Volume 9, Issue 7, July – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL157

Evaluation of Differences in Capacity of Nutrient Content Accumulation between two Ecotypes of Lotus (*Nelumbo Nucifera)* due to Environmental Difference in Tropical and Temperate Regions

Rajesh Kumar Tenguria[1,2]; Parveen Kousar Zargar[1,2*]
[1*]Department of Botany, Government Motilal Vigyan Mahavidyalaya, 462026 (M.P.), India.
[2]Barkatullah University, Bhopal, 462026 (M.P.), India.

Correspondence Author: Parveen Kousar Zargar[*]

Abstract:- Environmental fluctuations can amplify variations even in clonal plants. However, it is unclear whether these differences in environmental conditions can alter physiological activities of two different ecotypes of lotus. We intended to evaluate whether the difference in nutrient content accumulation capability between two ecotypes is different because of the different geographical distribution. The present study revealed us a substantial difference in capacity of nutrient accumulation of lotus (*Nelumbo nucifera*) due to environmental difference in tropical and temperate zone. The moisture content of lotus in the tropical region was 8.25%, whereas the temperate region was 86.04%.Maintaining a low moisture content might extend the shelf life of the seed. Crude protein and crude fibres levels were found to be high in tropical lotus (24.4% and 3.15%, respectively) and low in temperate lotus (17.50% and 2.00%). Growth amplifying environmental conditions leads to increase in production of protein content. The tropical lotus has the largest crude lipid content (3.68%), whereas the temperate lotus had the lowest (1.90%).Because of the presence of big rhizomes in temperate lotus, the amount of Ash content produced (8.00%) was about double that of tropical lotus (4.03%). Overall, the tropical lotus ecotype had the highest nutrient content accumulation for crude protein, crude fibres and crude lipids. However, temperate lotus has the highest moisture and ash content.

I. INTRODUCTION

An ecotype is a population that has adapted to particular environmental conditions. Furthermore, those more successful individuals carry genes that contribute to their success in that environment produce more individuals of their own kind. Thus, the adaptations of these ecotypes are dependent on the interactions between their own special set of genes and their own environment. Zhang and Wang (2006) classified *Nelumbo nucifera* populations into two ecotypes: tropical ecotype and temperate ecotype, depending on their geographic location. Lotus growing in East and north-east Asia belong to the temperate group while those grown in South-east Asia and Australia are classified tropical group(Zhang and Wang 2006; Li *et.al* 2010).These ecotypes differ in flowering time, growth and rhizome formation. Annual growth and large rhizome are the characteristic feature of temperate ecotypes while perennial growth and small rhizome are found in tropical ecotypes. Tropical lotus is often utilized to improve the ornamental value of temperate lotus by giving valuable features for producing varieties with longer flowering periods (Li *et al.* 2010; Liu et al 2012;Yang *et al.* 2013).

Lotus is a popular food plant in Australia, China, India, and Japan, known for its nutritional qualities (Anonymous, 1966). Generally, the entire plant serves as a coolant and is commonly used to treat diarrhoea and haemostasis (Yu & Hu, 1997).Lotus seeds are a popular health food, and an alkaloid (Liensinine) derived from them can effectively treat arrhythmia (Ling & Yang, 2005). The seeds have been employed in indigenous and folk medicine to treat tissue inflammation, cancer, diuretics, and skin illnesses such as leprosy (Chopra *et al.,* 1956).The study found that lotus seeds are a nutrient-dense source with low antinutrient levels, making them suitable for consumption. It is a valuable source of protein and carbohydrates for people and livestock. Lotus seeds provide adequate levels of potassium, calcium, magnesium, and iron. High potassium levels in meals can benefit patients suffering from hypertension and high potassium excretion associated disease (Siddhuraju *et al.*, 2001).

