

Research Article

An ethnobotanical survey of medicinal plants in Bellary district of Karnataka state, India

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Received: ; Accepted:

ABSTRACT

Ethnomedicinal survey of traditional medicinal plants was carried out in Bellary district using ethnobotanical and Participatory Rural Appraisal (PRA) methods. The data collected was analyzed by means of Ailment Categories, Informant Consensus Factor (ICF), Use Value and Fidelity Level (FL). The present investigation brought in light 148 medicinal plant species belonging to 132 genera and 56 families used in the treatment of various human diseases in Bellary district. The most commonly used species were *Achyranthes aspera* and *Momordica charantia* with a use value of 0.18 each, followed by *Calotropis procera* (use value 0.17), *Leucas aspera*, *Tinospora cordifolia*, *Withania somnifera* (use value 0.15 each), *Phyllanthus amarus* (use value 0.14) and *Azadirachta indica* with a use value of 0.13. The rural people of Bellary district are highly dependent on the traditional herbal medicine because of their poor socio-economic conditions and availability of effective drug plants. The information gathered on traditional medicinal plants is expected to serve as a useful tool for the establishment of herbal drug industries and improve the economy of the region.

Keywords: Traditional knowledge, medicinal plants, human ailments, Bellary, Karnataka

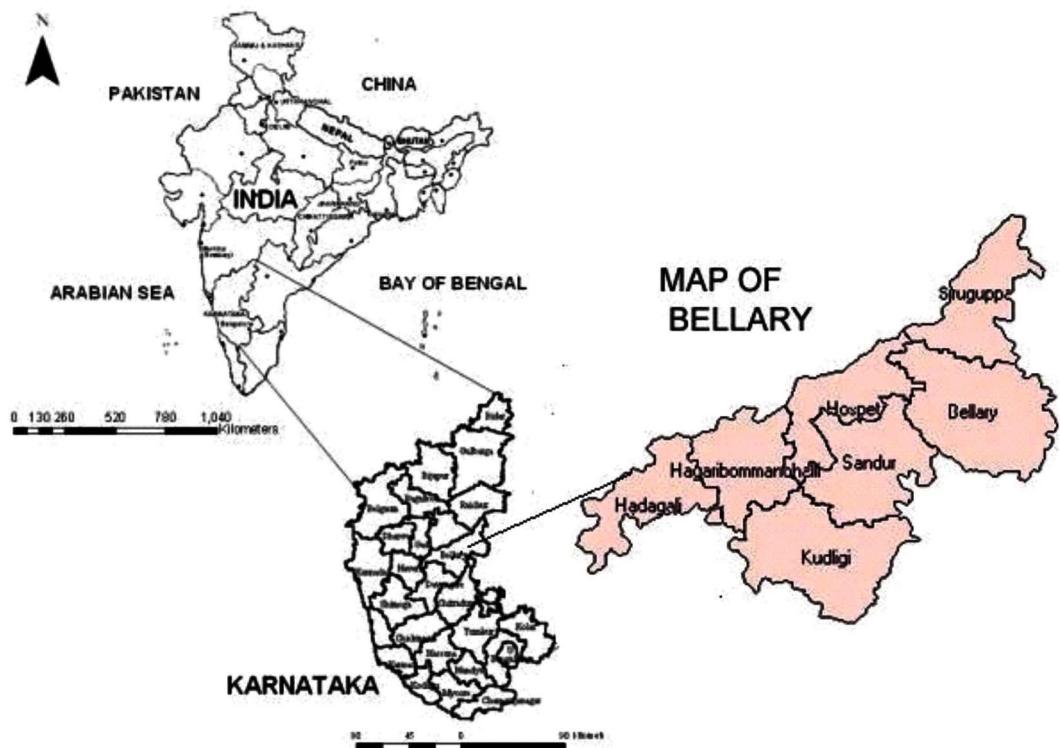
INTRODUCTION

The application of plants as medicines dates back to prehistoric period. There is evidence since early Vedic period of plants being used for a wide range of medicinal purposes. They have in fact been used in a continuous unbroken tradition for over four millennia (Pullaiah, 2002). Bellary, one of the districts in Karnataka state has a population of 25.32 lakhs as per the 2011 census. People exhibit a vast diversity in their culture, tradition and living system. The district occupying an area of 8,447 sq. km. encompasses the latitudinal parallels ranging from 14° 30' to 15° 50' north and to the longitudinal meridians of 75° 40' to 77° 11' East. The district has 7 taluks namely, Bellary, Hospet, Sandur, Hadagali, H.B. Halli, Kudligi, and Siruguppa with rich

heritage of herbal drugs (Figure 1). The soils of the district are mainly black cotton and red. The average elevation of the district is 478 m from sea level and annual rainfall is 636 mm. Most of the tribal, rural and poor people in the district use traditional medicine for various ailments. However, there is an increasing threat to wild medicinal plant resources and their habitats because of over exploitation and deforestation (Hoft *et al.*, 1999).

