Phytopharmacognostic Studies of *Ailanthus Excelsa* Roxb.

Dr Nidhi N Chauhan[1*], Mrs Parul Vasava[1], Dr Mohmmad Shoaib Patel[1], Mr Siddik Ughartdar[1]

[1]Department of Pharmacognosy, Laxminarayan Dev college of Pharmacy, Bholav, Bharuch, Gujarat, India.

ABSTRACT

A regular and widespread use of herbs throughout the world has increased serious concerns over their quality, safety and efficacy. *Ailanthus excelsa Roxb.* is a tree belonging to family Simaroubaceae, indigenous to Central and Southern India. Commonly it is known as a plant of Heaven. This study is important and lays down parameters for standardization and authentication of medicinal plants with the help of which adulteration and substitution can be prevented. All the parameters to be evaluated in pharmacognostic study such as organoleptic characters, macroscopic study, microscopic study, powder study, physico chemical analysis (moisture content, loss on drying, ash values, extractive values), phytochemical analysis, fluorescence analysis are enlisted along with their importance. This studies help for discovering new phytoconstituent that have been used for the treatment of number of diseases; many such treatments are useful even today as modern day medicine.

Keywords: Pharmacognostic, Organoleptic, Phytochemical, Fluorescence analysis.

INTRODUCTION

After decades of serious obsession with the modern medicinal system, people have started looking at the ancient healing systems like Ayurveda, Siddha and Unnani. This is because of the adverse effects associated with synthetic drugs. Herbal drugs play an important role in health care programs especially in developing countries. Ancient Indian literature incorporates a remarkably broad definition of medicinal plants and considers 'all 'plant parts to be potential sources of medicinal substances[1].

Indigenous to Central and Southern India. The plant found throughout Madhya Pradesh, in Bharuch and Panchmahal district in Gujarat, some coastal district in Andhra Pradesh, and Ganjam and Puri district in Orissa[2]. It grows well in semi-arid and semi-moist regions. It is suitable for planting in dry areas with annual rainfall of about 400 mm. It commonly found in mixed deciduous forests and some Sal forests, rare in moist areas with high monsoons relatively salt-tolerant species[3].

Indian Tree of Heaven - large deciduous tree,18-25 m tall, trunk straight, 2.5 m in diameter,

Bark: light grey and smooth, becoming grey-brown and rough on large trees, aromatic, slightly bitter.

Leaves: alternate, pinnately compound, large, 30-60 cm or more in length,leaflets 8-14 or more pairs, long stalked, ovate or broadly lance shaped from very unequal base, 6-10 cm long, 3-5 cm wide, often curved, long pointed, hairy gland, edges coarsely toothed and often lobed.

Flower: clusters droop at leaf bases, shorter than leaves, much branched; flowers many, mostly male and female on different trees, short stalked, greenish-yellow. Flower has five sepals, 5 narrow petals spreading 6 mm across, ovate to lanceolate, glabrous, filaments glabrous, about half as long as the anthers. Fruit present in flower. Fruit is 1-seeded samara, lance shaped, flat, pointed at ends, 5 cm long, 1 cm wide, copper red, strongly veined, twisted at the base. Flowering is in January-March[4-8].

Parts used: Leaves.

MATERIAL AND METHODS:

Identification and Collection

Fresh leaves were collected from fully grown flowering tree of *Ailanthus excelsa* Roxb. from New Vallabh Vidyanagar and its identification was confirmed by Dr. Geetha K. A., Senior Scientist, Directorate of Medicinal and Aromatic Plants Research, Boriavi, Anand, Gujarat. A voucher specimen of the plant (no. **BVJ/Ae-1/1/ARGH-09**) was deposited in the herbarium of the Department of Pharmacognosy, A R College of Pharmacy, V V Nagar, Gujarat.