The present study was conducted to evaluate the differences of nutrient content accumulation capacity of lotus ecotypes from different geographical regions. In India we have many cultivars of lotus which shows both phenotypic diversity and also distributed to different geographical region. These cultivars also have different ability to accumulation nutrient content in their plant body.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL157

II. MATERIALS AND METHODS

A. Study Site

This investigation was conducted on two different lakes of each region, one at temperate region (Kashmir) and other at tropical region (Bhopal) during the period of maximum growth of the plant. To evaluate the ability of accumulation of nutrient content by tropical ecotype and temperate ecotype literature available for the tropical and temperate ecotypes from different countries was used to analyse it.

B. Sample Collection:

Ten wild temperate and tropical N. nucifera populations were sampled over their natural distribution area. Because N. nucifera is a clonal species, leaf samples was used to avoid repeating the same individuals, thus collected at a minimum of ten meters apart. The collected leaves will be dried using silica gel and stored in the refrigerator. Plants from designated study regions will be collected from multiple observation stations. Plant components will be washed and shade-dried before laboratory testing.

C. Laboratory Analysis:

Plants was divided into three organs for chemical analysis: the leaf blade, the petiole, and the rhizome, which includes the roots. The organs were oven-dried at 70ºC for 24 hours before grinding in a Cyclotec mill.

D. Nutrient Lockup Studies:

To calculate nutrient accumulation per unit area, multiply the mean values for selected species by the plant density (number of plants per unit area). The moisture content of the seeds (cotyledon part) will be assessed by oven drying to a consistent mass at 105 degrees Celsius (16 ± 1 hour). The results were found by using the following formulae and expressed as the percentage moisture of the content.

$$\text{Moisture [\%]} = \frac{\text{Wet weight of sample[g]} - \text{Dry weight of sample[g]}}{\text{Wet Weight of the sample[g]}}$$

The conventional procedures will be followed to determine crude protein, crude lipid, crude fibre, and ash contents (Humphries, 1986; AOAC, 1990). The following formulas were used to calculate the above parameters:

$$\text{Total Ash [\%]} = \frac{\text{Weight of Ash[g]}}{\text{Weight of sample[g]}} \times 100$$

$$\text{Crude Fibres [\%]} = \frac{\text{Weight of dry residue} - \text{Weight of ash residue}}{\text{Weight of sample}} \times 100$$

E. Statistical Analysis:

To compare the mean values of tropical and temperate ecotype samples, a one-way analysis of variance (ANOVA) was performed using Origin 6.0 (Microcal Software Inc., Northampton, MA). The data reported is the mean of five independent determinations (±SD), unless stated otherwise. The criterion of significance was set at $p < 0.05$.

III. RESULTS

The moisture level of raw lotus seed (cotyledon portion) of tropical region was 8.25%.Maintaining a low moisture content can help extend shelf life. Raw seed flour included 24.4% crude protein and 3.15% crude fibres. Lotus seeds have a greater crude protein content than parboiled rice (7.7%), wheat (8.55%), eggs (12.6%), and various tribal pulses (12.9-20.2%). Lotus seeds are abundant in protein, making them a valuable source of nutrition. Ash levels considerably increased up to 4.03%.The amount of ash in a seed sample is crucial for determining nutritionally significant minerals. Lotus seeds have high carbohydrate ontent (64.6%), possibly due to low lipid levels. Crude lipid level of raw lotus seed was 3.68%

Table 1: Nutrient Content Analysis of Raw Lotus Seed of Tropical Region (on Dry Weight Basis) (n=5,mean±SD)

Components	Values
Moisture (%)	8.25±0.24
Crude protein (%)	24.4±5.22
Crude lipids (%)	3.68±0.73
Crude fibres (%)	3.15±1.74
Ash (%)	4.03±0.21
Crude carbohydrates (%)	64.6±5.69

The moisture level of lotus of temperate region was 86.04%.Lotus seed flour included 17.50% crude protein and 2.00% crude fibres. The study found that the crude protein percentage of lotus varies little with growth period, but is highest during the peak growing season. Protein composition changes across different places in the same plant due to physiochemical characteristics. Plant growth leads to the production of new tissues, which increases protein content.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL157

Ash content refers to the remaining inorganic component following biomass burning. The ash content level was observed to be 8.00%.Crude lipids level of temperate lotus seed was 1.90%.

