

International Journal Research Publication Analysis

Page: 01-29

ETHNOMEDICINAL REMEDIES FOR LIVER HEALTH AND JAUNDICE

K. Vishnupriya*, B. Santhiya, M. Prabha

¹Department of Dialysis Technology, Vivekanandha Medical Care Hospital, Elayampalayam, Tiruchengode, Namakkal.

Article Received: 24 July 2026***Corresponding Author: K. Vishnupriya****Article Revised: 12 August 2026**

Department of Dialysis Technology, Vivekanandha Medical Care Hospital,

Published on: 02 September 2026

Elayampalayam, Tiruchengode, Namakkal.

DOI: <https://doi-doi.org/101555/ijrpa.1936>

ABSTRACT

Ethnomedicinal plants are medicinal plants used by the indigenous communities, tribes or local inhabitants for therapeutic purposes. They're part of traditional medicine passed down through generations, relaying on traditional knowledge and cultural practices rather than scientific methods. Jaundice is a prevalent symptom of liver dysfunction. It is one of the medical conditions related to liver dysfunction, hemolytic disorders, and biliary obstruction, where the skin and eyes turn yellow due to elevated levels of bilirubin in the blood. Ethnomedicinal plants have been being used for centuries to manage jaundice, offering a promising alternative or adjunct therapy even as conventional treatments are available. Traditional formulations typically combine multiple plant species or specific plant parts, enhancing efficacy and reducing bilirubin levels. From the bitter root of "Picrorhizakurroa" to the anti-oxidant rich leaves of "Phyllanthus amarus", these plants have been being used for centuries to soothe the liver. Notable species with reported therapeutic efficacy are *Tinospora Cordifolia*, *Phyllanthus niruri*, *Emblica officinalis*, *Terminalia chebula*, *Ricinus communis*, *Boerhaviadiffusa*, and *Justicaadhatoda*. Traditional preparations involved decoctions, leaf juices, powders, and combinations with ghee, honey, or milk, administered orally or topically for periods ranging from 5 to 14 days. A comprehensive analysis of existing literature reveals a diverse array of plants with hepatoprotective, antioxidant and anti-inflammatory properties, masking them significant in traditional system like Ayurveda, which may contribute their therapeutic efficacy. Ethnomedicinal plants can facilitate the development of cost-effective, accessible, and culturally acceptable therapeutic agents for treating jaundice. This review highlights the enduring relevance and therapeutic promise of ethnomedicinal plants in

managing jaundice and liver disorders. It explores plants traditionally used to treat jaundice, covering the plant organs used, methods of preparation, ethnomedicinal uses, and their bioactive compounds.

KEY WORDS: Indigenous communities, Jaundice, liver dysfunction, Hemolytic disorders, Bilirubin, Hepatoprotective, Antioxidant, Anti-inflammatory.

1. INTRODUCTION

Jaundice is not just a disease rather a sign of a disease that occurs in the liver, which indicates impairments of the liver functioning. [1] Jaundice is a one of the Chronic Disease characterized by yellowing of the skin, eyes (scleral icterus), and mucous membranes due to elevated level of bilirubin (>2.5 mg/dL or $43 \mu\text{mol/L}$) in the blood. It is otherwise known as Icterus or Hyperbilirubinemia. In a human body normal levels of bilirubin should be in between 0.3-1.2 mg/dl. When any person has the problem of jaundice then the bilirubin level can increase up to 2-2.5mg/dl.

The term “jaundice” originates from the Old French word jaunisse, derived from jaune, meaning “yellow,” directly reflecting the characteristic yellowing of the skin and eyes seen in individuals with the condition. Jaundice may occur either from increased production or reduced excretion of bilirubin due to several diseases and conditions that affect the liver, such as different types of hepatitis, liver cirrhosis, Gilbert syndrome, cholestasis, alcohol or drugs abuse, autoimmune disorders, hemolytic anemia and liver cancer, etc. [6,7,14].

The body regularly breaks down older red blood cells and replaces them with new ones. This breakdown process produces bilirubin. Normally, the liver processes this bilirubin and incorporates it into bile, which is a bitter, greenish-brown fluid that aids digestion, before releasing it into the digestive system. Jaundice occurs when the liver cannot process all the bilirubin the body produces or has difficulty releasing it. As a result, excess bilirubin accumulates in the blood and begins to leak into the tissues surrounding blood vessels. This leaked bilirubin causes the skin and eyes to turn yellow, which is the most common sign of jaundice.

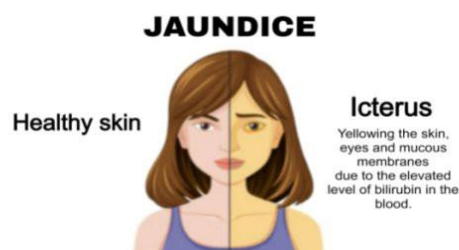


Fig.1.1 Jaundice.

2. BILIRUBIN

- Bilirubin is a by-product of the lysis of Red Blood Cells. It is a natural product synthesized in the body as a result of hemolysis. It is produced through the action of liver cells and in the presence of bilirubin reductase, leads to production of bilirubin or unconjugated bilirubin.
- Bilirubin is formed by the breakdown of heme present in hemoglobin, myoglobin, cytochromes, catalase, peroxidase, and tryptophan pyrrolase.
- 80% of daily bilirubin production [250 to 400 mg in adults] is derived from hemoglobin.
- The remaining 20 % is contributed by other hemoproteins and a rapidly turning-over small pool of free heme.
- Enhanced bilirubin formation is found in all conditions associated with increased red cell turnover, such as intramedullary or intravascular hemolysis.
- Examples include hemolytic, defective erythropoiesis, and megaloblastic anemias.

VOLUME OF BILIRUBIN	800 to 1200mililitres per day
REACTION	Alkaline
SPECIFIC GRAVITY	1.010 to 1.011
PH	8 to 8.6
COLOR	Golden, yellow or green

- There are 2 types of bilirubin measured in the blood.
 1. Direct (Conjugated) Bilirubin: It is Water-soluble bilirubin and processed by the liver. Elevated level of bilirubin indicates liver dysfunction or bile duct obstruction.
 2. Indirect (Unconjugated) Bilirubin: It is not water-soluble bilirubin and it indicates conditions, where the red blood cells are broken down too quickly, such as hemolytic anemia

2.1 Bile

Bile is a digestive fluid produced by the liver and stored in the gallbladder. It breaks down fats into absorbable fatty acids and also helps eliminate waste products from the body. It also

serves as an excretory route for metabolic waste. Bilirubin is simply one of the waste products present in bile.

