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PHYTOTHERAPEUTIC UTILIZATION OF *TRIDAX PROCUMBENS* (L.) : AN ASTERACEAE WEEDY HERB BY FARMING COMMUNITIES IN KANYAKUMARI DISTRICT, TAMIL NADU, INDIA

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Abstract

Agro-ecosystems served as landmarks for past and present therapeutic events of herbs. An immeasurable number of plants are used by folklore traditions in India for their diverse ailments. Weedy herbal plants characterize an essential constituent of the biodiversity of agroecosystems. Periodical weed surveys were conducted in various ecosystems of Kanyakumari district to identify *Tridax procumbens* Linn. dominant ecosystems, to determine its distribution and document the phytotherapeutic utilization by farming community. The highest IVI indicated that it was one of the popular weed in terms of frequency combined with density and abundance across agroecological and wild ecosystems. The study also revealed that farming community utilized fresh leaf extract as a natural first aid to their bleeding in case of cuts, scratches, injury, wounds, etc.

Key words : Agroecosystems, bio-resource utilization, indigenous traditional knowledge, importance value index, medicinal herbs, weeds.

Introduction

Indigenous Traditional Knowledge (ITK) is an indispensable part of the culture and history of a local community. ITK is a dynamic system, ever charming, adopting and adjusting to the local situations and has close links with the culture, civilization and religious practices of the communities (Pushpangadan *et al*., 2002). It is evolved through many years of regular experimentation on the day to day life and available resources surrounded by the community. Indigenous knowledge system is habitually not found in written form and is transmitted from generation to generation through word of mouth. It includes concepts, belief and perception and usually found in various folk forms. In this system every knowledgeable person act as a unique library, when that person pass away, a whole library disappears. At present, several ITK systems are at risk of becoming extinct because of the rapid changing natural environment and fast pacing economic, political and cultural changes. However, a number of practices disappear only because of intrusion of alien technologies or development concepts that promise short term gain or solution to problems without being capable of sustaining them (Singh and Tyagi, 2014).

Agroecosystems play a fundamental role in maintaining earth's environmental services and ecological sustainability. Herbal plants are recognized as one of the major natural bio-resource and contribute the essential needs of the living beings. The choice of herbal utilization varies from community to community and even person to person. Herbal plants are utilized as therapeutic as times immemorial in both organized and unorganized (native, folk, and tribal) forms. Traditionally wild plants endowed with imperative element to the welfare of the civilized as well as ethnic society. Phyto-therapeutic utilization is often known as a result of millennia of trial and error. In modern health care system, majority of the drugs are the isolation of the active ingredients found in plants or mixtures and its subsequent modifications.

The most of the herbs used by the rural communities have biologically active compounds that have been shown by generations to be effective against specific ailment (Rex Immanuel and Lyla Elizabeth, 2009; Kaul and Dwivedi, 2010). Hamilton (2004) reported that globally 4,160 to 10,000 herbal plants are endangered by habitat

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losses due to intensive agricultural practices or overexploitation in areas where rural families traditionally collected them. The increasing scarcity of such herbals may also enhance the loss of traditional knowledge about the phytotherapeutic uses (Chaudhary *et al*., 2006). Ethnobotanical information from India estimates that more than 6000 plants forming about 40 per cent of the plant diversity are used in folk healthcare traditions (Ved and Goraya, 2007).

Living nearer to natural and managed ecosystems, farming communities have acquired unique knowledge concerning the utilization of wild and weedy flora because of day today's sheltered relationship between land, vegetation and associated traditional knowledge. The plants growing in agroecosystems, having more negative values, commonly absorb nutrients as much and more rapidly than crops and also competing for light, space and moisture throughout the growing season are popularly termed as weeds (Hussain *et al*., 2008). However, weed is a relative term laden with value endowed by human beings in relation to their own activities and it is an anthrocentric concept rather than an absolute quality. In nature, there is no plant which is useless that can be considered as weed, but usually with few exceptions, weeds have short vegetative phase, high reproductive output and capable of limiting the target crop yields (Murty and Venkaiah, 2012).

About 70 per cent of the Ayurvedic drugs are of plant origin (Biswas and Mukherjee, 2003). Weedy plants provides raw materials to the pharmaceutical industries as they yield chemicals used in drugs, '*Vaidyas'* for preparing herbal formulations and virtual source of medicines for various ecosystem inhabitants (Rex Immanuel and Lyla Elizabeth, 2009). Several researchers gave information on phytotherapeutic significance of weeds (Thomas and Britto, 2000; Saikia and Hussain, 2005; Nath *et al*., 2007; Padal *et al*., 2013).

