

## Ethnomedicinal Importance of *Adhatoda vasica* in the South East Asian Countries: Review and Perspectives

R. S. Sai Murali<sup>1</sup>, G. Nageswara Rao<sup>2</sup> and R. Basavaraju<sup>3\*</sup>

<sup>1</sup>Department of Biosciences, Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilayam, Andhra Pradesh 515134, India

<sup>1</sup>Division of Research and Development, Lovely Professional University, Jalandhar-Delhi GT Road, Phagwara, Punjab 14441, India

<sup>2</sup>Department of Chemistry, Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilayam, Andhra Pradesh 515134, India

<sup>3\*</sup>Department of Biosciences, Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilayam, Andhra Pradesh 515134, India

Mobile: <sup>1</sup><91+8872257939>, <sup>2</sup><91+9492595462>

E-mail: <sup>1</sup><saimurali.19816@lpu.co.in>, <sup>1</sup><saimuralirs@gmail.com>, <sup>2</sup><gnageswararao@sssihl.edu.in>

**KEYWORDS** *Adhatoda vasica*. Medicinal Plants. Traditional Formulations. Aborigines

**ABSTRACT** The indigenous people of South East Asian countries have been using plants for treating various ailments for thousands of years. Since knowledge on medicinal importance of plants has been passed on orally from generation to generation there have been no written documents to store this information for posterity. In addition, colonial forces have disrupted the knowledge of plants in aboriginal healthcare systems. However, despite the prevalence of these issues, human community at large has been using plants for its primary healthcare needs. This paper brings out literature on the usage of one such medicinal plant, *Adhatoda vasica* Nees, by native people and folk medicine practitioners of the South East Asian countries. To the researchers' knowledge, this is the most comprehensive review till date disclosing the ethnomedicinal use of *A. vasica* based on over seventy research reports. A sum total of thirty-three diseases for which *A. vasica* has been used as medicine along with preparation methods is described in this paper. Future research endeavours should concentrate on acquiring the vast traditional knowledge on *A. vasica* from various ethnic groups in South East Asian countries that have received very less attention so far.

### INTRODUCTION

Medicinal plants have been used by mankind for so long dating back to prehistoric times (Oliver 2013). More than seventy to eighty per cent of the world's population is dependent on plants for primary healthcare needs (WHO 2002). Recently there has been an upsurge in strengthening the knowledge of traditional medicine of aborigines and folk practitioners. Since knowledge on medicinal importance of plants has been transferred orally from generation to generation, there are no written documents to store information for posterity. In addition, colonial forces have influenced and disrupted the native knowl-

edge (Hanazaki et al. 2013; Oliver 2013; Upreti et al. 2012). Hence, documentation of this wealth accumulated over thousands of years has been the focus in ethnobiology and ethnomedicine. The objectives put forth by the World Health Organization (WHO) and other global agencies strongly suggest the need to protect and restore these systems of knowledge before we lose them forever. In this review the importance of one such medicinal plant, *Adhatoda vasica* is being accentuated. South East Asia has been gifted with rich ethnic and cultural diversity. For example, according to the government of India, there are 622 tribal groups in the country speaking different languages and with various cultural practices (Pa and Mathew 2012). So far the scientific community has not reached all the tribal groups in their research endeavours. Hence, a considerable portion of knowledge has not been documented. Not only do the plants protect our health, they also act as a source of income and provide livelihood to many tribal families (Farnsworth and Soejarto 1991; Sonowal and Barua

Address for correspondence:

R. Basavaraju  
Department of Biosciences,  
Sri Sathya Sai Institute of Higher Learning,  
Prasanthi Nilayam 515 134, Andhra Pradesh, India  
Telephone: 91 8555 287235  
Fax: 91 8555 286919  
E-mail: rbasavaraju@sssihl.edu.in

2011). In the past, less attention has been given to document the facts and methodologies related to traditional medicine. Since concerns are being raised to preserve the fast depleting oral knowledge and resources of medicinal plants (Borins 1995; Leonti 2011; Negi et al. 2017; Srithi et al. 2009), this review gives a comprehensive ethnomedicinal documentation of the one such indigenous plant, *Adhatoda vasica* of the South East Asian (SEA) countries.

### METHODOLOGY

A pertinent literature search in scientific journals, books and reports was conducted. Leading databases and gateways like Pubmed, Sci-

ence direct, Springer, Elsevier and Google Scholar were browsed during the process of screening relevant literature. Explicit search terms were used in obtaining research papers from the mentioned resources. A sum total of seventy research papers were analysed and a comprehensive understanding of method of preparation and mode of administration was achieved. The papers were screened and shortlisted for accurate information. Though the researchers have conducted an extensive review on this topic, they do not claim to have included all the existing data on traditional medicinal use of *A. vasica*. Here the researchers focus their review on what is available over internet and libraries to which research community at large could get an easy access.

**Table 1a: Ethnomedicinal information on *A. vasica*: Pulmonary diseases and fevers**

Major ailment category	Preparation method	Description	Use reports
Pulmonary diseases and fevers (Cough, cold, fever, bronchitis, malarial fever, asthma, tuberculosis and pneumonia)	Decoction	Mature leaves were used to make 5 ml of decoction which was given twice a day for treating asthma. Leaf juice with goat's milk was given to treat tuberculosis for 6 months. 15 leaves of <i>A. vasica</i> with 15 leaves of <i>Tylophora indica</i> , one handful of <i>Albizia amera</i> , one or two leaves of <i>Aloe barbadensis</i> , 10 seeds of <i>Piper nigrum</i> , 1 <i>Allium sativum</i> , and 100 g cherry were ground and the decoction obtained was given twice a day for cough. Leaf and root decoction was used for cough, asthma and chronic bronchitis	Arjariya and Chaurasia 2009; Desale et al. 2013 Naik et al. 2012 Dulla and Jahan; 2017; Haq 2012; Kumari et al. 2013; Poonam and Singh 2009; Revathi and Parimelazhagan 2010
		Leaf decoction with honey thrice a day was given to treat cough.	Bhowmik et al. 2013 Goswami et al. 2013; Kaur and Kaur 2017; Mannaf et al. 2013 Shadangi et al. 2012
		Root bark decoction with honey was taken to for asthma.	Shadangi et al. 2012
		Roots and leaves with ginger were taken for cough and malaria.	Shadangi et al. 2012
		Decoction of the whole plant material was used in the treatment of fever, cough and cold	Sen et al. 2011; Shiddamallayya et al. 2010; Singh et al. 2010; Uniyal et al. 2002
		Five to eight leaves were boiled in 2 cups of water and the decoction was taken twice a day for cough and cold.	Khan and Singh 2010
		Five leaves with a pinch of rock salt were boiled with water and the decoction was taken twice a day for cough and fever; 10 ml of root decoction for seven days was given for chronic bronchitis.	Sahani and Mall 2013