Table 2: Nutrient Content Analysis of Raw Seeds of Lotus of Temperate Region (n=5,mean±SD)

Components	Values
Moisture(%)	86.04±0.60
Crude protein(%)	17.50±0.51
Crude lipids(%)	1.90±0.32
Crude fibres(%)	2.00±0.16
Ash(%)	8.00±1.20

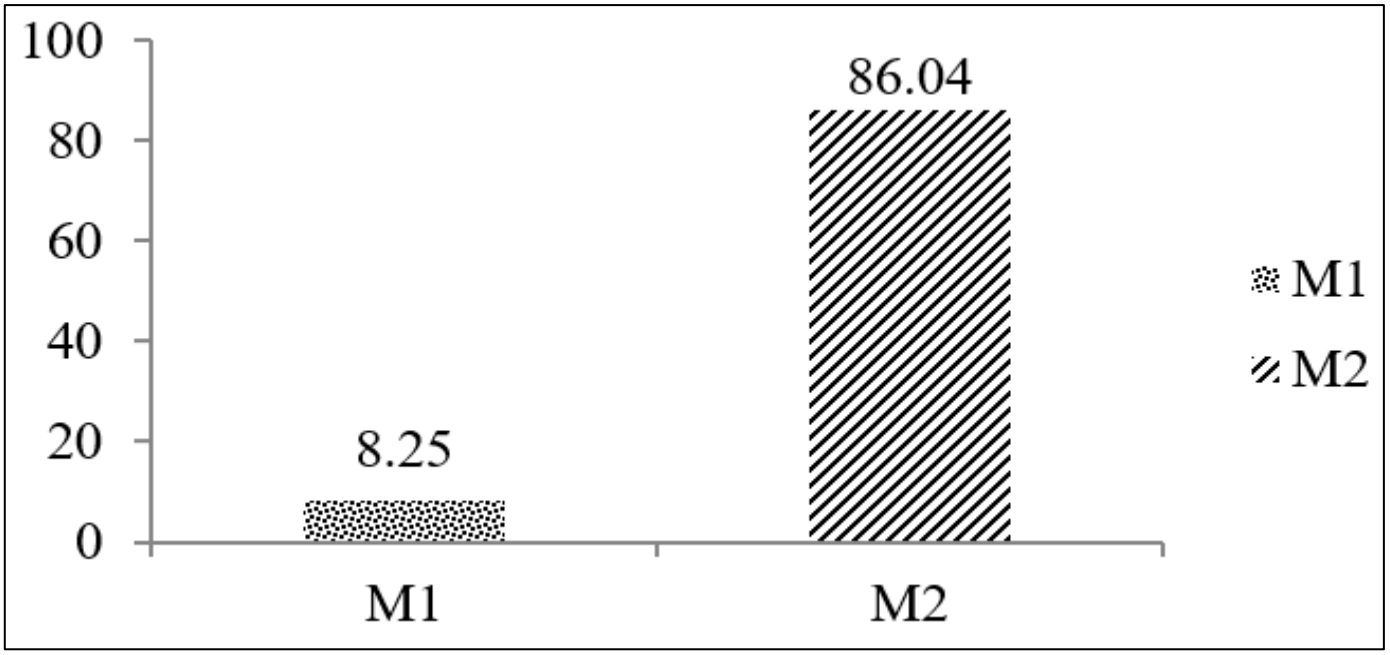

Fig 1: Mean Moisture Content (M) Accumulation of Lotus Ecotypes in Tropical (M1) and Temperate (M2) Regions of India.