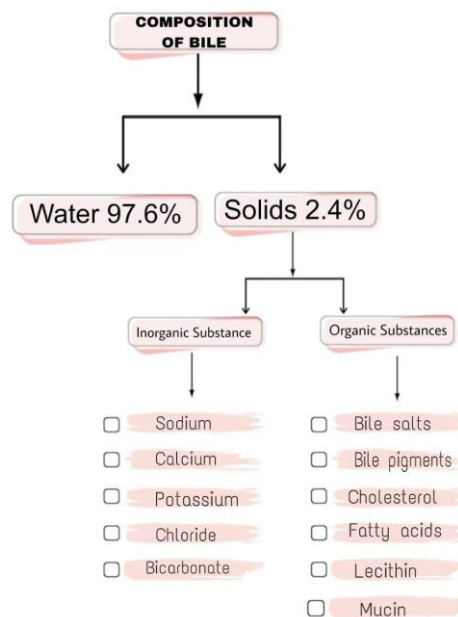


Fig.1.2 Composition of bile.

2.2 Functions of bile

- Bile contains the bile salts and it required to digest fats in the intestine. Emulsification is one of the process takes placed in the small intestine. Bile salts break down the large molecules into smaller fat molecules. This forms a milky fluid called as emulsion. The GI tract cannot digest the fat directly.
- Bile can helps to absorb the digested fat from the intestine into the blood. Bile salts create micelles, which are tiny clusters that enclose fat droplets in the small intestine. These clusters carry digested fats and fat-soluble vitamins to the intestinal wall for uptake.
- Laxative is an agent that helps in defecation. Here bile salt is acts as laxatives by stimulating the wave movement of the intestine.
- Bile inhibits the growth of certain bacteria in the intestine.
- Mucin in bile acts as a lubricant for food in the intestine during digestion.

3. CAUSES OF JAUNDICE:

- Excess production of bilirubin (Hemolytic anemia, Typhoid, Malaria)
- Reduction of hepatic uptake
- Impaired bilirubin conjugation
- Obstruction of gallstones in bile
- Genetic enzyme deficiency

- Viral and chemical induced liver damage
- Blood type incompatibility
- Food habituation
- Hepatitis
- Cirrhosis
- Drug-induced liver injury
- Genetic disorders
- Liver tumors
- Gallstones
- Pancreatitis
- Bile duct inflammation [1,2]

4. Table 1.1 Types of Jaundice

Types	Definition	Causes
Pre-Hepatic (HEMOLYTIC) Jaundice	It is caused by the conditions that increase the blood rate of hemolysis. This is the process through which red blood cells are broken down, converting haemoglobin into bilirubin. Because the liver can only process so much of bilirubin at once, bilirubin overflows into the body tissues and causing jaundice.	➤ Malaria ➤ Sickle cell anemia ➤ Spherocytosis ➤ Thalassemia
Hepatic (HEPATOCELLAR) Jaundice	Hepatic jaundice occurs when liver tissue is scarred (cirrhosis), damaged, or dysfunctional, impairing its ability to filter bilirubin from the blood. Bilirubin builds up to high levels in the blood because it can't be filtered into the digestive system for removal.	➤ Liver cirrhosis ➤ Viral hepatitis ➤ Primary biliary cirrhosis ➤ Alcoholic hepatitis
Post-Hepatic (OBSTRUCTIVE) Jaundice	It occurs when a blockage prevents bilirubin from being drained properly into the bile ducts or digestive tract. The bilirubin that is not excreted is conjugated by the liver, resulting in a conjugated hyperbilirubinemia.	➤ Gallstones ➤ Pancreatic cancer ➤ Bile duct cancer ➤ Pancreatitis
Neonatal Jaundice	It is a type of jaundice that happens to newborn babies. It typically occurs due to an immature liver that's unable to process bilirubin quickly enough. This leads to jaundice symptoms appearing a few days after birth, as the liver struggles to keep up with the breakdown of excess red blood cells. [1,2,4]	➤ Blood type incompatibility ➤ Hemolytic diseases ➤ Infection ➤ Liver disorder ➤ Hypoxia and polycythemia



Fig.1.3 Symptoms of Jaundice.

5. DIAGNOSIS

1. Physical Examination: Assessment of patient's general appearance including Skin and eye colour,

Abdominal Palpitation (tenderness, hepatomegaly, splenomegaly and any masses).

2. Blood Tests:

a. Serum Bilirubin: It is used to measure blood bilirubin levels, aiding doctors in evaluating liver function and detecting liver and bile duct diseases. The test typically includes total, conjugated and unconjugated bilirubin to identify the types of jaundice. Normal range of bilirubin varies based on the age, health conditions.

* Total bilirubin - 0.1 to 1.2 mg/dl

* Conjugated bilirubin - 0.0 to 0.3 mg/dl

* Unconjugated bilirubin - 0.2 to 0.8 mg/dl

b. Liver function Test: It assesses liver health by measuring enzymes and proteins, helping to identify

potential liver diseases.

c. Complete Blood Count: A CBC test assesses overall health and detects disorders like anemia, infection, and diseases causing jaundice. While bilirubin tests confirm jaundice, CBC helps determine the underlying cause, especially pre-hepatic jaundice (hemolytic anemia). Key indicators include:

I. RBCs: Low count, hemoglobin, or hematocrit may indicate hemolytic anemia (excess bilirubin release).

II. Reticulocyte Count: High levels suggest bone marrow compensation for RBC destruction.

III. WBCs: Elevated levels may indicate infection or liver damage.

IV. Platelets: Low count (thrombocytopenia) may indicate cirrhosis or liver congestion.

d. Viral Serologies: It detect hepatic jaundice-causing infections (Hepatitis A, B, C) by looking for blood antibodies or antigens, indicating liver damage or inflammation.

3. Imaging Tests

a. Ultrasound: Ultrasound is the preferred initial imaging test because it's cheap, reliable, noninvasive, and easy to access. It is minimally invasive imaging method evaluates liver and gallbladder pathology and detects steatosis, fibrosis, nodules, cholecystitis, and gallstone disease.

b. CT scan: This method is helps to visualize liver size, fatty deposits, tumors, or cirrhosis and is likely used when malignancy is suspected, offering detailed imaging over a larger area than ultrasound, though contrast nephrotoxicity and radiation exposure must be considered.

c. MRI: It can be used to assess diseases of the pancreaticobiliary ductal system.

4. Liver Biopsy: Liver biopsy is reserved for jaundice patients whose diagnosis remains unclear after history examination, blood and imaging tests. It should be performed only if biopsy results are required to guide prognosis and treatment.

5. Urine Analysis: Urinalysis in jaundice checks urine bilirubin and urobilinogen to assess hyperbilirubinemia, and it can also reveal glucose, protein, ketones, or blood that indicates liver disease or other health issues.

