

## Nephrotoxic Herbal Medicines used in Sri Lanka

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### Abstract

Chronic Kidney Disease due to the unknown etiology (CKDu) has become a developing issue in North, North-central, Uva, and North-western provinces in Sri Lanka. The increased number of patients with CKDu is becoming a burden on the health sector as treatments, dialysis, and organ transplant are costly procedures. There are many myths to describe CKDu; however, the real causative factor is remaining unknown. Some researchers believe that Nephrotoxic herbal medicines containing Aristolochic Acid could be a factor for Nephrotoxicity incidences. Therefore, this study's primary objectives were to examine which species of Aristolochia plants exist in Sri Lanka, to list the species if any ingredients are of Aristalochia in traditional herbal remedies used in Sri Lanka and study the prescription pattern of medications containing Aristalochia. The data was collected by literature survey, field and ethnobotanical surveys, and focus group discussions. Results showed that few Ayurvedic practitioners use leaf, root, fruit, or plant parts of *Aristolochia indica* as a part of their remedies to treat more than twenty diseases and poison bites occasions. Also, nearly 66 prescriptions containing *Aristolochia indica* as an ingredient were found in the literature used by a few Ayurvedic practitioners in CKDu prevalence areas. Therefore, the research team concluded that nephrotoxic herbal medicines could be a reason for the current CKDu situations in Lanka. Further investigations should be conducted to see the influences of other factors such as contamination of foods and water with heavy metals and Agrochemicals.

**Keywords:** CKDu, Ayurvedic remedies, Nephrotoxic compounds, Aristolochic Acid

## 1. INTRODUCTION

At the beginning of the 21st century, a new form of chronic kidney disease of unknown etiology (CKDu) has emerged in several areas of Sri Lanka. The CKDu is not related to diabetes, hypertension, snake bite, or other known causes of traditional chronic kidney disease. The disease is characterized by a slow, progressive, asymptomatic development, frequently starting at a younger age group. There is a possible propensity for this disease to be more prevalent among people engaged in agriculture, typically around the age of 40-60 years.

Chronic Kidney Disease has been reported in many countries, including China, America, Belgium, Hong Kong, and Vietnam. In Sri Lanka, CKDu is most reported from the North Central Region (NCR) of the country, including North Central, part of North-Western, and part of Uva province. The total number of affected individuals is unknown; however, speculations suggest that nearly 6000 people are currently undergoing treatment. In 2005, Anuradhapura Teaching Hospital alone recorded 742 live discharges and 140 deaths due to CKDu. Also, a recently issued article on Lankadeepa newspaper on 25/04/2011, reported that about 57 persons died due to this kidney disease in Polpithigama, Nikawewa, and around 449 patients living in the same area in North-western province. Mortality due to genitourinary disorders was the leading cause of death in many districts, being the 11th leading cause of Mortality in the country. In 2005, about 350 million rupees (4.6% of the Annual Health Budget) were spent on managing patients with Renal Diseases.

A few studies have been carried out over the last eight years to investigate the prevalence, nature, and causes of CKDu in several parts of the country. According to the data reported in the Annual Health Bulletin 2005, the hospital mortality rate for diseases of the genitourinary system has doubled during the period 1980 to 2005. Several studies have also investigated the prevalence of this type of CKDu. However, there has been no concrete evidence to support a particular environmental nephrotoxin from the studies done so far. Presence of high levels of fluoride, the widespread use of agrochemicals such as pesticides and heavy metals in soil and water systems could be postulated as contributing factors to the high prevalence of CKDu in certain areas.

As demonstrated in some studies, Mycotoxins, use of herbal / Ayurvedic medicines, smoking, and snakebite history are other factors to consider. A combination of two or more of the above factors, possibly a synergistic effect, could also be responsible. But as the people have been using herbal medicines as *Aristolochia indica* (Sapsanda), which contain Aristolochic acid for their various treatments in those areas for a long time, many researchers believe that primary causative agents for CKDu could be such situations. According to literature, Aristolochic acid is a major nephrotoxic compound causes for many cancers, mutations, and kidney's failure. Also, there have been many reports about incidences of nephrotoxicity resulting from the ingestion of different herbal products from several countries. Hence the

identification of plants used in herbal remedies that have nephrotoxic effects in Sri Lanka is timely important. Therefore, the primary objectives of this research were to :

01. examine which species of *Aristolochia* are habitat in Sri Lanka, particularly in the CKDu high prevalence areas.
02. list the species, if any, is/ are ingredients of traditional/ herbal remedies used in Sri Lanka, mainly in the CKDu high prevalence area.
03. study the prescription pattern of such remedies by the indigenous medical practitioners.

