

Assessment of Market Potential and Survey of Various Available Vegetable Species of Fabaceae Family in Dhubri District of Assam

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ABSTRACT

Various species of Fabaceae family are well known for their food value in the form of popular vegetable and also as a source of traditional ethnomedicine. A total of 17 available edible species of Fabaceae family viz. *Phaseolus vulgaris* (common name: Bush bean), *Vigna unguiculata* spp. *Sesquipedalis*, *Vigna unguiculata* spp. *Sesquipedalis*, *Vigna sinensis*/*Vigna unguiculata* spp. *Sesquipedalis*, *Dolichos bengalensis*, *Lablab purpureus*, *Lablab niger*, *Lablab vulgaris*, *Phaseolus limensis*, *Phaseolus lunatus*, *Phaseolus coccineus*, *Vigna umbellata*, *Canavalia enformis*, *Dolichos pruriens*, *Dolichos biflorus*, *Dolichos aciphyllus* and *Dolichos lablab* were explored in Dhubri district of Assam. These species show excellent market potential in the form of nutrient rich vegetable and also as a source of traditional medicine. Moreover, availability of such biodiversity of Fabaceae family in this region is studied for the first time.

Key words: Fabaceae family, Biodiversity, *Phaseolus* sp., *Vigna* sp., *Dolichos lablab*

Fabaceae family consists of 730 genera and more than nineteen thousand species has a worldwide distribution and are of great importance in terms of food and nutraceutical value [1]. Species of Fabaceae family are leguminous in nature and are consumed by people all across the globe and were amongst the first plants to have been domesticated by mankind [2]. The beans of Fabaceae family are rich in various essential nutrients such as protein as high as 40% of their dry weight, carbohydrate, minerals etc. at different concentration depending on the species [3]. Apart from their nutritional value, they are also known for their ethno medicinal use majorly as a traditional medicinal source for the treatment of diabetes in India [4]. In the year 2017, India was the largest producer of legumes in the world with a huge contribution of 23% of total legume produced worldwide [5]. Considering the market potential legumes in the country and worldwide, it is important to characterize the genetic resources and the market value of various species under Fabaceae family by morphological and agronomic traits for further improvement of traits by breeding [6], [7].

Assam, located in the Northeastern part of India is blessed with fertile soil and good climatic condition which

favours large scale production of various species of rice and leguminous crops. Even though their nutritional and medicinal values are well documented but no systematic market survey on various species of Fabaceae family available in the region is not yet available. On the other hand, agriculture is the major source of income in Dhubri district of Assam which produces the highest amount of pulses in the state [8]. According to the last latest agricultural census of Assam carried out during 2015-16 shows the production of 7160 tonnes of pulse in Dhubri district with an average yield of 779 tonnes/hect of cultivated area [8]. Hence, the current study focuses on the survey on the availability of various species under Fabaceae family in Dhubri district of Assam. It may be worth to mention that Northeastern region of India is considered as one of the biodiversity hotspots in the world and is a treasure trove of various flora and fauna diversity which are yet to explore [9].

MATERIALS AND METHODS

Data retrieval and market survey

Local market survey was also conducted in 200 local shops distributed all across of Dhubri district during the month of January-February and November-December to get a holistic idea on the market scenario.

Sample collection

Some of the popular locally grown beans of Fabaceae family were collected during the survey in suitable agricultural sites. The sample collection sites are shown in map (Fig 1) and the GPS locations are shown in (Table 1). The taxonomic identification was done in consultation with departmental plant taxonomists of Assam down town University, Guwahati, Assam, India.

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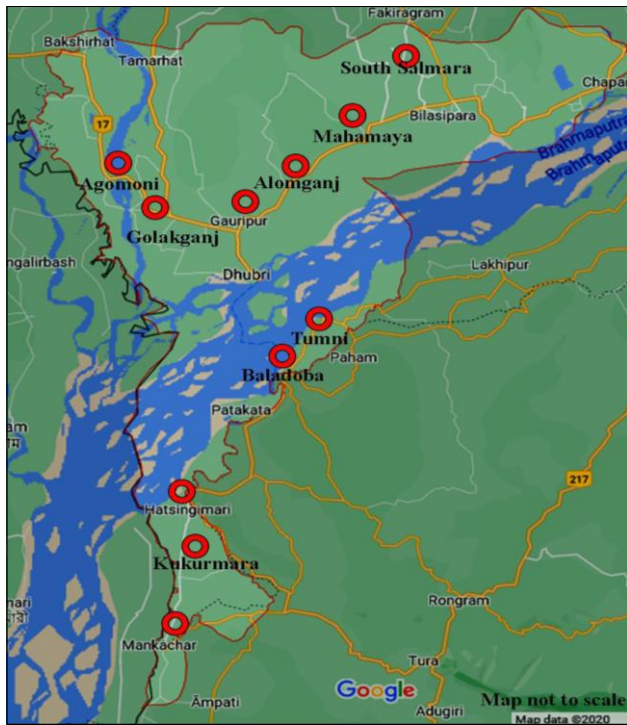