6. Stool Analysis: Stool analysis is crucial for jaundice differential diagnosis. Presence of urobilinogen in stool strongly indicates post-hepatic biliary obstruction because bilirubin hasn't reached the duodenum; absence of urobilinogen also suggests post-hepatic obstruction. Presence of stercobilin indicates bilirubin oxidation by intestinal bacteria, common in jaundice from liver diseases. Stool tests can reveal digestive disorders, infections, malabsorption, bleeding, or parasites, which are all potential causes of jaundice. [2]

6. COMPLICATIONS

- ✓ Cirrhosis
- ✓ Liver failure
- ✓ Kidney failure
- ✓ Severe Infections
- ✓ Bleeding Disorders
- ✓ Pruritus (Severe itching)

- ✓ Malnutrition and Vitamin Deficiency
- ✓ Gallstones
- ✓ Brain disorders

7. PATHOPHYSIOLOGY FOR JAUNDICE:

- As a red blood cell reaches the end of its 120-day lifespan or becomes damaged, its cell membrane weakens and becomes susceptible to rupture. As it circulates through the reticuloendothelial system, the fragile membrane of this old or damaged cell eventually ruptures, expelling the cell's contents into the bloodstream. Hemoglobin is one of the released cellular components, which is then ingested by phagocytic cells known as macrophages. Through phagocytosis, the hemoglobin is split into its constituent heme and globin portions.
- The globin portion is a protein that breaks down into amino acids and it plays number of roles in the pathogenesis of jaundice. The heme, on the other hand, undergoes an oxidation reaction catalyzed by the enzyme oxygenase, producing biliverdin, iron, and carbon monoxide. Biliverdin, is a green-colored pigment, then undergoes a reduction reaction to yield bilirubin, a yellow pigment. This reaction is catalyzed by the cytosolic enzyme biliverdin reductase.
- Approximately 4 mg of bilirubin per kg of body weight is produced daily, primarily from the breakdown of heme from expired red blood cells. The remainder comes from other heme sources, including failed red blood cell synthesis and the breakdown of heme-containing proteins like cytochromes and myoglobin.
- This insoluble bilirubin, referred to as “free,” “indirect,” or “unconjugated” bilirubin, it moves through the
- bloodstream bound to albumin and heads towards the liver. In the liver, bilirubin is conjugated with glucuronic acid to form bilirubin diglucuronide, or “conjugated” bilirubin, it is a water-soluble form of bilirubin that can be excreted. This conjugated bilirubin leaves the liver and enters into the biliary tree and cystic ducts as part of bile. In the intestine, bacteria convert bilirubin into urobilinogen, which is either converted to stercobilinogen and excreted in feces or reabsorbed by intestinal cells and transported via blood to the kidneys for excretion in urine.[3]

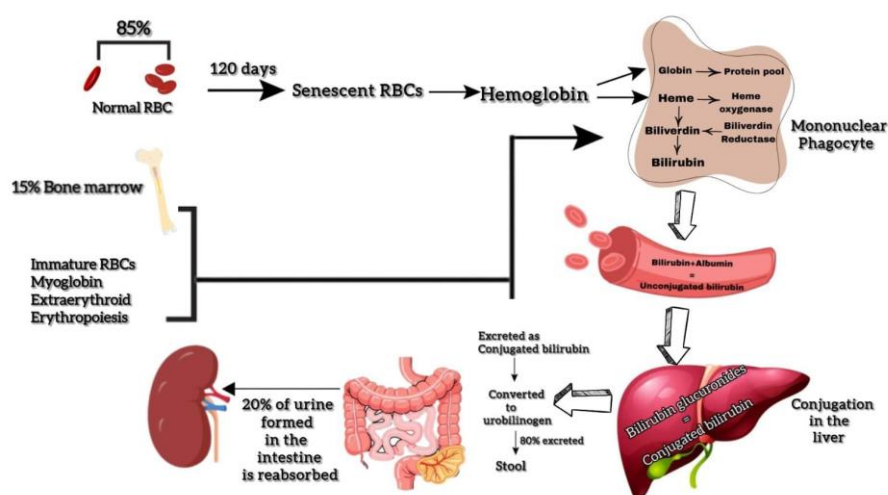


Figure.1.4 Pathophysiology for Jaundice.

8. ALLOPATHIC REMEDIES FOR JAUNDICE

1. Agents for Neonatal Jaundice/Unconjugated Hyperbilirubinemia

I. Phenobarbital: It is used to increase bilirubin conjugation and excretion by inducing hepatic enzymes.

II. Metalloporphyrine: It inhibits heme oxygenase, the rate-limiting enzyme in bilirubin production, thereby reducing bilirubin production.

III. Intravenous Immunoglobins (IVIG): It is used for immune-mediated hemolysis in newborns to reduce the breakdown of red blood cells and to manage bilirubin levels in isoimmune hemolytic disease.

2. Agents for Cholestatic/Obstructive Jaundice:

I. Cholestyramine: A bile acid sequestrant is used to relieve pruritus by enhancing biliary drainage.

II. Ursodeoxycholic acid (Ursodiol): It replaces toxic bile acids, increases bile flow in primary biliary cholangitis and pregnancy-related cholestasis, and also improves bile flow in cholestatic liver diseases.

III. Rifampin: It is used as a second-line treatment for pruritus (itching) when initial therapies are ineffective.

I. Bile acid sequestrants: Such as Cholestyramine bind to bile acids in the gut, reducing itching symptoms.

V. Opioid antagonists: Like Naltrexone and Naloxone are used to reduce severe pruritus by blocking endogenous opioid effects.

VI. Peroxisome proliferator-activated receptor (PPAR) agonists (e.g., Bezafibrate): Lowers bilirubin levels in cholestatic conditions.

3. Hepatoprotective and Antiviral Agents (Hepatocellular Damage):

I. Antiviral medications: It are used to manage hepatitis-induced jaundice, such as in Hepatitis B or C infections.

II. Corticosteroids: It are used to reduce inflammation in autoimmune hepatitis, severe acute hepatitis, and severe alcoholic hepatitis.

III. Immune suppressants: It is used to manage autoimmune-related liver diseases.

IV. Antihistamines: It provide symptomatic relief from pruritus associated with chronic liver disease.

V. Iron supplements: It are used to treat anemia-induced jaundice (hemolytic).

4. Anti-inflammatory and Immunosuppressive drugs:

I. Methylprednisolone: Used to reduce inflammation in autoimmune hepatitis and severe hepatitis.

9. AYURVEDIC REMEDIES FOR JAUNDICE:

9. 1. *Phyllanthus niruri* or *Phyllanthus amarus*:

Kingdom: Plantae

Family: Phyllanthaceae

Local Name: Bhumi Amla

Indian Regional Name: Keezhanelli

Genus: *Phyllanthus*

Species: *p. niruri*



Figure.1.5 *Phyllanthus amarus*.

Phyllanthus ninuri, commonly known as Bhumi Amla, Stone Breaker. It is a powerful medicinal herb, deeply rooted in traditional medicine across South American and Indian cultures. This plant is small in size, branched, erect shrub, grows 50–70 cm tall, with smooth, light green bark and ascending herbaceous branches. It bears pale green flowers often flushed with red and tiny, smooth capsules containing seeds. Its leaves resemble amla (gooseberry), measuring 8-12mm long and 3-5.5mm wide. *Phyllanthus ninuri* thrives in tropical and subtropical climates, typically found in regions with moist, sandy, or rocky soil. It is commonly spotted in areas like gardens, waterways, and disturbed spots, growing rapidly after monsoons.

Plant organs used: The whole plant of *Phyllanthus ninuri*, including leaves, roots, stem.

Table 1.2 Methods of Preparation.

