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**Jasmine Kaur**

Department of Botany,  
Kurukshetra University,  
Kurukshetra-136 119, India.

**Savita Rani**

Department of Botany,  
Kurukshetra University,  
Kurukshetra-136 119, India.

**Gajendra Singh**

College of Pharmacy, Pt.B.D.S.  
University of Health Sciences,  
PGIMS, Rohtak-124 001, India.

**Neelu Sood**

College of Pharmacy, Pt.B.D.S.  
University of Health Sciences,  
PGIMS, Rohtak-124 001, India.

**Correspondence:**

**Neelu Sood**

College of Pharmacy, Pt.B.D.S.  
University of Health Sciences,  
PGIMS, Rohtak-124 001, India.

## Trends of Diffusion Pattern and Denudation of Traditional Knowledge in Two Medicinally Important Plants- *Calotropis procera* and *Thevetia peruviana* in villages of Rohtak District, Haryana, India

**Jasmine Kaur, Savita Rani, Gajendra Singh, Neelu Sood**

### Abstract

Conservation of traditional knowledge of medicinal plants is fast emerging as a global need. Plants have been protected via different rituals, beliefs and superstitions since ancient times. Along with such social and religious activities, medicinal plants are being explored and screened constantly for their efficacious therapeutic use. Present survey was aimed to identify the target community in our society which is consistent carrier of traditional knowledge. Field survey to study denudation of TK and diffusion pattern was undertaken. On the basis of allocated scores, PCTK (Persons Carrying Traditional Knowledge) strength was evaluated. Based on person to person survey, an alarming decline in ethnomedicinal knowledge in respect of the number of uses and PCTK % score was observed. In the present study, *Calotropis procera* plant which is known to be well integrated to our cultural inheritance showed higher PCTK score strength as compared to *Thevetia peruviana* which is weakly integrated to rural folks in socio-cultural practices in Rohtak district of Haryana.

**Keywords:** Traditional knowledge, Ethnobotanical, Ethnomedicinal, *Calotropis procera*, *Thevetia peruviana*, PCTK.

### 1. Introduction

Traditional knowledge is the ancient knowledge transmitted over a period of time explaining the relationship between plants and traditional people for mutual care and benefit. In India, a wide spectrum of biodiversity exists and plants are integrated with our cultural heritage through cultural beliefs, rituals and festivals and as special offerings to Gods and ancestors<sup>[1]</sup>. The traditional knowledge of indigenous people is severely endangered as younger generation is no longer interested to acquire and transmit it further<sup>[2]</sup>. During ancient times, people used to rely on the local plant resources for both short term and long term treatment of ailments. As the world population is growing enormously and synthetic drugs are proving harmful in inducing drug resistance and adverse drug reactions, etc. therefore, there is a dire need to explore, conserve and practice our ethno botanical knowledge. In the next two decades when human population on this planet will explode, then the available medicare options will not be sufficient to treat every human being. Then in addition to allopathy, phytopharmaceuticals will also have to be opted along as one of the prime choices. According to a recent estimate, large population of the world i.e. about 70-80% depends on traditional medicinal plants to meet their demands<sup>[3]</sup>. Most of the population in Sikkim depends on more than one type of health care systems depending on the types of ailments and medicine available and cost preference while the majority of the population does not have a choice of allopathic medicine, due to side effects, unavailability and high cost<sup>[4]</sup>. In advanced world today, interest is shifting towards allopathy and other modern medicare options. A major part of diseases could not be treated well because of many shortcomings like safety and tolerability issues, inconvenience of medicinal dose<sup>[5]</sup>. In addition in response to fast changing global trading policies, our national resources will emerge as unfathomable biowealth to define our future national economy. Then patents will be driving tools and hence there is an urgent need to strengthen our traditional knowledge bank and after scientific analysis, plant based biosafe drugs/formulations need to be standardized in the near future. Traditional knowledge of medicinal plants is conserved and

