Use of tender bamboo shoot as food is an ancient ethnic food culture. However, the food value of tender bamboo shoot is less explored. In recent times globally people are becoming increasingly conscious about food quality and traditional foods are becoming increasingly popular. This is primarily because of the emerging facts that contrary to prevailing misconception, traditional food are rich in nutritive values as well as nutraceutical value. Changing lifestyle has given rise to new kind of health problem called life-style diseases like diabetes, coronary heart diseases, atherosclerosis etc. which is a global concern. Traditional food can considerably lessen this problem with their health protective and health promoting quality. Tender bamboo shoots became relevant in this context. The findings of the present study are very promising and are discussed in the backdrop of available information and in terms of significance.

5.1. **Moisture content and pH value**

Tender bamboo shoot is known for having fastest growth among higher plant. A rapid growth imply high rate of metabolic activity and for this, tissue and cell, require high amount of water. As per NMBA data (2009) involving seven species moisture content varied from 85.98% in *D. strictus* to 92.37% in *D. hamiltonii*. Sood *et al.* (2011) working with *D. hamiltonii* reported that for freshly harvested shoot moisture percent was 91.06%. In the present study moisture content varied from 89.97% in *B. pallida* to 93.46% in *B. tulda*. The findings of the present study are broadly in agreement with
earlier reported values. From the finding it appears that cultivated species from plain areas have comparatively higher moisture. Nirmala et al. (2011) working with 14 bamboo species from North East India found moisture content in the range of 89.30% in *D. membranaceus* to 92.51% in *D. hamiltonii* with the exception of *B. tulda* with 83.60%.

Most ethnic communities prefer bamboo shoot as food supplement for its sour taste apart from unique taste and flavour. The sour taste indicate that fast growing bamboo shoot contain organic acid. Singh et al. (2011) reported the presence of significantly high amount of citric acid and malic acid. The authors also reported difference in vertical distribution of organic acid and observed that organic acid concentration was high with 462mg/100g fw. at the top part of the shoot while the concentration decreases to 157mg/100g fw. at the base. This implies that the top part is more acidic than lower part of the bamboo shoot. Bamboo shoot is known to have variable amount of ascorbic acid ranging from 3.20mg/100g fw. (Nirmala et al., 2007) to 5.30mg/100g fw. ascorbic acid (Bhatt et al., 2005) which also appear to contribute to acidic condition of bamboo shoot. In the present study pH values varied from 4.56 in *D. hamiltonii* (H) to 6.03% in *B. teres* and from available information it is understandable that the acidic nature is due to the above organic acids. It is noteworthy that in Assam traditional fermented bamboo shoot ‘khorisa tenga’ the name implies that it is sour in taste (the word tenga stand for sourness).

### 5.2. Major nutritional components

**Crude protein**

In the present study for the 11 species the overall mean for crude protein is 23.82% which can be considered as reasonably high value for crude protein. However, the interspecific variation is remarkable. For instance, in *B. balcooa* protein content is as low as 15.6% whereas for *B. arundinacea* protein content is more than twice that value with 34.22%; the highest for the present study. Nirmala et al. (2011) working with 14 indigenous bamboo species of North East India found that crude protein content varied from 2.31% in *D. brandisii* to 3.72% *D. hamiltonii* on fresh weight basis. However, on
dry weight basis it will translate to 23.1% to 37.20% respectively. As per NMBA data (2009) for 7 bamboo species protein content varied from 19.80% in *D. strictus* while it was 32.90% in *M. bambosoides*. The findings of the previous works are broadly in agreement with the findings for the present study. However, for the present study the range of variation is much wider.

