Print : ISSN 0970 – 7662
Online : ISSN 2455 – 7129

Journal of Tree Sciences

online available at www.ists.in

Volume 40 No. 1 June, 2021

Wild Edible Fruit Tree Diversity and Population Status in Low and Mid Hills of Arunachal Pradesh

Lyngdoh Nicolee[1*], Kalidas Upadhyaya[2], Nagaraj Hegde[2], Suresh Kumar[2] and Mongjam Bishwapati Devi[3]

[1*]*Biodiversity Research Centre, Mizoram University, Tanhril, Aizawl, Mizoram -796 004, India;* [2]*Department of Forestry, Mizoram University, Tanhril, Aizawl, Mizoram- 796004;* [3]*Department of Basic Sciences, College of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh - 791102, India*

* Email: *lyngdoh@gmail.com*

DOI: 10.5958/2455-7129.2021.00007.8

ABSTRACT

Wild edible fruit (WEF) diversity and population status was assessed in 3 districts of Arunachal Pradesh, India. In each district 2 sites were selected; one close to district headquarter (HQ) and other farther away. One hectare area was sampled at each site in the form of 500m long and 10m wide linear transects in two directions from the village. A total of 28 species belonging to 21 genera and 17 families were recorded in the field survey the important ones included *Phoebe cooperiana, Canarium strictum, Terminalia chebula, Castanopsis indica, C. hystrix, Baccaurea sapida* and *Dillenia indica*. Highest species richness and diversity wererecorded atKamdi (14 species and 1.05) and lowest at Siluk (8 species and 0.64). In all the districts, species richness was seen to higher in sites closer to the district HQ compared to the sites farther away, but the trend was opposite for tree density. *Castanopsis indica* had the highest IVI in 5 of the 6 sites and highest density at all sites. According to information from village elders, not all species consumed were encountered in our study indicating the need for a more extensive survey.

Key Words:

Castanopsis indica, Importance Value Index, Siang, species richness

INTRODUCTION

Wild edible fruit form a significant portion of wild edibles consumed by local communities. For many, these wild fruits are the only source of protective food to meet their vitamins and minerals requirements in their poor diet (Erlund et al. 2008; Smith and Longvah 2009). In recent times, there is a growing concern

that wild edible fruit (WEF) tree resources have become highly vulnerable to local extinction due to land use changes (Pimm and Raven 2000) and large-scale extraction (Rist et al. 2011, Varghese et al. 2015). In response, efforts are being stepped up to conserve their genetic resources through documentation, domestication and undertaking *ex situ* conservation measures.

Wild edible fruits have been incorporated in a number of ethno-botanical surveys in India (Kumbhojkar and Vartak 1988, Maikhuri et al. 2000, Kala 2007, Lepcha et al. 2019, Elumalai et al. 2019) as well as other parts of the globe (Vasquez and Gentry 1989, Siregar 2006). In north east region of India, they have been included in the studies by Rawat et al. (1998), Angami et al. (2006), Yumnam et al. (2011) and Brahma et al. (2013). However, their demographic assessment in the wild is seldom done. Khaple et al. (2012) assessed the population status of wild edible fruit tree species in evergreen and moist deciduous forest of Kodagu district in Karnataka and reported diversity values of > 2.5. In a similar study of WEF diversity in scared groves of the same district of Karnataka, Vinayak and Patil (2018) recorded 18 species of WEF and aShannon's diversity value of 2.35. The mean density and mean basal area of WEF was found to be 202.67ha^{-1} and 42.65 mha^{-1}, respectively. Assessing species diversity and population status of WEF trees is an integral part of understanding extraction patterns, population size reduction and extinction patterns which becomes useful in planning domestication and conservation strategies for the species.

The state of Arunachal Pradesh has the largest area in the north eastern region of India and strategically located in the center of the Indo Myanmar biodiversity hotspot. With an altitudinal range between 100 to 7090 msl it is known for its diverse vegetation types, high biological plant diversity and various form of land use practices. In addition, it is home to diverse ethnic groups consisting of 26 major tribes and 110 minor/sub-tribes with distinct socio-cultural setting. Furthermore, given the rapid land transformation in the region, the status and threat of these important plant resources remains largely unknown. In the present paper, we primarily asses the diversity and population status of WEF resource in three districts of Arunachal Pradesh, India. We further tested whether distance of sites from district headquarter within the district had any impact on WEF diversity.

