



**INTERNATIONAL JOURNAL OF
PHARMACEUTICAL SCIENCES**
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: <https://www.ijpsjournal.com>



Review Paper

Kala Azar Management Through Herbal: Unfolding Traditional Therapies for Leishmaniasis Care

Harshil Talati*, Urvisha Panchal, Dr. Pragnesh Patani

khyati collage of pharmacy, palodia, Ahmedabad.

ARTICLE INFO

Published: 20 Apr 2026

Keywords:

Leishmaniasis, Nyctanthes arbor-tristis, Berberis aristata, Leishmania donovani, phytotherapy, iridoid glycosides, berberine

DOI:

10.5281/zenodo.19661229

ABSTRACT

Leishmaniasis, often called kala-azar, is a major ignored disease caused by tiny parasites from the Leishmania group, spread by bite of female sandflies. Even though drug treatments have improved, problems like resistance, side effects, and high prices make care tough - so better options are needed. Here, we look at two natural plants - Nyctanthes arbor-tristis (Night Jasmine) and Berberis aristata (Indian Barberry) - as possible helpers in treating visceral leishmaniasis (VL). In tests on cells and animals, Night Jasmine showed solid power against Leishmania donovani with the help of compounds like arbortristosides A-C and 6- β -hydroxyloganin; it also helps reduce damage from stress, shields the liver, and calms inflammation, all aiding healing. Meanwhile, Indian Barberry packs useful alkaloids - including berberine, palmatine, and berbamine - that fight microbes, lower blood sugar, ease swelling, protect the liver, and boost immune response to help clear out the infection. The use of these herbal treatments in classic Ayurvedic practices shows they work against parasites while also boosting overall defense. Together, this evidence supports plant-derived compounds as possible replacements or helpers to today's leishmania medicine urge more consistent prepared methods better delivery forms, and deeper studies on how they function inside cells.

INTRODUCTION

1.1 General:-

- Leishmaniasis spreads when certain tiny flies, called sandflies, bite people - they're infected with single-celled bugs known as Leishmania [1]. People call it different things like kala-

azar or Delhi boil, also Oriental sore and espundia. It shows up in many ways based on what part of the body gets hit - sometimes it hits internal organs, sometimes skin, sometimes deeper tissues; forms include viscera-related cases, skin issues after kala-azar, problems affecting nose and mouth

*Corresponding Author: Harshil Talati

Address: *khyati collage of pharmacy, palodia, Ahmedabad*

Email ✉: harshiltalati7442@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



areas, basic skin sores, plus serious whole-body infections [2].

- Leishmaniasis comes from more than 20 types of *Leishmania* parasites, leading to three kinds: skin sores (the usual kind), mouth and nose damage (rare, hits moist tissues), or organ harm. Different bug strains cause varied sickness signs - some make open wounds on arms or face, others attack inner organs and can kill without quick care. Tiny flies called sandflies - the females - pass these germs when they feed; though hundreds exist, just under thirty actually spread illness.[3] A major culprit is *Leishmania donovani*, part of the *L. genus*, growing mostly inside gut areas of certain bugs like *Phlebotomus orientalis*. [4] Risk climbs if you're in high-risk zones, carry specific genes, fight off weak defenses, lack proper food, or deal with ongoing medical issues. Most infections come from animals, especially rats and dogs, which carry the germs. Still, just two types - *L. donovani* and *L. tropica* - spread directly between people. These cause visceral leishmaniasis in parts of India and East Africa, while elsewhere they lead to skin sores known as cutaneous leishmaniasis. Out in the old continents, tiny flies called *Phlebotomus* pass it on; in newer lands, a similar bug named *Lutzomyia* does the job instead. In India specifically, one kind - *Phlebotomus argentipes* - is solely responsible for spreading the sickness.
- Leishmaniasis counts as a major illness in warm regions, ranking high on WHO's research list for tropical conditions[6]. Of all types, the kind hitting internal organs - often called kala-azar - is deadliest, usually ending lives if care gets delayed[7]. When diagnosis or therapy slows down, more people get sick or die, while chances of spreading rise across communities[8].
- A few weeks or even months after getting bitten by an infected sandfly, signs may start showing. A small bump shows up at the bite spot, slowly expanding until it becomes an open sore - this is usually how cutaneous leishmaniasis begins. Over time, it often develops a rim that sticks up and a sunken middle, kind of like a tiny volcano. You might see just one sore or several, along with swollen glands nearby. On rare occasions, leishmaniasis species, which are mostly prevalent in Central and South America, might harm mucous membranes in the mouth and nose in addition to the initial cutaneous sore on the face[9] The clinical manifestations of visceral leishmaniasis can be intricate, exhibiting symptoms like prolonged fever, weight loss, loss of appetite, fatigue, pallor, enlargement of the liver and spleen, swollen lymph nodes, decreased blood cell counts, and skin darkening[10,11]. Many of these symptoms overlap with those of other illnesses, including malaria, typhoid fever, tuberculosis, and brucellosis, which complicates prompt diagnosis. Factors such as malnutrition, poverty, and immunodeficiency further increase the likelihood of developing kala-azar[12]. In 1994, a single patient with post-kala-azar dermal leishmaniasis (PKDL) is thought to have caused an outbreak in 24-Parganas, a district of West Bengal, India, where kala-azar had never been seen before.[13] In 2023, 314 PKDL cases were reported, which is of concern to the elimination efforts, especially because recent research showed that these lesions are surprisingly infectious, with 35–80% of patients with PKDL capable of infecting sandflies with only 400 parasites per μg of skin, whereas normally several thousands are present.[14]