Natural habitats represent repositories of floristic germplasm and indigenous ethnobotanical knowledge. These biotic and cognitive resources are threatened by vegetation removal and culture change (Voeks, 1996). Ethnomedicinal information like any other form of traditional knowledge is verbally transmitted from generation to generation, and hence in danger of extinction as older people die and younger

Figure 1: Map of the study area



generations fail to learn the traditional way of life. This situation is worsened by rapid socio-economic, technological and environmental changes (Tabutty *et al.*, 2003). Indigenous knowledge about uses of wild plant resources such as medicinal plants is disappearing fast from traditional communities (Bagine *et al.*, 1997). Urbanization, mining, agricultural expansion and other developmental works have also resulted in the decline of interest in traditional culture as well as vegetation in the district. Hence, documentation of traditional knowledge has been taken up in the district to preserve all information on medicinal plants used by tribal and rural communities before it is completely lost. Documenting the indigenous knowledge is also helpful in creating awareness for the conservation of biological resources and their sustainable utilization.

MATERIALS AND METHODS

Ethnobotanical survey

Ethnobotanical survey of traditional medicinal plants was carried out in Bellary district using the standard developed by ethnobotanical society of India and Participatory Rural Appraisal (PRA) methods (Robert Chambers, 1994). Seventy

six traditional healers in which 68 males and 8 females were selected from different localities of the study area based on the recommendation from elders and local people of the district. The ages of the healers were between 40 years and 85 years. The information was recorded by means of interviews with the informants in a standard questionnaire. Personal interviews with the informants and field observation were employed to collect data on knowledge and management of medicinal plants. Group discussions were conducted to elaborate the methods of preparation, administration and conservation of medicinal plants. Interviews were conducted in local 'Kannada' language. During the survey, each informant was visited couple of times in order to confirm the reliability of the ethnomedicinal information. The data collected includes the vernacular names of drug plants, distribution, habitat, botanical description, parts used, diseases treated and route of administration of drug for each species. The reported medicinal plant species were photographed and collected from natural vegetation, cultivated fields and gardens during the field walks. The collected species were authenticated with the help of floras such as, Flora of Gulbarga district (Seetharam *et al.*, 2000), Flora of Davangere district

(Manjuanatha *et al.*, 2004) and Flora of Karnataka (Saldanha, 1996). The Voucher specimens were pressed, numbered and deposited at the Herbarium centre, department of Botany, Gulbarga University, Gulbarga. The collected data was analysed by means of Use categories, Informant consensus factor, Use Value and Fidelity level.

Use categories

The reported medicinal plant uses were classified into different ailment categories by a standard method (Cook, 1995). Each time a plant was mentioned as ‘used’ was considered as one use-report. If one informant used a plant to treat more than one disease in the same category, it was considered as a single use-report (Treyvaud *et al.*, 2005).

Informant consensus factor (ICF)

The Informant consensus factor (ICF) was calculated for each category to identify the homogeneity of the informants on the reported cures for the group of diseases. The ICF was calculated by using the formula as follows: number of use citations in each category (n_{ur}) minus the number of species used (n_t), and divided by the numbers of use citations in each category (n_{ur}) minus one (Subramanyam Ragupathy *et al.*, 2008).

$$ICF = \frac{n_{ur} - n_t}{n_{ur} - 1}$$

ICF values are low (near 0) if plants are chosen randomly or if there is no exchange of information about their use among informants, and approach one (1) when there is a well-defined selection criterion in the community and/or if information is exchanged between informants (Musa S. Musa *et al.*, 2011).

Use value

The use value, a quantitative method that demonstrates the relative importance of species known locally, was calculated (Luiz Rodrigo Saldanha Gazzaneo *et al.*, 2005).

$$UV = \frac{\sum U_i}{n}$$

Where, UV = use value of a species, U_i is the number of use-reports cited by each informant for a given species and n refers to the total number of informants.

Fidelity level (FL)

Because many plant species may be used in the same use category, it is interesting to determine the most preferred species used in treatment of particular ailment, which can be done with the FL (Auragh Singh *et al.*, 2012).

$$FL (\%) = \frac{N_p}{N} \times 100$$

Where, N_p is the number of use-reports cited for a given species for a particular ailment and N is the total number of use-reports cited for any given species. High FLs (near 100%) are obtained for plants for which almost all use reports refer to the same way of using it, whereas low FLs are obtained for plants that are used for many different purposes.