## 2. METHODOLOGY

A literature survey was done by referring statistical reports of the Ministry of Health, Sri Lanka, books on medicinal plants, handbooks and manuals of Ayurveda prescriptions, journals, and many other related articles published by WHO and other institutions. Field and Ethnobotanical Surveys were conducted by field visits to medicinal plant gardens located in Bandaranayke Memorial Ayurveda Research Institute, Maharagama, and many places where *Aristolochia* species are available. The preserved samples were observed referring to herbariums available in the same institutes. Direct and indirect observations were taken from focus group discussions with the participation of Ayurveda doctors, botanists, and other related resource persons and by their publications. Ayurvedic prescriptions were collected from Sri Lankan ancient Olas (scripts/manuscripts), and this could be a rare publication in terms of publishing prescriptions.

## 3. RESULTS AND DISCUSSION

### 3.1. History and distribution of CKDu in Sri Lanka

CKDu mostly found in the North Central Region (NCR) of the country in which North Central, part of North-Western, and part of Uva provinces are included in Sri Lanka. The populations at risk are scattered in the North Central Region with high prevalence at Medawachchiya, Padaviya, Dehiattakandiya, Girandurukotte, Medirigiriya, and recently Nikawewa. Generally, there were increasing cases reported from Agricultural colonies.

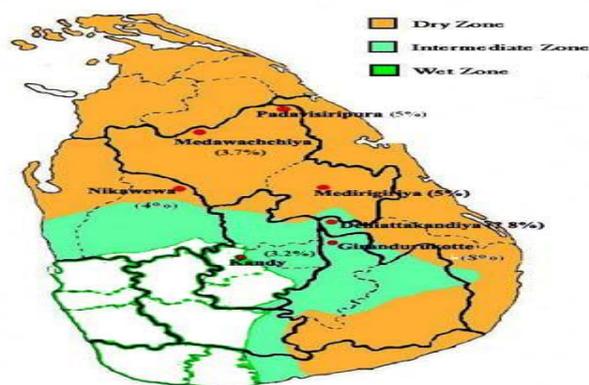
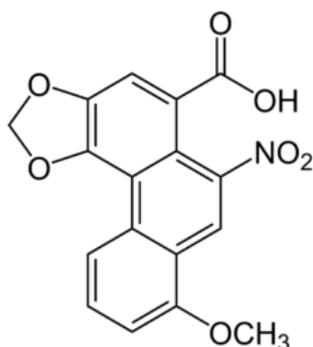


Fig.3.1. Map showing the CKDu affected areas in Sri Lanka. (Source-WHO publication)

### 3.2. Aristolochic Acid and its activity

Aristolochic acids are nitro phenanthrene carboxylic acid derivatives that are constituents of the Aristolochiaceae family (*Aristolochia* and *Asarum* sp). According to the International Agency for Research on Cancer, they are carcinogenic and nephrotoxic chemicals that make renal disorders. Aristolochic acid is a 1:1 mixture of two forms, Aristolochic acid I and Aristolochic acid II. In type II, the  $-OCH_3$  group is replaced with  $-H$ . Aristolochic acid is linked to an increase in urinary tract cancers. However, despite these well-documented dangers, Aristolochic acid still is present in herbal remedies (such as for weight loss), primarily because of the substitution of innocuous herbs with *Aristolochia* species



8-methoxy-6-nitrophenanthro [3, 4-*d*] [1, 3] dioxole-5-carboxylic acid ( $C_{17}H_{11}NO_7$ )  
Fig.3.2. Structure of Aristolochic acid (Danial, 2006)

### 3.3. Distribution and abundance of *Aristolochia* species

*Aristolochia* is a large plant genus, and more than 500 species have been identified. Collectively they are known as birthworts, pipevines, or Dutchman's pipe. They are widespread and occurred in the most diverse climates. Jaffna, Matale, and Hantana are the known natural habitats, but available in many conserved herbal gardens such as Bandaranayake Memorial Ayurvedha Research Institute, Girandurukotte, Bathgoda, Pallekelle, Faculty of Agriculture-University of Ruhuna, Botanical garden – Peradeniya, etc. in Sri Lanka.