MATERIALS AND METHODS

Study Site

The present study was conducted in East Siang, West Siang and Upper Siang districts of Arunachal Pradesh, India. The district names have originated from the Siang River, which merges with Lohit and Dibang Rivers in Assam to become the mighty Brahmaputra. In each district 2 sites were selected; one close to district headquarter (HQ) and the other farther away (Fig 1 and Table 1). Pasighat, Halleng and Kamdi are located within 3km of district HQ, while Siluk, Bomdo and Nyigam more than 40km from district HQ. The sites come under tropical and humid subtropical type of climate with vegetation mainly a mix of tropical and subtropical species such as *Terminalia myriocarpa, Dillenia indica, Actinodaphne obovate, Cinnamomum bejolghota, Litsea glutinosa, Litsea monopetala, Duabanga grandiflora, Magnolia hodgsonii, Gynocardia odorata, Liquidambar excelsa, Trevesia palmata, Garcinia pedunculata* in the lower areas (Taram et al. 2020) and *Castanopsis indica, C. armata, C. kurzii, Lithocarpus listeri, L. dealbatus, Alnus nepalensis, Engelhardtia spicata, Saurauia napaulensis* in the higher altitudes (Choudhary et al. 2012).

Methodology

At each site, before the field surveys an informal meeting with elders of the village was arranged to obtain information on the types and number of WEF resources availableand scale of trading. Following this, surveys were undertaken in forests nearby the village that consisted primarily of secondary forests. One-hectare area was

sampled at each site in the form of 500m long and 10m wide linear transects in two directions from the village. Each transect was divided into 10 plots of 50 m length and 10 m width (total 20 plots in each site). In each plot, all WEF tress ≥10 cm girth at breast height (GBH) were measured in centimeter and enumerated.

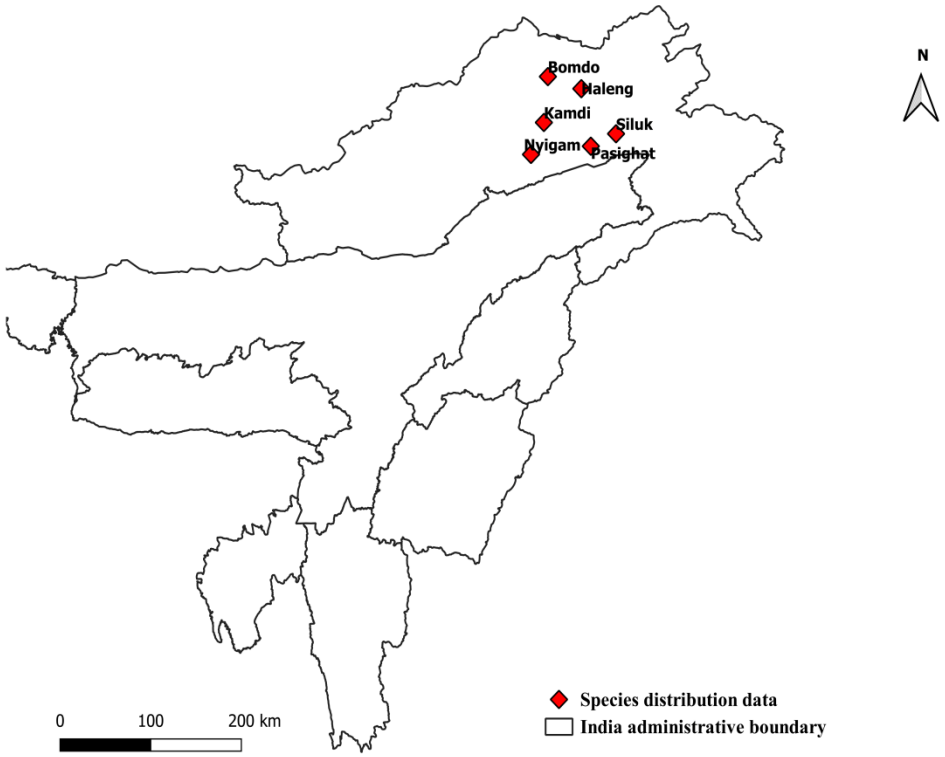

Fig 1. Map showing 6 sites in Arunachal Pradesh where the studies were conducted

The field data was analyzed for number of species and quantitative analysis of frequency; density per ha and basal area per ha and their relative values were calculated and summed to get Importance Value Index (IVI) using Ellenberg (1974). General diversity was calculated using Shannon and Wiener index (1963) and the index of dominance of the community was calculated by Simpson's index (1949).