Fig 1 Map showing the location of sample collections sites in Dhubri district (Source: Google maps)

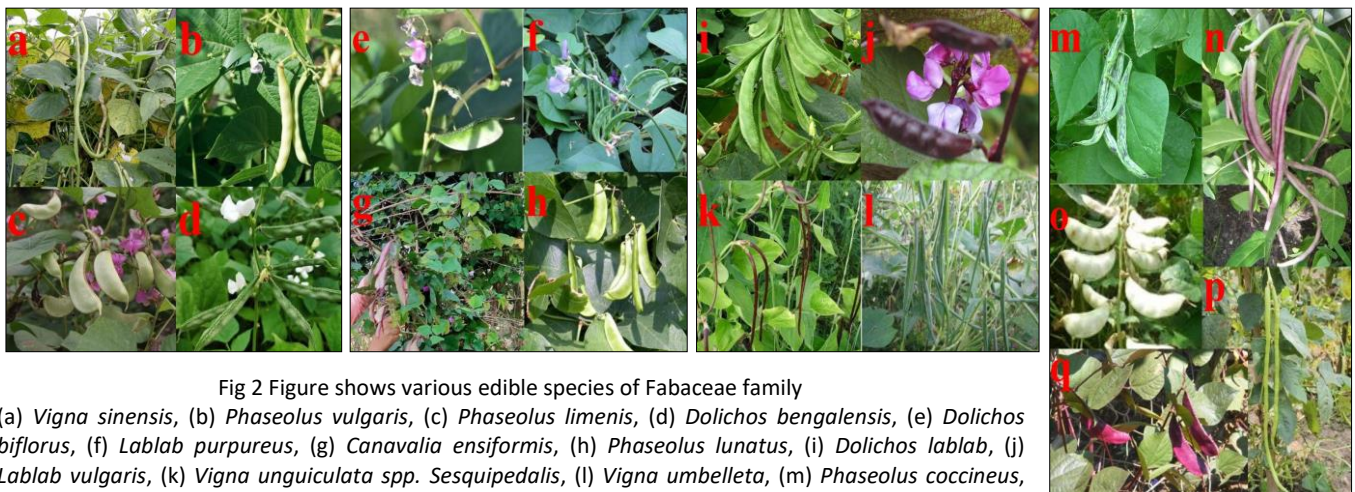


Fig 2 Figure shows various edible species of Fabaceae family

(a) *Vigna sinensis*, (b) *Phaseolus vulgaris*, (c) *Phaseolus limenis*, (d) *Dolichos bengalensis*, (e) *Dolichos biflorus*, (f) *Lablab purpureus*, (g) *Canavalia ensiformis*, (h) *Phaseolus lunatus*, (i) *Dolichos lablab*, (j) *Lablab vulgaris*, (k) *Vigna unguiculata* spp. *Sesquipedalis*, (l) *Vigna umbellata*, (m) *Phaseolus coccineus*, (n) *Dolichos aciphyllus*, (o) *Lablab niger*, (p) *Vigna unguiculata* and (q) *Dolichos pruriens*