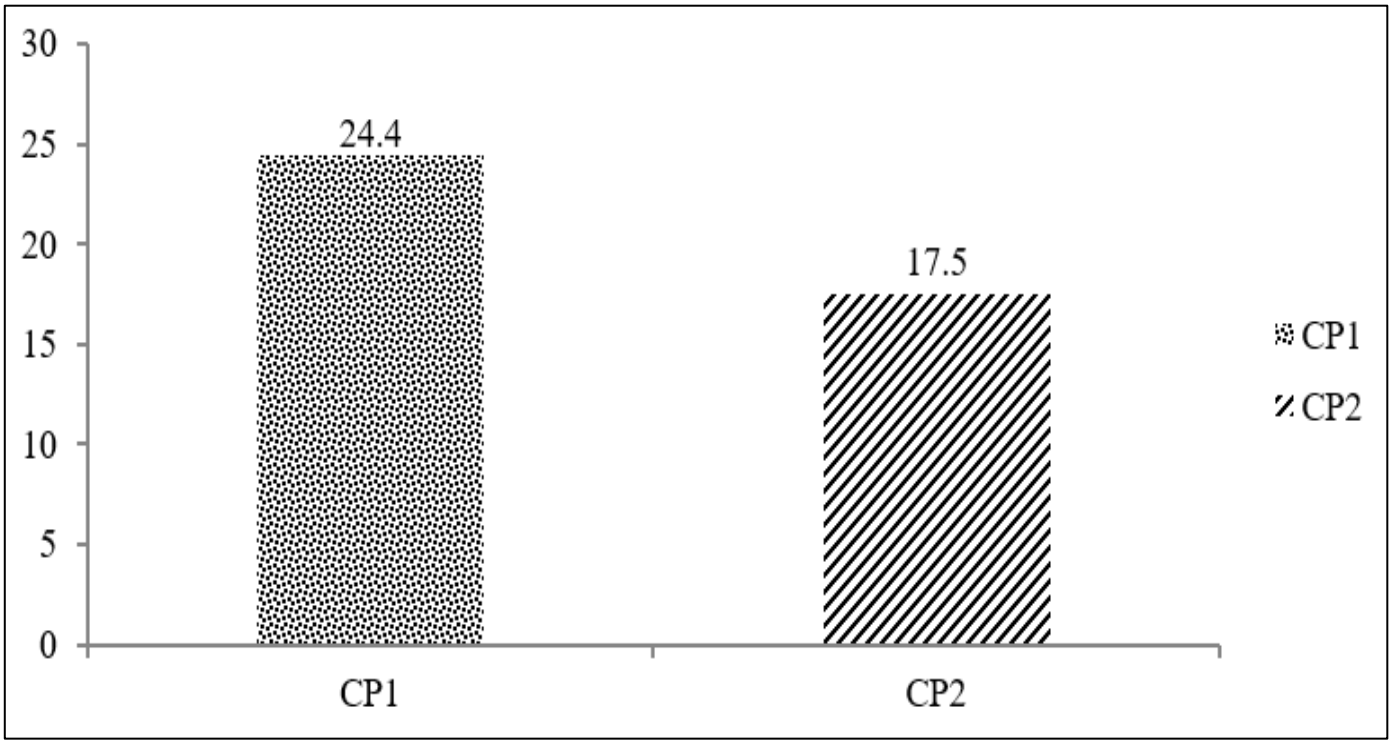

Fig 2: Mean Crude Protein Content (CP) Accumulation of Lotus Ecotypes in Tropical (CP1) and Temperate(CP2) Regions of India.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL157

