

Original Research Article

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## Evaluation of Physico-Chemical and Genetic Diversity of *Elaeagnus* species in Manipur, North East India

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### ABSTRACT

#### Keywords

*Elaeagnus* species, Physico-chemical parameters, *Heiyai*, Genetic diversity, SDS-PAGE

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A survey was conducted in different locations of Imphal East (Wangkhei, Khurai, Pourabi and Takhel) and Senapati districts of Manipur, India during the period 2017-2018 for the documentation on the variability of *Elaeagnus* species (*Heiyai*, in Manipuri) in this region. These plants are found wild or in the homestead garden and grow well both in the hill and valley region of Manipur. From the investigation, it was noticed that significant variation exists in fruit morphology (shape and size), fruit colour, fruit quality and seed shape characters among the different genotypes collected from studied areas. Analysis on its different physico-chemical quality parameters revealed that the TSS ranges from 7.6 to 13° Brix and the fruit physical parameters like fruit pedicel, fruit weight, seed weight, seed length, seed width, pulp weight, protein, carbohydrate, Vitamin C, TSS and acidity of the fruit among the different genotypes are found to be significantly varied. However, the biochemical marker (SDS PAGE) revealed monomorphic banding pattern and no variation was found in among the genotypes which can further be confirmed using molecular marker in the near future.

### Introduction

*Elaeagnus* species, belonging to family Elaeagnaceae, locally known as *Heiyai* in Meitei language of Manipur is found growing semi-wild in the hills and valleys of Manipur and is being grown in the homestead garden in these areas in small scale. It is having straggling woody deciduous shrub nature; bark darkish grey and the branches are densely covered with brown scales. It is among pet plants loved by householders wherever they are grown. It has also become an alternative source of income for the local people of the

Manipur (hill and valley) and fetches huge sum in the local market mainly during the ripening period (March-April) that coincides with *Sajibu Cheiraoba*- the New Year of Local Calendar in the state. This underutilized fruit crop is growing in wild in the states of Manipur, Meghalaya, Nagaland, Mizoram and parts of Arunachal Pradesh. There is variability in the colour, shape and taste of the fruit (sweet or sour) found in Manipur. Shadeque (1989) also reported that the North East Region has its own unique combination of living species, habitats and ecosystems, which together make up its rich diversity

resource and considered as hot spot for biodiversity of India. Besides, the North-Eastern Region of India including Manipur is part of both Himalaya as well as Indo-Burma biodiversity hotspots in the world supporting about 50% of the total India's biodiversity but represent only 8% of the total geographical area of India (Moa *et al.*, 2009).

Based on the fruit morphology there are two types of fruit among *Elaeagnus species* viz. oblong and pyriform type. Patel *et al.*, (2008) reported that two species of *Elaeagnus* viz *E. latifolia* having oblong shape and *E. pyriformis*, having pyriform shape, locally called *Soh-shang* in Khasi (Meghalaya) are grown throughout the North-Eastern Region. These species are found growing even up to elevations of 1500m above MSL in the Himalayan tracts. It is a large evergreen woody shrub with rusty-shiny scales that are sometimes thorny. Flowers are hermaphrodite (have both male and female organs) and are pollinated by bees. Fruits of *Elaeagnus latifolia* are oblong in shape with dark pink in colour at ripening, whereas, fruits of *Elaeagnus pyriformis* are pyriform in shape with slightly pointed at both the ends. It flowers during September-December and light pink coloured fruits are harvested during March-April.

Fruits are small fruits and among the choicest seasonal fruits for the locals. The fruit peel is thin and dotted with scattered silvery patches. Fruit contains a single large seed having very less viability in seed due to recalcitrant in nature. Sour types are eaten raw with salt and used for making pickle and squash. However, sweeter types are preferred for fresh/desert purposes. Singh *et al.*, (2014) also reported that the fruit of *Elaeagnus* species has digestive property and seeds are having medicinal properties for curing cough. Besides, *Elaeagnus conferta*, known locally as *Sokkua* found in Garo Hills of Meghalaya has

reported having antioxidant properties effective against cancer and its ripe fruits eaten raw for fresh consumption (Momin *et al.*, 2016).