Instrumentation and techniques:

Leaf specimens were cut into rectangular pieces that included the midrib and a portion of the lamina. For paradermal sections, specimens measuring 0.05 cm^2 were cut out from the midrib portion of the lamina. The leaf specimens were fixed and embedded in paraffin blocks[9], followed by dehydration, infiltration, and sectioning and finally staining and photographing of the sections[6].Photography was done by using a Nikon Labphot 2 microscopic unit. Descriptive features were matched with those included in standard anatomical books[10, 11]. Air-dried leaves were powdered using a homogenizer and the leaf powder was considered as drug. The leaf powder and the extracts of the powder in different solvents were examined under ordinary day light and in UV-light (254 nm). The fluorescence was determined according to the methods of Chase and Pratt[12]. The total ash, water-soluble ash, and acid-insoluble ash content was determined by employing standard methods of analysis as described[10] in the Indian Pharmacopoeia (1966). Quantitative determinations of the powdered drug like physicochemical constants[13], fluorescence[14], and were carried out.

Morphology Characteristic of leaves:

Ailanthus excelsa Roxb. have alternate, unequally pinnate phyllotaxy and have many leaflet on long petioles, lanceolate shape, irregularly toothed margin, size 25 cm long and 8 cm wide, soft and velvety texture, unequal base, greyish green color, faint odor and bitter taste.[(15-17)]

Figure 1: Twig of *Ailanthus excels*

Leaves of *Ailanthus excelsa*

Microscopical characteristics of the leaf:

Transverse sections through the midrib showed an upper and lower, single- layered epidermis that was externally covered with a thick, striated cuticle, a few epidermal cells on both lower and upper surfaces, parenchymatous cells that were thin-walled and isodiametric to circular. Intracellular spaces were present in ground tissue and composed of bicollateral and open vascular bundles. The xylem consisted mostly of vessels and tracheids, and a strip of cambium was present between the xylem and phloem tissues. pericyclic fibers were also present along with the phloem and parenchymatous zone.

The lamina which was dorsiventral with the mesophyll was seen to be differentiated into a palisade and spongy tissue. The upper and lower epidermises were covered externally with a thick, striated cuticle. Below the upper epidermis were three rows of elongated, closely arranged, palisade parenchyma. Spongy parenchyma tissues were almost radially elongated with intracellular spaces. Central cells were irregular in shape; pericyclic fibers and vascular bundles were also present scattered in this region; the details are shown in Figure 3.

Lamina of *Ailanthus excelsa* leaves shows Upper epidermis, lower epidermis, rosette crystals, Palisade cells, Granular trichomes, lignified covering trichrome [18-23].