**Total carbohydrate**

Total carbohydrate as well as its total soluble sugar is of critical importance. Because in case of a fast growing organ, rate of respiration as well as metabolic activity are high. This require sufficient amount of carbohydrate which are constantly synthesized and used as respiratory substrate. Earlier work by Nirmala *et al.* (2011) report, carbohydrate in the range of 4.32% in *D. rostrata* to 6.92% in *B. tulda* on fresh weight basis. However, on dry weight basis it work out to be approximately 43.20% and 69.20% respectively. Similarly Bhatt *et al.* (2003) also reported high values in the range of 5.32% in *B. balcooa* (bhaluka) to 6.12% in *M. baccifera* which works out to be 20.11% in *B. balcooa* to 43.84% in *D. hamiltonii* on dry weight basis. In the present study total carbohydrate content varied from 12.7% in *B. teres* to 18.7% in *B. pallida* on dry weight basis. In the present study the carbohydrate values were obtained from standard chemical analysis. But in case of the other authors the values are deduced from subtraction of other macronutrient and not based on chemical analysis. This appears to be reason for the discrepancy in carbohydrate value for the present study and earlier two works referred. In a fast growing organ like bamboo shoot with high respiration and metabolic activity sugar accumulation in stored form is unlikely to be high and therefore comparatively lower level of carbohydrate observed in the present study appear to be reasonable.

**Lipid content**

Among all the macronutrient lipid content is lowest. However, the importance of lipid and its constituent fatty acids are well documented. Bhatt *et al.* (2003) working on 4 bamboo species reported lipid content in the range of 0.57 in *M. baccifera* to 0.60% in *B. balcooa* which on dry weight basis worked out to be 2.28% and 3.75%
respectively. In the present study lipid content varied from 1.45% in \textit{B. teres} to 4.05% in \textit{B. tulda} on dry weight basis. The findings of the present study are in agreement with this reported value. On the other hand Nirmala et al. (2011) reported lipid content at a slightly higher level of 0.30 to 0.56g/100g fw. with limited variability. Kozukue and Kozukue, (1981) reported difference in vertical distribution in lipid content. While lipid content at the top was found to be 800 mg/100g fw. (8% on dry weight basis), at the base level it was much lower with 380mg/100g fw. (3.8% dry weight basis). The authors further reported that main fatty acids were palmitic acid, linoleic acid and linolinic acids.

**Crude fiber**

Crude fiber is not actually a component of food in the true sense of the term since it is not digested. However, its importance in human nutrition is well recognized and Indian Council of Medical Research (ICMR) has recommended a daily intake of 40gm crude fiber per day. Sood et al. (2011) reported 15% crude fiber in \textit{D. hamiltonii}. On the other hand Nirmala et al. (2011) working with 14 indigenous bamboo species of Manipur and North East India reported crude fiber in the range of 2.26 g/100g fw in \textit{D. strictus} to 4.49g/100g fresh weight in \textit{B. kingiana}. On dry weight basis it works out to be 22.6% and 44.9% respectively. These values are comparatively much higher. However, it is known that age of the shoot significantly influence the proportion of nutritional component (Hu, 1985). In bamboo shoot older than 10 days lignification occur, with resultant hardening of the shoot. Under such situation crude fiber may increase considerably. For the present study crude fibre content varied from 10.52% in \textit{B. teres} to 23.48% in \textit{M. baccifera} on dry weight basis. In the present study the crude fiber values are intermediate to these two extreme and appears to be reasonable value. A number of workers have reported diverse type of health benefit from dietary fiber. Since dietary fiber is not digested it help in retaining food component in the intestine for longer time along with sufficient water to facilitate the process of digestion. Additionally it provides bulk to food left over food in the intestine and help to get rid of constipation (Gopalan et al., 1971). For this reason dietary fiber is considered as highly beneficial as remedy for constipation. A number of anti-constipation medications are available in the
market which are essentially rich in crude fiber. Tender bamboo shoot both processed and fresh or freshly cooked can be considered as the remedy for constipation. Studies by Park and John (2010) reported that high fiber diet of bamboo shoot can lower blood cholesterol and improve bowel function. George et al. (1982) reported that dietary fiber is useful in the management of cardiovascular disease and obesity and can prevent onset of diabetes.

