An Underexplored Diversity in “*Yoksik Peron*” [*Lablab Purpureus* (L.) Sweet] in East Siang, Arunachal Pradesh, India

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Abstract

As a legume and a source of protein, hyacinth bean [*Lablab purpureus* (L.) Sweet] serves as a resilient and efficient source not only of calories but also of proteins and has several therapeutic properties besides, which makes it a truly multifunctional legume. The present study describes the wide morphological diversity in “*Yoksik peron*” (local name of lablab bean) found in Pasighat (East Siang district, Arunachal Pradesh) represented by 14 landraces conserved and cultivated by the indigenous people mainly in their backyards and kitchen gardens. The width of the pod ranged from 1.6 cm to 4.1 cm and its length, from 4.7 cm to 20.1 cm. The pods also differed in colour, seed size, and shape. Many of those landraces are more resistant to several biotic and abiotic sources of stress. Such diversity offers the opportunity to identify and select the genotypes with greater tolerance to stress, thereby contributing to making the ecosystem more resilient. In addition, contemporary studies on hyacinth bean have shown the wide range of health benefits it offers, especially its potent anti-obesity properties. To realize the bean's full potential, we need an enabling policy environment for furthering research and mainstreaming to other locations.

Introduction

Hyacinth bean otherwise called lablab bean [*Lablab purpureus* (L.) Sweet] (Syn. *Dolichos lablab*) is a Leguminous crop, which is a monotypic genus belonging to the family of Leguminosae (Fabaceae) and other crops like common bean, soybean, and the garden pea (*Pisum sativum* L.) also belong to this family. The lablab bean is considered one of the ancient cultivated plants because of the fact the *Sanganakallu* excavation dating back to 1800 BC and other several excavations in India have recorded the remains of Lablab bean (Fuller 2003). Further, there are ancient evidences to prove that lablab bean might have originated in India (Nene, 2006). For instance, testimonies of growing of lablab bean historically in India can be reasonably established from the archaeobotanical documents which points to as early as the earliest Iron Age site in Karnataka i.e. from 2000 to 1700 BC at Hallur, and also from 1200 – 300 BC at the Veerapuram excavation site in Andhra Pradesh (Fuller, 2003). By and large, *Lablab purpureus* is a self-fertilizing crop which is predominantly being farmed locally and is one of the underutilized crops, and mostly found in continents *viz* Asia, Africa and Australia (Maass et al. 2010). Based on ancient remains in India, it is supposed that from India, the lablab bean might have been introduced into Egypt, China and Western Asia (Ayyangar and Nambiar, 1935). In India's neighboring country Bangladesh, in central and south-western parts of the country, it is ranked as third in terms of most important vegetable (Rashid et al. 2007).

As a legume, hyacinth bean offers a resilient and efficient source not only of calories but also of proteins and has several therapeutic properties which makes it a truly multifunctional legume (Devaraj 2016; Habib et al. 2017). This herbaceous vine shows vigorous vertical growth by means of twining around any available support. The vine locates a source of support by continually nutating (Latin *nutare*, 'to nod') its tip; once the tip touches a support, the vine begins to twine around the support, forming a spiral (Goriely and Neukirch 2006). Among legumes, lablab shows greater tolerance to drought, and even among

different lines of the same species, the level of tolerance to drought varies a great deal (Ewansiha and Singh 2006; Murphy and Colucci 1999). In areas where the average annual rainfall is decreasing steadily, there is adverse effect on yields of conventional crops, which is why it is becoming increasingly important to look for alternative species of edible plants and for genotypes of existing species better suited to sparse rainfall (Guretzki and Papenbrock 2013).

However, the lablab bean remains an underexplored legume in terms of its genetics and utilization despite its wide diversity and multiple uses (Kimani et al. 2012). Although, exploration on the diversity of underutilized Lablab legume is of paramount importance to setup nutritional and economic database of the crop (Minde et al. 2020). Globally it is cultivated in different parts of the world, but in India this is highly region specific crop, especially the seed type. Given the renewed emphasis in research and development of pulses and legumes, which are now considered climate-smart crops (Kumar et al. 2019), the present study seeks to document the landraces of hyacinth bean from East Siang district of Arunachal Pradesh and to review the bean's potential as a source of protein in other parts of the country and its test its adaptability in the context of climate change.