Comprehensive analysis of the past work and current study provided the researchers insights on the medicinal value of *A. vasica*. The traditional uses of this invaluable plant are substantially supported by modern pharmacological experimentation to determine antiasthmatic (Bhide and Naik 1980; Dhuley 1999; Mahindroo et al. 2005; Srinivasarao et al. 2006), antihistaminic (Chattopadhyay et al. 2011; Dash et al. 2010; Mahajan et al. 2010; Patil 2010; Sarker et al. 2009), antibronchitic, radioprotective (Bhattacharyya et al. 2005; Kumar et al. 2005; Kumar et al. 2007; Singh et al. 2000), wound healing (Subhashini and Arunachalam 2011; Vinothapoo-han and Sundar 2010), immunomodulatory, anti-inflammatory, as well as antioxidant (Chakraborty and Brantner 2001; Hussain et al. 2010; Srinivasarao et al. 2006), antihelminthic, anticestodal, larvicidal (Al-Shaibani et al. 2008; Anuradha et

al. 2010; Lateef et al. 2003; Nazar et al. 2009; Yadav and Tangpu 2008), antiretroviral (Kumar et al. 2010), uterine stimulant and abortifacient (Gupta et al. 1978) activities. Even though there are couple of reports suggesting the use of vasicine (an alkaloid from *A. vasica*) as an efficient ligand to inhibit some of the targets in the disease biology of tuberculosis (Jha et al. 2012) and cancers (Sai Murali et al. 2017), the research approaches so far have been scanty and leave sufficient room for advanced mechanistic experimental research (Lamchouri et al. 2010; Lamchouri et al. 2013).

### CONCLUSION

So far, ethnomedicinal reports on *Adhatoda vasica* have been scattered and are devoid of uniformity. To the best of the researchers' knowl-

**Table 1b: Ethnomedicinal information on *A. vasica*: Pulmonary diseases and fevers**

Major ailment category	Preparation method	Description	Use reports
Pulmonary diseases and fevers (Cough, cold, fever, bronchitis, malarial fever, asthma, tuberculosis and pneumonia)	Decoction	Leaves were boiled in water; 20ml of this decoction was taken twice a day for 3 days to cure malarial fever.	Rai and Lalramghinglova 2010
	Raw roots and flowers	Raw roots and flowers were chewed empty stomach once a day to treat tuberculosis.	Goswami et al. 2013; Sahani and Mall 2013
	Flower extract	Floral extract was mixed with <i>Solanum surtense</i> and given for treating asthma.	Rauf et al. 2012
	Leaf extract	Leaf extract in water (2 to 3 drops) was given orally to children with cough; leaf extract with jaggery and honey was given twice a day for 3-5 days to cure asthma; leaf extract with sugar was given thrice a day for seven days to cure cough.	Das et al. 2012; Deepa and Saravanakumar 2013; Murthy and Vidyasagar 2013; Padal and Viyayakumar 2013
		Leaf and bark juice was given orally to treat cough, fever and phlegm.	Das et al. 2008; Rahman et al. 2010; Tuhin et al. 2013
	Leaf and stem bark juice	Young leaf and bark juice was used for asthma and cough.	
	Extract	Leaf and flower extracts ground with <i>Hibiscus rosasinensis</i> was given orally to cure asthma.	Muthu et al. 2006
	Dried bark powder	Bark powder was used to treat tuberculosis, pulmonary effusions and asthma.	Tuhin et al. 2013; Vijendra and Kumar 2010
Dried leaf powder	One tea spoon full of dried leaf powder with one spoonful honey was given for cough and coryza.		Sahani and Mall 2013
	Leaf powder was used to cure malaria		Poonam and Singh 2009

**Table 1c: Ethnomedicinal information on *A. vasica*: Pulmonary diseases and fevers**

Major ailment category	Preparation method	Description	Use reports
Pulmonary diseases and fevers (Cough, cold, fever, bronchitis, malarial fever, asthma, tuberculosis and pneumonia)	Dried leaf powder	Dried leaf powder of <i>A. vasica</i> , seeds of <i>Trachyspermum ammi</i> , seeds of <i>Foeniculum vulgare</i> , rhizome of <i>Zingiber officinale</i> and <i>Terminalia bellerica</i> were mixed and given thrice a day for 8 to 10 days to cure cough, tuberculosis and asthma.	Abbasi et al. 2010
	Root powder	Dried root powder was given for asthma	Poonam and Singh 2009
	Root and leaf extract	Extracts were used against bronchitis, asthma and fever.	Rai and Lalramnghinglova 2010; Rashid et al. 2013; Sadale and Karadge 2013; Sarmah et al. 2008
	Tonic	Tonic made of leaves and flowers was given to patients with bronchitis, malaria, fever, cold, flu and asthma.	Mahmood et al. 2011
	Vapour therapy	Smoke obtained from burning dry leaves was inhaled by the patients with asthma, chronic bronchitis ( <i>A. vasica</i> based inhalation therapy was found to have high index among inhalation therapies); dry leaf powder was puffed during breathing difficulty.	Desale et al. 2013; Ningthoujam et al. 2013
	Root, Leaf and whole plant extract	Root extract was used for treating pneumonia. Leaf extract was used against pneumonia, asthma and cough.	Hazrat et al. 2011; Rahmatullah et al. 2009b
	Extract	Whole plant body was used against cough, cold, asthma and bronchitis.	Masum et al. 2013a; Kadir et al. 2012; Kanwal et al. 2011; Masum et al. 2013b; Mondal 2012; Sahani and Mall 2013
	Leaf extract	5 leaves with honey were taken for 3 days against cough; <i>A. vasica</i> with <i>Terminalia arjuna</i> bark and <i>Helicteres isora</i> was taken twice a day (7 days) to treat asthma.	Panda 2010
	Leaf juice	For bleeding nose and for phlegm control.	Das et al. 2012; Hossain and Hoq 2016; Masum et al. 2013; Rahmatullah et al. 2009a

edge, review of past work described in this paper is the most comprehensive account on ethnomedicinal uses of *Adhatoda vasica* till date. The amount of literature on ethnomedicinal uses of this plant suggests that in the midst of growing scientific advancement indigenous people of South East Asia are still dependent on traditional medicine for their primary healthcare. Future work should focus on acquiring more information from the 622 tribal groups of India and many more throughout South East Asia on the

usage of *A. vasica* plants in their traditional and folk medicine practices. Understanding the rational use of *A. vasica* by narrowing down to specific diseases would help researchers in modern medicine to discover potent drugs for neglected and pressing diseases.