METHODS	PREPARATION	DOSAGE
Paste	Collect the 100g of fresh <i>Phyllanthus ninuri</i> leaves or whole plants include roots wash and crush them into a fine paste. Mix two spoonsful of this paste with 50ml milk or buttermilk.	Take once or twice daily for 7-30 days.
Swarasa (juice)	Extract juice by crushing the fresh whole plant.	10-20 ml, three times a daily.
Decoctions (Boiled Water Extract)[12]	Boil a handful of fresh or dried whole plant in 2 litres of water until reduced to 1 litre. The water is strained and sometimes mixed with a little orange juice to mask the bitterness.	30-50 ml of the decoction, 2-3 times daily.

Ethnomedicinal Uses

- 1. Hepatoprotective action:** The plant contains bioactive compounds like phyllanthin and hypophyllanthin that helps to protect liver cells from damage caused by toxins, alcohol, and viruses due to lignans, flavonoids, and tannins.
- 2. Bilirubin Reduction:** It helps to lower the bilirubin levels and normalize liver enzymes (Alanine Aminotransferase and Aspartate Aminotransferase).
- 3. Viral Hepatitis Treatment:** It treats viral hepatitis by inhibiting hepatitis B replication via DNA Polymerase blockage.
- 4. Liver Stimulant:** It stimulates liver function, by increases bile secretion and aids digestion as a cholagogue.
- 5. Antioxidant Effects:** This herb is rich in antioxidant; it helps to combat oxidative stress in liver and the body. [18]

9.2. *Andrographis paniculata*

Kingdom: Plantae

Family: Acanthaceae

Local Name: Green chiretta

Indian Regional Name: Nilavembu or Kalmegh

Genus: *Andrographis*

Species: *A. paniculata*



Fig.1.6 *Andrographis paniculata*.

Andrographis paniculata, commonly known as Green Chiretta or the "king of bitters", is widely cultivated in Southern and South-eastern Asia for treating bacterial infections and diseases. This erect herb grows 30-110 cm tall in shady, moist spots. Its stem is slender, dark green, and square-shaped with furrows and wings. The lance-shaped leaves are up to 8cm long and 2.5cm wide. Small, pink flowers grow in racemes or panicles, while the fruit is a 2 cm long capsule with yellow-brown seeds. These seeds are subquadrate, rugose, and glabrous. Green Chiretta thrives in tropical and subtropical Asian regions with warm, humid climates and plenty of rainfall.[15]

Plant organs used: The whole plant of *Andrographis paniculata* including leaves, stem, roots and twigs.[10]

Table 1.3 Methods of Preparation.

METHODS	PREPARATION	DOSAGE
Decoction (Boiled Water Extract)[12]	Take 5 grams of dried <i>A. paniculata</i> powder or crushed leaves and boil in 500 ml of water.	Drink 50 ml of boiled water in morning and evening.
Infusion	Put 10-12 fresh leaves in a cup. Pour boiling water over, cover the cup, and let it steep for 10 minutes.	Drink 250 ml of water in 3-4 times a day.
Swarasa (juice)	Extract juice by crushing and straining fresh	2-3 teaspoons,

	leaves.	twice a day.
Paste	Mix 3-4 Kalmegh leaves with neem or turmeric, grind, and add with water or buttermilk.	Take twice daily for 10-15 days.
Tincture (concentrate liquid extract)	Add 50 gms of fresh leaves to a glass jar with 500 ml ethyl alcohol, seal tightly. Shake occasionally and let it sit for 2 weeks, then strain and store in a glass bottle.	8-10 drops, 3 times a day.

Ethnomedicinal Uses

- 1. Anti-inflammatory Effects:** Andrographolide reduces liver inflammation by inhibiting TNF- α , IL-1 β , and IL-6, pro-inflammatory cytokines that contribute to liver injury.
- 2. Antioxidant Activity:** It protects liver cells from oxidative stress and damage by boosting antioxidants like glutathione and superoxide dismutase.
- 3. Liver Enzyme Modulation:** Andrographolide restores normal liver enzyme levels in animal models when they're elevated due to toxin-induced liver damage.
- 4. Antiviral Potential:** The herbs have an antiviral property that may help to treat infectious hepatitis caused by viruses.
- 5. Liver Regeneration:** It promotes the regeneration of liver cells, reducing edema and normalizing the liver structure.
- 6. Fatty Liver Support:** It helps to reduce oxidative stress and lipid accumulation in the liver.[8,16,17]

9.3. *Silybum marianum*:

Kingdom: Plantae

Family: Asteraceae

Local Name: katiya (or)Bhat kataiya

Indian Regional Name:Pal Nerunjil

Genus: *Silybum*

Species:*Silybum marianum* (L.) Gaertn



Fig.1.7 *Silybum marianum*.

Silybum marianum is also known as Milk Thistle, is a spiny herb from the Asteraceae family. In the wild, it spends its first season in the vegetative stage post-germination, making it a biennial. When cultivated, it's usually an annual crop with cycle lengths varying by sowing time. Milk thistle grows upright, 30-200 cm tall, with a conical shape and a base diameter up to 160 cm. Its grooved stem may have a light cottony fuzz and is hollow in larger plants. Leaves are oblong-lanceolate, 15-60 cm long, typically pinnately lobed with spiny edges, hairless, and shiny green with milk-white veins. Flower heads are 4-12 cm long and wide, red-purple, blooming June-August (North) or December-February (South). They're surrounded by hairless bracts with triangular, spine-edged appendages tipped with a stout yellow spine. Fruits are black achenes with a simple white pappus, surrounded by a yellow basal ring. The long pappus helps disperse seeds via wind.[15]

Plant organs used: Seeds, fruits, leaves, root and stem.

Table 1.4 Methods of Preparation.

METHODS	PREPARATION	DOSAGE
Alcoholic Tinctures (concentrate liquid extract)	For extracting silymarin from seeds, alcohol is the most effective solvent. The process involves soaking the pericarp or husk of ground or whole seeds in a high-concentration ethanol solution (70-95%).	Typically, 3-6 mL of tincture is taken 3 times a day.
Standardized Extracts (capsules/tablets)	Silymarin extraction with methanol or acetone, the seeds typically undergo defatting using n-hexane.	A typical dosage for managing liver function and jaundice is 140-200 mg of standardized extract, taken 2-3 times a day.
Powdered Seed	The seeds are usually dried, ground, and mixed with other substances.	Typically, 12-15 g of crushed, fried seeds is taken with meals, 3 times a day.
Decoction (Boiled Water Extract)	Crush the seeds and prepare a decoction by boiling 3.0 g of seeds in cold water, bringing to a boil, and simmering for 20-30 minutes.	1 cup, 2-3 times a day.

Ethnomedicinal Uses

1. Hepatoprotection & Liver Regeneration: Silymarin works by strengthening liver cell membranes, blocking toxin penetration, and promoting tissue regeneration, which shields liver cells from damage and supports their repair.

2. Antioxidant Action: It can reduce oxidative stress on the liver by scavenging free radicals, which helps minimize jaundice-related inflammation.