Still now seed propagation method is commonly followed in Manipur so variation is present among the present plant population having mild acidic and sweet genotype having various fruit shape and size. For fresh consumption, sweet type is preferred. However, no improved cultivar or prominent types have been selected/ identified or available for this region. Besides, there is no varietal screening in North East India for this popular underutilized fruit crop. The leading international research organizations including the Consultative Group on International Agricultural Research (CGIAR) are among those taking a keen interest in strengthening the work on underutilized fruit crops. The Global Forum on Agriculture Research (GFAR) in 1999 also emphasized the role of underutilized species in raising income of the rural poor (Singh *et al.*, 2014).

The Nitrogen fixing ability of the genera *Elaeagnus* and more particularly *E. latifolia*, *E. umbellata*, *aungustifolia* etc were reported long back by Baker *et al.*, (1979) and also recently reiterated by Bargali (2011). Besides, Panja *et al.*, (2014) also concluded that a 70% methanolic extract of *Elaeagnus latifolia* contains small amounts of phenols, flavonoids, ascorbic acid, carbohydrates and tannins. Various *in vitro* assays indicate that the extract exhibits moderate antioxidant and free radical scavenging activities and, hence, the fruit is considered to be a significant source of natural antioxidants, which might be helpful in preventing the progress of oxidative stress in the body system. Therefore, in the present study, an attempt has been made to evaluate the physico-chemical and biochemical marker for the screening of variability of *Elagneous*.

## Materials and Methods

The study was carried out in Manipur which is located at 23°83' N to 25°68N' and 93°E to 94°E covering with an area of 22,327 square kilometers comprising of sixteen districts (Bishnupur, Chandel, Churachandpur, Imphal East, Imphal West, Senapati, Tamenglong, Thoubal, Ukhrul, Kangkokpi, Tengnoupal, Pherzawl, Noney, Kamjong, Jiribam and Kakching) inhabited by *Meitei* community in the valley and *Kuki* and *Naga* tribes in the hill. It is bordered by Assam in the West, by Nagaland in the North, and Mizoram in the South.

Manipur shares an international boundary with Myanmar in the East. The rainfall ranges from 933 mm in the valley to 2593 mm in the hills. The temperature ranges from a minimum of sub-zero to 36°C. The soil types comprises of red ferruginous in the hilly tracts to alluvium in the plain and are acidic in nature exhibiting a range of pH from 5.4 to 6.8. Of the total geographical area, the hilly terrain occupies 90 per cent and whereas, the valley represents 10 %.

The average altitudes of the valley is about 750m above MSL and represent a typical subtropical zone with cool, dry winter, a warm summer and a moderate monsoon season. The fruits were subjected for studies on physico-chemical and SDS PAGE analysis for the genetic diversity found in this region and collected from Imphal East (valley region) and Senapati district (hill region). Three fruit bunches were harvested randomly from each selected plant and ten fruits from each bunch were taken for the evaluation of fruit morphology variable viz. length (cm), fruit diameter (cm), fruit weight (g), peel weight (g), peel thickness (mm) in average, seed weight (g), juice content (ml/fruits) and quality parameters like total soluble solids (TSS), total carbohydrate, total protein,

tritabile acidity and vitamin C with standard of A.O.A.C. (1985) and observations were analyzed in simple Completely Randomized Block Designed (CRD) as suggested by Gomez and Gomez (1983). The genetic diversity of the selected genotypes is screen by using SDS PAGE method as described by (Nei and Li, 1979).

## Results and Discussion

In Manipur, still now there is no report about the variability of *Elaeagnus species (Heiyai)* which is growing in the hill and valley regions as homestead garden. During our survey, it is observed that morphological variation in fruit shape and size, fruit colour, seed size and variation in silver covering in the fruit surface (Fig. 1) and two types of in this region viz. sweet (13° Brix) and acidic (7.6° Brix) based on the sweetness character and the edible part of G<sub>3</sub> (Khurai) are larger (10.43g/fruit) and smallest fruit size (04.47g/fruit) are found in G<sub>2</sub> (Wangkhei).

The physical and physiochemical properties of the morphotypes of *Heiyai* are found to be significant viz. fruit pedicel length, fruit weight, seed weight seed length, seed breadth and fruit pulp are presented in Table 1 and the quality parameters like protein, vitamin c, carbohydrate, TSS and acidity are presented in Table 2.