### RECOMMENDATIONS

Since *Adhatoda vasica* has been widely used in pulmonary and inflammatory diseases, peo-

**Table 1d: Ethnomedicinal information on *A. vasica*: Pulmonary diseases, fevers and diabetes**

Major ailment category	Preparation method	Description	Use reports
Pulmonary diseases and fevers (Cough, cold, fever, bronchitis, malarial fever, asthma, tuberculosis and pneumonia)	Leaf paste	Leaf paste was applied to whole body and left for 24 hrs to cure chronic malaria; given during fever and cough.	Asharaf and Sundaramari 2017; Hussain and Hore 2007; Rai and Lalramnghinglova 2010
		Orally taken for curing asthma and cold.	Ayyanar and Ignacimuthu 2011
	Leaf juice	Leaf juice was administered against whooping-cough and asthma.	Bhatt and Negi 2006; Dahare and Jain 2010; Shende 2017
	Mixed paste	Leaves of <i>A. vasica</i> , roots of <i>Solanum surrattense</i> and fruits of <i>Piper longum</i> in equal proportions were made as a mixed paste. One gram of this paste was added with honey and administered to asthma patients orally for one week.	Savithramma et al. 2007
Diabetes	Boiled leaf extract	Leaves of <i>A. vasica</i> with the leaves of <i>Clerodendrum indicum</i> or <i>C. siphonanthus</i> and /or with the leaves of <i>Azadirachta indica</i> and <i>Zanthoxylum acanthopodium</i> was given by two tribal communities in Thoubal district in Manipur, North East India against diabetes.	Khan and Yadava 2010; Mootoosamy and Mahomoodally 2014
	Juice	Leaf juice of <i>A. vasica</i> and <i>Andrographis paniculata</i> were given together for 21 days to treat diabetes.	Goswami et al. 2013
	Young leaf juice	Young leaves (two) were chewed empty stomach daily for treating diabetes.	Mannaf et al. 2013; Sahani and Mall 2013
	Extracts	Flowers with <i>Solanum surrattense</i> were mixed and given for diabetes; flowers with neem leaf powder and gum of <i>Acacia nilotica</i> were administered to patients with diabetes.	Ahmad et al. 2004; Rauf et al. 2012

ple have associated it mainly for these two diseases. Attempts should be made to obtain more information regarding other disease categories which may help discover new medicines from plant origin. Though represented with handful of reports, the medicinal properties of *A. vasica* could be further explored for specific categories of cancers especially hormone regulated types; as the extracts have been used in hormonal regulation and uterine stimulation. In addition, proven for its ability to treat pulmonary ailments, the plant could further be explored against multidrug resistant (MDR) *Mycobacterium tuberculosis*. Pragmatic use of *A. vasica* genetic resources with a blend of traditional and modern pharmacological investigations could perhaps provide solutions to multidrug resistant tuberculosis and cancers. Lastly, given the distribution of

*A. vasica* in varied habitats and the inhabitation of number of aboriginal communities in the remote forests, the methods used in the preparation of medicines for various ailments should be captured extensively by designing structured or semi-structured ethnomedicinal surveys. Such studies would pave way for efficient drug discovery against specific disease categories.

#### ACKNOWLEDGEMENTS

The researchers offer their heartfelt gratitude to Bhagawan Sri Sathya Sai Baba, the Founder Chancellor of Sri Sathya Sai Institute of Higher Learning, for providing inspiration to take up this task. The researchers extend deep sense of appreciation to the tribal communities for sharing their valuable information for the betterment of

**Table 2: Ethnomedicinal information on *A. vasica*: Stomach ailments, pains and nausea**

Major ailment category	Preparation method	Description	Use reports
Stomach pain, body pain, ear pain and nausea	Extracts	Stem and root bark was extracted and given for stomach pain.	Rashid et al. 2013; Raut et al. 2012
	Leaf paste	Leaf paste was applied for sprains.	Hussain and Hore 2007
	Leaf paste	Leaf paste was taken orally for relief against ear pain and headache.	Ayyanar and Ignacimuthu 2011
	Extracts	Leaf and root extracts were given as anti-spasmodic agents.	Haq 2012
	Extracts	Flower and fruit extracts were used for muscular spasms.	Rai and Lalramnghinglova 2010
	Extracts	Leaf extract was taken for muscular spasms.	Rai and Lalramnghinglova 2010
	Leaf extract	Fresh leaf extract and boiled water was used and Vethuvellam (Medicated water) for giving bath to women after delivery; Mature leaves of <i>A. vasica</i> with <i>Calycopteris floribunda</i> , <i>Careya arborea</i> , <i>Clerodendrum infortunatum</i> , <i>Musa paradisica</i> , <i>Quassia indica</i> , <i>Tamarindus indica</i> was made as a formulation for bath.	Rajith et al. 2010
	Decoction	Leaf decoction was used as antispasmodic agent and for ear pain.	Hazrat et al. 2011
Gastric problem	Warmed leaves	Leaves (8-10) were warmed on fire and lastered over the joints and lumbar portions to get relief from pains and sprains.	Jamir et al. 1999
	Leaf extract	Leaf extract was given to treat gastric problems.	Sonowal and Barua 2011
Nausea	Leaf and bark juice	Young leaf and bark juice was used as anti-emetic tonic.	Rahman et al. 2010; Shiddamallayya et al. 2010
Worm killing	Leaf and bark juice	Young leaf and bark juice was given to treat patients with intestinal worms.	Rahman et al. 2010
	Root extract	Used as anthelmintic agent.	Rai and Lalramnghinglova 2010

mankind. Dr. R.S. Sai Murali wishes to express sincere thanks to the administrators of Lovely Professional University for encouragement and facilities for drafting this paper.

