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

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**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 aboriginals 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 knowledge (Hanazaki et al. 2013; Oliver 2013; Uprety 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...
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, \textit{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, Science 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 \textit{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 \textit{A. vasica}: Pulmonary diseases and fevers**

| Major ailment category | Preparation method | Description | Use reports |
|------------------------|--------------------|-------------|-------------|
| Pulmonary diseases and fevers | 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 \textit{A. vasica} with 15 leaves of \textit{Tylophora indica}, one handful of \textit{Albizia amera}, one or two leaves of \textit{Aloe barbadensis}, 10 seeds of \textit{Piper nigrum}, 1 \textit{Allium sativum}, 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 |
| Pulmonary diseases and fevers | Leaf decoction with honey thrice a day was given to treat cough. | | Naik et al. 2012 |
| Pulmonary diseases and fevers | Root bark decoction with honey was taken to for asthma. Roots and leaves with ginger were taken for cough and malaria. Decoction of the whole plant material was used in the treatment of fever, cough and cold | | Dulla and Jahan; 2017; Haq 2012; Kumari et al. 2013; Poonam and Singh 2009; Revathi and Parimelazhagan 2010 |
| | Decoction of the whole plant material was used in the treatment of fever, cough and cold | | Bhowmik et al. 2013; Goswami et al. 2013; Kaur and Kaur 2017; Mannaf et al. 2013 |
| | Five to eight leaves were boiled in 2 cups of water and the decoction was taken twice a day for cough and cold. 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. | | Shadangi et al. 2012; Sen et al. 2011; Shiddamallayya et al. 2010; Singh et al. 2010; Uniyal et al. 2002; 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; Vinodhaopoothan and Sundar 2010), immunomodulatory, anti-inflammatory, as well as antioxidant (Chakraborty and Brantner 2001; Hussain et al. 2010; Srinivasarao et al. 2006), antihelmintic, 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-

| 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 Lahmanghinglova 2010 |
| Raw roots and flowers | Flower extract | Raw roots and flowers were chewed empty stomach once a day to treat tuberculosis. Floral extract was mixed with Solanum surtense and given for treating asthma. | Goswami et al. 2013; Sahani and Mall 2013 |
| 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 Vityayakumar 2013 |
| Leaf and stem bark juice | Extract | Young leaf and bark juice was used for asthma and cough. Leaf and flower extracts ground with Hibiscus rosa-sinensis 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 1: 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 A. vasica, seeds of Trachyspermum ammi, seeds of Foeniculum vulgare, rhizome of Zingiber officinale and Terminalia belerica 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 Lalrammehinglova 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 (A. vasica 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, A. vasica with Terminalia arjuna bark and Helicteres isora 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-
people 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.

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| 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 Lalramghinglova 2010 |
| Diabetes | Boiled leaf extract | Leaves of A. vasica with the leaves of Clerodendrum indicum or C. siphananthus and/or with the leaves of Azadirachta indica and Zanthxylum acanthopodium was given by two tribal communities in Thoubalz district in Manipur, North East India against diabetes. | Khan and Yadava 2010; Mootoosamy and Mahomoodally 2014 |
| | Juice | Leaf juice of A. vasica and Andrographis paniculata 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 Solanum surattense were mixed and given for diabetes; flowers with neem leaf powder and gum of Acacia nilotica were administered to patients with diabetes. | Ahmad et al. 2004; Rauf et al. 2012 |
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. | Raji et al. 2010 |
| | Leaf extract | Leaf extract was taken for muscular spasms. | Sonowal and Barua 2011 |
| Gastric problem | Decoction | Leaf decoction was used as antispasmodic agent and for ear pain. | Hazrat et al. 2011 |
| | Warmed leaves | Leaves (8-10) were seasoned on fire and lanced over the joints and lumbar portions to get relief from pains and sprains. | Jamir et al. 1999 |
| Nausea | Leaf extract | Leaf extract was given to treat gastric problems. | Sonowal and Barua 2011 |
| | 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 | Young leaf and bark juice was given to treat patients with intestinal worms. | Rahman et al. 2010 |
| | Root extract | Young leaf and bark juice was given to treat patients with intestinal worms. | Rai and Larramghinglova 2010 |