- Several types of plant compounds - such as naphthoquinones, neolignans, lignans, alkaloids, chalcones, or triterpenoids - have demonstrated activity against *Leishmania* parasites. Because of its diverse flora and deep roots in Ayurveda, India is sometimes called the “Medical Garden of the World,” offering strong potential for finding treatments for overlooked illnesses such as leishmaniasis[15].

1.2 Epidemiology:-

- Visceral leishmaniasis (VL) can lead to death; it ranks second in deaths from tropical illnesses, also ranking seventh in lost healthy years [16,17]. Twenty-two species fall under the *Leishmania* group - these split into two subgroups, *Leishmania* and *Viannia*, depending on how they grow inside sandflies. Different parasites favor certain regions, affect distinct hosts, show unique symptoms. As an instance, *L. donovani* causes VL mainly in South Asia (India, Bangladesh, Nepal), plus parts of East Africa like Sudan, Ethiopia, Somalia, Kenya - commonly affecting youth more than elders because prior exposure builds protection there [18]. *L. infantum* - which matches *L. chagasi* in Latin America - can cause VL, yet it mainly appears in regions like the Mediterranean, the Middle East, parts of Pakistan, Iran, and Brazil. Meanwhile, in Texas, every local case of leishmaniasis was linked to *L. mexicana* causing CL [19].

1.3 Life Cycle:-

- The female phlebotomine sand fly spreads leishmaniasis during night activity, typically between sunset and sunrise. While inside the insect, *Leishmania* sp. exists as promastigotes - mobile due to a whip-like tail in the gut. As the fly feeds on blood, these forms enter the

skin of mammals through saliva. Once inside, host immune cells engulf them; this shift triggers transformation into amastigotes. These non-motile stages multiply within cells and are often called Leishman-Donovan bodies. The amastigotes grow inside the host's reticulo-endothelial system, leading to symptomless or noticeable illness depending on traits of both parasite and host. These parasites spread via blood or lymph flow, triggering infections in internal organs or mucus membranes. In recent findings, scientists identified a virus - *Leishmania* RNA Virus (LRV1) - co-infecting *L. Viannia guyanensis* and *L.V. braziliensis*, provoking an exaggerated immune reaction by activating toll-like receptors, which worsens tissue harm and enables spreading infection. While this viral presence has also been spotted in *L. major* under the type LRV2, there's still no clear link found between its activity and how severe the disease becomes.

- The spread of *Leishmania* sp. mainly comes from visible infections along with PKDL, since silent carriers likely don't pass it to sandflies. In certain regions, people sustain the cycle - called anthroponotic transmission - seen in *L. tropica*, causing CL in the Americas, as well as *L. donovani*, behind VL in India. Still, animals also keep the parasite alive, showing illness or staying healthy. Hosts at risk include dogs, rats, opossums, primates, and armadillos. In particular, dogs serve as the main animal host for *L. infantum*. Rarely, leishmaniasis spreads via organ transplants - also through blood donations, shared needles, or from mother to child during birth.[20]

1.4 Symptoms:-



- **Fever:** A main sign of VL, caused by inflammation-linked proteins - such as IL-1 β , TNF- α , or IL-6. Once Leishmania meets macrophages, these substances form, then affect the brain's heat control center, increasing body warmth.
 - **Weight loss:** often happens when nutrition is poor. This may stem from reduced hunger, increased calorie use during fever, or muscle breakdown triggered by inflammatory processes.
 - **Nausea or vomiting:** not common, yet possible because of illness, medications, or issues in digestion and nerves. When throwing up happens, it's tied to elevated IL-6 - often seen when recovery is slower.
 - **Anemia:** often occurs in VL - commonly due to low iron. It stems from enlarged spleen activity; sometimes from altered iron processing caused by inflammation. Bleeding plays a role only occasionally.
- **Localized symptoms:-**
 - **Hepatosplenomegaly:** This usually signals an underlying issue, arising when parasites grow both in liver and spleen. In many cases, the spleen may enlarge over tenfold due to this growth.
 - **Protracted edema and anasarca:** Long-lasting swelling and body-wide fluid buildup usually stem from reduced blood albumin during acute inflammation. As a result, liquid escapes blood vessels, leading to puffiness.
 - **Cough:** This with crackling sound also shortness of breath - could point to lung issues. Breathing troubles might stem from an infection or arise due to inflammation triggered by Leishmania.