**Ash content**

There is wide variation in ash content in different bamboo species reported by various workers. As per NMBA (2009) data based on analysis of seven species ash content varied from 0.91% to 1.14% on fresh weight basis in *B. polymorpha* and *D. strictus* respectively, which on dry weight basis worked out to be 9.1% and 11.4% respectively. Sood et al. (2011) working on *D. hamiltonii* reported ash content 0.81% fw basis (8.1% dry weight basis). However, Nirmala et al. (2011) working with 14 indigenous bamboos of Manipur and North East India reported ash content in the range of 0.63% in *D. membraneous* to 1.38% in *B. bambos* and *B. kingiana*. On dry weight basis it works out to be 6.30% and 13.80% respectively. In the present study ash content varied from 8.04% in *B. pallida* to 20.03% in *D. giganteus*. The findings of the present works are comparable to the earlier reported value but most species in the study have significantly higher ash content than average. There are diverse report about mineral profile and their relative proportion by various workers. As a whole bamboo shoot is known to be rich in calcium, sodium, potassium and magnesium. Sood et al. (2011) reported that calcium content in *D. hamiltonii* is 15mg/100g and that of copper, sodium, potassium, phosphorous and magnesium is 0.29, 4.80, 5.33, 6.00 and 3.90mg/100g respectively. Whereas, for the selenium it is 6.80µg/100g. Earlier Jetwig (2007) had analysed bamboo sample for their mineral components and reported values for calcium (10mg), magnesium (2mg), phosphorous (45mg), potassium (40mg) and sodium (3mg) per 100g.

Bamboo shoots are consumed as fresh food, with or without cooking as well as processed food. Bamboo shoot is perishable, with short lifespan and available only in season which happen to be June/July in NE India. In processed food nutrient
component varies depending upon the method of processing and preservation. Therefore the nutritional parameter of freshly harvested shoot can be considered as standard parameter for comparison with other plant food. So far as protein content is concerned some bamboo shoots are comparable or superior to many plant species used as leafy vegetables. Some of the best known examples are, tender fern Diplazium esculentum with 33.27% (Handique, 2003a) and Amaranthus viridis with 29.45% Handique, (2003b).

The nutritional component of any food grain or food plants are variable and the variability may be due to soil, climatic factors, nutrient and moisture in soil, geographical factors, biotic and abiotic stress and cultivation practice. In the present study the bamboo shoot samples were collected from their natural and undisturbed habitat. Moreover, the geographical and climatic condition of the locations from which the bamboo shoots are collected were identical. Therefore, the observed variability in nutritional component in the present study appears to be due to genetic differences. Similar interspecific variation for different bamboo species has been reported by Nirmala et al. (2011). Similar interspecific variations were also reported by Bhatt et al. (2003), and the authors opined that this variation is likely to be genetic variation of the species. Information about major nutritional component is a paramount importance to select the best species for consumption and for processing on commercial scale. In case of processed food nutrient components are likely to change, but the nutritional parameters of the freshly harvested shoot served as base line value. There is growing consumer awareness about food and therefore such information has both academic and applied value.

5.3. Evaluation of nutraceutical value

One of the reason why traditional food crops and ethnic food practice is attracting the attention of researchers and general public is that most of such plant studied so far are found to be rich in dietary antioxidant with strong antioxidant activity as shown by in vitro assays (Loying et al., 2008; Gogoi and Rajkhowa, 2015). The role of dietary antioxidant as health protecting and health promoting agent is well established and well documented. In the present study analysis were done for total free amio acid, dietary antioxidants viz phenolics and flavonoids. All these components were found in
impressive amount which support the ethnic knowledge that tender bamboo shoot is not only delicacy but health promoting and health protective.

**Total free amino acids**

Free amino acids are constituent of proteins as well as precursor for many biosynthetic pathways. In nature free amino acids are quickly polymerized into protein and seldom accumulate as reserve food. Therefore the relative proportion of free amino acid indicates high degree of amino acid synthesis. Among leafy vegetable young tender leaves have comparatively higher level of free amino acid than the corresponding mature and old leaf (Handique, 1993) implying that metabolically active tissue has high rate of amino acid synthesis. In the present study total free amino acid content varied from 2.53 mg/100g dw in *B. arundinacea* to 25.0 mg/100g dw in *D. giganteus*. Tender bamboo shoot is metabolically highly active and considering this high amount of free amino acid appears to be reasonable.