Tridax procumbens Linn. (Asteraceae), commonly known as 'coat buttons or tridax daisy' is an annual, semi prostate and creeper herb. It is known to have originated from tropical America and spread to tropical and subtropical regions of the world. It is a common weedy herb grows in fine to coarse textured soils, irrigated and rainfed ecosystems, except waterlogged soils. Its widespread distribution and importance as a weed are due to its spreading stems and abundant seed production (Chauhan and Germination, 2008).

On dry weight basis Tridax leaf consists 35 per cent of crude protein, 6 per cent crude fiber, 51 per cent total carbohydrates, and rich in sodium, potassium, calcium, etc. with the total metabolizable energy of 398 kcal/100g DW (Jain and Amita, 2012). The phytochemical studies revealed the presence of alkaloids, carotenoids, flavonoids, saponins and tannins. It is richly endowed with carotenoids (94.57 mg/100 g DW) and saponins (103.52 mg/100g DW). It suggests the likelihood of this plant serving as a potential protein supplement. It has been commonly used as a traditional medicine for various ailments. The vernacular legendary 'vettukkaya puntu' in Tamil and 'muriyampachila' in Malayalam exhibits the instant wound healing ability of Tridax is incredibly familiar among all the rural communities. Principally, when farming community gets injuries, cuts or wounds from tools applied fresh juice of crushed leaves in injured part. Community children also experienced right from their childhoods with Tridax to heal their injuries. According to the traditional healers, the wild rabbits preferred Tridax as fodder and hence the droppings of wild rabbits are used for preparation of traditional medicines.

In the changing agroecological situations, recent distribution pattern and ecological status of *Tridax procumbens* meagrely studied. Therefore, it is essential to identify the Tridax invaded locations, *i.e*., the geographical range, its abundance and severity of invasion in the study site. It is crucial to know the critical analytical character such as important value index (IVI) of the species helps to know its availability in an ecosystem. The IVI is used to determine the ecological position of the species. Calculation of IVI leads to the description of plant population changes in communities. IVI expresses the relationship between plant populations and community components that consider species frequency and dominance and number of individuals. The present study was initiated to know the IVI and for the documentation of phyto-therapeutically beneficial Tridax and their traditional knowledge by dependent communities.

Materials and Methods

The study area Kanyakumari district situated at the southernmost tip of the Indian peninsula. The district lies between 77^{o} 15' and 77^{o} 36' Eastern Longitudes and 8^{o} 03' and 8^{o} 35' Northern Latitudes. Kanyakumari district has an area of 167,200 ha it occupies 1.29 per cent of the total area of Tamil Nadu and the altitude varies from sea level to 1829 m. It has a coastal line of 71.5 kms stretched on the three sides (GoT, 2014).

Kanyakumari district comes under Agro-Climatic Region of West Coast Plains and Ghats Region (XII) (Planning Commission), Agro Ecological Region / Sub Region of Eastern Ghats and Tamil Nadu Uplands and Dry Region (ICAR) (8.1) and High Rainfall Zone of

Tamilnadu (TN-6) (NARP). The proximity of equator, its topography and widespread climate factors favour the growth of diversified vegetation. Kanyakumari district has a rainfall both during the South West and the North East monsoons. The rainfall pattern varies from 1030 mm in plains to 3100 mm in hills with an average of 1404 mm. Southwest monsoon accounts for 36.65 per cent, Northeast monsoon being 38.11 per cent, winter being 3.10 per cent and summer being 22.13 per cent of total rainfall.

The northern region of Kanyakumari district (Melpuram, Thiruvattar and Thackalai blocks) is characterized by a growing period of > 210 days with an annual rainfall of >1800 mm that has a bimodal distribution trend. The first rains start at late in March or the beginning of April and end in August popularly called as '*Kannipoo'* season. The second season starts in early September and ends in early December conventionally known as '*Kumbapoo*' season. The other blocks have a growing period of 150–180 days and annual rainfall between 1300 and 1800 mm. The rainfall trend is unimodal and lasts for approximately 6 months (June – November). Minimum temperature prevailing is 24°C and maximum temperature is 34°C.