### REFERENCES

- Abbasi AM, Khan MA, Ahmad M, Zafar M 2010. Herbal medicines used to cure various ailments by the inhabitants of Abbottabad district, North West Frontier Province, Pakistan. *Indian J Traditional Knowl*, 9(1): 175-183.
- Ahirwar RP, Tripathi J, Singh R 2017. Ethnomedicinal study of plants used by tribal person for dysentery diseases in Tikamgarh district MP. *IJAR*, 3(4): 818-823.
- Ahmad M, Khan MA, Arshad M, Zafar M 2004. Ethnophytotherapical approaches for the treatment of diabetes by the local inhabitants of District Attock (Pakistan). *Ethnobot Leaf*, (1): 1-10.
- Al-Shaibani IRM, Phulan MS, Arijo A, Qureshi TA 2008. Ovicidal and larvicidal properties of *Adhatoda vasica* (L.) extracts against gastrointestinal nematodes of sheep *in vitro*. *Pak Vet J*, 28(2): 79-83.
- Alagesaboopathi C 2011. Ethnomedicinal plants used as medicine by the Kurumba tribals in Pennagaram Region, Dharmapuri District of Tamil Nadu, India. *Asian J Exp Biol Sci*, 2(1): 140-142.
- Antonio RL, Kozasa EH, Galduróz JCF, Dorjee Y, Kalsang T, Norbu T, Tenzin T, Rodrigues E 2013. Formulas used by Tibetan doctors at Men-Tsee-Khang in India for the treatment of neuropsychiatric disorders and their correlation with pharmacological data. *Phytotherapy Res*, 27: 552-563.
- Anuradha A, Rajan K, McConnell MS 2010. Feeding deterrence activity of *Adhatoda vasica* L. against *Spodoptera litura* (Fab). *J Biopest*, 3(1): 286-288.
- Arjariya A, Chaurasi K 2009. Some medicinal plants among the tribes of Chhatarpur District (MP) India. *Ecoprint: An Int J Ecol*, 16: 43-50.
- Asharaf S, Sundaramari M 2017. A Quantitative study on indigenous medicinal plants used by tribes of Kerala. *Journal of Extension Education*, 28(3): 5695-5702.
- Ayyanar M, Ignacimuthu S 2005. Medicinal plants used by the tribals of Tirunelveli hills, Tamil Nadu to

**Table 3: Ethnomedicinal information on *A. vasica*: Digestive system and liver problems**

Major ailment category	Preparation method	Description	Use reports
Diarrhoea and dysentery	Leaf extract	One tea spoon full of leaf extract was given twice a day for diarrhoea.	Ahirwar et al. 2017; Rokaya et al. 2014; Shiddamallayya et al. 2010; Singhal et al. 2017; Venkaiah et al. 2010
	Paste	Fresh leaf paste was used twice a day for treating diarrhoea, dysentery and gastric problem in cattle.	Abbasi et al. 2010
	Root extract	Fresh root extract was taken for dysentery.	Sarmah et al. 2008; Sen et al. 2011
	Leaf extract	Leaf extract was given as anti diarrhoeal and anti dysentery agent.	Basumatary et al. 2004; Bhatt and Negi 2006; Hussain and Hore 2007; Jamir and Takatemjen 2010; Rai and Lalramghinglova 2010; Sarmah et al. 2008
	Decoction	Leaf decoction was used for curing dysentery in cattle.	Hazrat et al. 2011
	Juice	Leaf juice was given against dysentery.	Sen et al. 2011; Shanmugam et al. 2011
	Jaundice and liver problems	Root and leaf extracts	Root and leaf extracts were used against jaundice.
Leaf paste		Leaf paste was used against jaundice.	Jamir and Takatemjen 2010
Decoction		Decoction of the whole plant body was used in the treatment of jaundice.	Singh et al. 2010
Leaf extract		2 spoonful of leaf extract with sugar was taken twice a day for a month to treat jaundice.	Das and Rahman 2011
Leaf and stem decoction		Leaf and stem decoction with honey was taken on empty stomach twice a day (7 days) for Jaundice and liver problems.	Shadangi et al. 2012
Extract		Whole plant extract was used in the treatment of liver fever.	Antonio et al. 2013
Extract		Floral extract was given against jaundice.	Rauf et al. 2012

- treat poisonous bites and skin diseases. *Indian J Traditional Knowl*, 4(3): 229-236.
- Ayyanar M, Ignacimuthu S 2011. Ethnobotanical survey of medicinal plants commonly used by Kani tribals in Tirunelveli hills of Western Ghats, India. *J Ethnopharmacol*, 134(3): 851-864.
- Basumatary SK, Ahmed M, Deka SP 2004. Some medicinal plant leaves used by Boro (tribal) people of Goalpara district, Assam. *Nat Prod Radianc*, 3(2): 88-90.
- Bhatt V, Negi G 2006. Ethnomedicinal plant resources of Jaunsari tribe of Garhwal Himalaya, Uttaranchal. *Indian J Tradit Knowl*, 5(3): 331-335.
- Bhattacharyya D, Pandit S, Jana U, Sen S, Sur TK 2005. Hepatoprotective activity of *Adhatoda vasica* aqueous leaf extract on d-galactosamine-induced liver damage in rats. *Fitoterapia*, 76(2): 223-225.
- Bhide MB, Naik PY 1980. Antiasthmatic Potentiality of Vasicinone and Alkaloid from *Adhatoda vasika*, Nees. In: *4<sup>th</sup> Asian Symposium on Medicinal Plants and Spices*, 15-19 September, Bangkok, Thailand.
- Bhowmik S, Datta BK, Sarbadhikary SB, Mandal NC 2013. Contribution to the less known ethnomedicinal plants used by Munda and Santal community of India with their ethnomedicinal justification. *World Appl Sci J*, 23(10): 1408-1417.
- Borins M 1995. Native healing traditions must be protected and preserved for future generations. *Canadian Med Associ J*, 153(9): 1356.
- Chakraborty A, Brantner AH 2001. Study of alkaloids from *Adhatoda vasica* Nees on their antiinflammatory activity. *Phytother Res*, 15(6): 532-534.
- Chattopadhyay N, Nosál'ová G, Bandyopadhyay SS, Saha S, Ray B, Flešková D 2011. Structural features and antitussive activity of water extracted polysaccharide from *Adhatoda vasica*. *Carbohydr Polym*, 83(4): 1970-1974.
- Dahare DK, Jain A 2010. Ethnobotanical studies on plant resources of Tahsil Multai, district Betul,

**Table 4: Ethnomedicinal information on *A. vasica*: Inflammatory and skin diseases**

Major ailment category	Preparation method	Description	Use reports
Arthritis, rheumatism, inflammation, cuts and wounds	Leaf extract	Two tea spoons of leaf extract was taken twice a day for treating arthritis; applied externally on swellings.	Dutta 2017; Hazrat et al. 2011; Srivastava and Samuel 2013
	Paste	Leaf paste was applied to cure rheumatism.	Jamir and Takatemjen 2010
	Decoction	Decoction of the whole plant body was used in the treatment of rheumatism.	Haq 2012; Rai and Lalramghinglova 2010; Singh et al. 2010
	Root extract	External application for rheumatism.	Hazrat et al. 2011
	Decoction	One cup of leaf decoction made with <i>Murraya koeinigii</i> , <i>A. vasica</i> , <i>Azadirachata indica</i> was given thrice a day for 7 days for rheumatism.	Das et al. 2012
	Poultice	Leaves were used as poultice to cover fresh wounds to heal the inflammatory swellings.	Sen et al. 2011; Shah et al. 2012
	Paste	Fresh leaf past was applied to cure gout.	Hussain and Hore 2007
	Juice	Leaf juice was applied externally to cuts and wounds.	Rai and Lalramghinglova 2010
Skin diseases	Extracts	Floral extract was mixed with mustard oil and applied to cure pimples.	Rauf et al. 2012
	Decoction	Leaf decoction was used in treating skin diseases by old people in Gujarat.	Shah et al. 2011
	Paste	Leaf paste is used as an external application for eczema and to treat cuts and wounds.	Bhatt and Negi 2006; Poonam and Singh 2009; Sivaperumal et al. 2009
	Extract	Whole plant body was used in the treatment of scabies.	Mondal 2012
	Decoction	Leaf decoction was used against scabies and other skin problems.	Hazrat et al. 2011

