Eco. Env. & Cons. 28 (August Suppl. Issue) : 2022; pp. (S328-S333)
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ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i04s.049

Assessment of Morphological Diversity and physico-chemical characterization of *Elaegnus latifolia* under different agro-ecological system in East Sikkim

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(Received 21 November, 2021; Accepted 12 January, 2022)

ABSTRACT

The present study was conducted to investigate diversity of mallero (*Elaegnus latifolia*) across different agro-ecological systems in East Sikkim and to observe variations in physico-chemical parameters of the mallero fruits with variation in agro-ecological system. The study was conducted in mixed farming based agro-ecological system, farm based agro-ecological system, forest habitat based agro-ecological system, cardamom based agro-ecological system and sikkim mandarin based agro-ecological systems. The experiment was laid out in Completely Randomized Design with five treatments and three replications. Studies regarding growth parameters like highest plant population (4.66) and number of fruits per tree (308.00) was found in mixed farming agro-ecological system (T1). However, the number of fruits per branch (27.00) and plant spread (4.06 m) was found maximum in farm based agro-ecological system (T2). Similarly, plant leaf area (41.93 cm^2) was found maximum in forest based agro-ecological system (T3). Quality parameters like length of fruit (4.46 cm) and juice (3.50 ml) was found maximum in mixed farm based agro-ecological system (T1). The highest total acidity (8.59) and organoleptic test value (2.76) were found in farm based agro-ecological system (T2). Similarly, maximum fruit weight (22.16 g) and maximum shelf life in room temperature (21.66) was recorded in cardamom based agro-ecological system (T4). However, the highest TSS (13.33) was recorded in mandarin agro-ecological system (T5) and maximum shelf life of fruit in refrigerator (41.93 days) was found in forest based agro-ecological system (T3).

***Key words**: Agro-ecological system, Growth, Mallero, Organoleptic test*

Introduction

Fruits play an important role to our daily lives and it is equally important for nutritional, social, cultural, religious and economic value. India is considered as second largest producer of fruits (97.35 MT) in the world (NHB, 2018) contributing about 12.6% of the world fruits production after China. Andhra Pradesh (152.15 lakh tonnes) followed by Maharashtra (117.28 lah tonnes) are the leading fruit growing states in the country (NHB, 2018). In India, fruits share in the horticulture sector is about 29% of the area and 32% of total production (NHB, 2017). Despite this huge contribution, there are still so many untapped and under-utilized fruits in the germplasm resources which need to be explored and evaluated to bring into commercialization for better income and nutritional security to local people. In Sikkim, a total of 190 wild species of fruit crop have been found till date and among which 43 of them are edible.

Mallero (*Elaeagnus latifolia*) is an underutilized fruit crop belonging to family *Elaeagnaceae*, which is locally known as Soh-Shang in Khasi hills of

Meghalaya and mallero or muslleri in Sikkim. It is a plant of the subtropical and warm temperate zone, though it can be found at a higher elevation in the tropics. This large spreading evergreen shrub is mostly grown in a semi-wild condition and can be found up to an elevation of 1900 m and can grow up to the height of 5 meters and can spreads up to 3 meters with shiny silvery leaves and rusty-shiny scales that are often thorny. This species is widely distributed from Northern region of Asia to the Himalaya and Europe (Ahmadiani *et al*., 2000). It is a wild edible fruit that is consumed raw as well as its fruit pulp is used for making jam, jelly and refreshing drinks. The fruit is considered to be a very rich source of vitamins, minerals and other bioactive compounds. It is also a fairly good source of essential fatty acids, which is unusual for a fruit. It is being investigated as a food that is capable of reducing the incidence of cancer and also as a means of halting or reversing the growth of cancers (Patel *et al*., 2008). This crop has an ability to fix atmospheric nitrogen to the soil (Baker *et al*., 1997). It has been also reported that the fruits of *Elaeagnus* species has high digestive property and seeds are used as medicinal propose for curing cough (Singh *et al*., 2014).

Elaeagnus latifolia is an underutilized, local species of Sikkim which is found in other northeastern states like Meghalaya etc. too. The analysis of the diversity within and among plant populations of a crop species is important to understand the historical progress underlying the genetic diversity and provide basic information for breeding approaches and for the conservation of germplasm of the concerned species.