Nirmala *et al.* (2011) reported free amino acid is in the range of 3.01mg/100g in *D. brandisii* to 3.98mg/100g in *B. bambos* which is limited variation unlike wide variation in the present study. Analysis of amino acid by Zhang *et al.* (2011) detected 12 free amino acids in shoots of *Phyllostachys praecox*. The six amino acids viz-aspartate, glutamate, glycine, alanine, tyrosine and histidine are known found to be non essential and remaining six amino acids viz-valine, methionine, isoleucine, leucine and lysine, were essential amino acid. Generally dietary as well as other proteins are hydrolyzed during digestion process to release free amino acids which is then utilized by the body for protein synthesis and other metabolic activities. Free amino acids are directly utilized by body and the question of hydrolysis does not arise. Among the essential free amino acids cysteine is known to have antioxidant property. Therefore, occurrence of comparatively high level of free amino acid enhance the nutritive and nutraceutical value of bamboo shoot.

**Phenolics**

Extensive works by a number of workers have established it beyond doubt that
phenolic compounds have varied degree of antioxidant property. Phenolic compounds are fairly wide spread in higher plants both edible and nonedible (Rice-Evans et al., 1995). Phenolic compounds are in large number and they are known as polyphenol and are synthesized as secondary metabolite from pentose phosphate sikimate and phenyl propanoid pathway (Wuyts et al., 2007). More than 8000 phenolics have been identified that ranged from simple molecules, such as phenolic compounds, to highly polymerized compounds such as tannins (Bravo, 1998). For a long time their biological significance was unclear. However, it was learned that phenolics act to protect plants against pathogen and predator attack. Additionally they contribute towards colour and sensory characterization of fruit and vegetables (Alasalvar et al., 2001, Balasundaram et al., 2006). Grains containing high amount of polyphenols are resistant to birds attack (Sadasivam and Manickm, 1992). However, some phenolics like tannins are responsible for imparting bitter and unpleasant taste to food, fruits, grains and vegetables, when they are present in relatively higher amount.

However, phenolics came to the attention of researcher with the discovery that they can scavenge reactive oxygen species (ROS) and other reactive species (Rice-Evans et al., 1997) and hence can be utilized as dietary antioxidant. Additionally they can act as metal chelator (Kris-Etherton et al., 2002). These observations lead to a search for phenolics in different plant species viz-vegetable, leafy vegetable, fruit, grain and other organs. However, information about dietary antioxidant in bamboo is scarce, Karanja et al. (2015) working with African bamboo species (Yushania alpina) West Kenya, reported that phenolics compound varied from 25.9mg/g dw to 27.6mg/g dw and found that antioxidant activity was very high with IC50 value in the range of 1.0mg/ml to 5.0mg/ml, using DPPH reduction test. Park and John, (2010) working with polyphenol profile of two bamboo species P. pubscens and P. nigra detected high phenolic compound viz-protocataduic acid, p-hydroxybenzoic acid, catechin, caffeic acid, chlorogenic acid, syringic acid, p-coumaric acid and ferulic acid. The authors further reported that phenolic content was highly correlated with antioxidant activity.

Subhasree et al. (2009) working with four medicinal plants and leafy vegetable viz Trigonella foenum-graecum, Centella asiatica, Sauropus androgynus and Pisonia alba reported that among others phenolics were in the range of 3.5 mg/g fw to 19.0 mg/g fw. There were proportionate high antioxidant activity. Gulleria et al. (2011)
working with eleven medicinal herbs and leafy vegetable reported considerably high amount of phenolic in the range of 4.78 mg/g to 23.04 mg/g and found proportionately high antioxidant activity. Similar findings have been reported by Rababah et al., 2005; Kumar et al., 2009). In the present study impressive amount of phenolics have been observed with wide variation in the range of 1.36 mg/g in B. balcooa to 6.70 mg/g in D. hamiltonii (H). Moreover Radical Scavenging Activity (RSA) values are also positively correlated with considerable antioxidant activity. Similarly IC<sub>50</sub> value also was found to be impressive in the range of Dendrocalamus giganteus with 2.8 mg/ml to D. hamiltonii with 14.4 mg/ml. It is noteworthy that like phenolic content, RSA% as well as IC<sub>50</sub> values also exhibited considerable variation. The phenolic content and corresponding, RSA% values exhibited positive correlation of varied degree. Likewise phenolic content and IC<sub>50</sub> value exhibited negative correlation. This is understandable because lower the IC<sub>50</sub> value, greater free radical scavenging activity (Acharya et al., 2012).