Figures 3.4 to 3.14 shows some of the identified *Aristolochia* species. Among these *Aristolochia indica* (Sapsanda/Sassanda in Sinhalese ) is the common, occurring species in most parts of the country, including North-Central Province. It is the common species used in Ayurvedic Medicine. Also, *Aristolochia labiosa*, *Aristolochia littoralis*, *Aristolochia bracteolate*, and some other species are considered to occur. Still, further

investigation should be done to identify the correct species and their usage by Ayurvedic practitioners.

Other than these *Aristolochia* species, *Asarum* species (Wild Ginger) are considered to be contained Aristolochic acid, and no evidence was found to prove that they are being used in Sri Lanka.



Fig.3.3. *Asarum* (wild ginger)

#### 3.4. Botanical Description of *Aristolochia indica*

Scientific classification (Jayaweera DMA, 1982)

Kingdom:	-	Plantae
Order:	-	Piperales
Family:	-	Aristolochiaceae
Genu	-	<i>Aristolochia</i>
Species:	-	<i>indica</i>
Binomial Name	-	<i>Aristolochia indica</i>

*Aristolochia* is a genus of evergreen and deciduous woody vines and herbaceous perennial belonging to the *Aristolochiaceae* family, where the smooth stem is erect or somewhat twining. The simple leaves are alternate and cordate, membranous, growing on leaf stalks. There are no stipules. The flowers grow in the leaf axils. They are inflated and globose at the base, continuing as a long perianth tube, ending in a tongue-shaped, brightly colored lobe. There is no corolla. The calyx is one to three whorled, and three to six toothed. The sepals are united (gamosepalous). There are six to 40 stamens in one whorl. They are united with the style, forming a gynostemium. The ovary is inferior and is four to six locular. These flowers have a specialized pollination mechanism. The plants are aromatic, and their strong scent attracts insects. The inner part of the perianth tube is covered with hairs, acting as a fly-trap. These hairs then wither to release the fly, covered with pollen. The flowering season is

September to January and found in humid environments where the elevation is up to 3000 ft. (Ayurvedic Herbarium, BMARI)



Fig.3.4. *Aristalochia indica* (Sapsanda/Sassanda)



Fig.3.5. *Aristalochia littoralis*



Fig.3.6. *Aristalochia littoralis* flower



Fig.3.7 *Aristolochia lindneri*



Fig. 3.8. *Aristolochia macrophylla*



Fig.3.9. *Aristolochia pistolochia*



Fig.3.10. *Aristolochia maxima*



Fig.3.11. *Aristolochia pontica*



Fig.3.12. *Aristolochia sempervirens*



Fig.3.13. *Aristolochia arborea*



Fig.3.14. *Aristolochia eriantha*



Fig.3.15 *Aristolochia gibertii*



Fig.3.16. *Aristolochia bracteolata*

### 3.5. Historical background of usage of Aristolochia species.

*Aristolochia clematitis* is regarded as a medicinal plant since the ancient Egyptians, Greeks, and Romans time. It has been mentioned in Traditional Chinese Medicine as well. Virginia Snakeroot (*Aristolochia serpentaria*) is named because the root is used to treat snakebite. *Aristolochia pfeiferi*, *Aristolochia rugosa*, and *Aristolochia trilobata* are also used in folk medicine to cure snakebites. Aristolochic acid does appear to bind and deactivate the Phospholipase A2 of certain snake venoms (source: interviews with practitioners)

Others claim that a decoction of birthwort stimulates the production and increases the activity of leukocytes (white blood cells), or that pipevines contain a disinfectant which assists in wound healing. *Aristolochia bracteolata* is colloquially known as "Worm Killer" due to antihelminthic activity. *Aristolochia indica* is reported as a widely used plant in many Ayurveda medical remedies in Sri Lanka. (Source: Traditional Ayurvedha manuscript)

### 3.6. Studies on toxicity of Aristolochia species.

*Aristolochia clematitis* is most notable for containing toxic Aristolochic acid, sometimes in quantities fatal to humans. Due to the doctrine of signatures, "birthwort" has been used in childbirth. Some researchers have observed some treatments for women in labor help expel the placenta.