- Madhya Pradesh, India. *Ethnobot Leaf*, 14: 694-705.
- Das AK, Dutta BK, Sharma GD 2008. Medicinal plants used by different tribes of Cachar district, Assam. *Indian J Traditional Knowl*, 7(3): 446-454.
- Das P, Rahman I 2011. Medicinal plants traditionally used by scheduled caste community of Lakhimpur District, Assam. *J Frontline Res Art Sci*, 1(1): 54-57.
- Das PR, Islam MT, Mahmud ASMSB, Kabir MH, Hasan ME, Khatun Z, Rahman MM, Nurunnabi M, Khatun Z, Lee YK et al. 2012. An ethnomedicinal survey conducted among the folk medicinal practitioners of three villages in Kurigram district, Bangladesh. *American Eurasian J Sustain Agr*, 6(2): 85-96.
- Dash RP, Chauhan BF, Anandjiwala S, Nivsarkar M 2010. Comparative pharmacokinetics profile of vasa swaras with vasicine and vasicinone. *Chromatographia*, 71(7): 609-615.
- Deepa J, Saravanakumar K 2013. Traditional phytotherapy in Chidambaram taluk of Cuddalore district, Tamil Nadu. *Curr Res Med Medical Sci*, 3(1): 1-5.
- Desale MK, Bhamare PB, Sawant PS, Patil SR, Kamble SY 2013. Medicinal plants used by the rural people of Taluka Purandhar, District Pune, Maharashtra. *Indian J Traditional Knowl*, 12(2): 334-338.
- Dhuley JN 1999. Antitussive effect of *Adhatoda vasica* extract on mechanical or chemical stimulation-induced coughing in animals. *J Ethnopharmacol*, 67(3): 361-365.
- Dulla O, Jahan FI 2017. Ethnopharmacological survey on traditional medicinal plants at Kalaroa Upazila, Satkhira district, Khulna Division, Bangladesh. *Journal of Intercultural Ethnopharmacology*, 6(3): 316.
- Dutta ML 2017. Plants used as ethnomedicine by the Thengal Kacharies of Assam, India. *Asian Journal of Plant Science and Research*, 7(1): 7-8.
- Farnsworth NR, Soejarto DD 1991. Global importance of medicinal plants. In: V Heywood, O Akerele, H Syngue (Eds.): *The Conservation of Medicinal Plants*. Cambridge: Cambridge University Press, pp. 25-51.
- Goswami H, Hassan MR, Rahman H, Islam E, Asaduzaman M, Prottoy MA, Seraj S, Rahmatullah M 2013. Ethnomedicinal wisdom of the Tripura tribe of Comilla district, Bangladesh: A combination of medicinal plant knowledge and folk beliefs. *American-Eurasian J Sustain Agricult*, 7(3): 178-187.
- Gupta OP, Anand KK, Ghatak BJ, Atal CK 1978. Vasicine, alkaloid of *Adhatoda vasica*, a promising uterotonc abortifacient. *Indian J Exp Biol*, 16(10): 1075-1077.



**Table 5: Ethnomedicinal information on *A. vasica*: Other ailments**

Major ailment category	Preparation method	Description	Use reports
Glandular tumours	Leaf juice	NA	Shiddamallayya et al. 2010
Ophthalmic	Extract	Fresh flower extract was used for ophthalmia.	Masum et al. 2013
Anti septic	Extract	Root extract was used as antiseptic.	Rai and Lalramng-hinglova 2010
Fits	Decoction	Leaf decoction was used as an antiseptic lotion.	Hazrat et al. 2011
	Juice	Leaves of <i>A. vasica</i> with <i>Zingiber officinalis</i> and <i>Piper nigrum</i> and beetle leaf were made into juice and given in the treatment for epilepsy.	Alagesaboopathi 2011
Paralysis	Decoction	A decoction was made out of <i>A. vasica</i> roots (50 g) with bark of <i>Oroxylum indicum</i> (100 g), bark of <i>Terminalia paniculata</i> (100 g), <i>Trachyspermum ammi</i> (10 g) and <i>Piper nigrum</i> (10 g) for paralysis in cattle.	Harsha et al. 2005
Thrombopoietic agent	Paste	Leaf paste was used for blood clotting.	Rajan et al. 2002
Leucorrhoea and gynaecological problems	Juice	Root bark juice with honey is given for leucorrhoea.	Yadav et al. 2006
	Decoction	Decoction of 5-7 leaves with 1g of <i>Daucus carota</i> and <i>Raphanus sativus</i> seeds was administered for menstrual cycle regulation.	
	Paste	Root paste was applied on the abdomen and vagina during the time of labour pains in carrying mothers.	Hussain and Hore 2007
Gonorrhoea	Decoction	Roots and leaves with ginger were taken for curing gonorrhoea.	Shadangi et al. 2012
	Root extract	Root extract was given as anti gonorrhoeal agent.	Rai and Lalramng-hinglova 2010

**Table 6: Ethnomedicinal information on *A. vasica*: Poisonous bites**

Major ailment category	Preparation method	Description	Use reports
Poisonous bites	Leaf paste and leaf juice	Leaf paste and leaf juice were applied externally and internally as an antidote for scorpion sting.	Rao et al. 2006
	Decoction	Root and leaf decoction of <i>A. vasica</i> mixed with the extracts of <i>Alangium salvifolium</i> and <i>Coccinia grandis</i> was given orally as an antidote to snake bite.	Ayyanar and Ignacimuthu 2005

Hanazaki N, Herbst DF, Marques MS, Vandebroek I 2013. Evidence of the shifting baseline syndrome in ethnobotanical research. *J Ethnobiol Ethnomed*, 9(75): 1-11.

Haq F 2012. The ethnobotanical uses of medicinal plants of Allai Valley, Western Himalaya, Pakistan. *Int J Plant Res*, 2(1): 21-34.