transmitted via two modes i.e. documented knowledge including recently compiled TKDL (Traditional Knowledge Digital Library) in India and scattered segmented knowledge (uncompiled and undocumented) which is disbursed randomly in society amongst rural and urban people. Extensive work has been done on traditional knowledge [4, 6, 7], yet voluminous traditional knowledge is lying scattered in patches worldwide. Ethno botanical knowledge is of great mutual benefit for both the developed and developing countries. A great economic potential exists in trade of traditional folklore medicines as ethno botany deals with acknowledging and protecting intellectual property rights of indigenous people and ensuring maximum efficiency. Though Government of India has done a praiseworthy effort by establishing TKDL (Traditional Knowledge Digital Library), yet no policy or mechanism has been adopted to retrieve and compile the scattered traditional ethno botanical knowledge in different strata of our society. TKDL only deals with listed uses. There is no authentic volume or book to impart first hand information about the plant. Traditional knowledge specifically in medicinal plants needs to be explored fully to build a holistic understanding in a revised text for both commercial and purposeful usage.

The present survey is an effort on the part of authors to study diffusion pattern and trends with respect to traditional knowledge collected for two economically important medicinal plants i.e. *Thevetia peruviana* (KUK/BOT/IPS-19) *Calotropis procera* (KUK/BOT/IPS-21) from indigenous people of 4 villages of Rohtak district of Haryana, India. The two plants are quite different in their morphology, growing habits, mode of cultivation and medicinal uses etc. *Calotropis* plant is very popular and socially integrated since ancient times as its uses have been documented in Charaka Samhita and other age old medicinal books. Different medicinal properties of *Calotropis procera* have been studied by various workers [8-13]. The extracts of different parts of *Calotropis procera* have significant therapeutic value [14].

*Thevetia peruviana*, on the other hand, is comparatively a new plant to Indian culture and conditions. The plant is recorded to be more than 2000 years in its native countries- West Indies, Brazil and Mexico. It was taken to Europe about three hundred years ago, and from there finally to India and today it has naturalized in virtually all countries in the tropical region [15]. It became more visible and its popularity was highlighted when National Highways were beautified with their extensive plantation. In urban areas it is grown as ornamental plant and hence it is important horticultural plant. But frequency of cultivation of this plant is sporadic in rural areas. Many attempts have earlier been made to study different medicinal properties of *Thevetia peruviana* [15-23].

During present survey ethnomedicinal knowledge disbursed amongst remote rural people of Haryana was gathered. Selected site was never explored previously for person to person contact collection of TK. Remote rural locations are assumed to be conserve houses of TK. Ethnomedicinal methods can show how different ethnic groups living within the same geographic landscape interact with environmental resources [24]. A comparative study of two select plants on the basis of PCTK (Persons Carrying Traditional Knowledge) score strength helped study pattern and trends of diffusion of traditional knowledge along with denudation threats. PCTK score is proposed by the authors for the first time to identify the plants facing threat of losing ethnomedicinal significance due to various reasons. Highly unexpected results emerged out of the present study which point out to set newer challenges and strategies for true conservation and use of TK as an alternative medication method for masses.

## Materials and Methods

In order to derive benefit from our scattered traditional knowledge in varied classes and strata of society, a well structural format was designed in the lab. Care was taken that voluminous useful data is collected from primary source.

Selection of sampling sites:

It is a general perception that traditional knowledge is practiced and conserved amongst rural people as compared to urban people who can avail modern healthcare facilities. Selection of sites and sampling was done randomly and four villages of Rohtak district of Haryana state in India were selected i.e. Farmana Khas, Farmana Badshahpur, Saman, Bedwa for the field survey. Adults above 18 years of age were selected randomly. Survey included adults who voluntarily agreed. Photograph and signatures were obtained on the format to maintain authentic records.

## Design of format

An ethnobotanical format was designed in order to help the authors to screen out the significant informative features relating to traditional medicinal knowledge in our society. Format included two parts:

### Part I

Socio-economic profile of the person and his village were obtained. Personal details of an individual were filled up i.e. age, sex, qualification, occupation, address, etc.

### Part II

Knowledge regarding the medicinal plant in which medicinal uses of plants, their side effects, plantation (wild/cultivated), level of information, domain of diffusion, status of knowledge were included. The survey was carried out under following steps:

#### 1. Field visit to select villages:

Random selection of four different villages of Rohtak district was done and a field survey trip was planned to these villages for the collection of first hand native, useful and effective data.