Epidemiological and laboratory studies have shown the toxicity of herbal remedies containing plant species of the genus *Aristolochia*. Herbal compounds containing *Aristolochia* are classified as a Group 1 carcinogen by the International Agency for Research on Cancer. In July 1999, two cases of nephropathy associated with Chinese herbal preparations were reported in the United Kingdom. Researchers have observed that those medications (Herbal preparations) contain Aristolochic acid. Biopsy samples also have shown an extensive loss of cortical tubules with interstitial fibrosis.

In 1993, a series of end-stage renal disease cases were reported from Belgium associated with a weight loss treatment. *Stephania tetrandra*, in some herbal preparation, was suspected of being substituted with *Aristolochia fangchi*. More than 105 patients have been identified with nephropathy following the ingestion of this preparation from the same clinic from 1990-1992. (WHO, 2008). Many of them have been reported to require renal transplantation or dialysis. Subsequent follow up of these patients had shown they are at an increased risk of urological cancers. Some other researchers say that contamination of grain with European Birthwort (*Aristolochia clematitis*) is a cause of Balkan nephropathy, a severe renal disease occurring in parts of southeastern Europe. (WHO, 2008)

### 3.7. Prescription patterns and incidence which Aristolochia species are used

It is a fact that *Aristolochia* species are frequently used as an ingredient in Ayurvedic treatments in Sri Lanka since those treatments were begun. Most preferable plant parts are whole plant, seeds, vines, roots, and leaves. Though many other species are also used, the most used species is *Aristolochia indica*, known as Sapsanda or Sasanda in Sinhalese.

According to table 3.1, 3.2, and 3.3 in Sri Lankan Ayurvedic medicine, there are more than 66 recipes that contain *Aristolochia indica* (Sapsanda/Sassanda) as an ingredient against more than 20 widespread disorders.

Also, Table 3.1 shows that the pre-prepared commonly using Ayurvedic remedies found in Ayurvedic pharmacopeia, which is considered as the Bible of Ayurveda. Table 3.2 shows the different pre-prepared treatments found in Traditional Manuscript of Olases, which come from ancient Ayurvedic practitioners (Vayidyacharya). Table 3.3 shows the miscellaneous mixed recipes containing *Aristolochia* (Sapsanda/Sasanda) as ingredients found in the same traditional Olases. Most of the time *Aristolochia* sp. is included in recipes to cure snake and other poison bites, diarrhea, fever, body pains, pains in eye, teeth, throat, and ear, post-delivery depression, delivery pains, indigestion, stomachache, headache like common diseases.

*Aristolochia ringens* (Guruluraja-Sinhala name) (Fig. 3.17) is another *Aristolochia* species found in few Sri Lankan Ayurvedic prescriptions. Also, there is a pre-prepared syrup called "Guruluraja Thailaya" in some handbooks to prove the usage of Guruluraja in Ayurvedic Medicine. But in most available Sri Lankan literature, the plant species known as Guruluraja (Fig. 3.14) is not believed to be *Aristolochia*. The synonyms for Guruluraja are 'Foxtail Orchid' and 'Batticaloa Orchid'. According to the Uva provincial council website, Guruluraja is identified as *Rhynchostylis retusa*, which belongs to the Orchidaceae family. Therefore, the research team concluded that further studies should be conducted to determine the Guruluraja plant.