According to 2011 census, Kanyakumari district population was 1.87 million and even though, it is the smallest in terms of area, the population density is 1119 km². Average literacy rate was 91.75 per cent. Agricultural land holdings in the district are 380,248 with an average operational size of 0. 22 ha. About 3.66 per cent of the total population of the district involved as agricultural human resources (GoT, 2014). Historically, majority of community were self effacing cultivators of *Borassus flabellifer* (State tree of Tamil Nadu) and engaged in trade and Palmyra based cottage industry. They have the immeasurable knowledge on the tradition and at present they are highly educated, and each and every one involved in systematic social activities. These dominant communities also have an enormous belief in the traditional healing system of medicine (Jeeva and Femila, 2012). In Kanyakumari district the elderly people specialized in ethno-medicinal knowledge are recognized as Vaidhyars (Rex Immanuel and Lyla Elizabeth, 2009). One of the oldest groups of the ethnic people in Peninsular India named '*Kanikaran*' also resides in remote and inaccessible forest regions and they depend on forest related activities such as collection and trade of non-forest produces for their livelihood and also specialized in ethno-medicinal knowledge to cure various ailments.

Red and black are the major predominant soils. In the high lands and midlands there prevails comparatively fertile soil of the fine type, while in plains there is neither sand nor sandy loam. Due to the high humus content, the forests soils and rice growing regions the colour of the soil type is black. The Western Ghats and its flourishing forests structured the catchment area for three major rivers (Thambraparani, Valliyar and Pazhayar) and its tributaries and seven reservoirs. These water resources are connected with the Kodayar Command System and it function as a back bone of the irrigation network with the gross irrigated area of 36,281 ha (44 per cent of net cultivated area).

The forests in Kanyakumari district are verdant and virgin forests and believed to be of 75 million years old. Fourteen types of forests from flourishing tropical wet evergreen to tropical thorn forests occur in this district because of diverse nature of landscape. It occupies an area of 54,155 ha which comes to about 32.39 per cent the total district geographic area and 52 per cent of its forests as dense forests (GoT, 2014). Trees outside the forests includes *Artocarpus hirsutus* (wild jack), *Artocarpus heterophyllus*, *Mangifera indica*, etc. are being the major trees; however at present this massive vegetation has been replaced by monoculture with *Heavea brasiliensis*.

The Kanyakumari district is purely agriculture oriented (net area sown 46%) and its economy solely depends on agricultural production. The cropping pattern varies with the effect of climate, topography, soil and irrigation facilities. Based on the agro-climatic and topographic conditions, the district can be divided into three regions *viz*., mountainous terrain, undulating valley and plain lands, which are suitable for growing diversified food and commercial crops. The mountainous terrain comprising of hills and hill bases with lavishness forests and ideal for growing crops like tea, cloves, nutmeg, pepper, arecanut, jack, pineapple, rubber, *etc*. The undulating valley comprising mixture of plains and valleys fit for growing crops like rice, vegetables, tapioca, bananas, coconut, mango, *etc*. The plain lands comprising the coastal belt ideal for growing rice, vegetables, coconut, *etc*. The marine landforms along the region are restricted to the width of less than one km due to high relief of inland areas which represent the slope of the Western Ghats, where ideal for the growth of *Cocos nucifera* and *Anacardium occidentale*.

Data collection

A systematic survey is necessary to address the current weed problems in the farming regions and in the mean time survey information is absolutely important in building target oriented research programs such as

documentation of weedy herbs and phytotherapeutic utilization. The prevailing environmental conditions determine the specific weed spectrum, composition and population of each region. Weed flora and its composition in cropping systems are influenced by season, soil type, land form, soil pH, the type of cultivation, management practices like irrigation, tillage systems, nutrition, etc. The present survey was undertaken to investigate the prevalence of phytotherapeutically important *Asteraceae* weedy herb *Tridax procumbens* in the agroecosystems of Kanyakumari district.

Importance Value Index (IVI) is a significant quantitative analytical parameter of weed species. It reflects the degree of overall spreading of individual species in a particular ecosystem and usually calculated with the help of following equations (Curtis and McIntosh, 1950). Importance Value Index (IVI) was computed by summing up by the per cent relative frequency, per cent relative density and per cent relative abundance in each cropping /ecosystem.

Frequency (%) = (Total number of quadrates in which the species occurred / Total number of quadrates studied) × 100

Density = Total number of individuals of a species in all quadrates / Total number of quadrates studies.