3. Reduction of Bilirubin: It may lower bilirubin levels and shorten phototherapy duration in jaundiced infants.

4. Anti-inflammatory Effects: It can reduce the liver inflammation by blocking tumor necrosis factors of inflammatory effects.

5. Liver Tonic: Milk thistles are called as liver tonic, due to silymarin, a flavonoid combo (silybin, silydianin, silychristin) that shields liver cells, fights inflammation, and boosts regeneration. It's popular for tackling hepatitis, cirrhosis, and fatty liver.[19]

9.4. *Tinospora cordifolia*:

Kingdom: Plantae

Family: Menispermaceae

Local Name: Seendil Kodi

Indian Regional Name: Seendil Kodi

Genus: *Tinospora*

Species: *T. cordifolia*



Fig1.8 *Tinospora cordifolia*.

Tinospora cordifolia, also known as guduchi or amrita, is a large, deciduous, climbing vine native to South and Southeast Asia, commonly used in Ayurveda for various health issues. It's also known as heart-leaved moonseed. The vine has several elongated twining branches. Its leaves are simple, alternate, and exstipulate, with long, roundish petioles (up to 15 cm) that are pulvinate at both ends. The lamina is broadly ovate or heart-shaped, 10-20 cm long and 8-15 cm wide, with 7 nerves and a deep chordate base, feeling pubescent above and whitish-tomentose below. Unisexual, small flowers appear when the plant is leafless, greenish-yellow on axillary and terminal racemes. Male flowers are clustered, but female flowers are usually solitary, with six sepals in two series of three each and 6 tiny, obovate,

and membranous petals. Fruits come in clusters of 1-3, ovoid and smooth, with a thick stalk and scarlet or orange colour.[20]

Plant organs used: The whole plant of *Tinospora cordifolia* including stem, roots and leaves.[10]

Table 1.5 Methods of Preparation.

METHODS	PREPARATION	DOSAGE
Fresh Stem Juice	The stem is washed and crushed to extract the juice.	Use over several weeks
Aqueous Stem Decoction or Infusion[11]	Crush a fresh stem, soak it in water overnight, and drink it on an empty stomach in the morning.	Consumed on an empty stomach in the morning.
Stem Paste	Crush the fresh stem into a thick paste	Consumed on an empty stomach in the morning.
Guduchi Satva (Solid Extract)	Soak crushed fresh stem in water, filter, rest, and collect the sediment (Satva) to dry.	2-3 grams of dried Satva or 10-15 ml of stem juice, twice daily.

Ethnomedicinal Uses

1. Hepatoprotective Agent: It acts like protective shields for liver cells from damage, helping with hepatitis and jaundice treatment.

2. Detoxification: The stem is used to detox and boost liver function, pretty useful for overall health.

3. Appetite Stimulation: It tackles anorexia and gives energy a boost, especially helpful during jaundice

4. Modulation of Immune System: Its ability to boost the immune system is thought to aid in fighting infections that cause liver damage.

5. Bile Secretion and Digestion: The stems' bitter taste is thought to stimulate bile secretion, sparking appetite and aiding digestion.

6. Antioxidant Support: It boosts glutathione (GSH) levels, helping the liver detox and fight oxidative damage.[21]

9.5. *Boerhavia diffusa*:

Kingdom: Plantae

Family: Nyctaginaceae

Local Name: Mookkarattai

Indian Regional Name: Punarnava

Genus: *Boerhavia*

Species: *B. diffusa*



Fig.1.9 *Boerhavia diffusa*.

Boerhavia diffusa is a widespread, prostrate perennial herb from the Nyctaginaceae family is widely used in Ayurveda for its potent medicinal properties, particularly as a diuretic, hepatoprotective, and anti-inflammatory agent. This creeping herb has stout, fusiform roots and much-branched stems with purplish, thickened nodes. Its opposite leaves are oblique, ovate or suborbicular, rounded, entire, with slightly pinkish, wavy margins, and small white scales on the lower surface. Small, 5 mm diameter flowers with dark-pink, funnel-shaped perianths grow in umbels forming corymbose, axillary and terminal panicles. The flowers have 2-3 stamens, a superior ovary, and a single ovule. The fruit is a rounded, 6-ribbed achene containing a minute, albuminous seed with endosperm and a curved embryo. Pollens are round, roughly 65 microns in diameter.[23]

Plant organs used: The whole plant of *Boerhavia diffusa* including roots and leaves.[10]

Table 1.6 Methods of Preparation.

METHODS	PREPARATION	DOSAGE
Fresh Juice (Swarasa)	Crush the roots of <i>Boerhavia diffusa</i> using a mortar and pestle; strain the mixture to extract the fresh juice. 10 ml of root juice + 1/2 g <i>Psoralea corylifolia</i> (Bakuchi) seed powder.	Twice daily.
Decoction (Boiled Water Extract)	Crush 10-15 g of fresh roots and boil in 500 ml water until reduced to 100 ml.	50 ml decoction, morning and evening.
Powdered Mixture	Dry and crush roots into a fine powder.	5 g powder with sugarcane juice or coconut water, twice daily on empty stomach for 3 days.

Ethnomedicinal Uses

1. Liver Detoxification & Regeneration: It serves as a liver tonic, helping with detox and stimulating bile secretion, making bilirubin processing more efficient. Plus, it helps to regenerate liver cells.

2. Enzyme Regulation: It helps lower high liver enzyme levels like ALT, AST, and ALP, which are typically high during jaundice.

3. Diuretic Action: It is a natural diuretic, it property helps to flush out the toxins and excess fluids (edema) often associated with liver congestion and ascites.

4. Antiviral & Antioxidant action: It contains phytochemicals like flavonoids and rotenoids that protect the liver from oxidative stress. It may inhibit hepatitis viruses.[24]

9.6. *Cichorium intybus*:

Kingdom: Plantae

Family: Asteraceae

Local Name: Chicory

Indian Regional Name: Kasini

Genus: *Cichorium*

Species: *C. intybus*



Fig1.10 Cichorium intybus.

Cichorium intybus, it also known as blue daisy, blue dandelion, blue sailors, blue weed, and wild endive, is a perennial herbaceous plant of the Asteraceae family, usually with bright blue flowers, rarely white or pink. It's a biennial or perennial herb growing up to 1-1.5 meters tall with a tough, grooved, and sometimes hairy stem, having a deep, fleshy taproot (up to 75 cm) and a basal rosette of leaves. The root is a thick, long, white-fleshed, and brown-skinned taproot. The stem is erect, stiff, and branching, 30-150 cm tall, with grooved surfaces and hairy or glabrescent texture. The basal leaves form a rosette, are 7-30 cm long, runcinate-pinnatifid with a toothed margin, and are hispid. The cauline leaves are smaller, sessile, and lanceolate-shaped, clasping the stem. The flower heads are 2-4 cm in diameter, consisting only of ligulate florets, primarily light blue, sometimes pink or white, with dark blue anthers. The fruit is a small, 1.5-3 mm long achene, angled and brown to black when ripe, with a very short, scale-like, persistent pappus measuring less than 0.5 mm.

Plant organs used: The whole plant of *Cichorium intybus* including roots, seeds and leaves.