Materials and Methods

Extensive survey was carried out to identify the different agro-ecological system in the studied area of Pakyong and Assamlingzey in East district of Sikkim during the fruiting season in 2018-19. The identified AES were geographically located at an altitude ranging from 1100-1300 meter above mean sea level. The different identified agro-ecosystem in East district of Sikkim is as follows:

I. Mixed farming based Agro-ecological system
II. Farm based Agro-ecological system
III. Forest habitat based Agro-ecological system
IV. Cardamom based Agro-ecological system
V. Sikkim mandarin based Agro-ecological system

Experiment was conducted by taking five identified agro-ecosystem as treatment with three replications. The design adopted is simple Completely Randomized Design suggested by Gomez and Gomez (2010). The variability in fruit morphology and physico-chemical was determined by taking ten fruit representative randomly from the branches with the standardization of A.O.A.C. (1985). The parameters observed were plant populations, plant height (m), plant spread (m), leaf area (cm^2), flowering time, no. of fruit per branch, no. of fruits per tree, fruit weight (g), fruit length (cm), TSS (°Brix), titrable acidity (%), pulp juice (ml), organoleptic test (score ranging from 1 to 5- very sour-1;sour-2;average-3; sweet-4; very sweet-5), shelf life in room temperature and refrigerator (days). All the data obtained from the experiments were subjected to the analysis for the mean, standard error and critical difference @ 5% by Completely randomized design using the STPR statistical computer package with three replications.

Results and Discussion

The results obtained in the present study are being presented under various subheads.

Plant population

The Fig. 1 showed that there were statistically no significant differences among the treatments. It is observed that plant population was not observed to be affected under different agro-ecological systems in Sikkim. However, the maximum population of the plant was recorded in T1 (4.66), *i.e.* Mixed farm based agro-ecological system. The maximum number of plants in mixed farming based might be due to plant habitat and adaptation of *Eleaegnus latifolia* or advantage of symbiotic association offered by cardamom based farming system.

Plant height (m)

The height of the plant was found to be statistically different from each other as shown in Figure 2. The maximum height of the plant was recorded in T1 (7.80 m) which was at par with T2 (3.50 m) and T3 (4.13 m) respectively. The similar finding was reported by Ahmed *et al*., 2006, where they have found the plant height decreases with the increase in altitude.

Number of fruits per branch

The data shown in the Table 1 revealed significant

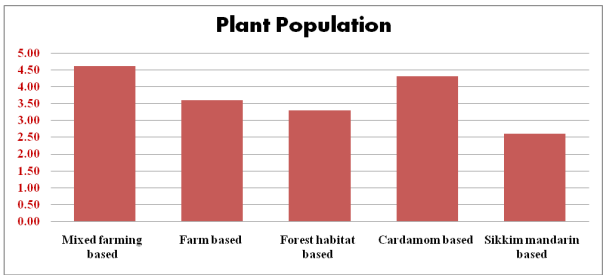

Fig. 1. Plant population in different agro-ecological system in East district of Sikkim

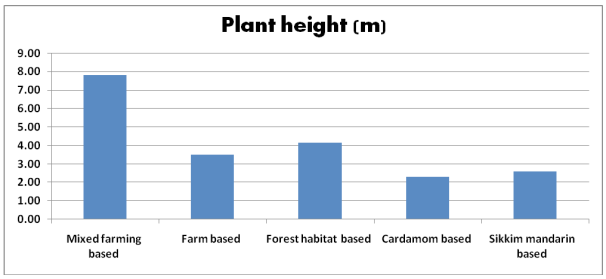

Fig. 2. Plant height in different agro-ecological system in East district of Sikkim

differences among the treatments. The maximum number of fruits was recorded in Farm based system *i.e.* T2 (27.00) which were at par with T4 (26.33) and T5 (21.00).

No. of fruits per tree

However, the maximum number of fruits per tree was recorded in mixed farming based system, *i.e.* T1 (308.00) which was found to be at par with T2 (296.00) and T4 (216.33) respectively. The greater numbers of fruit in mixed farming despite less number of fruit in branches than farm based were due to the lesser number of branches present in the tree.