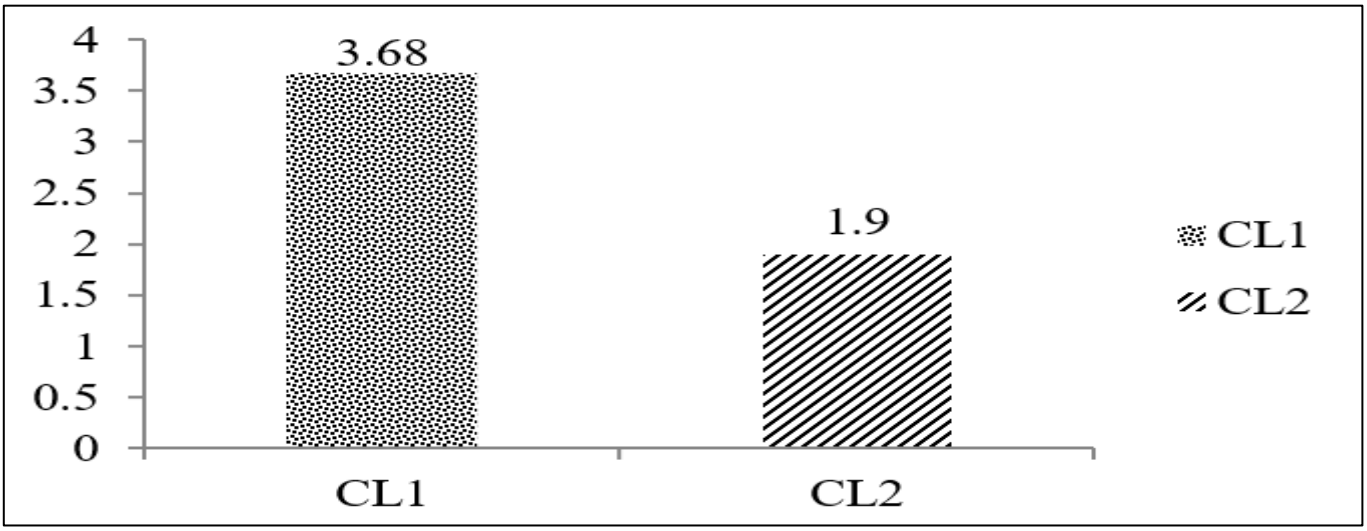

Fig 3: Mean Crude Lipids Content (CL) Accumulation of Lotus Ecotypes in Tropical (CL1) and Temperate (CL2) Regions of India