Materials And Methods

East Siang district of Arunachal Pradesh is part of one of the world's biodiversity hot spots. Using snowball sampling, which involves tapping local networks, 43 respondents were selected, all of them being tribal farm women who regularly sell their surplus agricultural produce in the local market in Pasighat town (Fig. 1). The respondents also served as key informants and supplied details of the location of others who also cultivate "*Yoksik peron*" (local name of lablab bean). This information was collected from December 2019 to January 2020, that being the peak season for harvesting the "*Yoksik peron*". We then collected distinct landraces from the fields of those growers. Indeed, studies on plant diversity are best done through the participatory research to capture the perceptions of the local people. As a protocol, we also discussed with growers the free prior informed consent (FPIC) agreement and obtained their verbal consent for participating in the study and for allowing the data and samples collected from them to be used for the study. For revalidating the landraces of "*Yoksik peron*", we consulted plant breeders and other scientists from the vegetable sciences department of the College of Horticulture and Forestry, Pasighat.

Results And Discussion

Broadening the genetic base through enhancing the diversity of cultivars is the key to sustainable production of the lablab bean (Vaijayanthi and Ramesh 2019). Recognizing it, the present study documents hitherto undescribed and unreported landraces of the lablab bean.

Table 1
Morphological characteristics of pods of different landraces of the lablab bean (*Lablab purpureus*)

Land-race	Pod length		Pod width		No. of seeds per pod	Pod colour
	Mean (cm)	Standard deviation	Mean (cm)	Standard deviation		
DKP1	8.08	0.55	1.96	0.09	5	Tea green
DKP2	12.38	0.44	2.06	0.18	6	Purple
DKP3	20.10	1.26	2.02	0.16	6	Forest green
DKP4	16.94	1.19	4.12	0.54	7	Kelly green
DKP5	4.66	0.18	1.78	0.04	4	Green
DKP6	13.64	1.54	2.04	0.09	5	Light green
DKP7	7.28	0.32	1.76	0.11	4	Purple
DKP8	12.94	0.98	2.34	0.28	6	Light green
DKP9	15.74	1.18	2.00	0.14	6	Banana yellow
DKP10	11.42	0.37	2.62	0.26	6	Light purple
DKP11	4.98	0.60	1.56	0.23	3	Green
DKP12	13.84	1.05	2.20	0.20	5	Light green
DKP13	7.36	0.59	2.62	0.30	4	Light purple
DKP14	10.22	1.04	2.42	0.19	6	Green

The indigenous people of East Siang have carefully maintained varieties of *Yoksik peron*, which is extensively consumed locally. Based on the present survey, which also compiled information on its cultivation and usage, 14 types of the *Yoksik peron* were documented. These differed in many parameters; for example, the width of the pod ranged from 1.6 cm to 4.1cm and its length, from 4.7 cm to 20.1cm (Table 1); the pods also differed in colour, seed size, and shape. Of the types, Nos. DKP1, DKP 4, and DKP 6 (Fig. 2) were found in abundance and also fetched higher prices than other types in the local market of Pasighat. The indigenous people consume boiled tender pods or use the bean seeds in curries or cook the pods with fish as a side dish. Thus, in this area, the *Yoksik peron* is in greater demand as a pod, for use as a vegetable, than as seed, unlike in southern India, where both the forms are used. Further, it was clear from information gathered from local vendors and based on our field observations that most of the *Yoksik peron* in East Siang were climbers, grown mainly in the backyard or in kitchen gardens and not on a commercial scale, which indicates that these are of the indeterminate type. Seeds for the next season are traditionally harvested on new moon days, locally referred to as *Amavasya*, which is believed

to protect the stored seed from pests and also to prolong seed viability. Indeed, elderly women of *Adi* tribe are considered to be “living encyclopedias” in biocultural knowledge systems. These women play a pivotal role in retaining and transmitting on biodiversity-related traditional knowledge to the next generations (Singh et al., 2013). The knowledge and practice of elderly women about habitats and multi-storey vegetations, multiplication methods, selective harvesting, and cultivation practices contribute significantly to food and livelihood security while sustaining an array of threatened plant species. The conservation of biodiversity including *Yoksik peron* occurs in three different habitats: jhum lands (shifting cultivation), Morang forest (community managed forests), and home gardens (Singh et al., 2013).