Leaf Area (cm^2)

The data (Table 1) pertaining to the plant leaf area of *Elaeagnus latifolia* showed no statistical significant difference found regarding the different treatments. However, the maximum plant leaf area was found in forest based eco-system, *i.e.* T3 (41.93) and found to be at par with the other treatments.

Fruit weight (g)

In the Table 2, the maximum fruit weight of *Eleaegnus latifolia* was recorded in cardamom based system *i.e.* T4 (22.16 g) which was significantly superior over the other treatments followed by T2 (18.35 g) and T1 (18.26 g) respectively.

Fruit length (cm)

There were no significant differences found among the treatments regarding the fruit length of *Eleaegnus.* However, the maximum length of the fruit was recorded in mixed farming based, *i.e.* T1 (4.46 cm) and found to be at par with all the other treatments (Table 2).

Pulp juice (ml)

The maximum juice was recorded in mixed farming based, *i.e.* T1 (3.50) as shown in Table 2, which was at par with T3 (3.13) followed T4 (2.90) and T2 (2.56) respectively. The finding was in line with Devachandra *et al*., (2018) where they found maximum juice per fruit was to be 3.10 ml.

Organleptic test

As evident in Table 2, there was significant statistical difference among the treatments. The highest scoring for organoletic test was observed in T2 (2.76) which was at par with T1 (2.26) and T3 (2.06). The treatments T4 and T5 showed minimum value 1.90.

TSS (^{0}Brix)

Total soluble solids of the fruits of *Eleaegnus latifolia* as shown in Fig. 3 revealed statistically significant differences among the treatments. It was observed that Sikkim mandarin based agro-ecosystem (T5)

Table 1. Fruit parameters of *Eleaegnus latifolia* in different agro-ecological system in East Sikkim

Treatments	No. of fruits per branch	No. of fruits per tree	Leaf area (cm^2)
Mixed farming based	19.00	304.08	39.03
Farm based	27.00	296.66	38.56
Forest habitat based	17.00	178.00	41.93
Cardamom based	26.30	216.33	39.56
Sikkim mandarin based	21.60	156.33	40.53
C.D. @ 5%	7.16	105.49	3.57
SEm	2.27	33.49	1.13

Table 2. Fruit parameters of *Eleaegnus latifolia* in different agro-ecological system in East Sikkim.

Treatments	Fruit weight (g)	Fruit length (cm)	Pulp juice (ml)	Organoleptic test
Mixed farming based	18.26	4.46	3.50	2.26
Farm based	18.35	3.93	2.76	2.76
Forest habitat based	17.97	3.96	3.13	2.06
Cardamom based	22.16	3.86	2.90	1.90
Sikkim mandarin based	14.54	4.26	2.56	1.90
C.D. @ 5%	2.35	0.79	0.50	0.84
SEm	0.74	0.25	0.16	0.26

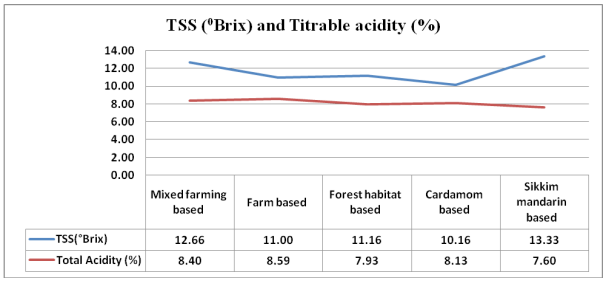

Fig. 3. TSS (°Brix) and Titrable acidity (%) of *Eleaegnus latifolia* in different agro-ecological system in East district of Sikkim

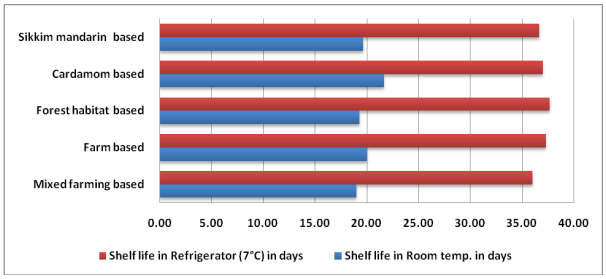

Fig. 4. Shelf life (days) of *Elaeagnus latifolia* fruits in room temperature and refrigerator (7 °C)

recorded the highest TSS (13.33 ^{0}Brix) which was found superior over rest of the treatments followed by T1 (12.66 ^{0}Brix), *i.e.* mixed farming based.The finding was in conformity reported by Devachandra *et al*., (2018) where they have recorded highest TSS of 13.50 °Brix in mallero Genotype 1 (Senapati). Ersoy *et al.* (2013) observed highest total soluble solids in *E. angustifolia.*