Fig.3.17. Guruluraja(*Rhynchostylis retusa*) Flower found in Badulla area( Uva Province)



Fig.3.18. *Aristolochia ringens* (Sinhalese name yet to be identified for this species)

**Table 03.1 Pre-prepared (Ready to use) commonly used remedies**

No.	Source	Name of the remedy	Disorder/ Disease	Method of Application	Plant part
1	A. P. 1* page 152	Waalu Kasaya I	Delivery and Post Delivery Depression, Delivery stress, Fever, Headache, Neuritis, Thriving,	Internal (Drinking)	Root
2	A. P. 1* page 152	Waalu Kasaya II	Delivery and Post Delivery Depression, Delivery stress, Fever, Headache, Neuritis, Thriving,	Internal (Drinking)	Root
3	A. P. 1* page 152	Waasa Musthakadee Kwathaya I	Fever, Diarrhea, wheezing	Internal (Drinking)	Leaves
4	A. P. 1* page 181	Abin Guliya	Vomiting, Diarrhea, Indigestion, Worm infections	Internal (Eating)	Leaves and Roots
5	A. P. 1* page 274	Dasa waga Prameha Thailaya	Urinary Disorders, Wheezing, Constipation, Heart Diseases, Eczema, Filarial fever	Internal (Eating)	Roots
6	A. P. 1* page 276-277	Nawapatala Thailaya (Kesarasingha Nawapatala Thailaya)	Headache, Catarrh, Eye Diseases,	Internal and External	Leaves and Roots
7	A. P. 1* page 279	Neelaraja Thailaya	Rabies, Snake Bites, Scorpion Bites, Earth worm Bites, Rat Bites and other poison bites	Internal (Drinking)	Vine with Leaves
8	A. P. 1* page 289	Maha Waayuraksha Thailaya	Post Delivery Depression, Fit, Muscle pains	Internal (Drinking)	Roots
9	A. P. 1* page 290-291	Yama devaraja Thailaya	Fit, Thyroid Disorders, Tonsils, Respiratory tract infection and swelling, Tumors	Internal (Drinking and Inhalation)	Roots
10	A. P. 1* page 296	Vishagarrbha Thailaya	Muscle pains	Internal (Drinking)	Vine with Leaves
11	A. P. 1* page 300	Saththawaadee Thailaya	Mental disorders, Delivery Depression, Hiccup	Internal (Drinking and Inhalation)	Roots

\* AYURVEDA Pharmacopoeia, Volume 1, Part 1, Department of Ayurveda, Colombo, Sri Lanka.

**Table 03.2 Miscellaneous pre-prepared Remedies containing *Aristolochia indica* as an ingredient.**

No.	Source	Name of the remedy	Disorder/ Disease	Method of Application	Plant part
1	*Book No. 05, 29ii	Gandhakadee Rasaya	Indigestion, Diarrhea	External and Internal	Leaves and Roots
2	*Book No.05, 43ii	Kolaraja Kalkaya	Fever, Chest pains, Cold and cough, Wheezing	Internal (Drinking and eating)	Roots
3	*Book No. 616, page 4	Maha Jeevaanada Thailaya (Sannipatha Thailaya)	Fever and other acute situations	Internal (Drinking)	Leaves
4	*Book No. 616, page 2	Sarwalokeshwara chinthamani Thailama/ Yamadevaraja Thailaya	Stomachache, Pains in ear, Vomiting, Diarrhea, Stomach discomfort.	Internal (Drinking and inhalation) and External	Leaves
5	*Book No. 7,32 <sup>nd</sup> poem	Kudaamaalu Kasaya	Post delivery pains, Thirsty, Headache, Fever, Rabies	Internal (Drinking)	Roots
6	*Book No. 09, 43 <sup>rd</sup> poem	Udaranda Guliya	Tonsils, Body pains, Fever	Internal (Drinking and Eating)	Roots
7	*Book No.04, 31 <sup>st</sup> section	Kaalaraaja Guliya	Headache, Catarrh, Cold	Internal (Drinking and inhalation)	Roots
8	*Book No.04, 33 <sup>rd</sup> section	Grahanaaraayana Thailaya	Tonsils, Cold	Internal and External	Roots
9	*Book No.04, 45 <sup>th</sup> section	Grahana Maandam Guliya	Constipation, Fever, Milk vomiting,	Internal (Drinking and Eating)	Seeds
10	*Book No.11, paragraph 01	Vishnu Thailaya	Headache, Toothache, Lesions in tong .	Internal (inhalation)	Roots
11	*Book No.59	Mahayoga Churnnaya	Wheezing, Indigestion, Various body pains,	Internal (Drinking and Eating)	Roots
12	*Book No.134,	Yamadevaraaja Thailaya	Throat pains	Internal (Drinking)	Leaves
13	*Book No.140, Page 15	Chinthamanikya Thailaya	Fever, Swelling, Pains	Internal (Drinking)	Leaves
14	*Book No.196,	Anada Bahirawa Kayama	Fever, Cough, Stomachache, Stomach cancers, Malnutrition, Delivery pains	Internal (Drinking)	Roots and Leaves
15	*Book No.89	Sarwalokeshwara Chinthamanikya Thailaya	Diarrhea	Internal (Drinking)	Leaves
16	*Book No.86	Siyalu wishwaneelee Thailaya	Snake bites, Poison bites, Plant toxicities, Scorpion bites	Internal (Drinking)	Leaves