The physicochemical analysis of the selected genotypes was done at fully mature stage (fruit turn red colour).

According to earlier investigations, physical and biochemical profiling of *soh-shang (Elaeagnus latifolia)* fruit was done which recorded the fruit weight of 16.38 g, fruit length 39.23 mm and diameter 25.91 mm, TSS 11.90%, acidity 2.69-2.82%, ascorbic acid 16.00-19.20 mg/100 ml and total sugar 6.06% (Patel *et al.*, 2008; Patel *et al.*, 2009).

**Table.1** Fruit parameters of *Heiyai* found in Manipur, North East India

Genotypes	Replication	Pedicle length (mm)	Fr. Wt. (g/frt)	Seed wt (g/seed)	Seed length (cm)	Seed Breadth (cm)	Juice (ml/fruit)	Pulp (g/fruit)
G <sub>1</sub>	R <sub>1</sub>	6.33	8.07	0.94	3.60	1.40	1.80	7.13
	R <sub>2</sub>	6.30	8.00	0.90	3.00	1.00	1.00	7.10
	R <sub>3</sub>	6.36	8.14	0.98	4.20	1.80	2.60	7.16
G <sub>2</sub>	R <sub>1</sub>	6.00	4.47	1.12	3.00	1.18	1.80	3.35
	R <sub>2</sub>	5.50	4.00	1.00	2.50	1.10	1.00	3.30
	R <sub>3</sub>	6.50	4.94	1.24	3.50	1.26	2.60	3.40
G <sub>3</sub>	R <sub>1</sub>	5.50	10.30	0.77	2.78	0.96	2.80	9.53
	R <sub>2</sub>	5.00	10.00	0.75	2.70	0.90	2.50	9.50
	R <sub>3</sub>	6.50	11.00	0.79	2.86	1.20	3.10	9.56
G <sub>4</sub>	R <sub>1</sub>	3.50	8.93	0.94	3.04	1.20	2.20	7.89
	R <sub>2</sub>	3.00	8.90	0.90	3.00	1.00	2.00	7.80
	R <sub>3</sub>	4.50	8.96	0.98	3.08	1.40	2.40	7.98
G <sub>5</sub>	R <sub>1</sub>	3.50	8.50	0.44	2.14	0.68	2.00	8.06
	R <sub>2</sub>	3.00	8.00	0.40	2.10	0.60	1.50	8.00
	R <sub>3</sub>	4.00	9.00	0.48	2.18	0.76	2.50	9.12
Mean		5.03	8.08	0.84	2.91	1.09	2.12	7.25
SEM±		0.334	0.233	0.038	0.213	0.132	-----	0.172
CD@5%		1.051	0.700	0.114	0.640	0.397	-----	0.521

G<sub>1</sub>-Senapati (Hilly region)

G<sub>2</sub>-Wangkhei (Imphal East, valley region)

G<sub>3</sub>-Khurai (Imphal East, valley region)

G<sub>4</sub>-Pourabi (Imphal East, valley region)

G<sub>5</sub>-Takhel (Imphal East, valley region)

**Table.2** Quality parameters of *Heiyai* found in Manipur, North East, India

Genotypes	Replication	Protein (mg/100g)	Vit C (mg/100g)	CHO (mg/100g)	TSS (°Brix)	Acidity (%)
G <sub>1</sub>	R <sub>1</sub>	1.32	16.50	23.10	13.00	2.40
	R <sub>2</sub>	1.30	16.00	23.00	12.50	2.40
	R <sub>3</sub>	1.34	17.00	24.20	13.50	2.50
G <sub>2</sub>	R <sub>1</sub>	1.24	12.20	21.29	10.50	2.70
	R <sub>2</sub>	1.22	12.00	21.20	10.00	2.80
	R <sub>3</sub>	1.26	12.40	21.38	11.00	2.80
G <sub>3</sub>	R <sub>1</sub>	1.02	7.25	20.81	12.00	2.50
	R <sub>2</sub>	1.04	7.00	20.80	11.50	2.50
	R <sub>3</sub>	1.00	7.50	20.82	12.50	2.60
G <sub>4</sub>	R <sub>1</sub>	0.91	10.00	19.42	7.60	2.70
	R <sub>2</sub>	0.91	9.50	19.40	7.00	2.80
	R <sub>3</sub>	0.91	10.50	19.44	8.20	2.80
G <sub>5</sub>	R <sub>1</sub>	1.06	11.50	18.33	8.00	2.90
	R <sub>2</sub>	1.06	11.00	18.30	7.50	3.00
	R <sub>3</sub>	1.06	12.00	18.36	8.50	2.90
Mean		1.11	11.49	20.65	10.22	2.68
SEM±		0.009	0.250	0.038	0.316	0.028
CD@5%		0.028	0.751	0.114	0.949	0.084