Harsha VH, Shripathi V, Hegde GR 2005. Ethnoveterinary practices in Uttara Kannada District of Karnataka. *Indian J Traditional Knowl*, 4(3): 253-258.

Hazrat A, Nisar M, Shah J, Ahmad S 2011. Ethnobotanical study of some elite plants belonging to Dir, Kohistan valley, Khyber Pukhtunkhwa, Pakistan. *Pak J Bot*, 43(2): 787-795.

Hossain MT, Hoq MO 2016. Therapeutic use of *Adhatoda vasica*. *Asian Journal of Medical and Biological Research*, 2(2): 156-163.

Hussain I, Khan N, Khan H, Ahmad M, Marwat GA, Khan L, Khan FU, Khan FA, Shah SMH 2010. Screening of anti-oxidant activities of selected medicinal plants. *World Appl Sci J*, 11(3): 338-340.

Hussain S, Hore DK 2007. Collection and conservation of major medicinal plants of Darjeeling and Sikkim Himalayas. *Indian J Traditional Knowl*, 6(2): 352-357.

Jamir NS, Takatemjen L 2010. Traditional knowledge of Lotha-Naga tribes in Wokha District, Nagaland. *Indian J Traditional Knowl*, 9(1): 45-48.

Jamir TT, Sharma HK, Dolui AK 1999. Folklore medicinal plants of Nagaland, India. *Fitoterapia*, 70(4): 395-401.

Jha DK, Panda L, Lavanya P, Ramaiah S, Anbarasu A 2012. Detection and confirmation of alkaloids in

- leaves of *Justicia adhatoda* and bioinformatics approach to elicit its anti-tuberculosis activity. *Appl Biochem Biotechnol*, 168(5): 980-990.
- Kadir MF, Sayeed MSB, Mia MMK 2012. Ethnopharmacological survey of medicinal plants used by indigenous and tribal people in Rangamati, Bangladesh. *J Ethnopharmacol*, 144: 627-637.
- Kanwal AMM, Shaukat S, Javed R, Ilyas R 2011. Exploration of ethnomedicinal values of imperative plants of district Gujrat, Pakistan. *Middle-East J Sci Res*, 7(3): 397-400.
- Kaur R, Kaur H 2017. Plant derived antimalarial agents. *Journal of Medicinal Plants*, 5(1): 346-363.
- Khan JB, Singh GP 2010. Ethno-medicinal active plants for treating cold and cough in the vicinity of Nahargarh Wildlife Sanctuary, Jaipur, India. *Our Nat*, 8(1): 225-230.
- Khan MH, Yadava PS 2010. Antidiabetic plants used in Thoubal district of Manipur, Northeast India. *Indian J Traditional Knowl*, 9(3): 510-514.
- Kumar A, Ram J, Samarth RM, Kumar M 2005. Modulatory influence of *Adhatoda vasica* Nees leaf extract against gamma irradiation in Swiss albino mice. *Phytomedicine*, 12(4): 285-293.
- Kumar A, Singh KP, Upadhyay B, Prasad R 2010. Screening of *Adhatoda vasica* Nees as a putative HIV-protease inhibitor. *J Phytol*, 2(4): 78-82.
- Kumar M, Samarth R, Kumar M, Selvan SR, Saharan B, Kumar A 2007. Protective effect of *Adhatoda vasica* Nees against radiation-induced damage at cellular, biochemical and chromosomal levels in Swiss albino mice. *Evid Based Complement Alternat Med*, 4(3): 343.
- Kumari S, Batish DR, Singh HP, Negi K, Kohli RK 2013. An ethnobotanical survey of medicinal plants used by Gujjar community of Trikuta Hills in Jammu and Kashmir, India. *J Med Plant Res*, 7(28): 2111-2121.
- Lamchouri F, Toufik H, Bouzzine SM, Hamidi M, Bouachrine M 2010. Experimental and computational study of biological activities of alkaloids isolated from *Peganum harmala* seeds. *J Mater Environ Sci*, 1: 343-352.
- Lamchouri F, Zemzami M, Jossang A, Abdellatif A., Israili ZH, Lyoussi B 2013. Cytotoxicity of alkaloids isolated from *Peganum harmala* seeds. *Pak J Pharma Sci*, 26(4): 699-706.
- Lateef M, Iqbal Z, Khan MN, Akhtar MS, Jabbar V 2003. Anthelmintic activity of *Adhatoda vasica* roots. *Int J Agri Biol*, 5(1): 86-90.
- Leonti M 2011. The future is written: Impact of scripts on the cognition, selection, knowledge and transmission of medicinal plant use and its implications for ethnobotany and ethnopharmacology. *Journal of Ethnopharmacology*, 134(3): 542-555.
- M Naik R, Venugopalan V, Kumaravelayutham P, Krishnamurthy YL 2012. Ethnoveterinary uses of medicinal plants among the Lambani community in Chitradurga district, Karnataka, India. *Asian Pacific J Tropical Biomed*, 2(Suppl): S470-S476.
- Mahajan N, Dhar KL, Suri OP, Nepali K, Kamra N, Garg A, Sharma A 2010. Synthesis of some N-heterocyclic analogs of vasicine. *Int J Pharma Sci Res*, 1: 78-87.
- Mahindroo N, Ahmed Z, Bhagat A, Bedi KL, Khajuria RK, Kapoor VK, Dhar KL 2005. Synthesis and structure-activity relationships of vasicine analogues as bronchodilatory agents. *Med Chem Res*, 14(6): 347-368.
- Mahmood A, Mahmood A, Naveed I, Memon MM, Bux H, Majeed YM, Mujtaba G, Mumtaz SM 2011. Indigenous medicinal knowledge of common plants used by local people of Hattian Bala district, Azad Jammu and Kashmir (AJK), Pakistan. *J Med Plant Res*, 5(23): 5517-5521.
- Mannaf MA, Islam MA, Akter S, Akter R, Nasrin T, Zarin I, Seraj S, Rahmatullah M 2013. A randomized survey of differences in medicinal plant selection as well as diseases treated among folk medicinal practitioners and between folk and tribal medicinal practitioners in Bangladesh. *American-Eurasian J Sustain Agricult*, 7(3): 196-209.
- Masum GZH, Dash BK, Barman SK, Sen MK 2013a. A comprehensive ethnomedicinal documentation of medicinal plants of Islamic University region, Bangladesh. *Int J Pharma Sci Res*, 4(3): 1202-1209.
- Masum GZH, Sharkar P, Nayeem MA, Rahman M, Rahman MM 2013b. Medicinal plants used by Kabiraj of fourteen villages in Jhenaidah District, Bangladesh. *Global J Res Med Plant Indigen Med*, 2(1): 10-21.
- Mondal T 2012. An investigation on ethno-veterinary medicinal plants of Siliguri subdivision of Darjeeling District, West Bengal, India. *J Today's Biol Sci Res Rev*, 1(1): 45-50.
- Mootoosamy A, Mahomoodally MF 2014. Ethnomedicinal application of native remedies used against diabetes and related complications in Mauritius. *Journal of Ethnopharmacology*, 151(1): 413-444.
- Murthy SMS, Vidyasagar GM 2013. Traditional knowledge on medicinal plants used in the treatment of respiratory disorders in Bellary district, Karnataka, India. *Indian J Nat Prod Resources*, 4(2): 189-193.
- Muthu C, Ayyanar M, Raja N, Ignacimuthu S 2006. Medicinal plants used by traditional healers in Kancheepuram District of Tamil Nadu, India. *J Ethnobiol Ethnomed*, 2(1): 43.
- Nazar S, Ravikumar S, Williams GP, Ali MS, Suganthi P 2009. Screening of Indian coastal plant extracts for larvicidal activity of *Culex quinquefasciatus*. *Indian J Sci Tech*, 2(3): 24-27.
- Negi VS, Pathak R, Sekar KC, Rawal RS, Bhatt ID, Nandi SK, Dhyani PP 2017. Traditional knowledge and biodiversity conservation: a case study from Byans Valley in Kailash sacred landscape, India. *Journal of Environmental Planning and Management*, 1-22. DOI: 10.1080/09640568.2017.1371006
- Ningthoujam SS, Talukdar AD, Potsangbam KS, Choudhury MD 2013. Traditional uses of herbal vapour therapy in Manipur, North East India: An ethnobotanical survey. *J Ethnopharmacol*, 147: 136-147.
- Oliver SJ 2013. The role of traditional medicine practice in primary health care within aboriginal Australia: A review of the literature. *J Ethnobiol Ethnomed*, 9(46): 1-14.
- Pa R, Mathew L 2012. Antimicrobial activity of leaf extracts of *Justicia adhatoda* L. in comparison with vasicine. *Asian Pac J Trop Biomed*, 2(3): 1556-1560.