2.PLANT PROFILE SHOWING THE SYMPTOMATIC MANAGEMENT:-

2.1 Nyctanthes arbor-tristis linn (Night Jasmine) [22,23].



Fig 1 : Nyctanthes arbor-tristis linn

2.2 Taxonomical Classification:-

Table 1: Taxonomical Classification of Nyctanthes arbor-tristis linn

Kingdom:	Plantae
Division:	Magnoliophyta
Class:	Magnoliopsida
Order:	Lamiales
Family:	Oleaceae
Genus:	Nyctanthes
Species:	arbor-tristis
Binomial name:	Nyctanthes arbor-tristis

2.3 Botinical Description:-

- A big shrub or small tree, Nyctantes arbor-tristis reaches around 10 m high; it shows patchy grey bark alongside bristly white hairs on new shoots. Leaves grow in pairs, not divided, with a coarse texture - typically between 6 and 12 cm long while spanning 2 to 6.5 cm wide. Scented blooms feature a pale petal ring plus a reddish-orange middle core, forming groups from two up to seven blossoms. The plant bears flattened, brown, heart-like pods roughly 2 cm across, each holding a pair of seeds sized near 2 cm both ways. Known mainly due to unique shape

combined with sweet-smelling evening flowers[24].

- **Leaves:** The leaves are simple, opposite on stalks lacking tiny parts. They measure 5–10 cm long by 2.5–6.3 cm wide. Their form shifts from egg-shaped to stretched oval. The tip is sharp or gradually narrows. Margins tend smooth, now and then bearing few large spaced teeth. At the base, they slightly constrict or curve inward. Short, stiff-tipped hairs appear here and there. The upper surface shows dark green coloration with scattered gland dots. Beneath, the hue turns lighter green - softly hairy - and contains similar glands. Edges either even, toothed, or wavy toward the bottom part. Vein pattern features a central rib plus netted branching, around twelve secondary veins extending outward, major lines faint above yet clear when viewed underneath. Petioles measure 5–10 mm, carry fine hair, while curving inward on upper side. This plant loses leaves each year, dropping them between October and March.
- **Flowers:** The small sweet smelling blooms of *Nyctanthes arbor-tristis* which grow in groups of 2 to 7 at branch ends or in the place where leaves join. blossoms which sit directly on stems within bundles that have 3 to 5 bracts; stalks are thin, fuzzy, and four-sided. Bracts tend to be wide oval or nearly round, covered in hair, measuring 6–10 mm. Calyx shape is narrow bell-like, around 6–8 mm in size - hairy externally but smooth internally - with a flat edge or faint teeth. Flowers measure around 13 mm in length, featuring a smooth orange tube along with white, tapering lobes that have a noticeable reddish-orange core - blooming takes place between July and October[25,26].
- **Fruits:** The fruit of *Nyctanthes arbor-tristis* appears as a brown flattened capsule of heart-shaped or slightly round with a width of 1–2

cm [25,26]. This structure tends to be elongated, compressed, two-chambered; it divides into two thin carpels, each holding a single seed. These segments show net-like veins while remaining smooth and hairless [28].

- **Seeds:** One dark seed sits tightly packed in every chamber. They lack endosperm, feature a dense outer coat plus show clear, broad cells on their nourishing surface layer [24]. Harvesting can also occurs from late summer into early fall.
- **Bark:** The *Nyctanthes arbor-tristis* features in four-sided stems along with coarse bark, appearing either grey or greenish-white; this Linn tree sheds leaves seasonally and can grow up to 10 m tall. Circular sections peeling away create sunken areas on the outer layer - these expose irregular spots coloured grayish-brown, making the surface uneven. Scales come off in rounded pieces gradually. Inside, the undamaged phloem stands out distinctly - it's creamy white and feels soft.[27].

2.4 Geographical Distribution:-

- In its natural environment, *Nyctanthes arbor-tristis* Linn grows on stony soils along arid slopes - also appearing beneath trees in dry forest areas [29]. While the origin of the Betel vine points to Malaysia, particularly male specimens. Cultivation spreads across India and various nations in South and Southeast Asia such as China or Vietnam, regions marked by warm, moist air alongside wet woodland conditions. Rather than emerging elsewhere, *Piper betel* first developed in tropical parts of Asia, later spreading toward Madagascar and eastern African zones. Records show usage going back over two millennia in places like India, Sri Lanka, Bangladesh, Indonesia, Nepal,



Pakistan, Vietnam, Thailand, Laos, Cambodia, the Philippines, Myanmar, Malaysia, Taiwan - and several other Southeast Asian territories [30]. Within India, it occurs in states including Bengal, Bihar, Orissa, Andhra Pradesh, Karnataka, Uttar Pradesh, together with Tamil Nadu [31,32]. It ranges from eastern Assam into Nepal, extending across the outer Himalayan belt and parts of Jammu along with Kashmir. In addition, it occurs in isolated pockets of Tripura together with Bengal [33,34].

Cultivating betel vines represents a widespread agricultural practice. Ideal spots for growth involve elevated areas featuring rich, loose soil - sandy, that drain well while maintaining a pH level between 5.6 and 8.2. Waterlogged saline or alkaline types of ground prove unsuitable; favorable climate needs annual rainfalls ranging from 2250 to 4750 mm, humidity levels from 40% up to 80%, plus temperatures within 15–40°C[35].

