6. CONCLUSION AND FUTURE OUTLOOK

The present analysis revealed the morpho-histometric, phytochemical, biochemical and molecular comparison of *Dolichos biflorus* Linn. Morphoforms viz., black, cream and brown. No significant variation was observed in morphometric and histological characters among the morphoforms. Morphometric characteristics of mature plants showed strong positive correlation between height of the plant and number of nodes / mean length of internodes. The length and breadth of pod, and number of seeds / pod showed no characteristic difference between the different morphoforms studied. Similarly, the stomatal nature and vein islets distribution showed minor variations. Histometric data on length and breadth of epidermal cells, diameter of xylem and cortical cells, length of trichomes, stomatal index and vein islets showed more or less identical quantitative measurements between morphoforms. However, the difference in the breadth of epidermal cells was highly significant at 95% probability level.

The proximal analysis includes moisture content, ash and crude fiber, which varied among the morphoforms. Total soluble proteins, carbohydrates and fat content are comparable with other common pulse foods. Mineral analysis
revealed the presence of substantial quantities of essential elements required for a human body (Fig-44). Moreover, the different morphoforms possessed a pool of many essential and non-essential amino acids. Phytochemicals such as phenols, flavonoids, alkaloids, saponins and steroids were observed by qualitative analysis, almost in all parts of the plant. Thus, the horse gram seeds are rich in primary and secondary metabolites, so had therapeutic significance in addition to the nutritional qualities. The photosynthetic efficiency is dependent on the amount of photosynthetic pigments. It has been noticed that cream seeded morphoform is more photosynthetically efficient, because it contains higher amount of chlorophyll $a$ and total chlorophylls. The content of chlorophyll $b$ was greater in the black morphoform and that of carotenoids in brown. The variation in the amount of different photosynthetic pigments was highly significant. Protein and DNA banding pattern may be used to distinguish the three morphoforms, as revealed by electrophoretic, RAPD and Isozyme analysis. The non-toxic nature of the horse gram was confirmed by haematological and liver analysis in animals. As the last phase of the work, the enzyme urease was purified from black morphoforms showing 364.5 fold purification with 16.4% yield. Purity was checked by SDS-PAGE and native PAGE. The mass was detected by size elution chromatography, suggesting as a hexamer with the mass 480 kDa. The enzyme was characterized for pH, temperature and inhibitors. Kinetics was studied for the substrates (urea, thiourea, hydroxyl urea and $N$-methyl urea) and inhibitors such as KCN, $\text{NaN}_3$, $\text{Hg}^{2+}$ and $\text{Pb}^{2+}$. 
Obtaining adequate nutrients from various foods plays a vital role in maintaining normal function of the human body. With recent advances in medical and nutrition sciences, natural products and health-promoting foods have received extensive attention from health professionals among the common population. New concepts have appeared with this trend, such as nutraceuticals, nutritional therapy, phytonutrients, and phytotherapy. These functional or medicinal foods and phytonutrients or phytomedicines play positive roles in maintaining and enhancing health, and modulating immune function to prevent specific diseases. Due to their potentiality, they also hold great promise in clinical therapy to reduce side effects associated with chemotherapy or radiotherapy and significant advantages in reducing the health care cost. The original idea in these concepts goes back to three thousand years ago. Hippocrates, the well-recognized father of modern medicine, stated “Let food be thy medicine and medicine be thy food” to predict the relationship between appropriate foods for health and their therapeutic benefits. Since the start of the industrial age, lifestyles of human beings have dramatically changed. Increasing work and living speed, longer work schedules, and various psychological pressures have pushed people into various fast-eating cultures with more instant and tasty meals, but decreased quantity and quality in nutrients. Similarly industrialization has caused air and water pollutions, and soil and food contamination because of extensive use of various chemicals, heavy metals, electromagnetic waves, and other potentially harmful man-made items. These problems have led to an increased incidence of diabetes, obesity, various cancers and vascular diseases,
physiological problems, as well as other degenerative diseases. The raised demands for health care have dramatically increased the cost of medical care. Now, more and more people realize that a healthy body is more important than money or work in their lives. Therefore, people have tried to achieve a better quality of life by eating more vegetables, fruits, and other plant foods, taking dietary supplements or nutraceuticals, or using nutritional therapy or phytotherapy to replace chemotherapy or radiotherapy.

Scientific studies have to be expanded to these areas of nutraceuticals and phytonutrients to support therapeutic services. Furthermore, plant biotechnologists have put lots of effort to engineer plants and crops in order to improve their nutritional value. There are already many plant biotechnological products, which are patented in an increasing number and diversity. Further studies are warranted to establish the outcome of this study. Similarly the phytochemicals may be further quantified and characterized in terms of its medical potentiality. Although, nutraceuticals and phytonutrients have significant promise in the promotion of human health and disease prevention, health professionals, nutritionists and regulatory toxicologists also could strategically work together to plan appropriate regulations to provide the ultimate therapeutic benefits to mankind. The nutraceutical, phytonutrient, and phytotherapy markets are still not well regulated. Concerns from scientists, professionals, and customers continuously arise, due to increase, in the use of these products and therapies. Quality, safety, long-term adverse effects, and toxicity are primary concerns. For manufacturing processes of nutraceuticals and phytonutrient products, quality
controls such as the composition and contents of active constituents in natural plants, and maintenance are critically important. To establish product safety and efficacy, extensive safety studies including acute, sub acute, sub chronic, chronic and long-term toxicity studies, reproductive toxicology, as well as supplementation studies in animals and clinical trials in humans are necessary. The safety assessment of botanicals and botanical preparations in food and food supplements is complicated and should at least involve the characterization and quality of the material, its quality control; the intended use and consequent exposure; toxicological information, and risk evaluation. Although these concerns exist, governments, scientists, nutritional professionals, and other related parties are making great efforts to build the nutritional product and therapeutic system markets. Advances in biotechnology at different levels will greatly enhance these markets, as well as other technologies in diagnosis, product quality control, service style, etc. In this era of genomics, cDNA oligonucleotide microarray technology has emerged as a powerful tool. The potential of this technology in diagnostics is promising. Similar to DNA fingerprint technology and epigenetic studies, the technology may someday be able to identify each individual’s genetic background and accordingly nutrient conditions. Based on this information, nutrition professionals could prescribe an improved dietary supplement for the individual. The DNA microarray technology may be used to examine the safety and efficacy of drugs, chemicals, food supplements and nutraceuticals. With advances of analytic technique, now it is feasible to do metabolic screening on the newborns to predict or find out possible metabolic diseases, which may be
treated with particular nutritional therapy or phytotherapy. For plant biotechnology, although concerns about unintended effects of transgenic crops or plants on humans and the environment is warranted, stopping the use of these beneficial biotechnological products only because of unproven worries is unfortunately misguided. In summary, agricultural, food, and biomedical biotechnology continue growing as a nonstop to change our life, the potential is high that one day our foods will also serve as medicines.
Diagrammatic representation of morphometric, histometric, analytical, biochemical, and molecular characters of *Dolichos biflorus* L. seed morphoforms viz., black, cream and brown.