\*Book- Traditional manuscript of Olas coming from ancient Ayurveda Vaidyacharya (practitioners) which are available at the Library, BMARI. Navinna, Maharagama, Sri Lanka.

**Table 03.3 Miscellaneous Mixed Recipes containing *Aristolochia indica* as an ingredient.**

No.	Source	Name of the remedy	Disorder/ Disease	Method of Application	Plant part
1	*Book No. 05, 8ii	Mixed recipe	Diarrhea	Internal (Drinking)	Leaves
2	*Book No. 05, 18ii	Mixed recipe	All Fevers	Internal (Drinking)	Root
3	*Book No. 05, 20ii	Mixed recipe	All Fevers	Internal (Drinking)	Leaves
4	*Book No. 05, 31Ia	Mixed recipe	Severe Fever	Internal (Drinking)	Vine with Leaves
5	*Book No. 05, 31ib	Mixed recipe	Severe Fever	Internal (Drinking)	Vine with Leaves
6	*Book No. 05, 33ii	Mixed recipe	Severe Fever	Internal (Drinking) and External	Vine with Leaves
7	*Book No. 05, 36i	Mixed recipe	Pains in Throat and Ear	Internal (Drinking)	Fruit Juice
8	*Book No. 05, 37i	Mixed recipe	Snake Bites	Internal (Drinking) and External	Leaves
9	*Book No. 05, 38i	Mixed recipe	Toothache, pains in Eye and Ear, problems in vision and at their increased symptoms, Delivery Pains, Wheezing, Cold	Internal (Drinking)	Leaf Juice
10	*Book No. 05, 41i	Mixed recipe	Urinary problems	Internal (Drinking)	Roots
11	*Book No. 616, page 23(ii)	Mixed recipe	Pains in throat, ear and eye	Internal (Drinking and Eating) and External	Roots and Leaf Juice
12	*Book No. 605, 14 <sup>th</sup> poem	Mixed recipe	Severe Fever	Internal (Drinking)	Leaf Juice
13	*Book No. 09, 173 <sup>rd</sup> poem	Mixed recipe	Body pains, Stomachache and stomach discomfort	Internal (Drinking)	Roots
14	*Book No. 04, 19 <sup>th</sup> section	Mixed recipe	Tonsils, Cold, Catarrh	Internal (Drinking)	Roots
15	*Book No.614, page 05	Mixed recipe	Snake Bites	Internal (inhalation) and External	Roots and Leaves
16	*Book No.614, page 03	Mixed recipe	Snake Bites and other poison bites.	Internal (inhalation)	Roots
17	*Book No.614,	Mixed recipe	Snake Bites and other poison bites.	Internal (inhalation)	Roots