**Flavonoids**

Like phenolics flavonoids are a large group of compound and more than 4000 flavonoid compounds have been identified (Merilyn Sterling, 2001). Extensive work by many workers have established that like phenolics, flavonoids also have varied degree of antioxidant potency. Earlier, they were considered as of limited importance for imparting colouration to leaf, flowers, and fruit to attract insect and small animals (Salisbury and Ross, 1986) which facilitate the pollination and fruit dispersal. However, academic interests on flavonoid received a boost with the discovery that many flavonoids are powerful antioxidants (Paiva and Russel, 1999; Tiwary, 2001). Like phenolics, flavonoids are fairly widespread in all higher plants in different organs like- leaf, flower, fruit, a leafy twig except root in varied amount (Subhashree et al., 2009; Wang and Jiao, 2000). Available information shows that flavonoid content varies from plant to plant widely. Pourmorad et al. (2006) reported flavonoids in the range of 25.15 QE mg/g to 78.3 QE mg/g in Plantago major and Adiantum capillus-veneris. On the other hand Subhashree et al. (2009) reported total flavonoid content in the range of 2.5mg/g (Trigonella-foernum-graceum) to 15.00mg/g (Sarupus androgynous). Both the
authors reported strong positive correlation between flavonoid content and antioxidant activity which clearly shows that flavonoid is a potent dietary antioxidant. However, reference about bamboo shoot is scarce. Karanja et al. (2015) working with African bamboo (Yushania alpina) reported flavonoid content in the range of 20.10 to 24.60 mg/g dw. In the present study also a positive correlation between flavonoid content and antioxidant activity has been found.

Additionally it was found that result obtained by DPPH reduction test and reducing power assay complement each other. For example Dendrocalamus giganteus shows highest RSA% based on DPPH reduction with 91.02%; for reducing power also it exhibited highest activity with 86.00 GAE mg/g. Likewise B. tulda exhibited second highest RSA% (85.84%) value based on DPPH test; at the same time for RPA also it exhibited a high value of 53.00 mg GAE/g. Lowest reducing power was observed for B. pseudopallida with 26.25 mg GAE/g and its corresponding RSA% value (85.84%) is also among the lowest (36.15%). Most workers are of the opinion that more than one antioxidant assay should be carried out for the same material to see whether the result complement to each other or not. When results of more than one assay are similar or exhibit similar trend that is an indication that results are confirmatory. In the present study DPPH reduction test and RPA are totally different but the results are closely similar. From this, it can be inferred that tender bamboo shoots have high degree of antioxidant value.

There are conflicting reports about correlation between major antioxidant groups and radical scavenging activity. While some observed positive correlation; others reported negative or no definite trend which is attributed to diversification of phytochemical (Subhashree et al., 2009). It is likely that in a plant extract apart from phenolics and flavonoids, other antioxidants like ascorbic acid, alpha-tocopherol, cysteine, etc. may also be present which collectively act in a synergistic manner which may affect the correlation between an estimated compound and antioxidant activity. In the present study statistical analysis revealed a positive co-relation between phenolics content and RSA% and RPA values. Likewise there were positive co-relations between flavonoid content and RSA% and RPA values. However, only the co-relation between phenolics and RPA (+ 0.697 P < 0.05) was significant. On the other hand there were negative co-relation between IC50 values and phenolics and flavonoid. But statistically
the co-relation were not significant. In the present study only phenolics and flavonoids were studied but it is likely that other antioxidants like ascorbic acid, alpha-tocopherol reported by other workers also contribute to total antioxidant activity.