#### 2. Collection and analysis of data:

Village Sarpanch of the concerned village was approached so that the verification of credentials through a responsible authority could be done. Following the guidelines of village Sarpanch, accurate, authentic and related information about the village could be collected. Rural subjects were queried according to the format to collect information about the plant, its vernacular names, medicinal value, side effects and any other related information. Authors tried to communicate with them in their local language with the help of a local woman so that maximum information could come out in an easy way. Traditional/vernacular words originally used by them for the plant and plant parts were noted down with the help of translator interpreter. The socio-economic profile of each individual was filled up along with a photograph and signature, thumb impression as a record. Health care centres, hospitals, doctors, aanganwari workers, hakims (local physicians) were also approached for the collection of maximum information. Minimum ten samplings were done in each selected village. The native data was analyzed, regrouped and lately managed in tabular and graphical form for better interpretation (Tables 1&2).

**Table 1:** Socio-economic profile of villages of Rohtak District

S.No.	Name of the village	Name of Sarpanch	Total Literacy Rate	Health Facilities
1	Farmana Badshahpur	Smt. Saroj	70%	Satisfactory
2	Saman	Smt. Rajbala	60%	Not Satisfactory
3	Bedwa	Sh. Rajmal	50%	Not Satisfactory
4	Farmana Khas	Sh. Jagdish	70%	Satisfactory

**Table 2:** Showing demographic profile of the three districts of Haryana, India.

DISTRICT	ROHTAK
GEOGRAPHIC LOCATION	28.54°N 76.34°E
MALE POPULATION	566,708
FEMALE POPULATION	491,975
SEX RATIO (females per thousand males)	868
LITERACY RATE (%)	80.40
MALE LITERACY RATE (%)	88.40
FEMALE LITERACY RATE (%)	71.20

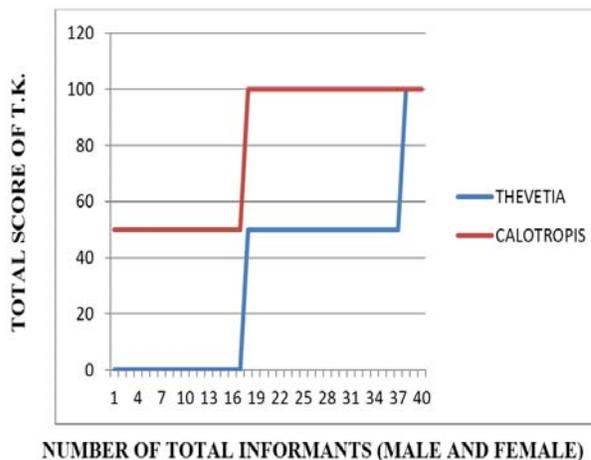
Source: www.census2011.co.in, Population Census India  
Scoring pattern:

To plot histograms, scores were allotted to different attributes on the basis of their significance and contribution e.g. people having complete knowledge about the plant were assigned with 20 grade scores and 10 grade scores were allotted for incomplete information. Authentic information was allotted 20 grade scores and for vague information, no scores were allotted. For high extent of diffusion, 20 grade scores were granted, for moderate 10 and no scores were awarded for low diffusion.

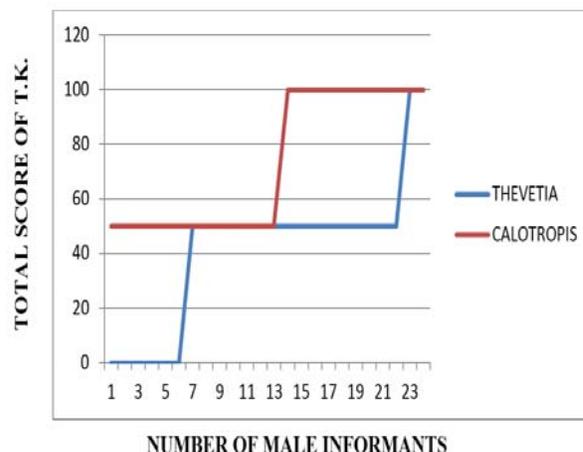
For the purpose of collecting data the selected population was categorized into various classes with the aim of random and variable sampling. Various classes were defined on the basis of sex (male or female), age group (30-50 or 50 and above) and qualification (illiterate or below matric or above matric). A minimum of ten samplings were done in each selected village. The native data was analyzed and regrouped in tabular, bar diagram and histogram format for better interpretation. Computational tool helped us handle the bulk data in an accurate and error-free manner.