(Fig 2a-e) shows some of the most commonly found species of Fabaceae family in Dhubri district. Such evidences on availability of 17 species of Fabaceae family in the region were not documented before. Hence such information may be considered as significant from biodiversity perspective. The fruit colour varies from deep green to light green, white, and pink to purple from species to species. The details of available species of Fabaceae family in Dhubri district along with their fruit dimension, fruit, seed and flower colour are listed in (Table 2). Out of these 17 species, the fruit colour of seven species viz. *Phaseolus vulgaris*, *Vigna unguiculata* spp. *Sesquipedalis*, *Vigna sinensis/Vigna unguiculata* spp. *Sesquipedalis*, *Dolichos bengalensis*, *Lablab purpureu*, *Phaseolus lunatus*, *Phaseolus coccineus*, *Vigna umbellata*, *Dolichos biflorus* and *Dolichos lablab* was found green. Rest of them were found to have purple coloured fruits (viz. *Vigna unguiculata* spp. *Sesquipedalis*, *Lablab vulgaris*, *Canavalia ensiformis*, *Dolichos pruriens*, and *Dolichos aciphyllus*) except *Phaseolus limenis* and *Lablab niger* with pale white coloured fruits. The highest fruit length was observed in *Vigna*

Statistical analysis

Data obtained were presented in the form of mean \pm SD and student's *t*-test was carried out to see the significance using CalculatorTM online tool (www.calculator.net).

RESULTS AND DISCUSSION

Survey on the availability of species under Fabaceae family shows the availability of 17 species in the region under study. The prevalence of the following species of Fabaceae family was studied viz. *Phaseolus vulgaris* (common name: Bush bean), *Vigna unguiculata* spp. *Sesquipedalis* (common name: Snake bean), *Vigna unguiculata* spp. *Sesquipedalis* (common name: Red noodle bean), *Vigna sinensis/Vigna unguiculata* spp. *Sesquipedalis* (common name: Asperagus bean), *Dolichos bengalensis* (common name: Dolichos bean), *Lablab purpureus* (common name: Hyacinth bean), *Lablab niger* (common name: Small white bean), *Lablab vulgaris* (common name: Purple bean), *Phaseolus limenis* (Butter bean), *Phaseolus lunatus* (common name: Lima bean), *Phaseolus coccineus* (common name: Runner bean), *Vigna umbellata* (common name: Rice bean), *Canavalia ensiformis* (common name: Jack bean), *Dolichos pruriens* (common name: Velvet bean), *Dolichos biflorus* (Horse tail bean), *Dolichos aciphyllus* (common name: Seim bean), and *Dolichos lablab* (common name: Papdi bean).

unguiculata spp. *Sesquipedalis* (25.94 ± 0.66 cm) followed by *Vigna sinensis/Vigna unguiculata* spp. (23.77 ± 0.53 cm) and *Vigna unguiculata* spp. *Sesquipedalis* (23.24 ± 0.71 cm).

A small-scale market survey indicates *Phaseolus purpureus* with highest per kg cost during November-December followed by *Dolichos bengalensis* and *Vigna unguiculata* ssp. *sesquipedalis* which may be due to the demand versus supply in spite of their fruiting season (Table 3). Rest other species have similar rates in local market which may be due to their large-scale availability in the market as popular vegetable option.

Planning and attention are the keys for successful marketing of local bean crops. However, proper irrigation, implementing modern scientific agricultural techniques in harvesting, commercially appealing scientific packaging, refrigerated transportation, cold storage and compliance with health and safety regulations etc. may increase the demand of such varieties not only locally but also globally [10], [11]. Global export may also be enhanced by involving local

farmers with modern startups and self-help groups who can promote the products through e-commerce platforms [12].