RESULTS AND DISCUSSION

Field survey of WEF carried out at 6 sites in 3 districts of Arunachal Pradesh revealed a total of 28 species belonging to 21 genera and 17 families. The list of WEF, period of availability and status of trade is given in Table 1. The percentage of WEF traded in the region was 32.14%, occurring mostly at Pasighat market which is one of the biggest district capitals of the state. Some of the highly traded species include *Phoebe cooperiana, Canarium strictum, Terminalia chebula, Castanopsis indica, C. hystrix, Baccaurea ramiflora* and *Dillenia indica*. The percentage of fruits available during the monsoon months was 60.71% (Table 1). Monsoon is a harsh period for the hill people because transportation becomes restricted due to frequent landslides. The availability of WEF during the season provides nutritive supplements to the food basket of many households.

The WEF tree diversity values, based on species richness and species diversity for 6 sites, are given in Table 2. The highest species richness and diversity were recorded at Kamdi (14 species and 1.05) and the lowest at Siluk (8 species and 0.64). The species richness and diversity values were much lower than those

reported by Vinayakumar et al. (2018) who assessed WEF diversity in the protected areas of Karnataka. While the above surveys were undertaken inside sacred groves and state forests, we conducted the survey inside secondary forests, probably developed during the fallow period of jhum cultivation, and were easily accessed by the local people for collection of forest products.

In all the districts species richness was found to be higher in sites closer to the district HQ compared to the sites farther away (Table 2). This pattern was also observed for Shannon indices in the East and West Siang districts; diversity indices of sites in Upper Siang district were similar (Table 2).

Table 1. List of wild edible fruits (WEF) along with availability period and trade status

Sl. No	Species Name	Trade status	Period of availability
1	*Artocarpus chaplasha* Roxb. (Moraceae)	NO	Oct-Nov
2	*Artocarpus heterophyllus* Lam.(Moraceae)	YES	May-Oct
3	*Baccaurea ramiflora* Lour. (Euphobiaceae)	YES	June-Aug
4	*Bischofia javanica* Blume(Phyllanthaceae)	NO	Dec-Jan
5	*Canarium strictum* Roxb.(Burseraceae)	YES	Dec-March
6	*Castanopsis hystrix* Hook.f. & Thomson ex A. DC. (Fagaceae)	YES	June-Nov
7	*Castanopsis indica* (Roxb. ex Lindl.) A. DC. (Fagaceae)	YES	June-Nov
8	*Cinnamomum tamala* (Buch.-Ham.) T. Nees&Eberm. (Lauraceae)	NO	June- Oct
9	*Cordia dichotoma* G. Forst. (Boraginaceae)	NO	Throughout the year
10	*Dillenia indica*L. (Dilleniaceae)	YES	June-Oct
11	*Ficus auriculata*Lour. (Moraceae)	NO	June-Sept
12	*Ficus hirta*Vahl (Moraceae)	NO	Aug-Sept
13	*Ficus fistulosa* Reinw. ex Blume(Moraceae)	NO	Nov-Feb
14	*Ficus semicordata* Buch.-Ham. ex Sm. (Moraceae)	NO	June-Aug
15	*Garcinia cowa* Roxb. ex Choisy(Clusiaceae)	NO	June -July
16	*Garcinia paniculata* Roxb. ex Wight(Clusiaceae)	NO	July-Aug
17	*Mangifera sylvatica* Roxb.(Anacardiaceae)	YES	June-Aug
18	*Melastoma malabathricum* L. (Melastomaceae)	NO	May-July
19	*Morus macroura* Miq.(Moraceae)	NO	April-May
20	*Nephelium lappaceum* L. (Sapindaceae)	YES	May-June
21	*Phoebe cooperiana* P.C. Kanjilal& Das (Lauraceae)	YES	Sept-Oct
22	*Saurauia armata* Kurz(Actinidiaceae)	NO	June-July
23	*Saurauia napaulensis* DC. (Actinidiaceae)	NO	June-Oct
24	*Spondia spinnata* (L. f.) Kurz(Anacardiaceae)	NO	Dec-Jan
25	*Sterculia hamiltonii* (Kuntze) Adelb. (Sterculiaceae)	NO	April-May
26	*Syzygium cumminii* (L.) Skeels (Myrtaceae)	NO	June- July
27	*Terminalia chebula* (Combretaceae)	YES	Dec- Jan
28	*Zizyphus jujuba* Mill.(Rhamnaceae)	YES	June-July

Table 2. Population estimates and diversity values of wild edible fruit trees in 3 districts \of Arunachal Pradesh