Table 2
Nutritional value of the lablab bean (*Lablab purpureus*) per 100 g of raw, mature seeds

Constituent	Nutrient value	Percentage of RDA ^a
Energy	344 kcal	17%
Carbohydrates	60.74 g	47%
Protein	23.90 g	43%
Total fat	1.69 g	8.5%
Cholesterol	0 mg	0%
Dietary fibre	25.6 g	67%
Vitamins		
Folates	23 µg	6%
Niacin	1.610 mg	10%
Pyridoxine	0.155 mg	12%
Riboflavin	0.136 mg	10%
Thiamin	1.130 mg	94%
Vitamin A	0 IU	0%
Electrolytes		
Sodium	21 mg	1.5%
Potassium	1235 mg	26%
Minerals		
Calcium	130 mg	13%
Copper	1.335 mg	148%
Iron	5.10 mg	64 %
Magnesium	283 mg	71%
Manganese	1.573 mg	68%
Phosphorus	0.372 mg	53%
Selenium	8.2 µg	15%

^arecommended dietary allowance

Constituent	Nutrient value	Percentage of RDA ^a
Zinc	9.30 mg	84%
^a recommended dietary allowance		

Source: USDA National Nutrient database; <https://www.nutrition-and-you.com/hyacinth-bean.html>

Apart from the nutritional value of the bean (Table 2), a scooping review (Al-Snafi 2017) describes its value in pharmacology and its medicinal importance. Recent studies on the nutraceutical properties of the lablab bean confirm its value as a functional food, which could be used for the treatment of obesity and related diseases (Suh et al. 2017; Vidigal et al. 2018; Yin et al. 2018). Thus, apart from its nutty creamy taste, the bean, not only a source of calories and of proteins but also has other health benefits. The lablab bean, given its prolific yield, versatility, and adaptability to adverse and harsh conditions is undeniably one of the legumes for the future. Because of its phenomenal resilience to drought and salinity, it is also suitable for field production (Murphy and Colucci 1999; Jaleel. et al. 2009; D’Souza and Devaraj 2010; Devaraj and D’Souza 2016). The bean is well adapted to dry environments and copes with droughts by minimizing the loss of water by maintaining the right balance between vegetative and reproductive growth (Sennhenn et al. 2017; Naeem et al. 2020).

Market Potential

Although primarily cultivated for household consumption, of late, in villages like Balek, Bodak, Mirem, Rani, Ruksin and Taki Lalung, local people ventured its mass cultivation, after realizing its huge market demand. Like most of the less known crops and wild plants/ vegetables were sold in regular market of “Pasighat” and “Ruksin” local markets directly by farmers (Fig. 1) as well as by a few permanent retailers in commercial markets. Interviews with the sellers/retailers revealed almost a threefold increase in price from 2017-18. The market rates for the pods/ seeds was INR 150–200/Kg. in market of Pasighat town, Arunachal Pradesh while, fresh pod sold at 50–75/Kg. The local types *Yoksik peron* with green colored pods were commonly available and fetched better price as compared to others. On an average, a farmer growing ten clumps in backyards earns INR 5000 per annum.

Conclusion

The lablab bean has hitherto been only of regional significance because of its restricted cultivation and its limited popularity; it has remained localized and has not been subjected to sufficient selection pressure. Furthermore, the study uncovers diversity with nutritional and medicinal values may pick interest of market value for underutilized *Yoksik peron* as a commercial product and this is vital to farmer’s economic advantages. The literature briefly reviewed here shows its nutritional and pharmacological properties and its ability to adapt to abiotic and biotic forms of stress-that are likely to

become even more severe as a result of climate change. Despite these considerable merits, the *Yoksik peron* has received little attention from researchers and conservationists, and the current agricultural statistics ignore its production. It is therefore necessary to formulate conducive policies and garner institutional support for research on the effective utilization of the many and diverse landraces of the *Yoksik peron*, which will be a valuable addition to mainstream diets.

Declarations

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Compliance with ethical standards

Conflict of interest Authors declare that they have no conflict of interest on the content of the manuscript and study undertaken.

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Figures

Figure 1

Study area: Pasighat, East Siang district, Arunachal Pradesh.

Figure 2

Diversity of landraces of the lablab bean (*Lablab purpureus*) collected from East Siang district, Arunachal Pradesh.