**Results and Discussion**

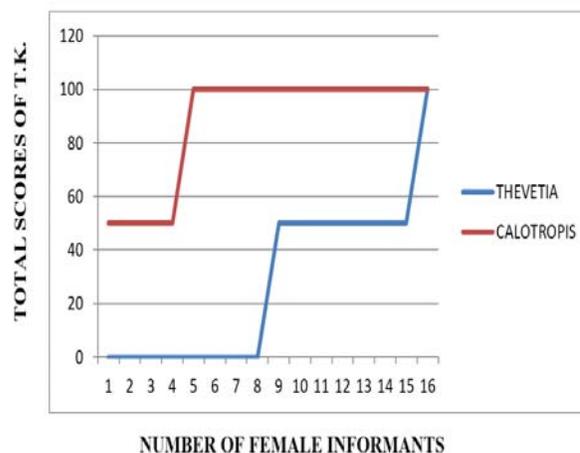
Our survey pointed out that traditional knowledge does not percolate in unilinear inheritable manner but it is dependent on number of other socio economic factors also. *Calotropis* plant is commonly addressed as Aak, Akta and Dudha in their local language which was confirmed to be the same plant after showing them the photographs and voucher specimens etc. *Thevetia peruviana* is commonly addressed as Ashavmar, Haymar and Pita Kaner in their local language. The collected data pointed out that the traditional knowledge about the *Calotropis procera* plant, which grows abundantly in wastelands, is high amongst indigenous people because the plant is growing in close vicinity of their habitation and has a deep religious integration too. Therefore, ethnomedicinal knowledge of this plant is highly diffusing amongst rural people. In case of *Thevetia peruviana*, the pattern or trend of knowledge percolation was altogether variable under similar governing socio-economic factors/ conditions.



**Fig 1:** Total score of T.K. amongst total informants of Rohtak district in *Thevetia peruviana* and *Calotropis procera*



**Fig 2:** Total score of T.K. amongst only male informants of Rohtak district in *Thevetia peruviana* and *Calotropis procera*.



**Fig 3:** Total score of T.K. amongst only female informants of Rohtak district in *Thevetia peruviana* and *Calotropis procera*

On the basis of scores allotted to informants, line graphs were plotted (Figs 1-3). Total scores of both the plants were compared and it was deduced that due to higher integration of *Calotropis procera* in rural areas, prevailing traditional knowledge about this plant is more than that of *Thevetia peruviana*.

**Table 3:** PCTK strength in *Thevetia peruviana*:

S. NO.	ETHNOMEDICINAL USES	PCTK STRENGTH (%)
1	Ornamental Value	48.83
2	To cure skin Infections	2.32
3	*To kill animals	2.32
4	To cure fever	1.55
5	To cure stomach Inflammation	0.77
6	To cure earache	0.77
7	Nasal/Eye drops formulation	0.77
8	To cure leprosy	0.77
9	Diuretic	0.77
10	Improves Blood circulation	0.77
11	Induce abortion	0.77
12	Induce menstruation	0.77
13	Used as Sedative	0.77
14	To cure cough	0.77

\*Use was not earlier cited in literature but information was narrated by informants during survey.

**Table 4:** PCTK strength of *Calotropis procera*:

S. No.	ETHNOMEDICINAL USES	PCTK STRENGTH
1	Religious value	94.0
2	Thorn removal	91.47
3	To cure joint pain	31.78
4	To cure toothache	19.37
5	To cure boils	17.82
6	To cure asthma	16.27
7	To cure skin diseases	13.95
8	To cure snake bite	8.52
9	To cure cough	7.75
10	Blood purifier	5.42
11	To cure cyclic fever	4.65
12	To cure jaundice	3.87
13	To cure piles	3.87
14	To cure stomachache	3.87
15	To cure wasp bite	3.87
16	To cure chest Congestion	2.32
17	*To cure gastric trouble in animals	2.32
18	To cure earache	2.32
19	Wound healing	2.32
20	To cure ring worm	1.55
21	To cure corns	0.77
22	To cure flatulence	0.77
23	Removal of intestinal worms	0.77
24	To cure chicken Pox	0.77

\*Use was not earlier cited in literature but information was narrated by informants during survey.