Table 1.7 Methods of Preparation.

METHODS	PREPARATION	DOSAGE
Syrup Preparation (Seed-Based)	Boil 100g chicory seed powder in 1 liter water for 6-10 minutes, filter, and concentrate with 50% sucrose syrup.	10 cc for three times a day.
Decoction (Boiled Water Extract)	Boil 100g root powder in 300 ml water for 5-10 minutes, simmer, then strain.	2-3 times daily.
Infusion (Tea)	Steep leaves or flowers in hot water to make a tea.	1-2 cups daily.
Fresh Juice	Crush fresh plant material to extract juice, mix with sugar if needed.	1 cup, twice a day for two weeks.

Ethnomedicinal Uses

1. Hepatoprotective Action: Chicory is a potent liver tonic, shielding the liver from damage, reducing congestion, and aiding in cirrhosis cases.

2. Bilirubin Reduction: It boosts bile production and flow, helping eliminate bilirubin through its cholagogue effect.

3. Detoxification: Chicory is used to purifies blood, removes toxins, and cleanses the liver and gallbladder

4. Antioxidant Properties: Cichorium intybus extract shows strong antioxidant (DPPH scavenging) and anti-inflammatory properties, helping reduce oxidative stress in liver tissue

5. Neonatal Jaundice Management: The whole plant or roots are used as a decoction, show chicory extract can lower bilirubin levels during maternal consumption.

6. Laxative Effect: It has mild laxative properties that facilitate the elimination of waste.[22]

9.7. *Terminalia chebula*

Kingdom: Plantae

Family: Combretaceae

Local Name: Harar

Indian Regional Name: Kadukkai

Genus: *Terminalia*

Species: *T. chebula*



Fig1.11 *Terminalia chebula*.

Terminalia chebula is commonly known as black- or chebulic myrobalan, is a medium to large deciduous tree growing up to 30 m tall with a trunk diameter of 1 m. The bark is dark brown to blackish-brown with deep longitudinal fissures, peeling off in thick, irregular woody scales. The leaves are simple, opposite or sub-opposite, ovate to elliptic, 10-25 cm long and 4-13 cm wide, with a yellowish-brown pubescent coating when young. The flowers are yellowish-white, bisexual, 5-6 mm across, in terminal or axillary spikes with a strong, unpleasant smell. The fruit is an ellipsoid or obovoid drupe, 2-4.5 cm long, changing from yellowish-green to orange-brown or blackish, with 5 ridges when dry. The seed is single, bony, hard, and pale yellow within the woody pericarp. The roots are a deep, strong taproot system.[15,25]

Plant organs used: Fruit/Pericarp.

Table 1.8 Methods of Preparation.

METHODS	PREPARATION	DOSAGE
Powder and Paste Preparations	Mix <i>T. chebula</i> fruit powder with honey or jaggery. Alternatively, mix with iron-ash and turmeric, or grind fruit to make a paste with water, or mix with cow urine.	1-2g powder with honey/jaggery, twice a day; or as a compound powder with honey/ghee; or semi-ripened fruit with lukewarm cow urine in morning.
Decoction (Boiled Water Extract)	Boil 10g raw/pounded/powdered fruit in 100-200ml water, reduce until a portion of water remains, strain.	Consume the decoction
Soaked Method	Soak 2-3 semi-ripen fruits in water.	Consume water or fruit early in the morning.

Ethnomedicinal Uses

1. Hepatoprotection: The fruit extract lowers liver enzymes (AST, ALT, LDH) and reduces damage from toxins or medication.

2. Anti-inflammatory: It reduces inflammatory cytokines like TNF- α , IL-1 β , and IL-6, helping the liver recovery.

3. Bilirubin Reduction: Traditionally, the fruit is used to clear "Ama" (toxins) and boost bile flow, lowering bilirubin levels that cause jaundice.

4. Liver Tonic: It helps to boost digestion and metabolism, indirectly aiding to the liver recovery.[26]

9.8. *Berberis aristata*:

Kingdom: Plantae

Family: Berberidaceae

Local Name: Daruhaldi

Indian Regional Name: Tree Turmeric or Indian Barberry

Genus: *Berberis*

Species: *B. aristata*



Fig.1.12 *Berberis aristata*.

Berberis aristata, it is also known as Indian barberry or mara manjal, is an erect spiny shrub 3.5-4.5m tall. The bark is yellow to brown outside and deep yellow inside. The stem is sub-cylindrical or sub angled, pale brownish-yellow to light brown with deeply furrowed and rough bark. The leaves are simple, 3-6 per node, 4-8cm long, elliptic with serrate margins and small spinules, leathery, dark green and glossy above, and pale beneath. The inflorescence is yellow, hermaphroditic flowers in 5-25 drooping clusters, blooming from March to May. The flowers are greenish-yellow, around 10-14mm across with 6 sepals and 6 petals. The fruit is succulent berries, ovoid in shape, 7-10mm long, blue-black with white bloom or bright red when mature. The bark of the root is deep yellow.[27]

Plant organs used: Roots stem and bark.

Table 1.9 Methods of Preparation.

METHODS	PREPARATION	DOSAGE
Decoction (Boiled Water Extract)	Boil 10-15g root bark in 200-300ml water, reduce to 50-100ml.	Consume twice daily.
Rasaut (Extract)	Boil roots and lower stem bark in water, evaporate liquid under low heat for 5-6 hours to form a semi-solid material. It can be further purified (Rasaut Mudabbar).	Not specified.
Powder	Dry and grind root bark into a powder.	3-5g daily with warm water or honey.
Fresh Juice	Extract juice from the root.	Used directly to treat jaundice.

Ethnomedicinal Uses

- 1. Hepatoprotective and Hepatostimulative:** It protects liver hepatocytes from damage and stimulates better liver function.
- 2. Anti-inflammatory:** It reduces inflammation of the liver and gall bladder.
- 3. Blood Purifier:** It helps in removing toxins (AMA) from the blood, aiding in the recovery from jaundice and associated skin issues.
- 4. Bile Secretion:** It acts as a choleagogue, stimulating the secretion of bile, which helps the liver process and eliminate toxins more efficiently.
- 5. Bilirubin Regulation:** It may increase the excretion of conjugated bilirubin and help lower elevated serum enzyme levels associated with liver stress.

9.9. *Eclipta alba***Kingdom:** Plantae**Family:** Asteraceae**Local Name:** False Daisy / Bhringraj**Indian Regional Name:** Karisalankani**Genus:** *Eclipta*

Species: *E. alba*



Fig.1.13 *Eclipta alba*.

Eclipta alba is also known as False Daisy. It is an annual spreading herb typically 30-60cm tall, commonly found in moist places, preferably in warm climates. It's a prominent Ayurvedic herb frequently called the "King of Hair", able to grow in a variety of soils. The stem is cylindrical or flat, rough, hairy, sometimes reddish-brown, and roots at nodes. The leaves are opposite, sessile to sub-sessile, oblong-lanceolate (2-10cm long and 0.5-2cm wide) with slightly toothed or entire margin and appressed hairs on both surfaces. The flowers are small, solitary or paired, white daisy-like, 6-8mm in diameter, found on short stalks in leaf axils with white ray florets and tubular disc florets. The fruits are achenial cypsela, 1-seeded, wedge-shaped, about 0.1-0.2 inches long, brown, with a narrow wing. The roots are a well-developed taproot, often white or yellowish-grey.[28]

Plant organs used: Whole Plants including leaves and roots.