	page 02				
18	*Book No.46, page 05	Mixed recipe	Fever, Sleepy, Vomiting, Headache	Internal and External	Vine with Leaves
19	*Book No.87, Paragraph 01	Mixed recipe	Fever, Sleepy, Vomiting,	Internal (Drinking)	Roots
20	*Book No.85, Paragraph 01	Mixed recipe	Post delivery pains	Internal (Drinking)	Vine with Leaves
21	*Book No.126, Paragraph 01	Mixed recipe	Fever	Internal (Drinking)	Vine with Leaves
22	*Book No.130, Page 7	Mixed recipe	Post delivery depression	Internal (Drinking)	Leaves
23	*Book No.130, Page 7	Mixed recipe	Fever	Internal (Drinking)	Leaves
24	*Book No.212,	Mixed recipe	Body pains	Internal (Drinking)	Vines
25	*Book No.227,	Mixed recipe	Headache, Ear pains	Internal (Drinking) and External	Leaves
26	*Book No.228,	Mixed recipe	Lunatic situations, Fever, Cough, Child diseases	Internal (Drinking) and External	Leaves
27	*Book No.106	Mixed recipe	Fit, Eye pains,	Internal (Drinking)	Leaves
28	*Book No.614, Page 11	Mixed recipe (Paste)	To induce Delivery of blue babies (Dead baby)	External Applying	Vine with Leaves
29	*Book No.614, Page 16	Mixed recipe	All body pains	Internal (Drinking)	Leaves
30	*Book No.95, Page 95(3)	Mixed recipe	Post delivery pains, Fever, Headache, Sleeplessness, Rabies	Internal (Drinking)	Roots
31	*Book No.85	Mixed recipe	Poison bites	Internal (Inhalation/Drinking) and External	Roots
32	*Book No.03, page 14	Mixed recipe	Diarrhea, Fever	Internal (Drinking)	Leaves
33	*Book No.03, page 13	Mixed recipe	indigestion, Diarrhea	Internal (Drinking)	Leaves

34	*Book No.03, page 27	Mixed recipe	Diarrhea	Internal (Drinking)	Vine with Leaves
35	*Book No.03, page 21	Mixed recipe	Indigestion	Internal (Drinking)	Leaves
36	*Book No.03, page 19	Mixed recipe	Any Diarrhea conditions	Internal (Drinking)	Leaves
37	*Book No.03, page 550	Mixed recipe	Diarrhea	Internal (Drinking)	Roots
38	*Book No.03, page 675	Mixed recipe	Diarrhea	Internal (Drinking)	Leaves
39	*Book No.03, page 110	Mixed recipe	Diarrhea, Fever	Internal (Drinking)	Leaves

### 3.8. Other uses of Aristolochia species

Due to the spectacular flowers, several species are used as ornamental plants. Many species of Aristolochia are food for larvae of Lepidoptera, namely swallowtail butterflies. These become unpalatable to most predators by eating the plants.

### 3.9. The Work-Shop conducted in Ayurvedic General Hospital, Anuradhapura.

A workshop was conducted to collect information on the usage of Nephrotoxic herbal medicines by Ayurvedic practitioners in the north-central province. Only 10% of the sample accepted that they still use Aristolochia species in their remedies. This is mostly only for external uses as a formula (mixture) rather than using it as a single ingredient. 90% of the sample confirmed that they are not using Aristolochia species in their remedies at all. However, according to traditional prescriptions, there were many treatments that Aristolochia is an ingredient.

## 4. CONCLUSIONS

01.About 66 Ayurvedic prescriptions were found, which consist of Aristolochia(Sapsanda/Sasanda). They have been used for more than 20 common diseases in Sri Lankan Ayurvedic medicine. These prescriptions are available in some of the Ayurvedic practitioners in Sri Lanka, including north and north-central provinces.

02.Aristolochia species are commonly used in remedies to cure snake bites and other poison bites.

03. *Aristolochia indica* is the main species known as Sapsanda or Sasanda by Sri Lankan Ayurvedic practitioners.
04. Aristolochic Acid is known to contain nephrotoxic compounds that contribute to kidney diseases and renal failures.
05. Aristolochic Acid can be accumulated in the human body due to prolonged intake of *Aristolochia* plant parts as no purification methods are being practiced in Ayurvedic medicine. After that, subsequent renal failures may arise due to the increased accumulation of Aristolochic Acid in the human body.
06. Therefore, prolong Ayurvedic treatments could be an acceptable reason for present developing CKDu situations found in Sri Lanka, especially in North and North Central Province, where CKDu is of high prevalence.
07. However, even though many prescriptions containing *Aristolochia* species in Ayurvedic Books, only a few practitioners were using them today.
08. Therefore, the research team concluded that further research should be conducted to investigate the effect of Nephrotoxic Herbal medicines on the prevailing CKDU.
09. Further investigations should be continued to identify the influence of other factors like food and water contamination from heavy metals, Pesticides, and agrochemicals.
10. Further research should be conducted to collect more information on the usage of prescriptions containing *Aristolochia* species and identify the other species of *Aristolochia* used by Ayurvedic Practitioners in CKDu high prevalence areas.

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