Sl. No	District	Site	Number of species	Density/ha	Total Basal Area (m^2/ha)	Shannon Diversity Index	Simpson Index
1	East Siang	Paisghat (C)	11	20.88	4.71	1.00	0.10
2		Siluk (F)	8	47.00	70.23	0.64	0.34
5	Upper Siang	Halleng (C)	13	36.00	6.03	0.83	0.11
6		Bomdo (F)	10	42.00	5.15	0.88	0.32
7	West Siang	Kamdi (C)	13	28.00	3.24	1.05	0.13
8		Nyigam (F)	11	37.22	11.18	0.85	0.52

C= close to district headquarter; F=far from district headquarter

The number of individuals per ha ranged from 20.88 in Pasighat to 47.00 in Siluk. Sites closer to district HQ had lower density as compared to distant sites (Table 2). Nevertheless, these values are very low when compared to the density of WEF reported in evergreen and moist deciduous forests of Kodagu in Karnataka, which were 251 and 80 per ha, respectively (Khaple et al. 2012). Extremely high basal area was also recorded for trees in Siluk (70.23m^2/ha). This value has been predominantly contributed by *Castanopsis indica* which had the highest density among trees across all 6 sites. The species was also reported to have the maximum IVI in 5 of the 6 sites, except Pasighat. It showed clear dominance in Siluk and Nyigam where IVI values dropped abruptly between the 1st and 2nd rank (Fig. 2). The Simpson Index values at both sites were higher compared to other sites, which reaffirm the dominance of a single species (Table 2). *C. indica* is a climax species of the region and its overwhelming dominance is a feature of a matured forest. However, sites at Bomdo and Halleng showed signs of an early successional forest where an equally strong presence is shown by pioneering species such as *Saurauiana paulensis* (Teegalapalli and Datta 2016).

Arunachal Pradesh is a state that has a forest cover of 79.63% and an average human density of 17 per km^2. Although prior to the field survey we gathered information from village elders about all the WEF resources that the locals consumed and when the information was compared with our field observations it was found that many species were not encountered (Fig. 3); documented fruit richness was always more than the surveyed richness at all the sites, we fail to have any convincing data to suggest that urban population and markets have an impact on WEF richness and diversity of sites. We suspect that activities related to land transformation which includes shifting cultivation and conversion of land into Citrus orchards, large cardamom plantations, tokopatta and opium cultivation, played a more devastating role. Therefore, there is a need to undertake more extensive surveys to assess the diversity and steps to conserve these resources should be encouraged so that the resources are not lost forever.

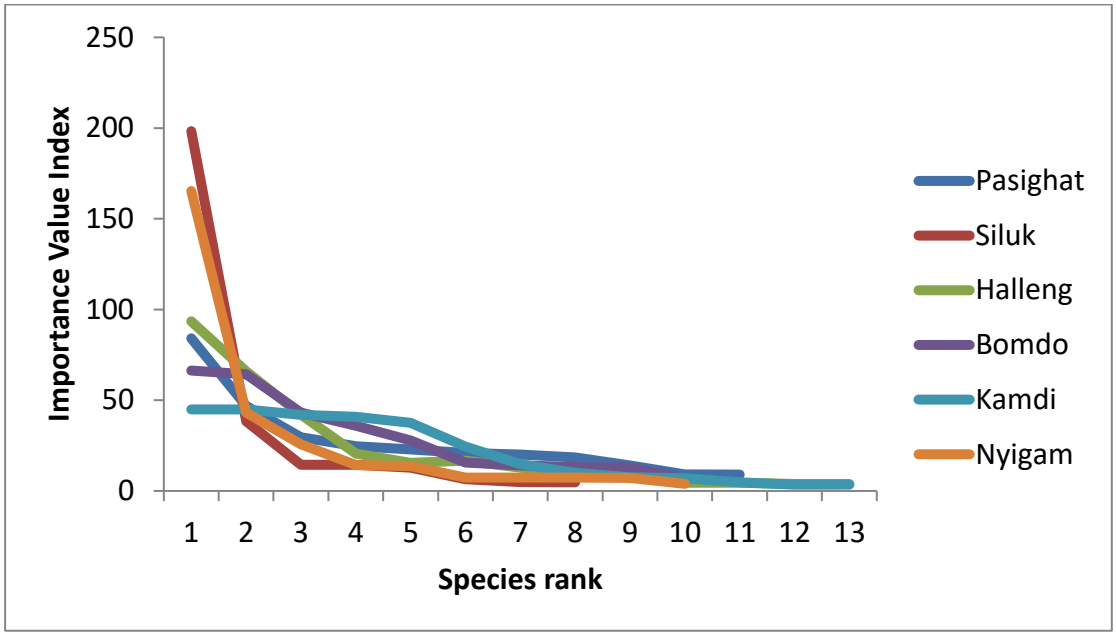

Fig 2. Species ranking of IVI values of wild edible fruit tree species at 6 sites in Arunachal Pradesh