Abundance = Total number of individuals of a species in all quadrates / Total number of quadrates in which the species occurred

Relative frequency (%) = Frequency of individuals of a species / Total frequency of all species × 100

Relative density (%) = Density of individuals of a species / Total density of all species × 100

Relative abundance (%) = Abundance of individuals of a species / Total abundance of all species × 100

IVI = Relative frequency + Relative density + Relative abundance

To find out the IVI of *Tridax procumbens* in different agroecosystems, an intensive weed survey was conducted during the general crop growing seasons in Kanyakumari district *viz*. '*Kannipoo'* (April – September) and '*Kumbapoo*' (October – February) at quarterly intervals from April, 2016 – March, 2018. The study was done in all the nine blocks and an area based sampling was adopted by superimposing grid cells measuring 10 by 10 km each on maps of the study area (27 grids). Farming/ eco-systems/ village nearest the centre of each cell except mountainous and reserve forest area were selected for data collection. From the centre of the village, four directions (north, south, east and west) and in each direction, at five km distance available appropriate ecosystems were surveyed.

Ten types of agroecosystems (Rice – rice – fallow (one year rotation), Rice – rice – vegetables (one year rotation), Rice – rice – banana (two year rotation), Rice – rice – tapioca (two year rotation), Vegetables – rice – tapioca (rainfed) + pulses (two year rotation), Coconut gardens (rainfed), Coconut gardens (irrigated), Rubber gardens (rainfed), Spices (clove) gardens (rainfed), Non-cropped ecosystems (Forest fringe, fallow lands, road sides, canal sides, wild)) were sampled in each grid. A quadrate is a frame of any shape that can be placed over vegetation so that cover can be estimated, plants counted and species listed (Sutherland, 1997). The weed survey was made by least count quadrate method using one m^2 quadrates (Misra, 1968). In each field, four quadrates were randomly laid down and number of each species in quadrate was recorded.

About 626 quadrate samples (twice in a farming year) approximately representing 73.50 ha of rice based farming system, 32.00 ha of coconut based farming system, 20.50 ha of rubber gardens, 6.40 ha of spice (clove) garden and 50 running km (once in 2 km 24 locations) of non-cropped ecosystems were sampled. Average field size in various farming system represents 0.32 ha. Among the total samples, 76.56 per cent was recorded from red soil regions while the remaining was from black soil regions.

Phyto-therapeutic information's

To the effective comparison and documentation, the knowledge of phyto-therapeutic utilization of *Tridax procumbens* was collected from the published literatures. During field surveys general conversations with elder farming communities and questionnaires were used to gather their knowledge on the therapeutic uses of *Tridax procumbens*. A proportionate sample of villagers from each selected village was taken to give a total sample size of 270 respondents.

Age was considered to be one of the factors, because the age reveals the mental maturity of an individual to convey the traditional knowledge from one generation to another. The elder farming community with the age of > 60 years was considered for the interview. Farming experience >20 years was also considered as another variable and it plays a key role in acceptance or rejection of their phyto-therapeutic knowledge.

Among the 23 phyto-therapeutic utilization reports mentioned in the published literature's, seven familiar operationalized adoptions, which have more score of response during a pilot interview with farming community were selected to study the direct utilization status during

Plate 1 : Prolific growth in rocky non-cropped area.

Plate 2 : Abundant growth in agroecosystems.

major study. For appraising the level of adoption, three point scale was used. Accordingly, score two, one and zero was assigned for frequently, occasionally and non-adopted respondents, respectively. Based on three point scale, the scores obtained by individual respondent were summed up and this sum of total indicated the raw adoption score for that individual. This raw score was converted into adoption index as below.

Adoption Index = (Sum of adoption score obtained by individual respondent / Maximum obtainable adoption score) × 100

The maximum obtainable score one could get was 14 where as the minimum score one could register was zero.

Results and Discussion

Overall weed species richness

Based on the Importance Value Index (IVI), the overall richness of weed species in study area was in the order of *Cynodon dactylon* (L.) Pers. (13.52), *Cyperus rotundus* L. (12.10), *Abutilon indicum* (L.) Sweet (8.59), *Phyllanthus niruri* (8.45), *Chromolaena odorata* (L.) R. M. King & H. Rob. (7.54) and *Tridax procumbens* L. (7.23).

Weed species richness

Weed species richness in fields dominated by *Tridax procumbens* was high in red soil (73.20) regions followed by black soil (51.30) regions (table 1). Mean number of species within a quadrate was high in non-cropped ecosystems (27.02) followed by rice – rice – banana (two year rotation) with 22.25 and perennial rainfed coconut gardens with 21.18. The least species richness was registered in rice – rice – vegetables (one year rotation) and spices (clove) gardens with 12.24.