PCTK score strength for both the plants was compiled in Tables 3&4. In order to calculate the PCTK score strength, randomly procured data was allotted scores and organized. Maximum and minimum scores were obtained on the basis of their maximum or minimal reported usage.

Pattern and trends of total score of informants in Rohtak District, Haryana, India:

Amongst total population in Rohtak District, a distinct pattern emerged highlighting almost equal proportion of knowledge carriers and users in total population in *Calotropis procera* and only knowledge carriers and no users in *Thevetia peruviana* (Fig. 1). Male informants for both plants and female informants for *Thevetia peruviana* in Rohtak District followed a same trend as discussed above (Fig. 2). In contrast, female informants emerged as maximum knowledge users in *Calotropis procera* (Fig. 3). Though, female constitute ignored and deprived group in rural society yet she figures out as

unrewarded commander in possessing and using ethnobotanical knowledge for the welfare of her family and relatives<sup>25</sup>.

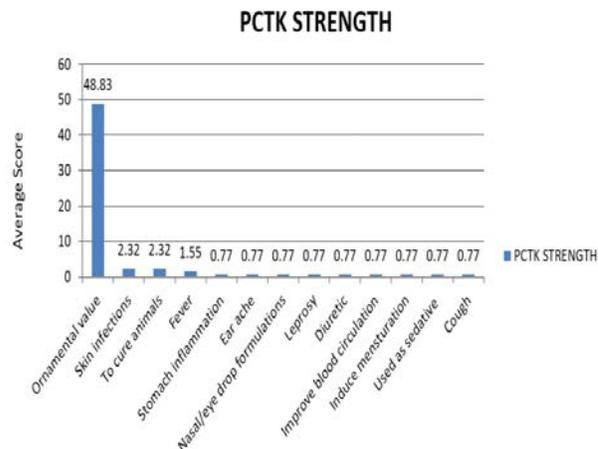
In total informant's category, two plateaus are observed in *Calotropis procera*, one at 50 and other at 100 showing that all of them are knowledge carriers and more than half of them are diffusers too. In *Thevetia peruviana*, 3 plateaus are observed, one at 0, second at 50 and third on 100 grade score indicating almost half of the people are knowledge carriers but very few of them are diffusers too (Fig. 1). A slightly deviating trend was seen in male informant category i.e. diffusion was less in case of *Calotropis procera* and in *Thevetia peruviana*, there are more knowledge carriers but very few of them are diffusers of the knowledge (Fig.2). In female informant's category, two plateaus are observed in *Calotropis procera*, a condensed plateau at 50 and another extended plateau at 100 grade score showing that most of the knowledge carriers are diffusers too. In *Thevetia peruviana*, half of the female informants have no knowledge about the plant, rest are carriers only but not diffusers.

PCTK strength of *Thevetia peruviana* and *Calotropis procera*:

Table 3 is showing PCTK strength of *Thevetia peruviana* and Table 4 is showing PCTK strength of *Calotropis procera*. *Calotropis procera* is well integrated to our cultural inheritance and hence showed higher PCTK score strength as compared to *Thevetia peruviana* which is weakly integrated to rural folks in socio-cultural practices.

Tables 3 & 4 are clearly indicating that *Thevetia peruviana* has more of ornamental value than its medicinal value. While in *Calotropis procera* more number of medicinal uses were listed. Stronger PCTK score strength in *Calotropis procera* shows that the plant is in deep integration with society and more specifically for ethnomedicinal purposes.

In *Thevetia peruviana*, a very alarming threat to ethnomedicinal usage was observed i.e. out of a total of 14 listed uses, 10 uses could score merely 0.77% indicating that the knowledge is not at all percolating and is at high threat of its loss in the society. Furthermore, other four uses scored less than 3% PCTK score. 48% of the PCTK score was only for its ornamental value (Fig.4). On the other hand, in *Calotropis procera*, out of a total of 24 ethnomedicinal uses, four scored 0.77 while 13 uses scored less than 10%. Only one use of *Calotropis latex* for thorn removal is in wide usage indicating a gradual denudation of many of the other known uses for want of a mechanism to diffuse and percolate the TK in the society (Fig.5).