RESULTS AND DISCUSSION

During the survey it is found that traditional medicinal plant species have been used by herbal healers, tribal, elders and many local people since a long time to cure human ailments. Several local communities and tribes such as Lambani, Medara, Adavichenchru, Valmiki, Budabudikae and korava have a rich knowledge on plants based traditional medicines. The present investigation brought in light 148 medicinal plant species belonging to 132 genera and 56 families used in the treatment of various human diseases in Bellary district.

Distribution and diversity

The most represented families in the study area were Euphorbiaceae and Fabaceae with 9 species each, followed by Mimosaceae (8 species), Lamiaceae (7 species), Asclepiadaceae, Asteraceae, Solanaceae (6 species each), Apocynaceae, Liliaceae, Malvaceae, Rutaceae (5 species each), Amaranthaceae, Caesalpiniaceae and Capparaceae (four species each). Other families were represented with three or two or one species each. Similar results were found in Coochbehar district of West Bengal where Euphorbiaceae and Fabaceae were dominant families (Tanmay Datta *et al.*, 2014). Medicinal plants belonging to families like, Euphorbiaceae and Lamiaceae were dominant in Kadapa district of Andhra Pradesh (Rajagopal Reddy *et al.*, 2011). Asteraceae and Apiaceae were the leading families in Kerala state (Rajith and Ramachandran, 2010), whereas in Kancheepuram district of Tamil Nadu, Euphorbiaceae and

Verbenaceae were dominant families (Chellaiah Muthu *et al.*, 2006).

Plant part used, method of preparation, and route of administration

Leaves contribute about 48.60% of plant part used, followed by roots (13.50%), stem (9.50%), whole plant (9.50%), bark (6.80%), seeds (5.40%), buds (2.70%), flowers (2.65%) and latex (1.35%). There are instances where different parts of the same plant being used for different purposes. For example; in *Acacia ferruginea*, stem bark is used to treat menstrual problems, while leaves are used to control dysentery. Whereas, in *Aegle marmelos* leaves are used to treat diabetes, jaundice and fever, while fruits are used for intestinal disorders. There are also cases where more than one plant is used to treat a particular ailment. For example; *Gymnema sylvestrae*, *Momordica charantia* and *Tinospora cordifolia* are commonly used for treating diabetes. Vrushabendrayya, a traditional healer from H B Halli taluk treats jaundice with a combination of whole plant of *Phyllanthus amarus*, roots of *Coccinia indica* and seeds of *Tephrosia purpuria*. Another healer, Andanappa of Hadagali taluk treats asthma by the mixture of leaves of *Ocimum sanctum*, *Leucas aspera*, *Momordica charantia* and fruits of *Piper longum*.

The herbal remedies were prepared in various forms such as, juice (47%), powder (18%), decoction (14%), paste (12%), mastication of fresh plant parts (8%) and fumigation (1%). The remedies are administered mostly by oral (73.64%), followed by dermal (21.62%), ocular (2.02%), auricular (1.35%) and nasal (1.35%). Water served mainly as solvents and to improve the acceptability of certain oral remedies. Honey, curd, butter, sugar candy, milk and buttermilk are frequently used as solvent. The remedy prepared from *Aloe vera* leaf gel, for instance, is mixed with curd and sugar candy so that the preparation can be swallowed without much difficulty. The units of measurement of plant parts used to fix the dosage was generally the fingered length (e.g. for root, stem and bark), pinch (e.g. for powdered plant parts) and numbers (e.g. for leaves, seeds, fruits and flowers). In most of the cases, the dose given to the patient depends on age and physical health conditions.

Traditional healers have reported that for the efficacy of the drug will be depends upon the time of drug plant collection, order in which different plants are added during drug preparation and the time of drug preparations and

administration. All identified traditional healers emphasized on the involvement of spiritual component in the efficacy of drug. This represents a common trait of traditional health practices (Herrick, 1995).

Plant use values, informant consensus factor and fidelity level

The most commonly used species were *Achyranthes aspera* and *Momordica charantia* with a use value of 0.18 each, followed by *Calotropis procera* (use value 0.17), *Leucas aspera*, *Tinospora cordifolia*, *Withania somnifera* (use value 0.15 each), *Phyllanthus amarus* (use value 0.14) and *Azadirachta indica* with a use value of 0.13. The most rarely used plants were *Thevetia nerifolia*, *Cardiospermum helicacabum* and *Lantana camara* with use value of 0.01 each. Other plants have the use values from 0.02 to 0.10. The disease categories with most use-reports were the categories of plants used for gastrointestinal disorders (121 use-reports, 70 species) while the least was fever (21 use-reports, 16 species) (Figure 2).