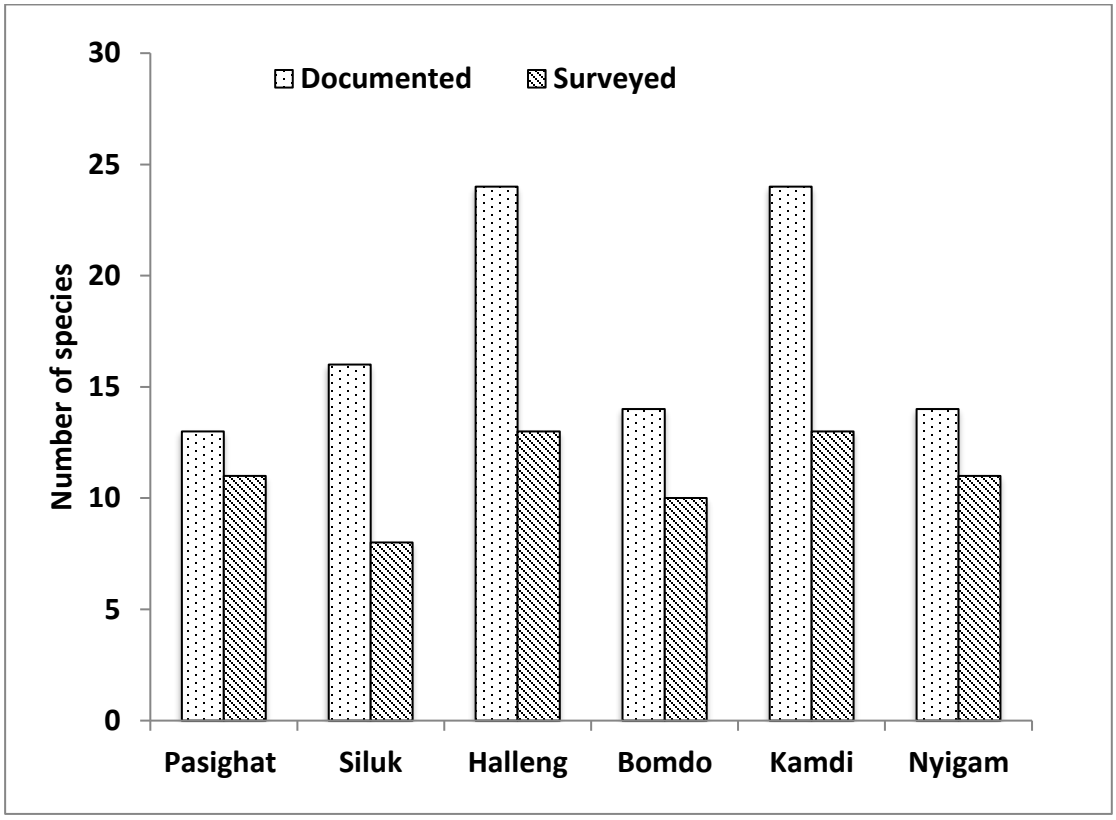

Fig 3. Documented and surveyed richness of Wild edible fruits at 6 sites in Arunachal Pradesh

ACKNOWLEDGEMENT

The authors greatly acknowledge the Science and Engineering Research Board, Government of India for providing financial

support (SR/FT/LS-107/2011). Authors are also thankful to the headman/elders of villages and farmers of Arunachal Pradesh for their providing information, help and support during the study period.

REFERENCES

Angami A., Gajurel P. R., Rethy P., Singh B. and Kalita S. K. 2006. Status and potential of wild edible plants of Arunachal Pradesh. Indian Journal of Traditional Botany, 5(4): 541-550

Brahma S., Narzary H. and Basumatary S. 2013. Wild edible fruits of Kokrajhar district of Assam, North-East India. Asian Journal of Plant Science Research, 3(6): 95-100

Choudhary R.,Srivastava R., Das A. and Lee J. 2012. Floristic diversity assessment and vegetation analysis of Upper Siang district of eastern Himalaya in North East India. Korean Journal of Plant Taxonomy, 42. 222-246. 10

Ellenberg H.1974. Indicator values of vascular plants in central Europe. Indicator values of vascular plants in central Europe,9

Elumalai Sannyasi, Saravanan Kasilingam, Rajesh Damodharan and Ravichandran Banupriya. 2019. Medicinal Plants Used Ethno Botanically by *ThenuKuruba* Tribes of Coorg District, Karnataka, India. Journal of Tree Science, 38(2): 46-58.