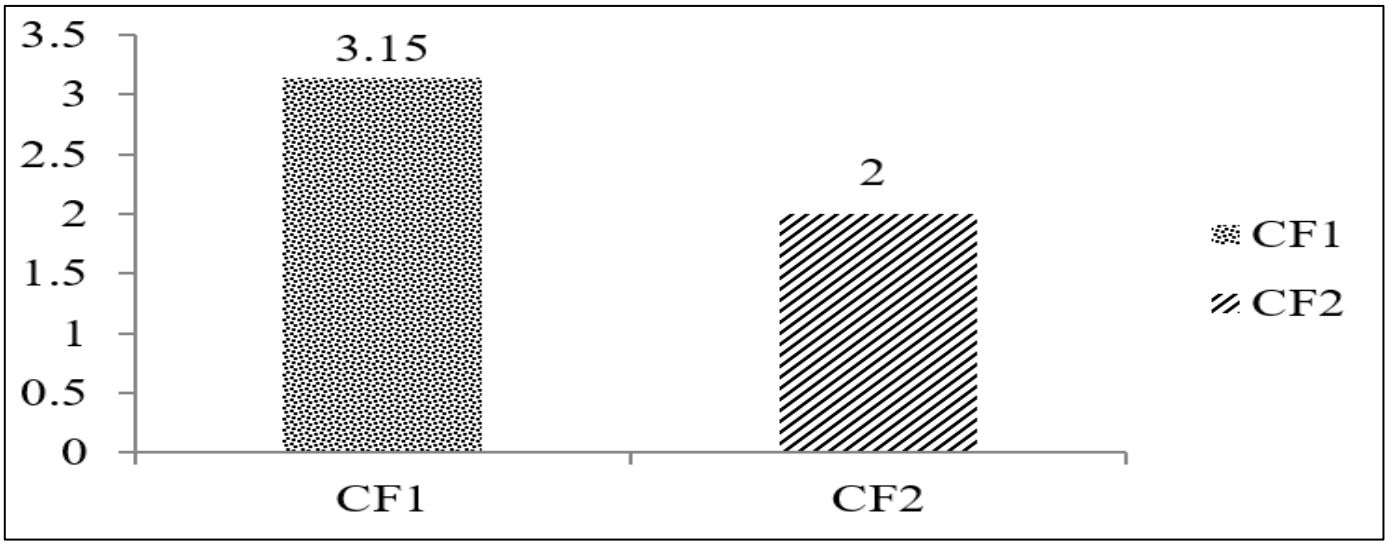

Fig 4: Mean Crude Fibre Content (CF) Accumulation of Lotus Ecotypes in Tropical (CF1) and Temperate (CF2) Regions of India

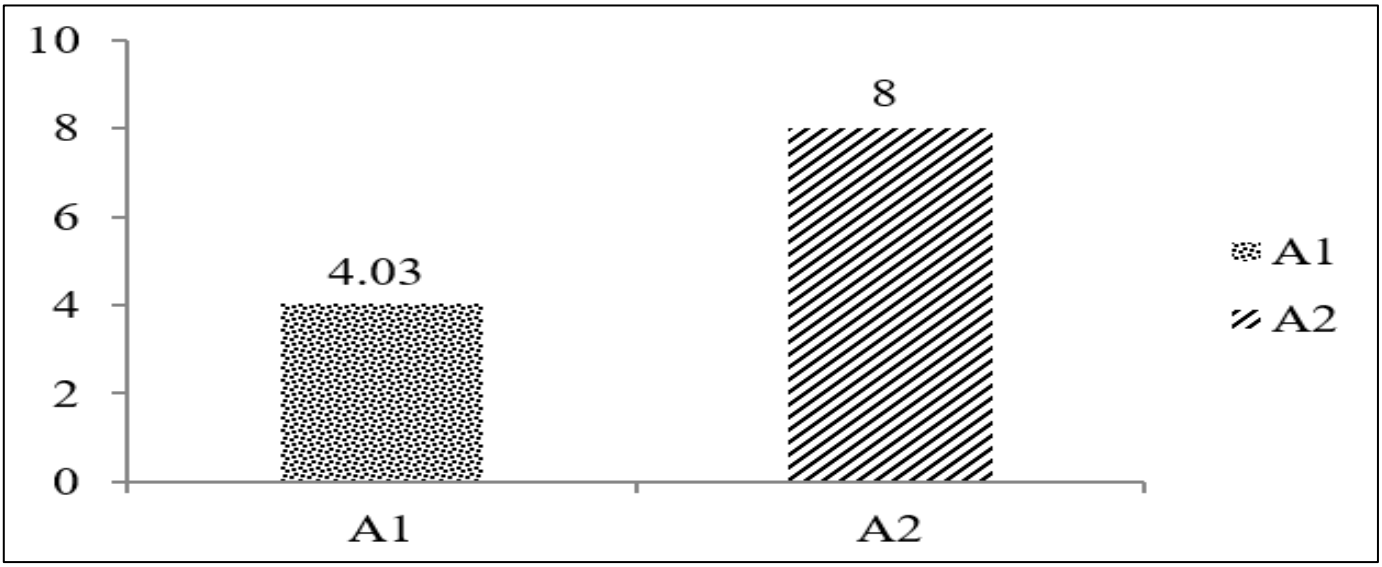

Fig 5: Mean Ash Content (A) Accumulation of Lotus Ecotypes in Tropical (A1) and Temperate (A2) Regions of India.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL157

IV. DISCUSSION

The present study showed us a huge difference in capacity of nutrient accumulation between two ecotypes of lotus (*Nelumbo nucifera*) due to environmental difference in tropical and temperate region. The moisture content level of lotus of tropical region was lesser than the temperate region **(Figure 1).** Maintaining of low moisture content level can increase the shelf-life of the seed. (Statens Livsmedelsverk,1988). Crude protein and Crude fibres level was found in large amount in case of tropical lotus and small amount in temperate lotus (**Fig.2 & Fig.3**). Growth amplifying environmental conditions leads to increase in production of protein content. The highest value of crude lipids was observed in tropical lotus whereas the lowest value was observed in temperate lotus **(Figure 4**). The amount of Ash content produced in lotus of temperate region was approximately double the amount produced by lotus of tropical region because of the presence of large rhizome of temperate lotus (**Figure 5**). In general the value of nutrient content accumulation for Crude protein, Crude fibres and Crude lipids was highest in tropical ecotype of lotus. But the value of moisture content and ash content was highest in temperate lotus.