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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; Venkaiyah 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 Basumatary et al. 2004; Bhatt and Negi 2006; Hussain and Hore 2007; Jamir and Takatemjen 2010; Rai and Lalramhinglova 2010; Sarmah et al. 2008 |
| | Leaf extract | Leaf extract was given as anti diarrhoeal and anti dysentery agent. | |
| | 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; Shannugam et al. 2011 |
| Jaundice and liver problems | Root and leaf extracts | Root and leaf extracts were used against jaundice. | Sadale and Karadge 2013; Rahim et al. 2012 Jamir and Takatemjen 2010 |
| | Leaf paste | Leaf paste was used against jaundice. | |
| | 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 |

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

| Major ailment category | Preparation method | Description | Use reports |
|------------------------|--------------------|-------------|-------------|
| Arthritis, rheumatism, Leaf extract inflammation, cuts and wounds | 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 Lalramnghinglova 2010; Singh et al. 2010 |
| Root extract | External application for rheumatism. One cup of leaf decoction made with Murraya koenigii, *A. vasica*, Azadirachata indica was given thrice a day for 7 days for rheumatism. | Hazrat et al. 2011 |
| Poul tide | Leaves were used as poultice to cover fresh wounds to heal the inflammatory swellings. | Shah et al. 2012 |
| Paste | Fresh leaf paste was applied to cure gout. | Hussain and Hore 2007 |
| Juice | Leaf juice was applied externally to cuts and wounds. | Rai and Lalramnghinglova 2010 |
| Extracts | Floral extract was mixed with mustard oil and applied to cure pimples. | Rauf et al. 2012 |
| Skin diseases | Decoction | Leaf decoction was used in treating skin diseases by old people in Gujrat. | Shah et al. 2011 |
| Paste | Leaf paste was 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 |
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| Major ailment category | Preparation method | Description | Use reports |
|------------------------|--------------------|-------------|-------------|
| Glandular tumours      | Leaf juice         | NA          | Shiddamallayya et al. 2010 |
|                        |                    |             | Masun et al. 2013 |
|                        |                    |             | Rai and Lalramninglova 2010 |
| Ophthalmic             | Extract            | Fresh flower extract was used for ophthalmia. Root extract was used as antiseptic. | Hazrat et al. 2011 |
| Anti septic            |                    |             | Alagesaaboopathi 2011 |
| Fits                   | Decoction          | Leaf decoction was used as an antiseptic lotion. Leaves of *A. vasica* with *Zingiber officinalis* and *Piper nigrum* and beetle leaf were made into juice and given in the treatment for epilepsy. | Harsha et al. 2005 |
| Paralysis              | Decoction          | A decoction was made out of *A. vasica* roots (50 g) with bark of *Oroxylum indicum* (100 g), bark of *Terminalia paniculata* (100 g), *Trachyspermum ammi* (10 g) and *Piper nigrum* (10 g) for paralysis in cattle. | |
| Thrombopoietic         | Paste              | Leaf paste was used for blood clotting. | Rajan et al. 2002 |
| agent                  |                    |             | Yadav et al. 2006 |
| Leucorrhoea and        | Juice              | Root bark juice with honey is given for leucorrhoea. | |
| gynaecological         | Decoction          | Decoction of 5-7 leaves with 1g of *Daucus carota* and *Raphanus sativus* seeds was administered for menstrual cycle regulation. | Hussain and Hore 2007 |
| problems               | Paste              | Root paste was applied on the abdomen and vagina during the time of labour pains in carrying mothers. | |
| Gonorrohhea            | 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. | Rao and Lalramninglova 2010 |

| Major ailment category | Preparation method | Description | Use reports |
|------------------------|--------------------|-------------|-------------|
| Poisonous bites        | Leaf paste and     | Leaf paste and leaf juice were applied externally and internally as an antidote for scorpion sting. | Rao et al. 2006 |
|                        | leaf juice         |             | Ayyanar and Ignacimuthu 2005 |

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

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