2.5 Phytochemical Profile:-

Table 2 : Phytochemical Profile of *Nyctanthes arbor-tristis* linn.

Plant Parts	Chemical constituents
Leaves[36,37]	D-mannitol, sitosterole, astragaline, nicotiflorin, oleanolic acid, nyctanthic acid, tannic acid, ascorbic acid, methyl salicylate, carotene, friedeline, lupeol, mannitol, glucose and fructose, iridoid glycosides, benzoic acid.
Flowers[38,39]	Essential oil, nyctanthin, d-mannitol, tannin and glucose, carotenoid, glycosides viz β -monogentiobioside ester of α -crocetin (or crocin-3), β monogentiobioside- β -D monoglucoside ester of α -crocetin, β digentiobioside ester of α -crocetin.
Seeds[40]	Arbortristoside A&B, Glycerides of linoleic oleic, lignoceric, stearic, palmitic and myristic acids, nyctanthic acid, 3-4 secotriterpene acid.
Stem[41]	Glycoside-naringenin-4"-0- β -glucapyranosyl- α -xylopyranoside and β sitosterol.
Bark[42]	Glycosides and alkaloids.

2.6 Pharmacological Profile:-

- Anticancer activity: Methanol-based extracts from *N. arbortristis* - fruit, leaf, stem - were evaluated in lab tests. At a concentration of 30 mg/ml, results showed modest impact; dried leaf extract led to 71% suppression. When lowered to 10 mg/ml, slight inhibition still occurred. In contrast, dry fruit solution strongly targeted MDA-MB 231 breast cancer lines, delivering nearly 86% blockage. IC50 levels stood at 9.72 mg alongside 13.8 mg.

Glycosides may contribute to anticancer effects - so might tannins, while phenols along with steroids could play a role.

- Activity against parasites:** A basic 50% ethanol-based leaf mix killed trypanosomes at 1000 μ g/ml. In hamsters with *Leishmania donovani*, clear antiparasitic action appeared. Ethanol solutions from seeds, leaves, roots, blooms, or trunk helped heal rats infected by *Entamoeba histolytica* - yet no effect occurred in lab tests. Water-ready parts taken from



ethanol-treated flowers, bark, seeds, and foliage slowed worm movement, suggesting deworming potential.

- **Antimalarial effect:** Research on 120 people showed that using a new mix made from five average-sized *N. arbortristis* leaves - taken thrice per day over seven days - led to improvement in 92 individuals (76.7%) within ten days. However, eight participants saw no change; meanwhile, major side effects weren't observed.
- **Anti-diabetic effect:** Taking chloroform or alcohol-based leaf and flower extracts by mouth raised SOD and CAT levels while cutting LPO, liver enzyme activity, cholesterol, plus triglycerides in diabetic test groups. Alcohol extract from stem bark decreased blood sugar in diabetic animals; results varied with dose size.
- **Anti-allergy effect:** In guinea pigs facing histamine mist, early use of a soluble part from alcohol-based leaf extract stopped breathing failure. Meanwhile, arbortristosides A and C show ability to reduce allergic reactions.
- **Antianemic effects:** In studies on rats, ethanol-based flower, bark, seed, or leaf extracts raised hemoglobin levels along with red blood cell numbers - more so at higher doses. Such preparations also slowed down worsening of blood markers in animals lacking healthy blood components.
- **Antileishmanial effect:** Iridoid glucosides - such as arbortristosides A, B, C, alongside 7-O-ethylguaiacoside - affect *Leishmania* parasites. Lab tests plus animal trials indicate action toward intracellular amastigotes within macrophages and infected hamsters.
- **Anti-inflammatory action:** Whole-plant water extract, alcohol-based stem and seed extracts, while a soluble leaf extract in alcohol showed short-term plus longer-lasting anti-

inflammatory results. These lowered granulation tissue formation in rats; at the same time they suppressed inflammatory responses in tests using Freund's adjuvant-induced arthritis along with tuberculin sensitivity models.

- **Antioxidant action:** *N. arbortristis* leaves - taken as herbal tea in traditional medicine - are powerful neutralizers of oxidative stress. Alcohol-based extracts from the leaves demonstrated effective scavenging of harmful radicals; IC50 recorded at 20 [26,43].

3.PLANT PROFILE SHOWING THE SYMPTOMATIC MANAGEMENT:-

3.1 Berberis Aristata (Daruhalidi):-



Fig 2 : Berberis Aristata.

3.2 Taxonomical Classification [43,44]:-

Table 3 :Taxonomical Classification of berberis aristata.