G<sub>1</sub>-Senapati (Hilly region)

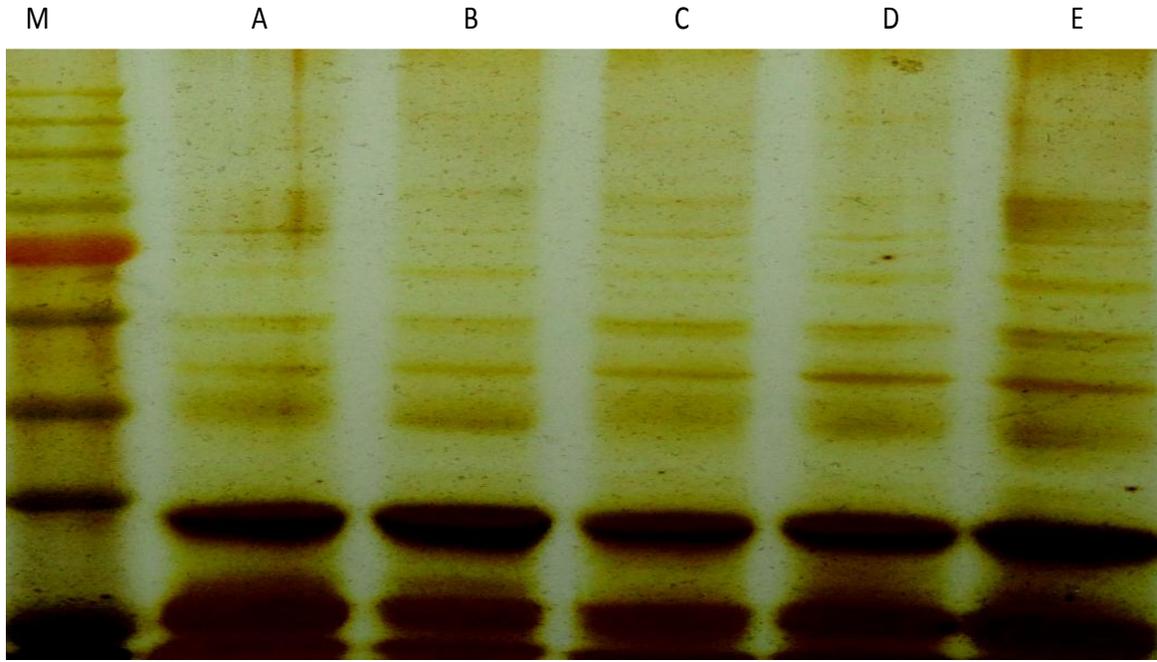
G<sub>2</sub>-Wangkhei (Imphal East, valley region)

G<sub>3</sub>-Khurai (Imphal East, valley region)

G<sub>4</sub>-Pourabi (Imphal East, valley region)

G<sub>5</sub>-Takhel (Imphal East, valley region)

**Fig.1** SDS-PAGE banding pattern of *Elaeagnus* species (Heiyai) from Manipur, North East, India  
A: Represent genotype from Senapati district, B: Representing genotype from Wangkhei, Imphal East, C: Represent genotype from Khurai, Imphal East, D: Represent genotype from Pourabi, Imphal East, E: represent from Takhel, Imphal East and M: Ladder of 245 KD



**Fig.2** Morphological variability of Haiyai (*Elaeagnus* species) fruit found in Manipur



**Fig.3** Variability of seed shape and size of *Heiyai* (*Elaeagnus* species) fruit found in Manipur



Dandge *et al.*, (2011) also reported that the fruits of the Elaeagnaceae family, especially *Elaeagnus conferta* which are found in the Konkan region of Maharashtra have various bioactive components such as phenolics (6.08 %), flavonoids (11.68 %), lipids (2.9 % from seed and 3.5% from pulp), carotenoids (1.35 % from seeds and 16.00 % from pulp), carbohydrates (39 %), ascorbic acid (8.2 %) and titratable acidity (2.37 %).