5.4. Biochemical assessment through growth enzyme activity

It is well documented that growth of any plant is basically governed by growth hormones and enzymes associated with growth process. Foremost among them are nitrate reductase (NR) and phosphatases, which govern nitrogen metabolism and phosphate metabolism respectively. In a fast growing plant activities of such growth related enzymes are expected to be high and this fact need verification. Both NR and phosphatases are widely influenced by a number of factors and not much information is available whether genotypic variation also influence the same. Apart from lack of adequate information on bamboo physiology, taxonomic aspects of bamboo are a perennial problem due to lack of adequate markers, particularly due to rare and irregular flowering. Against these backdrop the present study was undertaken to study interspecific variation for the three growth enzymes.

Nitrate reductase (NR) activity

It has been observed that in case of three species which are shorter, with smaller canopy and with only nodal branches; nitrate reductase activities for both culm sheath and young leaves were comparatively lower than that of the species which are taller, with bigger canopy and profuse branching. This general trend is evident in case alkaline phosphatase and to a considerable extent in case of acid phosphatase. Hence, there is an apparent co-relation between the degree of enzyme activity and growth, height and canopy of bamboo species. In the present study for culm sheath NR activity varied from 10.60 µmol NO₂ hr⁻¹g⁻¹fw in *B. pseudopallida* (shoot statured plant) to 16.80 µmol NO₂ hr⁻¹g⁻¹fw in *B. balcooa* and *B. teres* both of which are taller with big canopy. Likewise for young leaf lowest NR activity was found in *B. pseudopallida* with 4.26 µmol NO₂ hr⁻¹g⁻¹fw while highest activity were recorded in *B. arundinacea* with 14.43 µmol NO₂ hr⁻¹g⁻¹fw. On a comparative basis the degree of nitrate reductase
activities were considerably higher than many other plants. Nataraju et al. (1990) reported NR activities in the range of 3.20 to 8.42 μmol NO$_2$ hr$^{-1}$g$^{-1}$fw for 24 genotypes of finger millet implying significant variation. Similar genotypic variations were reported for other monocot plants like sugarcane (Kaur et al., 1992). Under natural condition NR activity varies widely. For nitrophilus weed it varies from 1.0 μmol NO$_2$ hr$^{-1}$g$^{-1}$fw in *Amaranthus viridis* to 3.64 μmol NO$_2$ hr$^{-1}$g$^{-1}$fw, in *Euphorbia hirta* (Sabale and Kulkarni, 1994). In medicinal plants *Ammi majus* it varies from 3.20 to 4.50 μmol NO$_2$ hr$^{-1}$g$^{-1}$fw (Ahmad et al., 2010). The significant interspecific variation in the present study are in agreement with these reports. NR activities in bamboo species appear to be much higher particularly in culm sheath which seem to be a major reason of why bamboo shoot has such a rapid and high growth.

**Alkaline phosphatase (ALPH) activity**

Alkaline phosphatase activity in the present study has been found to be 2-3 times lesser than acid phosphatase in culm sheaths and young leaf while in tender shoot it is absent. It is known that unlike ACPH, alkaline phosphatase works optimally at high pH of 10.00 (Sadasivam and Manickam, 1996). But in the present study tender bamboo shoot has been found to very acidic with pH value in the range of 4.56 to 6.03. It is possible that due to the acidic environment in tender bamboo shoot activities of ALPH and NR is absent.

