Chapter 6
Discussion

Present study, aimed at the exploration of medicinal plant wealth of Tulunadu and neighbouring areas resulted in the documentation of 1001 plants that used as medicine by the rural people. The 1001 plants belonging to 156 families and 624 genera can be categorized into two based on their availability i.e. those plants, which are either naturally found in the study area or are grown for various purpose and the bazaar medicines. A total of 941 species falling under 147 families and 573 genera come under first category and 60 species of 56 genera and 32 families belongs to the second. These plants which are not found in the study area but their products are brought from the market for treatment. 23 families and 5 genera are common to both the categories.

Among the diverse plant groups, Angiosperms are the most commonly used ones as they account for 983 plants, of which 57 are collected from the market. Dicotyledons dominate with 805 representatives from the wild and 47 products from the market. Details of different plants used as medicine and their categorization are depicted in Table 1. Adiantum capillus-veneris, A. caudatum, A. lunulatum, Asplenium trichomanes, Cheilanthes farinosa, Drynaria quercifolia, Lygodium flexuosum, Marsilea minuta, Parahemionitis cordata, Salvinia molesta, Selaginella delicatula and S. involvens are the twelve Pteridophytes which are used for medicinal purposes in Tulunadu. Cycas circinalis and Gnetum edule are the two naturally occurring Gymnosperms whose various parts are used as medicine, while heart wood of Cedrus deodara, gum resin of Pinus sylvestris and dried leaves of Taxus baccata were collected from the bazaar. Basidiocarp of Fomes fomentarius is the lone representative of the kingdom Fungi. Fungal basidiocarp and all the Pteridophytes were collected from the nature.

Of the 156 plant families, Papilionaceae dominates as 70 species are used for medicine, followed by Euphorbiaceae and Rubiaceae with 50 and 43 species respectively (Fig. 2). Distribution of medicinal species in each family is given in.
Table 2. There are 51 families, which are represented by single medicinally important species while majority of the families have species in the range of 2 – 9.

Among the 624 genera, *Ficus* (figs) showed dominance as 13 figs are much valued by the traditional healers, followed by *Ipomoea* and *Solanum* (Fig. 3). Herbs and trees are the most used plant forms as 326 herbaceous and 301 trees are in use as medicine. 188 climbers and 186 shrubs are also utilized by the medicine men (Table 3). Among these plants 274 are palatable and 44 poisonous. 172 plants are exotic in origin but are now naturalized. 182 plants which are usually known as weeds are also employed for medicine preparation. Use of aquatic plants in medicine is also significant as 35 plants belong to this category. Presence of 13 orchids in this list is another attraction. Epiphytes, parasites and insectivores contribute a little with 9, 9 and 2 species respectively. Analysis of the plant population made it clear that 36 plants are rare in the study area with very limited distribution (Fig. 4).

Different parts of each plant used and their number is shown in Table 4. Among the different parts, leaf is the most used part. Leaves of 474 plants are used 2124 times (21.27%) for preparing medicines, followed by whole plant, root, bark, fruit, seed, tuber, tender shoot, flower, stem and heart wood (Table 5). Heart wood forms the least used part with 104 (1.04%) uses.

Table 6 gives a clear picture regarding the different kinds of drug preparation employed by the traditional healers for each plant. Juice accounts for 31.25% of the preparations as juice from 665 plants are used 3084 times. Decoction has 25.62% share as it is prepared 2528 times from 721 plants. Other kinds of preparations namely paste, oil, powder, gruel, tambuli, latex, lehyam and pickle also make considerable contribution. Pickle has the least share of 0.23% (Table 7).

1001 plants are used for a total of 9898 formulations. The number of preparations from each plant and their nature is shown in Table 8. Of these 5813 formulations are single drug remedies with 59% share while the rest 41% by the combination drugs (Table 9). Thus each plant on an average is used for 9.89 formulations. The sacred basil, *Ocimum tenuiflorum* is the most used plant as it is used for 130 traditional formulations, followed by *Achyranthes aspera* and
*Tinospora cordifolia* with 93 and 79 formulations respectively (Fig. 5). 176 plants have single formulation to their credit, while 492 plants are utilized for formulations in the range 2 – 9. Only 17 plants were utilized for more than 50 formulations (Table 10).

Therapeutic profile of each plant is given in Table 11. Details regarding the diseases treated with a particular plant are shown, which helps to provide data regarding the number of plants available for a particular disease. There are 750 plants in *Tulunadu* which are utilized for digestive disorders. 458 plants are credited by their wound healing property and 433 are employed for rheumatic complaints. Numbers of plants utilized for particular disease are narrated in Table 12. 93 formulations of *Achyranthes aspera* are used for treating 59 diseases, while the most used plant *Ocimum tenuiflorum*, for 55 diseases. Plants with maximum therapeutic efficacy are depicted in Fig. 6.