Kingdom:	Plantae
Division:	Magnoliophyta
Class:	Magnoliopsida
Order:	Ranunculales
Family:	Berberidaceae
Genus:	Berberis
Species:	aristata

3.3 Vernacular Names [45]:-

Table 4 : Vernicular Name of Berberis aristata

English:	Indian Berberry
Gujrati:	Daruharidra
Hindi:	Daruhaldi, Darhald

3.4 Botanical Distribution:-

- Berberis aristata stands upright, without hair, classified under Berberidaceae. Its size reaches between 2 and 3 meters tall. Hard and woody, it shows outer bark colored yellowish-brown, while inner parts appear bright yellow. Instead of regular leaves, sharp structures form - these are altered leaf forms, split into three sections, each around 1.5cm long; they peel off cleanly by hand when pulled along the stem.
- Leaves:** Arranged in groups of 5–8, leaves show whorled positioning - simple, stiff, spear-shaped. They feature serrated edges, a thick texture, no stalks, and taper to a point. Veins which follow as branching feather like pattern. Each leaf measures about 4.9 cm in length and 1.8 cm in width upper side is dark green, while lower side appears paler.
- Flower:** Individual blooms sit on stems, show full structure, carry both sexes, display radial symmetry, attach around the ovary, measure about 12.5 mm wide when open; clusters form loose to flat-topped groups, each holding 11–16 blossoms. The outer ring appears yellow, splits into six parts - three smaller, three larger pieces - that fall early, range from 4 to 5 mm in size, maintain star-like shape. Petals total six, stay separate, match in color, mirror the symmetrical layout, reach similar length. Stamens number six, grow fused to petals, span 5–6 mm across. Female part occurs singly, measures 4–5 mm overall, features a brief style paired with a wide tip.
- Fruits:** Which range from spherical to egg-shaped often coated with a waxy layer like

beats they measure 7 mm in length and 4 mm across. Each weighs 227 milligrams, holding about 237 microliters inside. The outer hue appears as aconite violet - deep yet distinct under light.

- Seeds:** Range from two to five per fruit, differing in hue - some yellow, others pink; individual mass reaches 25 milligrams while occupying roughly 29 microliters [46].

3.5 Geographical Distribution Of Berberis Aristata:-

- The plant Berberis aristata originates from Nepal it occurs across India like Sri Lanka, Bhutan, and parts of Asia [47]. In India its primary existence lies in some Himalayan zone thriving at altitude from 1000 to 3000 meters also seen in the Nilgiri Hills of southern India where heights range between 1000 and 2400 meters. Regions like Jammu and Kashmir, Himachal Pradesh, Madhya Pradesh, Tamil Nadu, Uttar Pradesh, Uttarakhand, and Sikkim host this species, which can grow up to altitudes reaching 2000–3500 meters [48,49].

3.6 Phytochemical Studies:-

- Berberis aristata holds protoberberine along with bis-isoquinoline alkaloids. Its root includes compounds like berbamine; Berberine stands out among them. Oxycanthine appears too - so do epiberberine, palmatine, and dehydrocoryline. Jatrorhizine shows up alongside columbamine, karachine, and dihydrolkarachine. Taxilamine occurs as well - as does oxyberberine plus aromoline. Scientists have also extracted four others: pakistanine, 1-O-methylpakistanine. Pseudopalmatine chloride came from this plant; so did pseudoberberine chloride. One study found a secobisbenzylisoquinoline - or



possibly just an isoquinoline structure. Berberine remains the main compound here, making up around 2.23%; then comes palmitine.

- The level of Berberine in the root and stem of *B. aristata* changes with elevation; samples from lower elevations showed higher concentrations. In addition, soil potassium levels together with moisture affect how much Berberine accumulates in the plant. To measure this compound precisely, HPTLC profiling of Berberine was carried out on *B. aristata* specimens. Alkaloid content across the entire plant was assessed as well [45].

3.7 Pharmacological Profile:-

- **Pharmacological Value:** *B. aristata* (Indian barberry) holds alkaloids such as berberine, which fight microbes, reduce swelling and act opposite to oxidative damage which help manage diabetes, heart issues or digestive problems. Root and stem parts go into Ayurvedic plus Unani healing traditions. Some studies suggest tumor-inhibiting effects while the fruit delivers high vitamin C levels - this boosts body defenses. The plant displays fever-reducing action along with benefits for women's health, diarrhea control, heart support, cancer suppression, liver protection, fat regulation, HIV interference, germ fighting, eye care, and skin treatment.
- **Antibacterial Potential:** *B. aristata* works well against various Gram-positive and also Gram-negative bacteria, thanks to substances such as berberine, along with palmatine and magnoflorine. Ethanol-based or water-alcohol mixtures have demonstrated clear antibacterial action across every strain examined. Alkaloids found in it - combined with tannins, flavonoids, or terpenoids - help boost this effect.
- **Fungus-fighting ability:** *B. aristata* which works good against many fungi due to berberine it blocks key fungal processes such as enzyme function or building cell walls. While water-based solutions help, alcohol-based sometime also show strong results on microbes like *Candida albicans* or *Aspergillus niger*. This herb sometimes outperforms common medications suggesting it could offer new options from nature's own compounds.
- **Antidiabetic Effect:** Berberine from *B. aristata* helps balance blood sugar while improving how the body responds to insulin; studies show extracts lower glucose levels in diabetic animals. The root's extract works when taken by mouth - either boosting insulin output or acting like it instead. In lab tests on rats, berberine supports pancreatic health and increases key antioxidants linked to diabetes control [50].
- **Anti-viral Properties:** *Berberis aristata* extract inhibited Paramoxyviridae infection by interacting with erythrocyte receptors. Cytotoxicity assay on Vero cells showed 92.8% cell viability at 62.5 µg/ml, indicating low toxicity and good antiviral potential.
- **Cancer-fighting action:** Berberine a key plant compound triggers cell death in prostate cancer by stopping growth at the G0/G1 stage. The methanol-based stem extract blocks breast cancer cell spread through programmed death pathways. This substance harms multiple tumor types while supporting blood health in animal cancer cases.
- **Anti-inflammatory Effects:** In rat studies, water-based root extract shows activity at doses of 500–1000 mg/kg. Instead of direct action, berberine lowers key inflammatory markers like TNF- α and IL-6. Through NF- κ B and MAPK signaling paths, it reduces COX-2 expression. Through impact of T-cell development it controls Th17 cells while



supporting Treg formations which modify immune function.