Table 1 GPS locations of all the sample collection sites in Dhubri district

Local name	Scientific name	Name of sample collection site	Location	
			Latitude	Longitude
Bush bean	<i>Phaseolus vulgaris</i>	Bilasipara	26.2 ⁰ N	91.82 ⁰ E
		Alomganj	26.09 ⁰ N	89.9 ⁰ E
		Gauripur	26.21 ⁰ N	90.12 ⁰ E
		Mahamaya	26.21 ⁰ N	90.12 ⁰ E
Snake bean	<i>Vigna unguiculata</i> spp. <i>sesquipedalis</i>	South salmara	26.1 ⁰ N	91.8 ⁰ E
		Tumni	25.35 ⁰ N	89.98 ⁰ E
		Baladoba	26.10 ⁰ N	89.83 ⁰ E
Red noodle bean	<i>Vigna unguiculata</i>	South salmara	26.1 ⁰ N	91.8 ⁰ E
		Hatsingimari	25.72 ⁰ N	89.9 ⁰ E
		Kukurmara	25.72 ⁰ N	89.9 ⁰ E
Asperagus bean	<i>Vigna sinensis/Vigna unguiculata</i> spp. <i>sesquipedalis</i>	Hatsingimari	25.72 ⁰ N	89.9 ⁰ E
		Mankachar	25.53 ⁰ N	89.86 ⁰ E
Dolichos bean	<i>Dolichos bengalensis</i>	Agomoni	26.7 ⁰ N	89.7 ⁰ E
		Golakganj	26.10 ⁰ N	89.84 ⁰ E
Hyacinth bean	<i>Lablab purpureus</i>	Bilasipara	26.20 ⁰ N	91.82 ⁰ E
		Alomganj	26.18 ⁰ N	90.0 ⁰ E
Small white bean	<i>Lablab niger</i>	Mankachar	25.53 ⁰ N	89.86 ⁰ E
Purple bean	<i>Lablab vulgaris</i>	Hatsingimari	25.72 ⁰ N	89.9 ⁰ E
		Kukurmara	25.43 ⁰ N	89.54 ⁰ E
Butter bean	<i>Phaseolus limenis</i>	Agomoni	26.7 ⁰ N	89.7 ⁰ E
		Golakganj	26.10 ⁰ N	89.84 ⁰ E
Lima bean	<i>Phaseolus lunatus</i>	South salmara	26.1 ⁰ N	91.8 ⁰ E
		Tumni	25.35 ⁰ N	89.98 ⁰ E
		Baladoba	26.10 ⁰ N	89.83 ⁰ E
		Alomganj	26.18 ⁰ N	90.0E
Runner	<i>Phaseolus coccineus</i>	Mahamaya	26.21 ⁰ N	90.12 ⁰ E
		Kukurmara	25.43 ⁰ N	89.54 ⁰ E
Rice bean	<i>Vigna umbellata</i>	South salmara	26.1 ⁰ N	91.8 ⁰ E
Jeck bean	<i>Canavalia enformis</i>	Hatsingimari	25.72 ⁰ N	89.9 ⁰ E
		Mankachar	25.53 ⁰ N	89.86 ⁰ E
		Gauripur	26.09 ⁰ N	89.9 ⁰ E
Valvet bean	<i>Dolichos pruriens</i>	Alomganj	26.18 ⁰ N	90.0 ⁰ E
Horse tail bean	<i>Dolichos biflorus</i>	Mahamaya	26.21 ⁰ N	90.12 ⁰ E
		Bilasipara	26.2 ⁰ N	90.2 ⁰ E
		South salmara	26.1 ⁰ N	91.8 ⁰ E
Seim bean	<i>Dolichos aciphyllus</i>	Hatsingimari	25.72 ⁰ N	89.9 ⁰ E
Papdi Bean	<i>Dolichos lablab</i>	Mankachar	25.53 ⁰ N	89.86 ⁰ E

Table 2 Fruit details of all the species of Fabaceae family available in the region

Scientific name	Fruit colour	Seed colour	Flower colour	Fruit length (in cm)
<i>Phaseolus vulgaris</i>	Light green	White, green	White, pink, purple	5.92±0.86 (L) X 1.2±0.62 (B)
<i>Vigna unguiculata</i> spp. <i>sesquipedalis</i>)	Deep green	White, brown, creamy	White, pink, purple, yellow	25.94±0.66 (L) X 1.3±0.41 (B)
<i>Vigna unguiculata</i>	Purple	Green, brown	Pink, purple	23.77±0.53 (L) X 1.3±0.32 (B)
<i>Vigna sinensis</i> / <i>Vigna unguiculata</i> spp. <i>sesquipedalis</i>	Light green	Light green	White, pink, purple	23.24±0.71 (L) X 1.3±0.45 (B)
<i>Dolichos bengalensis</i>	Deep green	Light purple, Light green	White, purple	5.1±0.61 (L) X 2.5±0.25 (B)
<i>Lablab purpureus</i>	Light green	White, green	White, pink, purple	6.34±0.53 (L) X 2.3±0.22 (B)
<i>Lablab niger</i>	White	Light green	White, pink, purple	3.71±0.51 (L) X 2.2±0.1 (B)
<i>Lablab vulgaris</i>	Purple	Pink purple	Pink, purple	7.53±0.67 (L) X 1.8±0.23 (B)
<i>Phaseolus Limenis</i>	Pale white	Creamy, pale green	Pink, purple	2±0.35 (L) X 1.1±0.1 (B)
<i>Phaseolus lunatus</i>	Dark green	Pale green	White, pink, purple	2.71±0.51 (L) X 2.1±0.25 (B)
<i>Phaseolus coccineus</i>	Light green	White, creamy	White, pink, purple	10.61±2.92 (L) X 1.8±0.22 (B)
<i>Vigna umbellata</i>	Green	Pale green	Purple, pink	9.5±0.64 (L) X 1.7±0.12 (B)
<i>Canavalia enformis</i>	Light purple	Pale green, white	White, pink, purple	4.59±0.66 (L) X 2.5±0.12 (B)
<i>Dolichos pruriens</i>	Purple	Brown	Pink, purple	3.09±0.77 (L) X 0.22 (B)
<i>Dolichos biflorus</i>	Light green	Light green	Pink, purple	15.49±0.67 (L) X 1.2±0.1 (B)
<i>Dolichos aciphyllus</i>	Purplish white	Light green	Pink, purple	7.82±0.52 (L) X 2.8±0.2 (B)
<i>Dolichos lablab</i>	Light green	Brown, white, black	White, pink, purple	6.48±0.66 (L) X 2.1±0.11 (B)

