, A.U. 2003.** In: The mammals of Arunachal Pradesh. 1st Ed. Regency publication, New Delhi, India. Pp: 9-97
- Christenhusz, M. J.M., Reveal, J. L., Farjon, A., Gardner, M. F., Mill, R. R. and Chase, M.W. 2011.** A new classification and linear sequence of extant gymnosperms. Phytotaxa. 19: 55–70.
- Gupta, N., Gupta, R.P., Verma, N.D., Pundir, R.K., Joshi, B.K., Nivsarkar A.E. and Sahai, R. 1996.** Mithun, an important bovine species of Indian origin. Animal Genetic Resource Information. 18: 34-39.
- Harper, F 1940.** The nomenclature and type localities of certain old world mammals. J Mammal. 21: 191-203.
- Heli, T. 2002.** Natural fodder commonly relished by mithun in Arunachal Pradesh. Arunvet- A biannual publication of Arunachal Pradesh Veterinary Association. 29-31.
- Heli, T., Saikia, S. and Bara, N.N. 1994.** Carcass character in mithun under different age groups. Indian J Ani Prod Maag. 10 (182): 5-11.
- Heli, T, Thakuria, K., Sarma, D.N., Milli, B.C. and Baruah, K. K. 2009.** Natural fodders relished by mithun in Arunachal Pradesh. Indian Journal of Animal Nutrition. 25 (3): 201-205.
- Lambert, A.B. 1804.** Description of *Bos frontalis*, a new species from India. Transactions linn Soc London. 7: 57-59.
- Mishra, C. and A. Datta, A. 2007.** A new species from Eastern Himalayan Arunachal Pradesh- India's biological frontier. Current Science. 92 (9): 1206-1207.
- Prakash, B., Mondal, M., Rongsensusang, A. Hannah, K. and Rajkhowa, C. 2006.** Chemical composition and in sacco degradability of forest based fodders of Nagaland state of India in Mithun (*Bos frontalis*). Livestock Research for Rural Development. 18 (8): 1-8.
- Rajkhowa, S., Rajkhowa, C., Rahman, H. and Bujarbaruah, M.K. 2004.** Seroprevalence of infectious bovine rhinotracheitis in mithun (*Bos frontalis*) in India. Rev Sci tech off Int Epiz. 23 (3): 821-829.
- Shisode, M.G, Khanvilkar, A. V., Kulkarni, M.D., Samant, S.R., Yadav, G.B. and Bawaskar, M. S. 2009.** Mithun : The pride animal North-eastern hilly region of India. Veterinary world. 2 (12): 480-481.
- Simons F. J. 1984.** In: Gayal or Mithun: On evolution of domesticated animals, Longman, London, UK. Pp: 34-39.
- Tamang, N.B. and Perkins, J. M. 2000.** Cattle management systems in humid subtropical areas of Western Bhutan. Journal of Bhutan Studies. 6: 105-118.
- Tayo T., Meena T., Heli T., Longjam N., Safi V. and Tabyo T. 2013.** Assessment on Mithun, Jhum and other Interrelationship in Tribal Inhabitant Area of Papum Pare District, Arunachal Pradesh, India. Advance in Animal and Veterinary Science. 2 (1): 15-19.