- Padal SB, Viyayakumar Y 2013. Traditional knowledge of Valmiki tribes of G. Madugula Mandalam, Visakhapatnam district, Andhra Pradesh. *Int J Innov Res Dev*, 2(6): 723-738.
- Panda T 2010. Preliminary study of ethno-medicinal plants used to cure different diseases in coastal district of Orissa, India. *British J Pharmacol Toxicol*, 1(2): 67-71.
- Patil SS 2010. Study of herbal formulation consisting of various indigenous plants for their anti asthmatic activity in experimental animals. *Int J Res Ayur Pharma*, 1(2): 515-521.
- Poonam K, Singh GS 2009. Ethnobotanical study of medicinal plants used by the Taungya community in Terai Arc landscape, India. *J Ethnopharmacol*, 123(1): 1167-1176.
- Rahim ZB, Rahman MM, Saha D, Hosen SMZ, Paul S, Kader S 2012. Ethnomedicinal plants used against jaundice in Bangladesh and its economical prospects. *Bull Pharma Res*, 2(2): 91-105.
- Rahman AHMM, Kabir EZMF, Sima SN, Sultana RS, Nasiruddin M, Zaman ATMN 2010. Study of an ethnobotany at the village Dohanagar, Naogaon. *J Appl Sci Res*, 6(9): 1466-1473.
- Rahmatullah M, Das AK, Mollik ARH, Jahan R, Khan M, Rahman T, Chowdhury MH 2009a. An ethnomedicinal survey of Dhamrai Sub-District in Dhaka District, Bangladesh. *American Eurasian J Sust Agriculture*, 3(4): 881-888.
- Rahmatullah M, Mukti IJ, Haque AKMF, Mollik MAH, Parvin K, Jahan R, Chowdhury MH, Rahman T 2009b. An ethnobotanical survey and pharmacological evaluation of medicinal plants used by the Garo tribal community living in Netrakona district, Bangladesh. *Adv Nat Appl Sci*, 3(3): 402-418.
- Rai PK, Lalramghinglova H 2010. Ethnomedicinal plant resources of Mizoram, India: Implication of traditional knowledge in health care system. *Ethnobot Leaf*, 14: 274-305.
- Rajan S, Sethuraman M, Mukherjee PK 2002. Ethnobiology of the Nilgiri hills, India. *Phytother Res*, 16(2): 98-116.
- Rajith NP, Navas M, Thaha AM, Manju MJ, Anish N, Rajasekharan S, George V 2010. A study on traditional mother care plants of rural communities of South Kerala. *Indian J Traditional Knowl*, 9(1): 203-208.
- Rao DM, Rao Bhaskara, Gudivada S 2006. Ethno-medico-botanical studies from Rayalaseema region of southern Eastern Ghats, Andhra Pradesh, India. *Ethnobot Leaf*, 10: 198-207.
- Rashid A, Tariq SR, Chowdhury ZZ, Rashid SA, El Sherbini AM, Al-Fedaghi S 2013. Ethnomedicinal plants used in the traditional phytotherapy of chest diseases by the Gujjar-Bakerwal tribe of district Rajouri of Jammu and Kashmir state. *Int J Pharma Sci Res*, 4(1): 328-333.
- Rauf F, Qureshi R, Shaheen H 2012. Folk medicinal uses of indigenous plant species of Barroha, Bhara-Kahu and Maanga in Islamabad, Pakistan. *J Med Plant Res*, 6(11): 2061-2070.
- Revathi P, Parimelazhagan T 2010. Traditional knowledge on medicinal plants used by the Irula tribe of Hasanur hills, Erode district, Tamil Nadu, India. *Ethnobot Leaf*, 14: 136-160.
- Rokaya MB, Uprety Y, Poudel RC, Timsina B, Münzbergová Z, Asselin H, Tiwari A, Shrestha SS, Sigdel SR 2014. Traditional uses of medicinal plants in gastrointestinal disorders in Nepal. *Journal of Ethnopharmacology*, 158(Part A): 221-229.
- Sadale AN, Karadge BA 2013. Survey on ethnomedicinal plants of Ajara Tahsil, District Kolhapur, Maharashtra (India). *Trends in Life Sci*, 2(1): 21-25.
- Sahani S, Mall TP 2013. Ethnomedicinal plants from Bahraich (UP) India. *Indian J Sci*, 2(5): 112-120.
- Muraliteal SRS, Siddhardha SRS, Babu RD, Venketesh S, Basavaraju R, Rao NG 2017. Interaction of vasicine with calf thymus DNA: Molecular docking, spectroscopic and differential scanning calorimetric insights. *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 180: 217-223.
- Sarker AK, Ahamed K, Chowdhury JU, Begum J 2009. Characterization of an expectorant herbal basak tea prepared with *Adhatoda vasica* leaves. *Bangladesh J Sci Ind Res*, 44(2): 211-214.
- Sarmah R, Adhikari D, Mazumder M, Arunachalam A 2008. Traditional medicobotany of Chakma community residing in the Northwestern periphery of Namdapha National Park in Arunachal Pradesh. *Indian J Traditional Knowl*, 7: 587-593.
- Savithramma N, Sulochana CH, Rao KN 2007. Ethnobotanical survey of plants used to treat asthma in Andhra Pradesh, India. *J Ethnopharmacol*, 113(1): 54-61.
- Sen S, Chakraborty R, De B, Devanna N 2011. An ethnobotanical survey of medicinal plants used by ethnic people in West and South Districts of Tripura, India. *J Forestry Res*, 22(3): 417-426.
- Shadangi AK, Panda RP, Patra AK 2012. Ethnobotanical studies of wild flora at G. Udayagiri forest in Eastern Ghats, Odisha. *J Environ Sci Toxicol Food Tech*, 2(2): 25-37.
- Shah B, Sheth F, Parabia M 2011. Documenting Grandmas' prescriptions for skin ailments in Valsad district, Gujarat. *Indian J Traditional Knowl*, 10(2): 372-374.
- Shah GM, Ahmad M, Arshad M, Khan MA, Zafar M, Sultana S 2012. Ethnophyto-veterinary medicines in Northern Pakistan. *J Animal and Plant Sci*, 22(3): 791-797.
- Shanmugam S, Annadurai M, Rajendran K 2011. Ethnomedicinal plants used to cure diarrhea and dysentery in Pachalur hills of Dindigul district in Tamil Nadu, Southern India. *J Appl Pharma Sci*, 1(8): 94-97.
- Shende CB 2017. Ethnomedicinal study of Gadchiroli reserve forests Maharashtra. *Int J Appl Res*, 3(3): 100-102.
- Shiddamallayya N, Yasmeen A, Gopakumar K 2010. Hundred common forest medicinal plants of Karnataka in primary healthcare. *Indian J Traditional Knowl*, 9(1): 90-95.
- Singh PK, Kumar V, Tiwari RK, Sharma A, Rao CV, Singh RH 2010. Medico-ethnobotany of Chatara block of District Sonbhadra, Uttar Pradesh, India. *Adv Biol Res*, 4(1): 65-80.
- Singh RP, Padmavathi B, Rao AR 2000. Modulatory influence of *Adhatoda vasica* (*Justicia adhatoda*) leaf extract on the enzymes of xenobiotic metabolism, antioxidant status and lipid peroxidation in mice. *Mol Cell Biochem*, 213(1): 99-109.