**Fig 4:** PCTK strength of *Thevetia peruviana*:

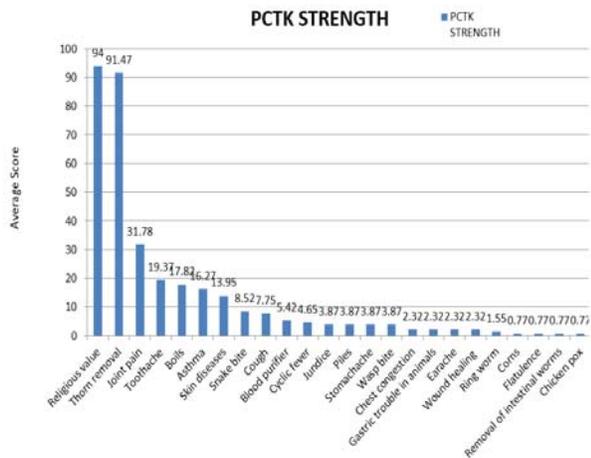


Fig 5: PCTK strength of *Calotropis procera*:

### Conclusion

The present survey concludes that two plants with variable socio-cultural integration showed totally opposite trend of percolation of traditional knowledge in all the villages of Rohtak district of Haryana. In case of *Thevetia peruviana*, a large number of informants were unable to even identify the plant. Some of the informants were only knowledge carriers while very few were the actual users. Various criteria laid down for survey failed to classify the data into interpretable form and the authors suggest that TK in the rural society is not under the governance of various socio economic factors such as age, sex, qualification and income etc. Therefore, a person to person contact information compiled ultimately into PCTK score is the only scientific way to conserve and compile ethnomedicinal knowledge.

A fairly contrasting trend was observed in *Calotropis procera*. Almost all the informants were able to identify the plant. Maximum number of informants were actual users also. The most deviating trend of diffusion and percolation of TK was observed amongst female informants of Karnal district who were least knowledge carriers. This trend indicates that *Calotropis procera* is more common amongst rural people and also people are using it for medicinal purpose. On the other hand, in *Thevetia peruviana* very few people are using the plant for medicinal purposes. On the basis of PCTK score strength again *Calotropis procera* emerged as a plant having deep ethnomedicinal social integration. According to the survey, lesser PCTK score strength indicated that the plant is endangered or threatened ethnomedicinally. A medicinal use in recurrence is supported by very high PCTK strength e.g. thorn removal in *Calotropis procera* with a PCTK score strength of 91.47% and a sporadic use has a very low PCTK score strength e.g. sedative usage of *Thevetia peruviana* with a PCTK score strength of 0.77% (Tables 3&4). Moreover, *Thevetia peruviana* is known for its ornamental value amongst rural people whereas *Calotropis procera* is known for its age old ethnomedicinal properties and religious integration. Keeping in view the emerging variable trend in these two plants specific plant protection and traditional knowledge conservation strategies need to be formulated. Such an approach will help us screen and utilize our unfathomable traditional knowledge resource for future planning and benefits. At present more emphasis is being laid on theoretical documentation of TK whereas authors conclude and strongly recommend to device a mechanism of person to person collection of this knowledge along with strategies to promote their efficient percolation in the society. This will further help

in practically conserving the TK and its use for mankind.

Our survey pointed out that traditional knowledge does not percolate in unilinear manner. Instead it is governed by a number of other dependent factors. Therefore, authors intend to propose a dire need to establish an IPCTKW which will enable future researchers to plan and prioritize their focus areas of medicinal plant research. Such protection strategy will not only project medicinal significance of select plant but also point towards future policies, plans and strategies for protection and conservation of ethnomedicinally threatened plants. Finally, generation of IPCTKW will help us create a knowledge pool for plant drug based researches and it will also prioritize selection of thrust areas to develop efficacious plant based drugs.

### List of abbreviations used

TK: Traditional knowledge; PCTK: Persons Carrying Traditional Knowledge; IPCTKW: Integrated Persons Carrying Traditional Knowledge Web; C.P.: *Calotropis procera*; T.P.: *Thevetia peruviana*; J: Jind; K: Karnal; R: Rohtak.

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