Microscopy of leaves

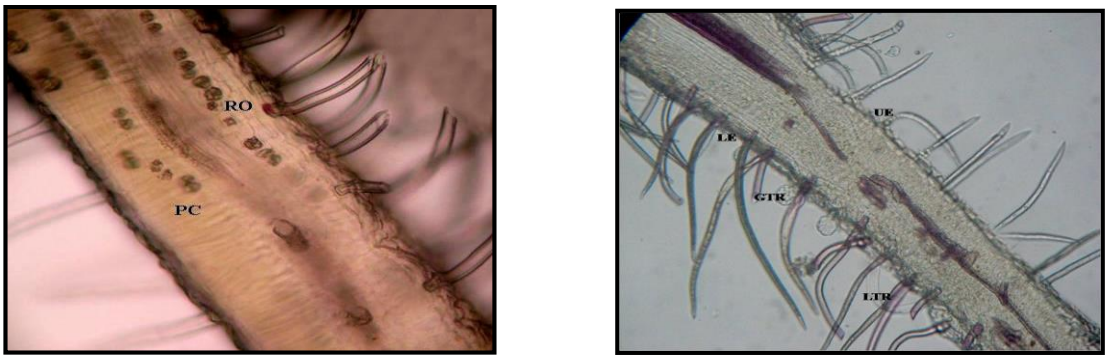


Figure 2: T.S. of lamina of *Ailanthus excelsa* leaves

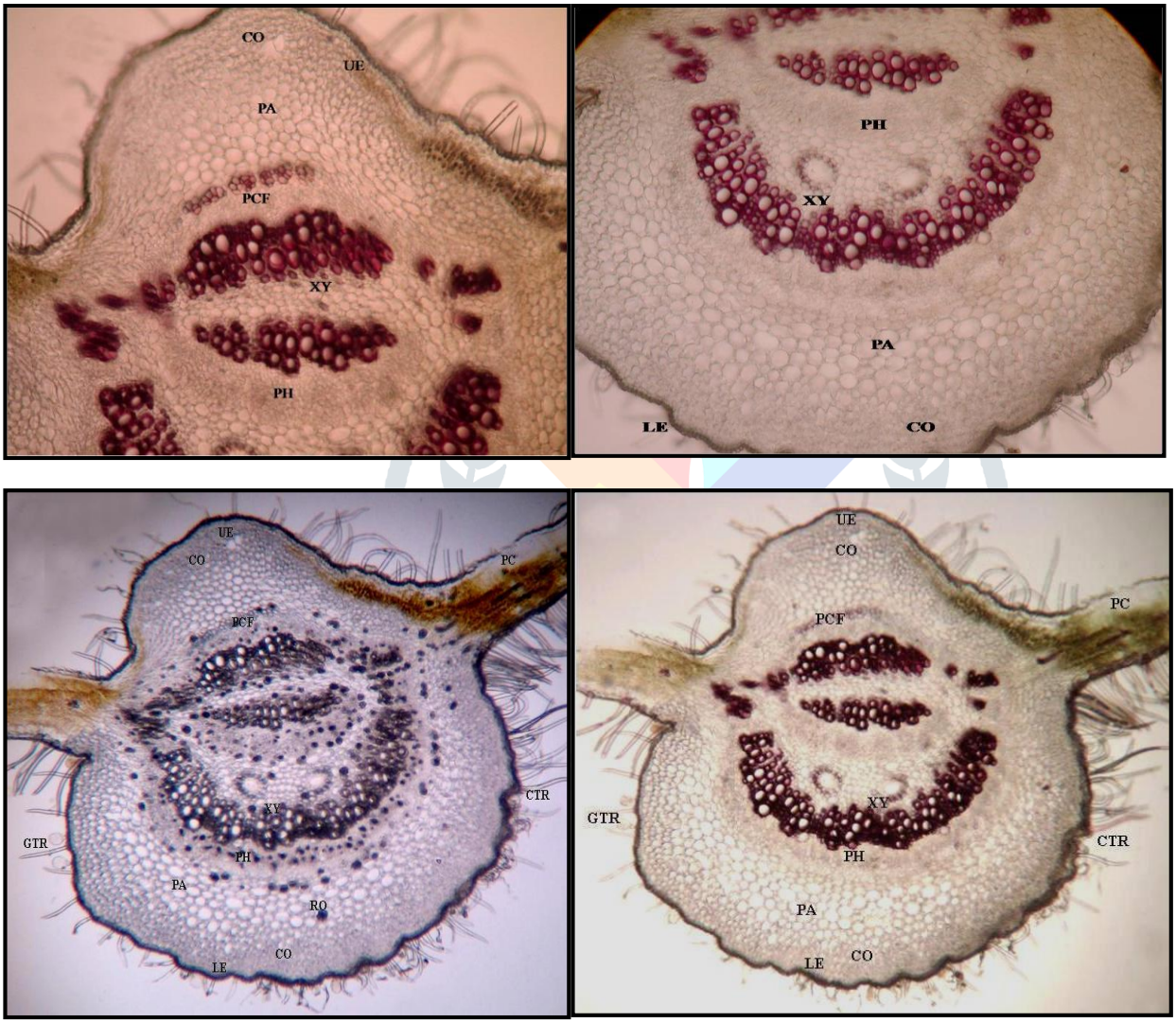
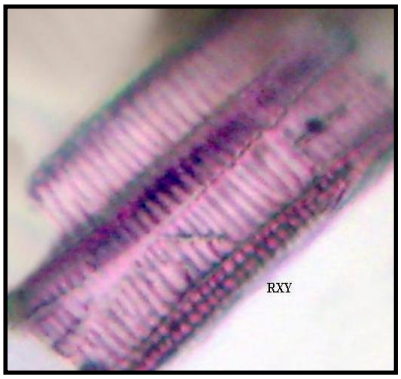
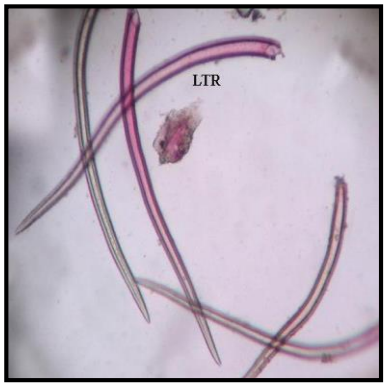