However, collection and evaluation for screening superior found in NE region has not been initiated till now, although there is variability in fruit morphology and quality parameters like sweetness of this underutilized fruit crop (Fig. 2 and 3).

*Heiyai* (*Elaeagnus* species) is an acidus fruit in nature, however, the low acidity, bigger size of fruit having smaller size seed and high TSS is the desirable characteristics for local fresh consumption. It is found from the present investigation that the genotype from Senapati having pyriform in fruit shape are superior genotype in term of sweetness which is desirable for local consumption and can be used for clonal multiplication in the future.

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## References

- A.O.A.C. (1985). Official methods of analysis. Association of Official Analytical Chemists International, Washington D.C.
- Baker, D., Jihn, G.T. and George, H.K. (1979). Isolation of sucrose density fraction and cultivation of *in vitro* of actinomycetes from nitrogen fixing root nodules. *Nature*, 281:76-78.
- Bargali, K. (2011), Actinorhizal plants of Kumaun Himalaya and their ecological significance, *African Journal of Plant Science* 5(7), 401-406.
- Dandge, P.B., Kasabe, P. J. and Patil, R. M. (2011). Evaluation of medicinal and nutritional components from the *Elaegnus conferta* fruit. *Science Research Reporter*, 1(2): 56-60.
- Gomez, A.K. and Gomez, A.A. 2010. Statistical Procedures for Agricultural Research. 2<sup>nd</sup> edition. Wiley India Private Limited, Ansari road, Daryaganj, New Delhi. pp. 134-138.
- Moa, A. A., Hynniewta, T.M. and Sanjappa, M. (2009). Plant wealth of North-East India with reference to ethnobotany. *Indian Journal of Traditional Knowledge*, 8: 96-103.
- Momin, K. Ch., Suresh, C.P., Momin, B. Ch., Singh, Y.S. and Singh, S.K. (2016). An ethno-botanical study of wild plants in Garo Hills region of Meghalaya and their usage. *International Journal of Minor Fruits, Medicinal and Aromatic Plants*, 2 (1): 47 – 53.
- Nei, M. and Li, W.H. (1979). Mathematical model for studying genetic variation in terms of restriction endonucleases. *Proc. Natl. Acad. Sci.*, 76(10): 5269-5273.
- Panja, S., Dipankar, Ch., Nikhil B.G. Ha Le, N. and Nripendranath, M. (2014). *In vitro* assessment of phytochemicals, antioxidant and DNA protective potential of wild edible fruit of *Elaegnus latifolia* Linn. *Fruits*, 69 (4):303-314.
- Patel, R. K., Singh, A. and Deka, B. C. (2008). *Soh-Shang (Elaegnus latifolia)*: An under-utilized fruit of North East Region needs domestication; *Himalayan Ecology* 16(2), 1-2.
- Patel, R.K., Singh, A, Patel, R.S., Deka, B. C. and Ngachan, S.V. (2009). Underutilized fruits of North Eastern Region of India: An unexplored potential. In: *Sustainable Hill Agriculture*. N. Prakash *et al.*, (Eds), Today & Tomorrow's Printers and Publishers, New Delhi, pp. 313-322.
- Shadeque, A. (1989). Genetic resource diversity in horticultural crops in North East Region. *Proceedings Indian National Academy*, B55 No.5&6: 473-476.
- Singh, S. R., Phurailatpam, A.K., Wangchu, L., Ngangbam, P. and Chanu, T.M. (2014). Traditional medicinal knowledge of underutilized minor fruits as medicine in Manipur. *International Journal of Agricultural Science*, 4 (8): 241-247.
- UNEP (1995). Global biodiversity assessment. United Nations Environment Programme University Press, Cambridge, UK.

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