Only two plants, *Achyranthes aspera* and *Ocimum tenuiflorum* are used for more than 50 diseases, while majority (516) are used for diseases in the range of 2 – 9 and 105 for any one disease (Table 13). Details regarding the administration media for medicine are given in Table 14. Of the total 9898 formulations, 26.07% (2570) formulations are administered through different media other than water (Table 15). Among the diverse media, milk is the most used one as it is used for 653 formulations from 266 plants. Honey is used for 378 formulations while breast milk has least share with 14 uses (Table 15).

Of the total 1001 medicinal plants, 103 are endemic (Appendix 2) while 119 qualify for IUCN red list categories with 5 critically endangered, 16 endangered, 32 vulnerable, 39 rare, 10 near threatened, 16 low risk and one data deficient plants (Appendix 7).

During extensive field visit, a total of 215 knowledgeable persons were interviewed for collection of data regarding the various aspects of medicinal plants. Of these 176 (82%) informants were male and the rest 39 (18%) females (Fig. 7). 67% (145) of the informants had the inherited knowledge regarding the medicinal uses of plants while 24% (51) have acquired knowledge through observation as well
as study and the rest 9% by both (Fig. 8). 181 traditional healers know the treatment for more than one disease, which accounts for 84% and 34 only for particular disease (Fig. 9). Majority of the traditional healers (84.5%) hesitate to make their own experimentation and were satisfied with the inherited or acquired knowledge. Only 15.5% healers are performing experimentation in their therapy (Fig. 10).

Number of informants in each age group is shown in Fig. 11. Only one informant was below the age of 40, while the majority (85%) above 50 and maximum in the age group 70 – 79. Agriculture is the occupation of 115 informants, 34 women are housewives and the rest with varied occupation (Fig. 12). Mother tongue of 104 informants is Kannada (Fig. 13) while scriptless languages Tulu, Konkani and Hindustani accounted for 70 (32.5%). 73 healers were well known for treating skin diseases while 68 were general practitioners. Number of informants or healers available for particular disease is also given in Fig. 14.

Critical analysis of the collected information and comparison with earlier literature made it clear that 459 out of 742 medicinal plants listed in classic *Hortus Malabaricus* (Rheede, 1678 – 1703) and 467 out of 523 plants narrated in Kanarese medicinal plants (Stolz & Plebst, 1881) are part of medical tradition of *Tulunadu*. Gradual erosion in the knowledge of the folk on the therapeutic efficacy of plants and erosion in biological diversity are believed to be the main reasons behind this difference in numbers.

**Etymology and doctrine of signature**

The folk, through trial and error developed their own method for identification of local plants through ethno linguistic approach and doctrine of signature. These masters of folk tradition and phytomedicines have classified and named plants based on their aroma, form, size, shape, distribution, habit, habitat, taste, colour and resemblance with many familiar plants (cacti, turmeric, basil, taro, jasmine and many more). Some of the important plant classifications or groupings are narrated in Appendix 3. A thorough insight into the socio-cultural profile of *Tulunadu* makes it clear that many place names and surnames have originated from respective plant names. (Appendix 5).
As a result of grouping and naming based on etymology and therapeutic efficacy, more than one botanical entity are attributed to a single drug. Careful evaluation of the etymology of medicinal plants of Tulunadu made it clear that in some cases a drug has up to eight plants as source. The rural physicians named all the plants having wound healing properties as ‘Gadimaddu’, which resulted in the use of Adiantum philippense, Pouzolzia wightii var. wightii, Eupatorium triplinerve, Hemigraphis colorata, Zornia diphylla, Zornia gibbosa, Hedyotis auricularia and Blepharis repens as ‘Gadimuddu’ in different parts of Tulunadu. Another important example is of ‘Elukootti’ (bone binder) as all plants used for bone setting are named as ‘Elukootti’ with Litsea glutinosa, Litsea ghatica, Lepidagathis incurva var. mucronata, Justicia trinervia, Hedyotis neesiana, Blepharis asperrima and Alysicarpus vaginalis as plant sources. There are a number of such examples which are given in Appendix 6. Such a tradition also resulted in the use of many plants as substitutes and some as adulterants for the actual drug. A critical evaluation of the medicinal plant profile of Tulunadu revealed the availability of one or more substitutes for 145 drugs and 16 plants are in use as adulterant for the actual drug (Appendix 6). Even though this trend aids much in the easy collection of drugs but causes much difficulty to the beginners in the correct identification.