Figure 3: T.S. of *Ailanthus excelsa* leaves





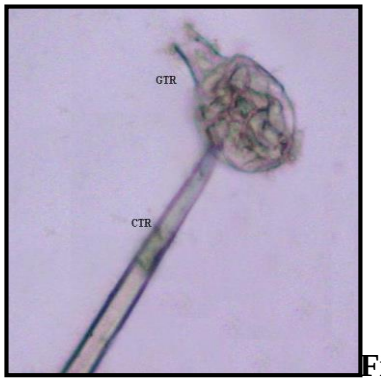
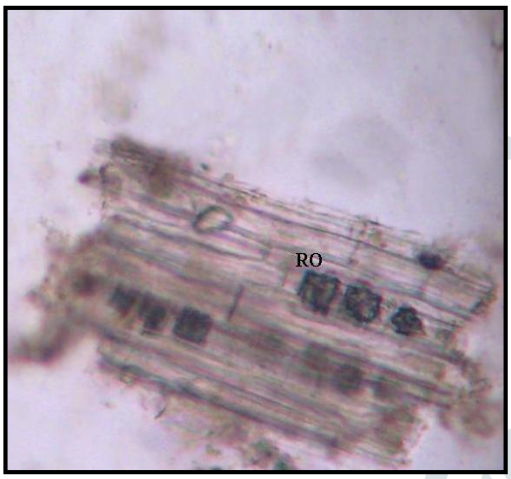
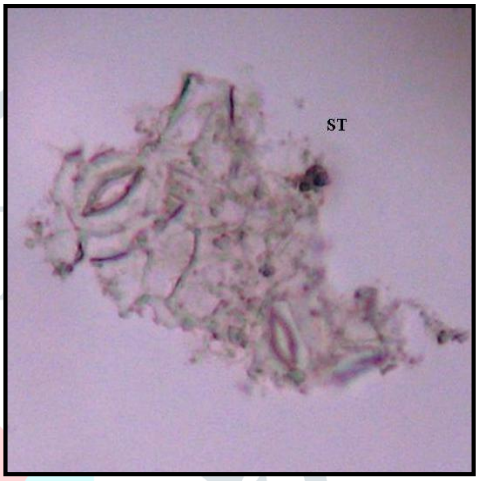


Figure 4:

Reticulate xylem **Lignified covering trichome** **Glandular trichome**





Rosettes **Anomocytic stomata**

RESULT:

The present study highlights the results of a comprehensive study on the microscopic parameters including the gross anatomical features, leaf constants, cellular composition, tissue organization, and cellular inclusion of the leaf. The lamina which was dorsiventral with the mesophyll was seen to be differentiated into a palisade and spongy tissue. The upper and lower epidermis was covered externally with a thick, striated cuticle. Below the upper epidermis were three rows of elongated, closely arranged, palisade parenchyma. Spongy parenchyma tissues were almost radially elongated with intracellular spaces. Central cells were irregular in shape; Palisade cells and vascular bundles were also present scattered in this region; the details are shown in Figure 2.