- **Antioxidant Traits:** *Berberis aristata* contain constituents like alkaloids, tannins and flavonoids that have properties of oxidation. Its methanol-based extract removes harmful molecules while blocking fat damage. This lowers signs of cell stress and boosts protective enzymes in diabetes plus inflammation cases.
- **Liver protection:** Extract from *Berberis aristata* stem bark, using ethanol, lowered high liver enzyme levels - like direct and total bilirubin, ALT, AST, ALP - in rats with CCl₄-damaged livers, tested at 100 and 300 mg/kg. Instead of just adding effects, berberine chloride cut down ALT, AST, and ALP in a way tied to dosage during both prevention and treatment of similar injury. When toxicity came from rifampicin plus isoniazid, the plant given at 50 mg/kg raised total protein while bringing down those same increased enzymes[51].

CONCLUSION

- Leishmaniasis mostly the visceral type still strains worldwide health systems due to the less treatment choices and growing of drug resistance. Using *Nyctanthes arbor-tristis* alongside *Berberis aristata* offers a hopeful plant-based option rooted in traditional medicine and supported by recent scientific findings. While *N. arbor-tristis* delivers iridoid glycosides *B. aristata* provides alkaloids like berberine where both showing wide biological actions such as fighting parasites reducing oxidation damage & protecting liver tissue thereby supporting their role in tackling *L. donovani* infections. Beside lowering parasite levels these herbs influence immune responses and cellular stress

mechanisms involved in disease progression. Yet obstacles remain when turning plant-based results into uniform treatments tested by clinical standards. Moving forward, studies ought to focus on consistent active compounds, how the body processes them, while also exploring combined effects with existing leishmania medications. With growing worldwide attention toward herbal medicine, blended approaches might transform kala-azar care - making it easier to reach, more eco-friendly, and comprehensive in practice.

REFERENCES

1. Torres-Guerrero E, Quintanilla-Cedillo MR, Ruiz-Esmenjaud J, Arenas R: Leishmaniasis: a review. *F1000Res.* 2017, 6:750. 10.12688/f1000research.11120.1
2. Bifeld, E. and Clos, J. (2015). The genetics of *Leishmania* virulence. *Medical Microbiology and Immunology*, 204(6):619-634.
3. Sadik M, Merlin RH, Allam R, Raj AS, Shankar TU, Sahani G. A review on kala-azar and management with Ayurveda herbs. *Annals of Phytomedicine.* 2024;13(1):189-95.
4. Magill AJ. Epidemiology of the leishmaniasis. *Dermatol Clin* 1995; 13: 505-23.
5. Berman JD. Human leishmaniasis: clinical, diagnostic, and chemotherapeutic developments in the last 10 years. *Clinical infectious diseases.* 1997 Apr 1;24(4):684-703
6. Desjeux P. The increase in risk factors for leishmaniasis worldwide. *Trans R Soc Trop Med Hyg* 2001; 95: 239-43.
7. Chappuis F, Sundar S, Hailu A, Ghalib H, Rijal S, Peeling RW, Alvar J, Boelaert M. Visceral leishmaniasis: what are the needs for diagnosis, treatment and control?. *Nature*