Generally the traditional healers believe that the morphology, growth pattern and habit of the plants are the best indicators of their therapeutic efficacy (doctrine of signature). It is believed that highly fragrant plants are having aphrodisiac properties which resulted in the use of Cananga odorata, Abelmoschus moschatus and Ocimum basilicum as sexual tonic. Plants which usually cause irritation to the skin are the best drugs for skin diseases with examples like Colocasia esculenta, Alocasia macrorrhiza, Remusatia vivipara, Laportea interrupta, Tragia involucrata, Amorphophallus spp. and Holigarna arnottiana. Cissus latifolia, Mussaenda belilla, Calycopteris floribunda, Loeseneriella arnottiana and Jasminum malabaricum are the plants which are having the property to ooze out water from the cut stem. This water oozing out just like tears is much used for eye diseases. The characteristic leaf shape (resembling brain) of Centella asiatica and Hydrocotyle spp. made them famous as memory boosters. Plants with jointed stem (Cissus quadrangularis),
mucilaginous bark and white bark (indicator of calcium) are highly credited with bone binding properties.

**Present investigation also explored:**

**Identification of closely related plants:**

The traditional healers employ their own methods to identify closely related plants. *Holostemma ada-kodien*, *Cosmostigma racemosa*, *Leptadenia reticulata* and *Wattakaka volubilis* are the closely related plants of the family Asclepiadaceae with different vernacular names. In *Holostemma*, the plant juice is milky in nature and lower side of the leaf is with reddish blotches. In other three it is watery. When leaf of *Cosmostigma* is plucked, watery latex starts to ooze out and crushing of leaves gives the smell of green chillies. *Leptadenia* has green bark and pale coloured leaves while in *Wattakaka* bark and leaves are dark coloured. The undersurface of *Wattakaka* leaf is waxy white.

Another best example of traditional identification method is that of ‘Basri’ (*Ficus* spp.). Both *Ficus amplissima* and *Ficus tinctoria* are known as ‘Bili basri’ (white pregnancy fig) due to their whitish barks and the later is identified by its unequal sided leaf base. *Ficus amplissima* and *Ficus virens* are widely used as substitute for *Ficus microcarpa* but the experts can easily identify *Ficus microcarpa* by the size of the bark pieces collected. It is very hard to get a *Ficus microcarpa* bark piece with more than one inch breadth. *Ficus tsjahela* and *Ficus virens* are known as ‘Kari basri’ (black pregnancy fig) due to their blackish bark. Easy character to differentiate these two is the presence of aerial roots in *Ficus virens*.

**New light on the botanical identity of some common medicinal plants:**

Usually after establishment of a botanical entity as the source of a popular drug, further investigation on the botanical identity of the drug source is not common. One of the best examples is of ‘Kizharnelli’ (ground gooseberry). *Phyllanthus amarus* is the most accepted source. Critical analysis of the plant sources of ‘Kizharnelli’ in *Tulunadu* made it clear that in addition to this source, *Phyllanthus airy-shawii* and *Phyllanthus kozhikodianus* are also used as the drug source. Personal observation of
the plant used by the traditional healers of Tulunadu as ‘Kzharnelli’, made it clear that about 90% of the healers use Phyllanthus airy-shawii as ‘Kizharnelli’ and not Phyllanthus amarus.

**Light on distribution of some medicinal plants:**

Some of the medicinal plants show restricted distribution and in turn limited therapeutic use. An investigation on this aspect reveals that Begonia malabarica, Croton malabaricus, Pogostemon quadrifolius and Ventilago denticulata are restricted to Kerala part of Tulunadu while Cissus elongata, Cayratia mollissima, Gymnacranthera farquhariana to Karnataka part. This trend also results in use of plants which are available in plenty in a region as the drug source. In Kerala part, Holostemma ada-kodien is more common and is the plant source for the drug ‘Jivanthi’ were as in Karnataka part it is Leptadenia reticulata. Lepidagathis keralensis is restricted to the Kerala part and is used as ‘Pademullu’ while in Karnataka part it is its counterpart, Lepidagathis prostrata. Another example is of ‘Kodali soppu’ (leaf for wound caused by axe – Blepharis). In Karnataka part Blepharis asperrima is the species which is easily available while in Kerala part it is Blepharis repens.

**Novel uses of a number of neglected plants:**

Critical analysis and comparison of collected information with authentic literatures resulted in the identification of 5815 (59 %) formulations as novel formulations (Table 8). Most important fact is that all the formulations of 360 (36 %) plants are new report to science. Ocimum tenuiflorum (71), Leucas aspera (55) and Calotropis gigantea (53) are the plants with highest number of novel uses.

**Common efficacy of related plants:**

It is also evident that a number of closely related plants are having similar therapeutic efficacies. From the collected pool of data it is very obvious that the seeds of cucurbits are having wormicidal property while their juice is diuretic. Asteraceae members are having wound healing property in common.