Total number of weed species registered in red soil region was maximum in non-cropped agroecosystems (126) followed by irrigated and rainfed coconut gardens, rice – rice – tapioca (two year rotation) and rubber gardens (rainfed) with the value of 112, 98, 86 and 84, respectively. In black soil regions the maximum number of weed species registered in non-cropped agroecosystems, vegetables – rice – tapioca (rainfed) + pulses (two year rotation) and coconut gardens (irrigated) with the value of 93, 81 and 76, respectively.

In red soil regions individual weed species was high when compared to black soil regions. Mostly black soil regions are clay soils and are used for rice based cropping systems. In these cropping systems intensive agronomic management is common one to manage the weeds this leads reduced availability of weeds during the cropping period. In the natural ecosystems there were no management practices; hence depending on the micro site environment the richness of individual weed species was high in non-cropped ecosystems. In perennial crop based agroecosystems such as coconut the intensive weed management operations were inadequate, it create more favourable condition for the survival of same species in particular agroecosystems.

Importance Value Index (IVI) of *Tridax procumbens*

Tridax procumbens had the highest IVI value of 8.28 in red soil regions and, hence, it was one of the popular weed in terms of frequency combined with density and abundance across agroecological and wild ecosystem of Kanyakumari district. In black soil regions, the IVI value of 6.17 indicated that it was less frequent when compared to red soil regions. Regarding the farming seasons, the first season from April to September (*Kannipoo*) registered the maximum IVI value of 8.82 and 6. 34 in both red and black soil regions, respectively. During the second cropping season, from October to

Table 1 : Richness of weed species found in agroecosystems dominated by *Tridax procumbens.*

S. no.	Farming/ eco-systems	No. of quadrates	Mean no. of species within a quadrate	Total number of species within regions	
				Red soil	Black soil
1.	Rice – rice – fallow (one year rotation)	87	16.19	28	58
2.	Rice – rice – vegetables (one year rotation)	102	13.68	42	31
3.	Rice – rice – banana (two year rotation)	56	22.25	34	52
4.	Rice – rice – tapioca (two year rotation)	29	17.81	86	47
5.	Vegetables – rice – tapioca (rainfed)+pulses (two year rotation)	19	18.16	73	81
6.	Coconut gardens (rainfed)	67	21.18	98	52
7.	Coconut gardens (irrigated)	62	18.47	112	76
8.	Rubber gardens (rainfed)	82	15.00	84	23
9.	Spices (clove) gardens (rainfed)	26	12.24	49	-
10.	Non-cropped ecosystems (Forest fringe, fallow lands, road sides, canal sides, wild)	96	27.02	126	93
Average		62.6	18.20	73.20	51.30

February (*Kumbapoo*), the maximum IVI value of 7.75 and 5.99 in red soil and black soil regions, respectively. Among the ecosystems, non-cropped ecosystems of both the red and black soil regions registered the highest IVI of 18.67 and 12.76 during first season, and 15.10 and 11.84 during second season, respectively. The rice based cropping regions, rubber plantations and spice gardens encountered least IVI of less than 4.50.

Weeds are genetically adoptable and can instantaneously take advantage of the variety of favourable conditions created by any ecosystem. Many common weed species also have the ability to establish themselves rapidly in the field (Mikulka and Chodova, 2000). This is primarily due to their ability to produce a large quantity of viable seeds or vegetative tissues such in a single growing season. It is noted that the weed species *C. dactylon*, *C. rotundus* and were reproduced by both the sexual (seeds) and asexual (cuttings and tubers) methods. *A. indicum* and *C. odorata* weeds are copious in natural ecosystems. These weeds are utilized by green leaf manures in the agroecosystems by farming communities. Hence, the seeds spread easily throughout the cultivated systems with dominant weeds and encountered the higher IVI.

The constant occurrence of *Tridax procumbens* with higher IVI is an indication of future dominance. Under well appointed situations prostrate nature of *Tridax procumbens* produces roots at the lower nodes (vegetative propagation) and spreads very quicker than the associated plants. Reproduction through seeds with an effective seed dispersal agent (Olorunmaiye and Afolayan, 2012) enhanced its mode of propagation. The dispersed seeds simply preserved in the soil seed bank and when optimum climatic factors occur immediately its lifecycle begins. This may be because this plant produces a lot of seeds that are easily dispersed by wind. This observation is in accordance with an earlier report by Oluwatobi and Olorunmaiye (2014), who reported high colonizing power of Tridax, readily brought about by the high fruit production and the efficient dispersal of seeds. *Tridax procumbens* is invaded in to most of the nutrient rich agroecosystems to nutrient poor hard rocky soils. It spreads quickly due to the huge number of achenes, upto1500 per plant. Each achenes can catch the wind in its pappus and are able of being dispersed over extensive areas of the variable ecosystems (Padal, 2013).