- Singhal A, Khare RK, Yadav R 2017. Comparative study of some ethnomedicinal plants among the tribals of Datia and Sheopurkalan District (MP). *Int J Life Sci Scienti Res*, 3(1): 838-843.
- Sivaperumal R, Ramya S, Ravi AV, Rajasekaran C, Jayakumararaj R 2009. Herbal remedies practiced by Malayali's to treat skin diseases. *Environ Int J Sci Tech*, 4: 35-44.
- Raut S, Raut S, Sen SK, Satpathy S, Pattnaik D 2012. An ethnobotanical survey of medicinal plants in Semiliguda of Koraput District, Odisha, India. *Bot Res Int*, 5(4): 97-107.
- Sonowal R, Barua I 2011. Ethnomedical practices among the Tai-Khamyangs of Assam, India. *Ethnomed*, 5(1): 41-50.
- Srinivasarao D, Jayaraj IA, Jayraaj R, Prabha ML 2006. A study on antioxidant and anti-inflammatory activity of vasicine against lung damage in rats. *Indian J Allergy Asthma Immunol*, 20(1): 1-7.
- Sriithi K, Balslev H, Wangpakapattanawong P, Srisanga P, Trisonthi C 2009. Medicinal plant knowledge and its erosion among the Mien (Yao) in northern Thailand. *Journal of Ethnopharmacology*, 123(2): 335-342.
- Srivastava S, Samuel CO 2013. Herbal cures practised by rural populace in Varanasi region of Eastern UP (India). *IOSR J Pharma Biol Sci*, 6(1): 1-5.
- Subhashini S, Arunachalam KD 2011. Investigations on the phytochemical activities and wound healing properties of *Adhatoda vasica* leaves in Swiss albino mice. *African J Plant Sci*, 5(2): 133-145.
- Tuhin MIH, Asaduzzaman M, Islam E, Khatun Z, Rahmatullah M 2013. Medicinal plants used by folk medicinal herbalists in seven villages of Bhola District, Bangladesh. *American-Eurasian J Sustain Agriculture*, 7(3): 210-218.
- Uniyal SK, Awasthi A, Rawat GS 2002. Traditional and ethnobotanical uses of plants in Bhagirathi valley (Western Himalayas). *Indian J Traditional Knowl*, 1(1): 7-19.
- Upreti Y, Asselin H, Dhakal A, Julien N 2012. Traditional use of medicinal plants in the boreal forest of Canada: Review and perspectives. *J Ethnobiol Ethnomed*, 8(1): 1-14.
- Venkaiah M, Babu NC, Naidu MT 2010. Ethnomedicinal plants of Kotia hills of Vizianagaram District, Andhra Pradesh, India. *J Phytol*, 2(6): 76-82.
- Vijendra N, Kumar KP 2010. Traditional knowledge on ethnomedicinal uses prevailing in tribal pockets of Chhindwara and Betul districts, Madhya Pradesh, India. *African J Pharma Pharmacol*, 4(9): 662-670.
- Vinothapooshan G, Sundar K 2010. Wound healing effect of various extracts of *Adhatoda vasica*. *Int J Pharma and Biosci*, 1: 530-536.
- WHO 2002. *World Health Organization's Traditional Medicine Strategy 2002-2005*. Geneva: WHO.
- Yadav AK, Tangpu V 2008. Anticestodal activity of *Adhatoda vasica* extract against *Hymenolepis diminuta* infections in rats. *J Ethnopharmacol*, 119(2): 322-324.
- Yadav JP, Kumar S, Siwach P 2006. Folk medicine used in gynecological and other related problems by rural population of Haryana. *Indian J Trad Knowl*, 5(3): 323-326.

---

**Paper received for publication on May 2016**  
**Paper accepted for publication on January 2018**