The results of the quantitative and qualitative analysis of the leaf samples are depicted in Tables 1–4.

QUANTITATIVE MICROSCOPY:

Table 1: Quantitative microscopy

No.	Determination	Value
1.	Somatal number : Upper epidermis Lower epidermis	33.33 311.11
2.	Stomatal index : Upper epidermis Lower epidermis	97.901 82.116
3.	Palisade ratio	6.62
4.	Vein-islet number	5
5.	Vein-termination number	32

FLOURESCENCE ANALYSIS:

The powder of leaves of *Ailanthus excelsa* under visible and UV lights (254 and 366 nm) were carried out. For tests, a sample of dry powdered drug was placed on a slide, treated with several drops of the specified reagent, and observed immediately under the UV lamp using UV cabinet. The color that develops must be observed within one minute because the color may change, due to evaporation of methanol[28].

Table 2: Fluorescence analysis

No.	Reagent	Day light	UV 254	UV 365
1	1M sodium hydroxide	Green	Yellowish green	Light brown
2	1% picric acid	Light green	Light green	Brown
3	Acetic acid	Pale green	Green	Pinkish brown
4	1M Hydrochloric acid	Yellowish green	Greenish brown	Brown
5	Dilute nitric acid	Yellowish green	Green	Brown
6	5% iodine	Green	Yellowish green	Brown
7	5% ferric chloride	Dark green	Black	Black
8	Methanol	Dark green	Dark green	Black
9	50% nitric acid	Brown	Green	Green
10	1M sulphuric acid	Dark brown	Light green	Light green
11	dil. Ammonia	Light green	Light green	Brown
12	10% potassium dichromate	Yellowish green	Yellowish green	Dark Brown
13	Sodium hydroxide in methanol	Light green	Yellowish green	Dark brown

PROXIMATE ANALYSIS:

Proximate analysis of the crude drug powder was carried out using reported methods by subjecting the seed powder to various determination as following[29, 30, 31] are moisture content and Total solids content, determination of Total Ash, determination of Acid Insoluble Ash, determination of Water Soluble Ash, determination of Alcohol Soluble Extractive, determination of Water Soluble Extractive.

Table 3: Proximate Analysis

No.	Standardization parameters	Percentage w/w
1.	Moisture content	6.82
2.	Total solids	93.18
3.	Total ash value	8.5
4.	Acid-insoluble ash value	2
5.	Water-soluble ash value	2
6.	Alcohol soluble extractive value	19.36
7.	Water soluble extractive value	40

ELEMENTAL ANALYSIS:

2gm of dried seeds were weighed and subjected to dry-ashing at 550° C then resultant ash dissolved in 5 ml of HNO_3:HCl:H_2O (1:2:3) and heated on hot plate until brown fumes disappeared. To remaining material add 5 ml of deionized water and heat until colourless. Mineral solution filtered through Whatman No 42 into volumetric flask and make volume with deionized water. Solution used for elemental analysis by inductively coupled plasma atomic emission spectrophotometer and concentration of each element was calculated as % of dry matter.

Table 3: Elemental Analysis

No.	Element	Wavelength	Instrument Detection Limit ppm (mg/l)	Sample Results ppm (mg/kg)
1.	Arsenic (As)	188.979	-	Not Detected
2.	Cadmium(Cd)	228.802	0.0027	Not Detected
3.	Lead (Pb)	220.353	0.0420	Not Detected
4.	Selenium (Se)	196.026	0.0750	Not Detected
5.	Zinc (Zn)	206.200	0.0059	29.822

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