- reviews microbiology. 2007 Nov;5(11):873-82.
8. Medley GF, Hollingsworth TD, Olliaro PL, Adams ER, 2015. Health-seeking behaviour, diagnostics and transmission dynamics in the control of visceral leishmaniasis in the Indian subcontinent. *Nature* 528: S102–S108.
9. Scarpini S, Dondi A, Totaro C, Biagi C, Melchionda F, Zama D, Pierantoni L, Gennari M, Campagna C, Prete A, Lanari M. Visceral leishmaniasis: epidemiology, diagnosis, and treatment regimens in different geographical areas with a focus on pediatrics. *Microorganisms*. 2022 Sep 21;10(10):1887.
10. Diro E, Lynen L, Ritmeijer K, Boelaert M, Hailu A, van Griensven J. Visceral leishmaniasis and HIV coinfection in East Africa. *PLoS neglected tropical diseases*. 2014 Jun 26;8(6):e2869.
11. Alvar J, Yactayo S, Bern C. Leishmaniasis and poverty. *Trends in parasitology*. 2006 Dec 1;22(12):552-7.
12. Bora D. Epidemiology of visceral leishmaniasis in India. *National Medical Journal of India*. 1999 Mar 1;12:62-8.
13. Addy M, Nandy A. Ten years of kala-azar in west Bengal, Part I. Did post-kala-azar dermal leishmaniasis initiate the outbreak in 24-Parganas?. *Bulletin of the World Health Organization*. 1992;70(3):341.
14. Mondal D, Bern C, Ghosh D, Rashid M, Molina R, Chowdhury R, Nath R, Ghosh P, Chapman LA, Alim A, Bilbe G. Quantifying the infectiousness of post-kala-azar dermal leishmaniasis toward sand flies. *Clinical infectious diseases*. 2019 Jul 2;69(2):251-8.
15. Li, K.; Luo, H.; Mehmood, K.; Shahzad, M. and Li, J. (2020). Exploring the potential parasitic pathogens causing diarrheal death to yak calves with bloody excrement through high-throughput sequencing. *Agrobiol. Records*, 1(1):1-5.
16. Wang H, Naghavi M, Allen C, Barber RM, Bhutta ZA, Carter A, Casey DC, Charlson FJ, Chen AZ, Coates MM, Coggeshall M. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015. *The lancet*. 2016 Oct 8;388(10053):1459-544.
17. Kyu HH, Abate D, Abate KH, Abay SM, Abbafati C, Abbasi N, Abbastabar H, Abd-Allah F, Abdela J, Abdelalim A, Abdollahpour I. Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*. 2018 Nov 10;392(10159):1859-922.
18. Bern C, Amann J, Haque R, Chowdhury R, Ali M, Kurkjian KM, Vaz L, Wagatsuma Y, Breiman RF, Secor WE, Maguire JH. Loss of leishmanin skin test antigen sensitivity and potency in a longitudinal study of visceral leishmaniasis in Bangladesh. *The American journal of tropical medicine and hygiene*. 2006 Oct 1;75(4):744-8.
19. McIlwee BE, Weis SE, Hosler GA. Incidence of endemic human cutaneous leishmaniasis in the United States. *JAMA dermatology*. 2018 Sep 1;154(9):1032-9.
20. Mann S, Frasca K, Scherrer S, Henao-Martínez AF, Newman S, Ramanan P, Suarez JA. A review of leishmaniasis: current knowledge and future directions. *Current tropical medicine reports*. 2021 Jun;8(2):121-32.
21. Costa CH, Chang KP, Costa DL, Cunha FV. From infection to death: an overview of the

- pathogenesis of visceral leishmaniasis. Pathogens. 2023 Jul 24;12(7):969.
22. Jadhav S, Kumar Patil M. A review on: *Nyctanthes arbor-tristis* Linn. Rejuvenating herbs. Int J Res Pharm Pharm Sci. 2016;1(1):54-62.
23. Rani C, Chawla S, Mangal M, Mangal AK, Kajla S, Dhawan AK. *Nyctanthes arbor-tristis* Linn.(Night Jasmine): A sacred ornamental plant with immense medicinal potentials. Indian J Tradit Knowl. 2012 Jul 1;11(3):427-35.
24. Santosh J, Manojkumar P. A review on: *Nyctanthes arbor-tristis* Linn. Rejuvenating herbs. Int J Res Pharm Sci. 2016;1(1):54-62.
25. Kumari S, Singh R, Gurav NP, Mehta N. Isolation and characterization of bioactive compounds from stem of *Nyctanthes arbor-tristis* linn. and effect of different fractions on phytopathogens. Asian Journal of Chemistry. 2017;29(4):787.
26. Jain PK, Pandey A. The wonder of Ayurvedic medicine-*Nyctanthes arbor-tristis*. Int J Herb Med. 2016;4(4):9-17.).
27. Tuntiwachwuttikul P, Rayanil K, Taylor WC. Chemical constituents from the flowers of *Nyctanthes arbor-tristis*. Sci Asia. 2003;29(1):21-30.
28. Dewi NK, Fakhrudin N, Wahyuono S. A comprehensive review on the phytoconstituents and biological activities of *Nyctanthes arbor-tristis* L. Journal of Applied Pharmaceutical Science. 2022 Aug 4;12(8):009-17.
29. Tandon JS, Srivastava V, Guru PY. Iridoids: a new class of leishmanicidal agents from *Nyctanthes arbor-tristis*. Journal of Natural Products. 1991 Jul;54(4):1102-4.
30. Wendy Voon WY, Ghali NA, Rukayadi Y, Meor Hussin AS. Application of betel leaves (*Piper betle* L.) extract for preservation of homemade chili bo. International Food Research Journal. 2014 Dec 1;21(6).
31. Arambewela L, Kumaratunga KG, Dias K. Studies on piper betle of Sri Lanka. Journal of the National Science Foundation of Sri Lanka. 2005 Jun 22;33(2).
32. Guha P. Betel leaf: the neglected green gold of India. Journal of Human Ecology. 2006 Feb 1;19(2):87-93.
33. Hiremath V, Hiremath BS, Mohapatra S, Das AK. Literary review of *parijata* (*Nyctanthus Arbor-Tristis* Linn.) an herbal medicament with special reference to Ayurveda and botanical literatures. Biomed Pharmacol J. 2016;9(3):1019-25.
34. Rawat H, Verma Y, Ayesha NS, Negi N, Pant HC, Mishra A, Singhal M, Khan A, Gaurav N. *Nyctanthes arbor-tristis*: a traditional herbal plant with miraculous potential in medicine. International Journal of botany Studies. 2021;6:427-40.
35. Kumar N. Betelvine (*Piper Betle* L.) cultivation : A unique case of plant establishment under Anthropogenically. Indian Journal of History of Science. 1999;34:1.
36. Paul BN, Saxena AK. Depletion of tumor necrosis factor- α in mice by *Nyctanthes arbor-tristis*. Journal of ethnopharmacology. 1997 Apr 1;56(2):153-8.
37. Hukkeri VI, Akki KS, Sureban RR, Gopalakrishna B, Byahatti VV, Rajendra SV. Hepatoprotective Activity of the Leaves of *Nyctanthes arbor* *Nyctanthes arbor-tristis* Linn. Indian journal of pharmaceutical sciences. 2006 Jul:542.
38. Rathee JS, Hassarajani SA, Chattopadhyay S. Antioxidant activity of *Nyctanthes arbor-tristis* leaf extract. Food chemistry. 2007 Jan 1;103(4):1350-7.
39. Ratnasooriya WD, Jayakody JR, Hettiarachchi AD, Dharmasiri MG. Sedative