Erlund I., Raika K., Alfthan G., Marniemi J., Puukka P., Mustonen P., Mattila, P. and JulaA. 2008. Favorable effects of berry consumption on platelet function, blood pressure, and HDL cholesterol. American Journal of Clinical Nutrition, 87: 323–331.

Lepcha Lakpa D., Shukla Gopal, Vineeta, Sarkar Biplov C., Tamang Mendup, Chettri Roman, Abha Manohar K, Pala Nazir A and Chakravarty Sumit. 2019. Ethno-Botanical Plant Diversity in Home Gardens based Agroforestry System in Kanchendzonga Biosphere Reserve, Sikkim, India. Journal of Tree Sciences. 38(2):59-69.

Kala C.P. 2007. Prioritization of cultivated and wild edibles by local people in the Uttaranchal hills of Indian Himalaya.

Khaple A.K., Gurav M. and Hubballi S. 2012. Population Studies of Wild Edible Fruit Tree Species in Kodagu. International Journal of Life Sciences, 1(3):48-55

Kumbhojkar M.S. and Vartak V.D.1988. Ethno botanical studies on wild edible grapes from sacred groves in Western Maharashtra. Journal of Economic and Taxonomic Botany, 12(2):257-63

Maikhuri R.K., Nautiyal S., Rao K.S. and Semwal R.L. 2000. Indigenous knowledge of medicinal plants and wild edibles among three tribal sub communities of the central Himalayas, India. Indigenous Knowledge and Development Monitor 8(2):7-13.

Pimm S.L. and Raven P. 2000. Extinction by numbers. Nature, 403(6772) 843-845.

Rawat M. S., Rama Shankar and Singh V. K. 1998. Wild edible plants of Arunachal Pradesh. *B.M.E.B.R.* Vol XIX: 23-33.

Rist L., Shanley P., Sunderland T., Sheil D., Ndoye O., Liswanti N. and Tieguhong J. 2011. The impacts of selective logging on non-timber forest products of livelihood importance. Forest Ecology and Management, 268: 57–69

Shannon C.E. and Wiener W. 1963. The mathematical theory of communication University of Illinois press Urbana Illinois

Simpson E.H. 1949. Measurement of diversity. Nature, 163: 688

Siregar M. 2006. Species Diversity of Local Fruit Trees in Kalimantan: Problems of Conservation and Its Development. Biodiversita,7 (1): 94-99

Smith I.F. and Longvah T. 2009. Mainstreaming the use of nutrient-rich underutilized plant food resources in diets can positively impact on family food and nutrition security. Data from Northeast India

and West Africa. ISHS Acta Horticulture, 806: 375–384

Taram M., Borah D., Tag H. and Choudhary R.K. 2020. An inventory of the native flowering plants in East Siang District of Arunachal Pradesh, India. Journal of Threatened Taxa, 12(17):17299-322

Teegalapalli K. and DattaA. 2016. Shifting to settled cultivation: Changing practices among the Adis in Central Arunachal Pradesh, north-east India. Ambio, 45(5):602-12

Varghese A., Ticktin T., Mandle L. and Nath N. 2015. Assessing the Effects of Multiple Stressors on the Recruitment of Fruit Harvested Trees in a Tropical Dry Forest, Western Ghats, India. PLoS One, 1-17

Vasquez R. and Gentry A.H. 1989. Use and misuse of forest harvested fruits in Iquitos region. Conservation Biology, 3: 350-361

Vinayakumar K.H., Kanive R.K. and La S.D. 2018. Fruit species in Kalbetta State Forest, Hunsur, Mysuru. International Journal of Usufructs Management, 19:93-102

Yumnam J.Y., Bhuyan S.I., Khan M.L. and Tripathi O.P. 2011. Agro-diversity of East Siang-Arunachal Pradesh, Eastern Himalaya. Asian Journal of Agricultural Sciences, 3(4): 317-326.

Received: 20th June, 2021 *Accepted: 25th June, 2021*