V. CONCLUSION

Lotus seeds are high in nutrients and low in anti-nutrients, making them an effective source of protein and carbohydrates for both people and livestock. But the nutrient content accumulation capacity is found to be different in tropical and temperate region due to presence of different environmental conditions in these regions. Some specific nutrient content accumulates more in low temperature condition while others accumulate more in high temperature conditions. Thus best breeding technique can utilised to achieve the goal of producing new varieties which overcome these differences which arises due to change of environmental conditions in these regions.

REFERENCES

[1]. Anonymous (1966). The wealth of India – A dictionary of Indian raw materials. Vol. 7, Council of Scientific Industrial Research, New Delhi.
[2]. Arinathan, V., Mohan, V. R., & De Britto, A. J. (2003). Chemical composition of certain tribal pulses in south India. International Journal of Food Sciences and Nutrition, 54, 209–217
[3]. Chopra, R. N., Nayar, S. L., & Chopra, I. C. (1956). Glossary of Indian Medicinal Plants # 22. Council of Scientific and Industrial Research, New Delhi, India.
[4]. Ling, Z. Q., Xie, B. J., & Yang, E. L. (2005). Isolation, characterization, and determination of antioxidative activity of oligomeric procyanidins from the seedpod of Nelumbo nucifera Gaertn. Journal of Agricultural and Food Chemistry, 53, 2441–2445.
[5]. Liu, C. P., Tsai, W. J., Lin, Y. L., Liao, J. F., Chen, C. F., & Kuo, Y. C. (2004). The extracts from Nelumbo nucifera suppress cell cycle progression, cytokine genes expression, and cell proliferation in human peripheral blood mononuclear cells. Life Science, 75, 699–716.
[6]. Siddhuraju, P., Becker, K., & Makkar, H. P. S. (2001). Chemical composition, protein fractionation, essential amino acid potential and anti-metabolic constituents of an unconventional legume, Gila bean (Entada phaseoloides Merrill) seed kernel. Journal of the Science of Food and Agriculture, 82, 192–202.
[7]. Yu, J., & Hu, W. S. (1997). Effects of neferine on platelet aggregation in rabbits. Yaoxue Xuebao, 32, 1–4.
[8]. Statens Livsmedelsverk. (1988). Energi och Naringsamnen. Livsmedelstabeller. Stockholm, Sweden: the Swedish Food Administration.
[9]. Humphries, E. C. (1986). Mineral composition and ash analysis. In K. Peach & M. V. Tracey (Eds.). Modern Methods of Plant Analysis (Vol. 1, pp. 468–502). Berlin: : Springer-Verlag
[10]. Zhang, X. Y. & Wang, Q. C. Perliminary study of the eco-types of genetic resources of tropical lotus. Landscape Plants 22, 82–85 (2006).
[11]. Yang, M., Zhu, L., Xu, L., Pan, C. & Liu, Y. Comparative transcriptomic analysis of the regulation of flowering in temperate and tropical lotus (Nelumbo nucifera) by RNA-Seq. Ann Appl Biol 165, 73–95 (2014)
[12]. Li Z, Liu X, Gituru RW, Juntawong N, Zhou M, Chen L (2010) Genetic diversity and classifcation of Nelumbo germplasm of diferent origins by RAPD and ISSR analysis. Sci Hortic 125(4):724–732. https://doi.org/10.1016/j. scienta.2010.05.005