- effects of hot flower infusion of *Nyctanthes arbo-tristis*. On rats. *Pharmaceutical biology*. 2005 Jan 1;43(2):140-6.
40. Aladesanmi AJ, Iwalewa EO, Adebajo AC, Akinkunmi EO, Taiwo BJ, Olorunmola FO, Lamikanra A. Antimicrobial and antioxidant activities of some Nigerian medicinal plants. *African journal of traditional, complementary and alternative medicines*. 2007;4(2):173-84.
 41. Girach RD, Aminuddin SA, Siddiqui PA & Khan SA. Ethnomedicinal studies on Harsinghar (*Nyctanthes arbor-tristis* L.) - A less known medicinal plant in Unani medicine. *Hamdard Med*, 1994; 37(2):60-66.
 42. Champa Rani CR, Sunaina Chawla SC, Manisha Mangal MM, Mangal AK, Subhash Kajla SK, Dhawan AK. *Nyctanthes arbor-tristis* Linn.(Night Jasmine): a sacred ornamental plant with immense medicinal potentials.
 43. Kushwah P, Jain G, Patidar A, Baghel JS, Agarwal A. From Ancient Remedies to Modern Marvels: Unveiling the Medicinal Secrets of *Nyctanthes Arbortristis* and *Piper Betle* Linn. *Leaves-A Comprehensive Review*. *Int. J. of Pharm. Sci. Med*. 2023;8(12):11-24.
 44. Marchelak A, Gieleta M, Krasocka W, Magiera A. *Berberis aristata* DC.(Indian barberry): Current insight into botanical, phytochemical, and pharmacological aspects, pharmacokinetics, safety of use and modern therapeutic applications. *Fitoterapia*. 2025 Apr 14:106539.
 45. Komal S, Ranjan B, Neelam C, Birendra S, Kumar SN. *Berberis aristata*: A review. *Int J Res Ayurveda Pharm*. 2011;2(2):383-8.
 46. Choudhary S, Kaurav H, Madhusudan S, Chaudhary G. *Daruharidra* (*Berberis aristata*): review based upon its ayurvedic properties. *International Journal for Research in Applied Sciences and Biotechnology*. 2021;8(2):98-106.
 47. Rajasekaran A, Kumar N. Rasont—a traditional crude drug prepared from *Berberis* sp. and its uses. *Indian J Tradit Know*. 2009 Oct 1;8(4):562-3.
 48. Chandra H, Patel D, Kumari P, Jangwan JS, Yadav S. Phyto-mediated synthesis of zinc oxide nanoparticles of *Berberis aristata*: Characterization, antioxidant activity and antibacterial activity with special reference to urinary tract pathogens. *Materials Science and Engineering: C*. 2019 Sep 1;102:212-20.
 49. Bhardwaj D, Kaushik N. Phytochemical and pharmacological studies in genus *Berberis*. *Phytochemistry reviews*. 2012 Dec;11(4):523-42.
 50. Sharma S, Chaitanya MV, Sharma S, Kumar S, Rustagi S, Singh S, Shreaz S, Rai AK, Negi R, Yadav AN. The medicinal plant *Berberis aristata* and its endophytes for pharmacological applications: Current research and future challenges. *J Appl Biol Biotech*. 2024;12:37-46.
 51. Goswami R, Arya D, Siddiqui R, Chand P. Unveiling the Medicinal potential of *Berberis aristata*: a traditional native plant of Uttarakhand.

HOW TO CITE: Harshil Talati, Urvisha Panchal, Dr. Pragnesh Patani, Kala Azar Management Through Herbal : Unfolding Traditional Therapies For Leishmaniasis Care, *Int. J. of Pharm. Sci.*, 2026, Vol 4, Issue 4, 3076-3088, <https://doi.org/10.5281/zenodo.19661229>