Table 1.10 Methods of Preparation.

METHODS	PREPARATION	DOSAGE
Fresh Leaf Juice	Clean, wash, and crush fresh <i>Eclipta alba</i> leaves/whole plant to extract juice.	10-15ml juice on empty stomach early morning for 7-12 days.
Leaf Juice with Goat Milk	Grind yellow <i>Eclipta prostrata</i> leaves to extract juice and mix with goat milk.	Consume on empty stomach in morning until recovery.

Ethnomedicinal Uses

- 1. Liver Enzyme Regulation:** It can significantly lower elevated levels of serum bilirubin and liver enzymes such as ALT, AST, and ALP.
- 2. Antimicrobial Action:** Jaundice is caused by infections like *Leptospira interrogans*, specific phytochemicals in the plant (pentadecane, heptadecane) may deactivate enzymes essential to the pathogen's lifecycle.
- 3. Detoxification:** It is considered a "blood purifier" that stimulates liver metabolism and promotes the flow of bile (cholagogue effect).

4. Hepatoprotective Action: The plant, particularly its leaves, contains compounds like wedelolactone and eclalbasaponins that help protect and regenerate liver cells.

5. Reduces Bilirubin: It is effective in reducing serum bilirubin levels in patients, making it useful for managing jaundice symptoms like yellowing of skin and eyes.

9.10. *Ricinus communis*:

Kingdom: Plantae

Family: Euphorbiaceae

Local Name: Castor oil plant or Castor bean

Indian Regional Name: Amanakku, Kottaimuthu,

Genus: *Ricinus*

Species: *communis*



Fig.1.14 *Ricinus communis*.

Ricinus communis, the growth habit and appearance of *Ricinus communis* can vary greatly, with breeder's further increasing variability through selection of cultivars for leaf and flower colours, and oil production. It is a fast-growing, suckering shrub that can grow up to 12 metres (39 feet) tall, resembling a small tree, but isn't cold hardy. Leaves are glossy, 15-45 cm long, alternate, palmate with 5-12 deep lobes and coarsely toothed segments, on long stalks. Young leaves are often dark reddish-purple or bronze, maturing to dark green, sometimes with a reddish tinge. Other varieties have green leaves practically from the start, while in others, a pigment masks the green colour in chlorophyll-bearing parts - leaves, stems, and young fruit remain dramatic purple-to-reddish-brown throughout the plant's life. Dark-leaved plants often grow alongside green-leaved ones, suggesting a single gene likely controls pigment production in some varieties. The stems and the spherical, spiny seed capsules also vary in pigmentation. The fruit capsules of some varieties are showier than the flowers. Flowers: Small, unisexual, with no petals. Calyx splits into 3-5 segments. The fruit is

a spiny, greenish (or reddish-purple) capsule with large, oval, shiny, bean-like seeds that are highly poisonous and have variable brownish mottling. Castor seeds have a warty appendage, the caruncle (a type of elaiosome), which promotes seed dispersal by ants (myrmecochory).[29]

Plant organs used: Leaves and root.[10]

Table 1.12 Methods of Preparation.

METHODS	PREPARATION	DOSAGE
Tender Leaf Paste with Milk/Water	Wash and grind coppery-red tender castor leave into a fine paste.	Take on empty stomach early morning to reduce bile.
Fresh Juice with Salt	Crush 50g tender castor leaves to extract juice, mix with 5g common salt.	20ml mixture once daily.
Juice with Herbs and Jaggery	Crush leaves to make a paste, combine with other herbal ingredients like rice husk and jaggery.	Not specified.
Compound Formulation (Avanakku, Cumin, &Kizharnelli)	Grind Avanakku, Jeerakam, and Kizharnelli together.	Take with milk in morning.
Leaf and Black Pepper Mix	Grind 15-16 juvenile castor leaves with 21 Black Pepper seeds to form a paste.	1 spoonful in morning on empty stomach, every 2 days for 10 days.

Ethnomedicinal Uses

- 1. Hepatoprotective Action:** The extracts of *Ricinus communis* leaves can help protect the liver from chemical-induced damage and aid in the regeneration of liver cells.
- 2. Antioxidant Properties:** The leaves contain phenolic compounds, flavonoids, and other antioxidants that help reduce oxidative stress, which is often severe during jaundice.
- 3. Hyperbilirubinemia Management:** The leaf extracts may be effective in the treatment of hyperbilirubinemia (excessive bilirubin in the body), the direct cause of the yellowish discoloration characteristic of jaundice
- 4. Hepatoprotection:** Ethanolic extracts have shown the ability to protect liver cells from necrosis and damage induced by toxins like carbon tetrachloride.
- 5. Antioxidant Action:** Bioactive compounds such as quercetin and N-dimethyl ricinine help reduce oxidative stress associated with jaundice.
- 6. Bilirubin Reduction:** Leaf extracts effective in treating hyperbilirubinemia (the excess bilirubin that causes yellowing of the skin and eyes).[30]

CONCLUSION

Ethnomedicinal plants offer a rich source of potential therapies for jaundice, with many species demonstrating hepatoprotective, antioxidant, and anti-inflammatory properties. These traditional remedies provide a promising alternative or adjunct to conventional treatments, warranting further scientific investigation. Plants like *Picrorhiza kurroa* and *Phyllanthus amarus* have shown promise, but further research is needed to isolate bioactive compounds, understand mechanisms, and establish efficacy and safety profiles. Tribes and local communities widely use medicinal plants to treat jaundice, offering a cost-effective, accessible, and traditionally accepted alternative, especially when allopathic treatments are expensive or produce side effects. These traditional remedies often have scientifically validated hepatoprotective, antioxidant, anti-inflammatory, and antiviral properties, helping reduce bilirubin levels and serum enzymes (AST, SGPT, ALP). Plants like *Justicia adhatoda*, *Phyllanthus amarus* (and related *Phyllanthus* species), *Terminalia chebula*, *Tinospora cordifolia*, and *Boerhavia diffusa* are frequently studied and found highly effective in reducing serum bilirubin levels and normalizing liver enzymes. By integrating traditional knowledge with modern science, we can develop effective, accessible treatments for jaundice and liver diseases, addressing global health disparities and promoting culturally sensitive and sustainable healthcare solutions.