Agronomic management practices such as types of crops, tillage and intercultural practices, weeding frequency, fallow length and cropping length after fallow frequency of cropping and cropping pattern affect the weeds in cropping systems (Palmer *et al*., 1997). *Tridax procumbens* is an annual herb, and this species complete their life cycle within one growing season. At the agroecological level, environmental variables describing soil chemical properties, texture and management practice may reflect the adaptation of weeds to specific ecosystem conditions. A high IVI was observed in red soils. The low IVI on black clay soils suggests that *Tridax procumbens* does not grow well on wetland soils, in general these soils intensively used for rice based cropping

Table 2: Importance Value Index (IVI) of *Tridax procumbens* in red soil regions (per cent).

S. no.	Farming/ eco-systems	Local Farming Seasons	
		Kannipoo **(Apr. – Sep.)**	***Kumbapoo*** **(Oct. –Feb.)**
1.	Rice – rice – fallow (one year rotation)	04.19	03.08
2.	Rice – rice – vegetables (one year rotation)	05.37	05.81
3.	Rice – rice – banana (two year rotation)	07.62	05.61
4.	Vegetables – rice – tapioca (two year rotation)	10.12	07.59
5.	Rice – tapioca (rainfed) + pulses (two year rotation)	14.15	12.31
6.	Coconut gardens (rainfed)	11.76	13.19
7.	Coconut gardens (irrigated)	08.28	06.78
8.	Rubber gardens (rainfed)	04.08	03.71
9.	Spices (Clove) gardens (rainfed)	03.92	04.27
10.	Non-cropped ecosystems (Forest fringe, fallow lands, road sides, canal sides, wild *etc*.)	18.67	15.10
Average IVI during farming seasons		08.82	07.75
Average IVI for cropping/ agroecosystems		08.28	

Table 3 : Importance Value Index of *Tridax procumbens* in black soil regions (per cent).

S. no.	Farming/ eco-systems	Local Farming Seasons	
		Kannipoo **(Apr. – Sep.)**	***Kumbapoo*** **(Oct. –Feb.)**
1.	Rice – rice – fallow (one year rotation)	02.36	03.48
2.	Rice – rice – vegetables (one year rotation)	03.79	03.67
3.	Rice – rice – banana (two year rotation)	03.18	03.85
4.	Vegetables – rice – tapioca (two year rotation)	05.02	08.10
5.	Rice–tapioca (rainfed crop)+pulses (two year rotation)	11.62	08.96
6.	Coconut gardens (perennial – rainfed)	10.15	09.20
7.	Coconut gardens (perennial – irrigated)	07.74	04.52
8.	Rubber gardens (perennial – rainfed)	03.20	04.17
9.	Spices (Clove) gardens (perennial – rainfed)	03.62	02.09
10.	Non-cropped ecosystems (Forest fringe, fallow lands, road sides, canal sides, wild *etc*.)	12.76	11.84
Average IVI for farming seasons		06.34	05.99
Average IVI for cropping/ eco-systems		06.17	

systems.

Capability to survive under a diverse growing conditions is one of the characteristic futures responsible for the biological success of *Tridax procumbens* as a weed. Raffaele and Gobbi (1996) observed higher species richness in a drier climate than in a wetter environment. Longer fallow often improves soil fertility and the increased nutrients after fallow can support the survival and growth of several weed species (Jornsgard *et al*., 1996). Similarly, in wild ecosystems the survivals of weeds are high. This principle attributes maximum IVI in non cropped ecosystems.

Phyto-therapeutic utilization of *Tridax procumbens*

The scientific information on the phyto-therapeutic utilization of *Tridax procumbens* were substantial and more than 21 ailments have reported (table 4). The systematic information on the constituents of *Tridax procumbens* revealed that it's a weedy herb sometimes

Table 4 : Phyto-therapeutic utilization of *Tridax procumbens*.