Table 3 Market analysis of the available species of Fabaceae family in Dhubri district

Name of beans	November / December		January / February	
	Per kg market price (INR) during	Per kg retail price (INR)	Per kg market price (INR) during	Per kg retail price (INR)
<i>Phaseolus vulgaris</i>	38	25	35	20
<i>Vigna unguiculata</i> spp. <i>sesquipedalis</i>	40	30	35	20
<i>Vigna unguiculata</i> spp. <i>sesquipedalis</i>	45	35	40	30
<i>Vigna sinensis</i> /	40	30	40	25
<i>Vigna unguiculata</i> spp. <i>sesquipedalis</i>				
<i>Dolichos bengalensis</i>	55	30	40	25
<i>Lablab purpureus</i>	45	30	35	25
<i>Lablab niger</i>	55	30	35	22
<i>Lablab vulgaris</i>	70	42	43	24
<i>Phaseolus Limenis</i>	50	35	30	20
<i>Phaseolus lunatus</i>	60	34	45	28
<i>Phaseolus coccineus</i>	55	35	45	28
<i>Vigna umbellata</i>	45	30	35	24
<i>Canavalia enformis</i>	50	35	34	20
<i>Dolichos pruriens</i>	70	45	48	25
<i>Dolichos biflorus</i>	54	35	45	32
<i>Dolichos aciphyllus</i>	60	45	47	25
<i>Dolichos lablab</i>	60	35	45	30

Various species of Fabaceae family are well known for their phytochemical values and are used in Ayurvedic research in India since long [13], [14], [15]. In traditional medicine, they are used to maintain healthy stomach by destroying the worms in it [16], [17]. Species of fabaceae family are also known to have antimicrobial activities against both gram positive bacterial pathogens such as *Bacillus cereus*, *Bacillus subtilis*, *Bacillus megaterium*, *Corynebacterium rubrum*, etc. and also against gram negative pathogens such as *Pseudomonas aeruginosa*, *Pseudomonas stutzeri*, *Pseudomonas pictorum*, *Klebsiella aerogenes* etc. [18] [19]. It may also be noted that various species of fabaceae family not only shows antibacterial activities but also inhibits the growth of fungal pathogens such as *Candida albicans*, *Aspergillus fumigates*, *Aspergillus niger* [20], [21]. They have also been used for treating jaundice, menstrual disorder, epilepsy etc. in Ayurveda and traditional medication [22], [23] [24]. Besides their enormous medicinal value in traditional medicine, they are also rich in protein, vitamin A, thiamin, potassium, phosphorus, iron, etc. [25]. Not only the fruiting part, which is popularly used as vegetable but also the flowers are used for making powder and to bake. Even the leaves are also used as home remedy for the treatment of allergy, ringworm and skin rashes etc. [26] [27]. Hence, study on the

biodiversity of Fabaceae family in the region and also the market value analysis advocates the scope for up-liftment in their marketing strategy and awareness among farmers.

CONCLUSIONS

The current investigation surveys the availability of 17 species of Fabaceae family in various regions of Dhubri district of Assam for the first time. These species are well known for their nutritional values in the form of popular vegetable in the region and the local market survey also demonstrates their export potential in near future which may be achieved with modern agricultural methods, generating awareness among local farmers, and also with the help of e-commerce platforms.

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Conflict of interest

The authors declare that there is no conflict of interest.

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