REFERENCES

1. Shrihari Nighot, Ankia Jadhav, Swati Deshmukh. A Clinical Case Study on Jaundice. *Int. J. of Pharm. Sci.*, 2025; 3(5): 2816-2833.
2. Dr. Rahul Tambe. 24 April 2023. What is Jaundice? Symptoms, Causes, Diagnosis & Treatment. 16 February 2026.
<https://www.nanavatimaxhospital.org/blogs/what-is-jaundice-symptoms-causes-diagnosis-and-treatment>.
3. Dr. Ananya Mandal. 17 June 2023. Jaundice pathophysiology. 19 February 2026.
<https://www.news-medical.net/health/Jaundice-Pathophysiology.aspx>.
4. Tim Jewell. 31 July 2018. Types of Jaundice. 16 February 2026.
<https://www.healthline.com/health/jaundice-types>.
5. Matthew Fargo.V, Scott Grogan. P, Aaron Saguil. Evaluation of jaundice in adults. *Am Fam Physician*. 2017; 95(3):164-168.
6. Magnus Johnston, Ravi (Rajan) Ravindran. Jaundice. (*Surgery Oxford*). June 2023; 41(6): 334-341.

7. Muhammad Waseem Abbas, Talha Shamshad, Muhammad Aizaz Ashraf, Rukhsar Javaid. Jaundice: a basic review. *Int J Res Mes Sci*. 2016 may; 4(5): 1313-1319.
8. Ruqiah Ganda Putri Panhaitan, Titin, Yohanes Gatot Sutapa yuliana. Ethno-medicinal plants used for medication of jaundice by the chinese, dayak, and malays wthnic in west kalimantan, indonesia. *Phrmacogn J*. 2021; 13(4): 916-923.
9. Sharmila Soren, Tapaji Bhattacharya, Rajib Biwas and Moitreyee Chakrabarty. Ethnomedicinal insights: Medicinal plants for jaundice treatment in India. *Journal of medicinal Plants studies*. 2025; 13(2): 149-157.
10. Pohekar. H.R. Ethnomedicinal plants used to cure jaundice by traditional healers kamtee tehsil, Ms, India. November 2018; 4(6): 287-292.
11. Keerti Shrivastava, Skand K. Mishra. Ethnomedicine for jaundice used by the tribals of Achanakmar Amarkantak biosphere reserve, India. *Res. J. Pharmacology and Pharmacodynamics*. 2017; 9(1): 27-30.
12. Ratna Manjul. R, Koteswara Rao. J, Seetharami Reddi. T.V.V. Ethnomedicinal plants used to cure jaundice in kammam district of Andra Pradesh, India. *Journal of Phytology*. 2011; 3(10): 33-35.
13. Jaydeep Kumar Sahu, Avinash R Nichat, Jyoti Chauhan. Herbal remedies for jaundice: Exploration of traditional knowledge of India. *Annual Research and Review in Biology*. 2025; 40(8): 1-8.
14. Jamileh Mahdavi Jafari, Shahdis Barimani, Fatemeh Aliasl. A mini-review on Medicinal plants used for the treatment of jaundice in the Canon of medicine. *Shiraz E-Medical Journal* 06 Jan 2021; 22(4): e102127.
15. Ankit Kumar, Rashi Miglani, Mahendra Rana. September 2021. Role of Traditional Practices and ethno medicinal plants for the management of jaundice and hepatic diseases. 19 Feb 2026. https://www.researchgate.net/publication/354533813_Role_of_Traditional_Practices_and_EthnoMedicinal_Plants_for_the_Management_of_Jaundice_and_Hepatic_Diseases.
16. Sanower Hossain, Zannat Urbi, Hidayah Karunaiwati. 16 April 2021. *Andrographis paniculate*: An Updated Review of Phytochemistry, Antimicrobial Pharmacology, and clinical safety and efficacy. 18 Feb 2026. <https://www.mdpi.com/2075-1729/11/4/348>.
17. Vijay Danapur, Seetharam. YN. *Andrographis paniculate* Nees a well-known Hepatoprotective drugs: A review. *International Journal of Pharmaceutical and Clinical Research*. 05 Dec 2019; 1(1): 12-16.

18. Aparupa Bose Mazumdar Ghosh, Anindita Banerjee, Sharmila Chattopadhyay. An insight into the potent medicinal plant *Phyllanthus amarus* Schum. And Thonn. National Library of Medicine. 12 Nov 2022; 65(3): 437472.
19. Abd-El-hady M.A.M, Arafa. S.G. Morphology, chemical characteristics and antioxidant activity of Egypt grown wild milk thistle (*Silybum marianum* L.) seeds evaluated their oil fast frying process comparing with some vegetable oils. Middle East Journal of Applied Sciences. Oct-Dec 2019; 9(4): 1198-1214.
20. Soham Saha, Shyamasree Ghosh. *Tinospora cordifolia*: One plant, many roles. National Library of Medicine. Apr-Jun 2012; 31(4): 151-159.
21. Dadasaheb maindad. 2024. *Tinospora cordifolia* (Gulvel/Guduchi) Induced hepatotoxicity. 18 Feb 2026.
<https://www.hilarispublisher.com/open-access/tinospora-cordifolia-gulvelguduchi-induced-hepatotoxicity.pdf>.
22. Renee A street, Jasmeen Sidana, Gerhard Prinsloo. Nov 2013. *Cichorium intybus*: Traditional Uses, Phytochemistry, Pharmacology, and Toxicology. 19 Feb 2026.
<https://pmc.ncbi.nlm.nih.gov/articles/PMC3860133/>.
23. Gulshan Chaudhary and Prem Kumar Dantu. Morphological, Phytochemical and Pharmacological studies on *Boerhaavia diffusa* L. Journal of Medicinal Plants Research. 4 June 2011; 5(11): 2125-2130.
24. Santhosha DU, Manasa R, Vishwanath.S. Hepatoprotective activity of *Boerhaavia diffusa* L. Journal of Nutrition Metabolism and Health Science. 2020; 3(4): 109-113.
25. Hemalata Sagar Wadkar and Rukhsana Mhiboob Pinjari. The Morphology, extractions, chemical constituents and uses of *Terminalia chebula*: A review. International Journal of Forest, Animal and Fisheries Research (IUFAF). Sep-Oct 2023; 7(5): 1-5.
26. Phytochemical profile and pro-healthy properties of *Terminalia chebula*: A comprehensive review. 31 Jan 2023; 26(1): 526-551.
27. Bhawana Rathi, Juhi Sahu, Sameksha Koul. Detailed pharmacognostical studies on *Berberis aristata* DC plant. National Library of Medicine. Apr-Jun 2013; 32(4): 234-240.
28. Isha Kumari, Hemlata Kaurav, Gitika Chaundhary. *Eclipta alba* (Bhringraj): A promising Hepatoprotective and hair growth stimulating Herb. 30 April 2021; 14(7):1-8. [29]. Iman H. Nour, Khadiga Alhadead, Faten Y.Ellmouni. Morphological, Anatomical and Chemical Characterization of *Ricinus Communis* L. (Euphorbiaceae). Agronomy. March 2023; 13(4): 1-25.

29. Sunita M. Bagul, Urmila B. Sonaware, Dipali J. Tribhuvan. Traditional Use of *Rinicus communis* leaves in Jaundice and their Therapeutic Activity in various Diseases. International Journal of Pharmacy and Pharmaceutical Research. January 2024; 30(1): 1-12.