S. no.	Phyto-therapeutic utilization	References
1.	Antiarthritic	Deepak *et al*. (2012)
2.	Antibacterial (*Bacillus cereus*, *Escherichia coli, Klebsiella pneumoniae*, *Mycobacterium smegmatis*, *Pseudomonas aeruginosa*, *P. mirabilis, Proteus vulgaris*, *Salmonella parathypi*, *Staphylococcus aureus*)	Sharma and Sharma (2010), Chitra *et al.* (2011), Kale and Dhake (2013), Muthusamy *et al*. (2013), Priyadarshini and Priya (2013), Shirish (2013), Kethamakka *et al*. (2014), Veena and Christina (2015)
3.	Anticancer (α-pinene, β-pinene, phellandrene and Sabinene)	Vishnu Priya (2011), Kethamakka *et al*. (2014)
4.	Antidiabetic	Bailey (1989), Ali *et al*. (2002), Bhagwat *et al*. (2008), Durgacharan *et al*. (2008)
5.	Antidiarrheoal	Jude *et al*. (2009)
6.	Antidysentric	Rastogi and Mehrotra (1999)
7.	Antifungal (*Aspergillus niger*, *Candida albicans*, *etc.*)	Nino *et al*. (2006), Jindal and Kumar (2013), Kethamakka *et al*., 2014
8.	Antihepatotoxic	Reddipalli *et al*. (2008)
9.	Antihyperglycemic	Pareek *et al*. (2009)
10.	Antiinflammatory	Jachak *et al*. (2011)
11.	Antioxidant	Habila (2010)
12.	Antiplasmodial	Rappiah *et al*. (2011)
13.	Bleeding piles	Kaul and Dwivedi (2010)
14.	Bronchial catarrh	Padal *et al*. (2013), Navin *et al*. (2014)
15.	Burn wound healing	Babu *et al*. (2003)
16.	Cataract	Singh *et al*. (2012)
17.	Hair growth restoration	Rathi *et al*. (2008), Kuldeep and Pathak (2013)
18.	Health-promoting food and food supplements (protein and carotenoids)	Priyanka and Satish (2011), Ikewuchi *et al*. (2015)
19.	Hepatoprotective	Saraf and Dixit (1991), Kuldeep and Pathak (2013)
20.	Immunomodulatory	Agarwal *et al*. (2010)
21.	Wound related injuries (Prevent haemorrhage)	Ayyanar and Ignacimuthu (2009), Raina (2008), Rex Immanuel and Lyla Elizabeth (2009), Logeeswari and Shubashini (2012), Kuldeep and Pathak (2013), Priyadarshini and Priya (2013), Veena and Christina (2015)

invasive herb endowed with huge number of phytochemicals. *Tridax procumbens* leaves contain alkaloids, flavonoids, phenols, tannin, terpenoids, saponin, glycosides and cardiac glycosides. Flavonoids are known to be synthesized by plants in response to microbial infection (Sharma and Sharma, 2010; Muthusamy *et al*., 2013). Oleanolic acid obtained from *Tridax procumbens* has found to be a potential antidiabetic agent (Ali *et al*. 2002).

The leaves of *Tridax procumbens* had thirty nine known alkaloids (mainly akuammidine 68.76 per cent), twenty three known flavonoids (mainly 17.59 per cent kaempferol and 12.54 per cent (-)-epicatechin), five known carotenoids (mainly lutein 62.61 per cent), four known benzoic acid derivatives (mainly ferulic acid, 46.09 per cent), two phytosterols (mainly stigmasterol, 80.85 per cent) and six known lignans (mainly galgravin, 77.35 per cent) and considerable amount of caffeic acid and tannic acid (Ikewuchi *et al*., 2015). These constituents are reported to have therapeutic properties and are involved in healing of various ailments.

Adoption of phyto-therapeutic utilization of *T. procumbens* by farming communities

The observations on phyto-therapeutic utilization of

Table 5 : Distribution of respondents according to phyto-therapeutic utilization of *Tridax procumbens* (n = 270).

S. no.	Utilization	Extent of utilization (%)		
		Frequently	Occasionally	Not adopted
1.	Fresh leaf extract to cure instant cuts, scratches, wounds, *etc.*	86.11	9.44	4.45
2.	Fresh leaf extract to cure wounds for the diabetic patients	36.11	56.67	07.22
3.	Treat infectious skin diseases	28.89	23.33	47.78
4.	Burn wound healing	20.00	30.56	49.44
5.	Fresh leaf extract to cure burned wounds	7.78	22.22	70.00
6.	Oral administration to cure dysentery	4.44	7.22	88.34
7.	Restoration of hair growth	12.77	15.00	72.23

Table 6 : Relationship of independent variables according to phyto-therapeutic utilization of *Tridax procumbens* (n=270).