**Acid phosphatase (ACPH) activity**

Like NR activity, which appears to be much higher particularly in culm sheath with wide variation; acid phosphatase (ACPH) activities also exhibit significant interspecific variation and compared to other plant species ACPH activities are higher. ACPH activities have been observed in all the organs studied viz - tender shoot, culm sheath and young leaves. On a comparative basis young leaves exhibited highest ACPH activities, followed by culm sheath and tender shoot. In *Sesamum indicum* seedling, and it varied from 14.53 to 17.79 μmol hr$^{-1}$g$^{-1}$fw in shoot while in root it is much lower (Muthusamy et al., 2001). By comparison in bamboo it has been found to be much higher with 8.00 to 22.6 μmol hr$^{-1}$g$^{-1}$fw in young leaves of *M. baccifera* and
B. arundinacea respectively. On the other hand acid phosphatase is known to work optimally at acidic condition at 5.5 (Zhawar et al., 2011). In tender bamboo shoot pH value was in this range and that explain why the acid phosphatase activity is much higher than alkaline phosphatase. Although tender bamboo shoot exhibit the fastest growth among higher plants yet it is devoid of activities of major growth enzymes viz nitrate reductase and alkaline phosphatase. Apparently, the metabolic products of these enzymes are translocated from calm sheath, which show high degree of enzyme activity. The present study shows some distinct trend in the in vivo activity of these growth enzymes.

5.5. Molecular analysis of genetic diversity based on RAPD

Bamboo taxonomy and for that matter study of genetic diversity is a complicated and perpetual problem. Because conventional taxonomy mostly rely on flower and flowering characteristics apart from morphological feature. While morphological characters are affected by environmental factors, flowers are not. But bamboo flowering is rare and whenever occur it is highly irregular and for most bamboo flowering time cycle is 25-70 years while some cultivated bamboos like Bambusa tulda and B. balcooa flowering rarely occur even in 100 years (Barooah, 2009). For the same season molecular characterization based on seed protein profile by SDS-PAGE is not possible. Although genetic diversity, phylogenetic study based on seed protein profile is widely appreciated as reliable, reproducible and reflective of genetic set up of a taxa (Ladizinksky and Hymowitz, 1979) and recognized by international seed Testing Association (ISTA, 1996); in case of bamboo it is not possible due to non-availability of seed.

Therefore the only approach is DNA based marker and RAPD is most widely used technique for this purpose. The advantage of DNA based marker is that unlike biochemical marker it is not affected by environment, external and internal factors except genetic factors. Moreover any tissue at any stage of growth and season can be used as source of material for DNA.

The present study clearly shows that there exist wide genetic diversity among the bamboo species. DNA profile shows that unlike most food crops no two taxa among
the 11 species have identical profile. In the present study all the primers generated diverse amplicon profile. The amplicons generated with RPI-10 are also highly diverse ranging in size from 1800bp to 180bp implying that wide variation exists among them viz. high, medium and low molecular weight amplicon. Among a total 28 amplicons only two amplicons with size 840bp and 560bp were common to 8 taxa while many amplicons occurred only once which are indicative genetic diversity and phylogenetic distances among the taxa. SI matrix shows that out of possible 55 pair wise comparisons only 5.4% pair show similarity little above 50% while for all others these are well below 50%. Dendrogram analysis shows two major clusters but within clusters all the taxa exhibit significant phylogenetic distances. The closest phylogenetic relationship was observed between *B. arundinacea* (S1) and *B. balcooa* (S3) with a SI value of 60%. Based on morphological features conventional taxonomy consider them as closely related and molecular analysis also support this view. In Assam as well as most part of NE India *B. tulda* and *B. balcooa* are most widely cultivated species but with distinct morphological difference. In the present study dendrogram analysis show that both belong to same cluster with close genetic distance which lend support to the conventional taxonomic view. On the other hand taxonomic status of *D. hamiltonii* of hills and plain areas are a taxonomic puzzle. Conventional taxonomist consider both as the same species despite some morphological difference (Barooah, 2009). For this reason in the present study they were demarcated as *D. hamiltonii* (Plains), *D. hamiltonii* (Hill). The present study show that contrary to conventional taxonomic view both belong to separate clusters with wide genetic distance as evident from the fact that SI value between both is only 26.8%. Hence molecular analysis indicate that *D. hamiltonii* (P) and *D. hamiltonii* (H) are two separate species. On the other hand *D. giganteus* appear to be unrelated to all other taxa with SI value from 0.0% to 30.77%. These apart as many as 10 amplicons of diverse size were observed in only a single taxa. Generally an amplicon with single appearance is considered as unique band for the taxa concerned. From this viewpoint it is evident that all the 11 taxa in the present are genetically distinct and also unique.