All these use categories had a high degree of consensus with ICF values greater than 0.33. The highest degrees of consensus (ICF = 0.60, 0.55, 0.50, 0.47, 0.44, 0.42 and 0.33) are, however, for jaundice, respiratory diseases, diabetes, gynecological diseases, skin diseases, gastrointestinal diseases and wounds respectively. The category of plants used for treatment of fever has the lowest degree of consensus (ICF = 0.25); only 21 informants mentioned ailment in this category. Species with high use value appear to simultaneously be the preferred species in at least one use

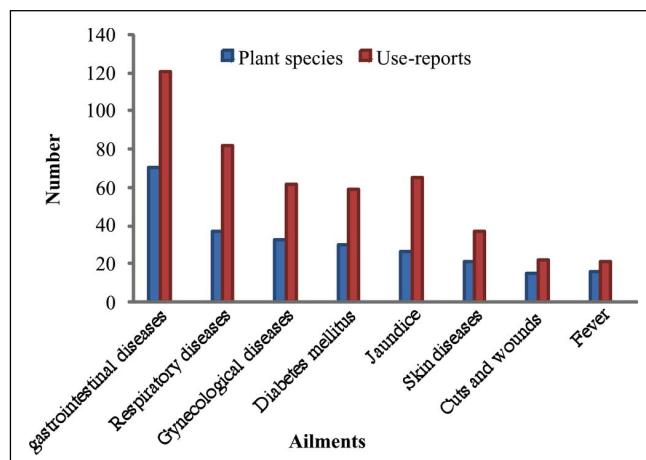


Figure 2: Medicinal plants and their use-reports against human ailments in Bellary district

Table 1: Informant consensus factor (ICF) and Fidelity level (FL) for the ethnobotanical information given by 76 informants in Bellary district

S.No.	Ailment categories	ICF	Preferred species	FL (%)
1	Gastrointestinal diseases	0.42	<i>Mucuna pruriens</i>	100
			<i>Capparis zeylanica</i>	67
2	Respiratory diseases	0.55	<i>Tylophora indica</i>	100
			<i>Acalypha indica</i>	89
3	Diabetes	0.50	<i>Cinnamomum zeylanicum</i>	75
			<i>Vitex negundo</i>	75
4	Gynecological diseases	0.47	<i>Caesalpinia bonduc</i>	80
			<i>Hibiscus rosa-sinensis</i>	67
5	Jaundice	0.60	<i>Boerhavia diffusa</i>	88
			<i>Leucas aspera</i>	59
6	Skin diseases	0.44	<i>Nicotiana tabaccum</i>	100
			<i>Gloriosa superba</i>	67
7	Cuts and wounds	0.33	<i>Argyreia elliptica</i>	100
			<i>Tridax procumbens</i>	67
8	Fever	0.25	<i>Polyalthia longifolia</i>	100
			<i>Argemone mexicana</i>	67

category. Still, some plants that are not widely used and did not show high use value are used for very specific therapeutic purposes, and therefore found high fidelity levels (FLs) for these plants; e.g. *Tylophora indica*, *Nicotiana tabaccum*, *Mucuna pruriens*, *Polyalthia longifolia* and *Argyreia elliptica* all had FLs of 100% (Table 1). This finding suggested that there is a well-defined selection criterion for these use categories. Because use values are dynamic and change through time, they may have decreased for some plants because of generational changes in preferences or transformation of actual use patterns (Camou-Guerrero *et al.*, 2008). Plants with low use values and/or FLs are not necessarily unimportant, but having low use values indicates that traditional knowledge about them is at risk of not being transmitted and that it may be gradually disappearing (Chaudhary *et al.*, 2006). Additionally, the low use value of some plant species could be related to their scarcity (Benz *et al.*, 1994).

CONCLUSIONS

Out of 148 medicinal plant species used for treating various diseases, *Leptadenia reticulata*, *Mucuna pruriens*, *Ruta graveolens*, *Andrographis paniculata* and *Gloriosa superba* are rare and endangered species. The rural people of Bellary district are highly dependent on the traditional herbal medicine because of their poor socio-economic conditions and availability of effective drug plants. The data collected

is expected to serve as a useful tool for the establishment of herbal drug industries and improve the economy of the region. It also provides some valuable information to phytochemists and pharmacologists in screening of individual plant species and assessing active substances against human diseases.

ACKNOWLEDGEMENTS

I am thankful to all the traditional healers, tribal and local people of Bellary district, who gave the valuable information on traditional medicinal plants and their consent for publication.

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