S. no.	Independent variable	"r" value
1.	Age	0.321**
2.	Education	-0.216**
3.	Land holding	0.089ns
4.	Farming experience	0.391**
5.	Food habit	0.375**
6.	Scientific point of reference	-0.326 **
7.	Attitude towards phyto-therapeutic utilization	0.345**
8.	Socio-economic status	0.098 ns
9.	Immediate access to hospitals	-0.171*
10.	Fatalism	0.184*
11.	Risk orientation	0.409**

*significant at 0.05 level of probability, ** significant at 0.01 level of probability, ns = non significant.

T. procumbens indicated that 86.11 per cent of the farming community respondents had frequently followed the fresh leaf extract of *Tridax procumbens* to cure instant cuts, scratches, wounds, *etc*. (table 5). It was further noticed that about 36.11 per cent of the respondents frequently followed fresh leaf extract of *Tridax procumbens* to cure wounds for the diabetic patients.

Farming community of Kanyakumari district had utilized *Tridax procumbens* as instant wound healing agent, essentially, because of its local availability, very fast therapeutic effect, cost free, readily prepared in the field itself, no skill required, no harmful effect, *etc*. Mostly all the seasons *Tridax procumbens* typically found along the bunds, canal sides and cultivated areas. The most frequently collected plant parts are the aboveground plant material, leaves (72 per cent), whole plant (19 per cent), flowers (6 per cent), stem (2 per cent) and subterranean parts such as roots (1 per cent). Regarding the restoration of hair growth, majority of them are not adopted, however according to their perception *Tridax procumbens* is the main source of forage for wild rabbits. The meat and droppings of wild rabbit was considered as medicinally significant constituent. The droppings are gathered and boiled with coconut oil along with cumin seeds and hibiscus flowers and used as hair oil. The elder community believed that this hair oil have the possessions of enhancing the health and longevity of hair.

Relationship with independent variables

The prosperous represents households with a high number of livestock, off-farm activities and a higher education level. Farming community use their rice as staple food and in some instances tapioca also included by elder members. Among the eleven independent variables six variables *viz*., age, farming experience, food habit, attitude towards phyto-therapeutic utilization, risk orientation and fatalism had positive and significant relationship with the extent of adoption of phyto-therapeutic utilization of *Tridax procumbens* (table 6).

Phyto-therapeutic utilization of *Tridax* being based on accumulated experience, low cost, favourable attitude and least risk. The farming community have ready access to modern health care practices except certain remote villages. Even they access to modern ailments, they do not prefer to use ailment such as wounds. The perception of elder farming community reported that, the incidence of diabetics was not as much of due to traditional food habit during their younger and middle ages. It includes utilization of diversified and naturally available food stuffs (palmyrah palm sugar, tender coconut, fruits of *Artocarpus hirsutus*, *Artocarpus heterophyllus*, *Mangifera indica*, *Tamarindus indicus* fruits for culinary purposes) including the food stuffs cultivated in their own or leased lands by using organic manures (rice, tapioca, yams, pulses, vegetables).

The survey revealed that farming community had utilizes fresh leaf extract of *Tridax procumbens* as a natural first aid to their bleeding in case of cuts, scratches, injury, wounds, etc. It is because of their knowledge about wound healing ability from their childhood itself, its easy access, instant preparation in the field itself, no skill required and no harmful effects. Fresh plant juice is applied immediately over the fresh wound and thereafter twice a day for 3-4 days to cure cuts and wounds. Tridax has antimicrobial activity on various species of bacteria. Owing to this property, it is used to provide protection against human dermal infection and it might facilitate faster wound healing. The leaf extract of *Tridax procumbens* L is being used widely as traditional medicine for healing open wounds due to is greater anti-inflammatory effect (Manjamalai *et al*., 2012). However, the scientific studies for confirmation of these observations by traditional farming communities have been conducted merely on experimental animals and '*in-vitro*' conditions. Hence, detail study of phyto-therapeutic relationships is vital before utilizing the full benefits and to make recommendations for human health care.

Conclusion

The uses of herbs are the basic health care for the majority of the households and the knowledge about their phytotherupic use are possibly shared over generations. Phytotherapeutic utilization of *Tridax procumbens* had contributed to the field of ethno-medicinal science by fulfilling the social and cultural needs of the farming community. This plant based raw herbal drug to cure wounds is relatively harmless, inexpensive, and easily available in the all agroecosystems. The study suggested that based on the perception of elder farming community of Kanyakumari district, the raw extract of *Tridax procumbens* could be a suitable herbal drug to stop bleeding and for healing of undersized wounds. Its natural abundant growth in agroecosystems makes it an '*unwanted plant*' to '*wanted herb*' to pharmaceutical industry.

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