Titrable acidity (%)

Fig. 3 showed the highest total acidity observed in T2 (8.59), *i.e.* farm based which was at par with T1 (8.40) and found to be superior over T4 (8.13), T3 (7.93) and T5 (7.60) respectively. The similar finding was reported by Devachandra *et al*., (2018) where they have recorded highest fruit acidity in mallero genotype 5 (Takhel). Wang *et al*., (2007) also observed highest fruit acidity in *Elaeagnus umbellate*.

Shelf life of the fruits (Days)

Fig. 4 showed no significant statistical difference found among the different treatments regarding shelf life of fruits in room temperature. However, the maximum shelf life of fruit was found in T4 (21.66), *i.e.* cardamom based system which was found to be at par with rest of the treatments. In case of refrigeration at 7 ^{o}C, the treatments did not show any statistical significant difference among them while the number of days has greatly increased as compared to shelf life of fruits in room temperature. Maximum shelf life of the fruit was 37.66 days recorded in T3, *i.e.* forest based agro-ecosystem.

Conclusion

Indigenous wild fruit tree plays an imperative role in nutritional security for local people and also for their livelihood. Utilization of this fruit may result in the commercialization which in turn helps in boosting fruit genetic resources and production share in local as well as national level. The above investigation searched out the morphological variation of *Elaeagnus latifolia* in the existing traditional farming system in East district of Sikkim. Mixed farming based agro-ecosystem suitably favors the plant growth and population distribution of mallero. Awareness and intensification of the plant in different agro ecosystem might help in health benefits for local people or tribal farming community through value addition due to fair physico-chemical properties of the fruit. The fruit is already liked by people of Sikkim but more awareness is needed regarding nutritional security so that more economic benefit can be acquired by farming community of Sikkim.

Acknowledgement

The authors are thankful to National Mission for Himalayan Studies for funding the research work and would also like to acknowledge Prof. Laxuman Sharma, Department of Horticulture, Sikkim University, Gangtok.

References

Ahmadiani, A., Hosseiny, J., Semnanian, S., Javan, M., Saeedi, F. and Kamalinejad, M. 2000. Antinociceptive and anti-inflammatory effects of *Elaeagnus angustifolia* fruit extract. *J Ethnopharmacol*. 72: 287–292.

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.

Devachandra, N., Singh, S.R., Wangchu, L. and Panday, A.K. 2018. Evolution of Physio-Chemical and Gene Diversity of *Elaeagnus* species in Manipur, North East India. *International Journal of Current Microbiology and Applied Science.* 7(5) : 315-321.

Ersoy, N., Kalyoncu, I. H. and Tolat, I. 2013. Some physicochemical and Nutritional Properties of Russion olive (*Elaeagnus angustifolia* L.) Fruits grown in Turkey. *International Journal of Agricultural and Biosystems Engineering*. 7(6).

Gomez, A. K. and Gomez, A. A. 2010. *Statistical Procedures for Agricultural Research.* 2nd edition. Wiley India Private Limited, Ansari road, Daryaganj, New Delhi. pp. 134-138.

National Horticulture Board, 2017. Horticulture Statistics at a Glance. pp. 141-142.

National Horticulture Board. 2018. Horticulture Statistics at a Glance. pp. 2.

Patel, R. K., Singh, A. and Deka, B. C. 2008. Soh-Shang (*Elaeagnus latifolia*): An underutilized fruit of North East Region needs domestication, *Himalayan Ecology*. 16(2): 1-2.

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.

Wang, S. Y., Bowman, L. and Ding, M. 2007. Variations in free radical scavenging capacity and antiproliferative activity among different genotypes of Autumn Olive (*Elaeagnus umbellata*), *Planta Medica*. 73(5) : 468-477.