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(Review Article)

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Unveiling Nature's Pharmacy: A comprehensive review of *Cassytha filiformis* bioactive and their therapeutic potential

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Abstract

The evolution of human civilization has been significantly influenced by medicinal plants. In almost every culture and civilization, medicinal plants have long been used as a source of medicine. Many modern medications are made from medicinal plants, which are considered to be abundant sources of traditional medicines. Medicinal herbs have been utilized for thousands of years to treat illnesses, preserve food, enhance flavor, and stop disease outbreaks. *Cassytha filiformis* medical plant known for its parasitic nature, attaching itself to host plants to obtain nutrients, it offers a wide range of therapeutic applications. In many regions of the world, this parasitic plant has been utilized for therapeutic and decorative purposes. It has been employed in European, Siddha, Ayurvedic, and Chinese traditional medicine. This review article aims in discussing about *Cassytha filiformis* historical and traditional use, bioactive components, therapeutic advantages and consolidate current knowledge on the botanical characteristics and ecological roles of *Cassytha filiformis*. The plant is rich in bioactive compounds such as flavonoids, alkaloids, and phenolic compounds which contribute to its Vaso-relaxant, Anti-Diabetic, Anti-piratic, Anti-inflammatory, Anti-typomania, antimicrobial, antioxidant, and possible anticancer effects.

Keywords: *Cassytha filiformis*; Medicinal Plants; Parasitic Plant; Traditional Medicine; Bioactive Compounds; Therapeutic Applications; Botanical Characteristics

1 Introduction

1.1 General importance of medicinal plant

Throughout history, communities across all continents have utilized a vast array of indigenous plants—ranging from hundreds to thousands—for the treatment of various ailments. Spices and herbs, in particular, are widely recognized for their potent antibacterial and antioxidant activities [1]. Today, many medicinal plants remain integral to modern medicine, serving as essential sources of raw materials for the development of numerous pharmaceutical drugs and therapeutic agents [2]. These plants hold immense value not only for individual health but also for the overall well-being of societies.

Phytochemicals are naturally occurring compounds in plants responsible for their color, taste, and aroma. Although they are available as dietary supplements, their most significant health benefits are typically realized through the consumption of the whole plant[3]. (Plant *Cassytha filiformis* shown in fig .1)

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Figure 1 *Cassytha filiformis*

Well-known for its extensive geographical range and distinct parasitic lifestyle, *Cassytha filiformis*—commonly referred to as "Love Vine" in English—is a twining, stem-like plant that thrives by attaching itself to other vegetation. It is predominantly found in tropical and subtropical climates, especially in regions like Central and South America, Africa, Asia, and across many Pacific Islands, with a particular affinity for coastal ecosystems where humidity supports its growth [4]. Classified under the Lauraceae family, the genus Cassytha comprises approximately 20 documented species, each with parasitic traits adapted to various environments, because the plant contains only a minimal amount of chlorophyll, it is unable to maintain adequate photosynthesis and thus survives by drawing resources from host species. These host plants often include vital horticultural and commercial trees such as mango, citrus, avocado, nutmeg, and clove, making *Cassytha filiformis* both ecologically and economically significant. In order to extract nutrients from host plants, *Cassytha filiformis* forms unique root-like structures known as haustoria—derived from the Latin word haustor, signifying "one who draws or drains." These specialized organs invade the surface of the host plant and extend into its vascular system, particularly the xylem and phloem, to access essential fluids and nutrients needed for growth. The plant exhibits a highly effective method of propagation, as its seeds are dispersed over vast distances through natural vectors like ocean currents, birds, and wind, which aids in its widespread colonization [5].

In traditional and folk medicinal systems, *Cassytha filiformis* is highly regarded for its curative properties and has been incorporated into therapeutic practices across various cultures. Phytochemical screenings of the plant have revealed the presence of diverse bioactive compounds, especially alkaloids, flavonoids, and aporphine-based alkaloids that contribute to its medicinal efficacy. The plant is recognized for a wide array of pharmacological benefits, including vasorelaxant, anti-diabetic, antipyretic, anti-inflammatory, and anti-typomania activities, making it a promising subject for further ethnopharmacological research [6]. This review compries available ethnobotanical, phytochemical, and pharmacological findings from past research to offer an in-depth perspective on the plant's medicinal properties and therapeutic significance.

2 Taxonomy and botanical description

2.1 Common names of Cassytha filiformis

- **English: -**Cuscuta, Hell weed, Devil's gut, Beggar weed, Scald weed, Dodder of thyme, Dodder plant, Lesser dodder, Greater dodder
- **Hindi: -**Akashbel, Amal bel, Kasus, Agas bel
- **Sanskrit: -**Akashvalli, Akashbhavana, Akashpavana, Amarvalli, Antravalli, Amaravallari, Khavalli, Nilatara, Vyomavallika
- **Bengali: -**Akasbel, Swarnalatha
- **Marathi: -**Nirmuli, Nirmuli akashvela
- **Assamese: -**Honborialoti, Akashilata
- **Arabic: -**Kasuth, Tikhme kasus
- **Telugu: -**Lanjasavaramu, Savarapukada, Sitamapurgonalu, Sitammapogunulu, Sithammasavaram, Sithamma-pogunulu, Passi teega, Sithamma-savaram

- **Kannada: -**Akasha balli, Amar balli, Bilu balli, Darada balli, Haadaragiththi balli, Janivaara balli, Mangana udidara (Obtained from Planet Ayurveda-*Cassytha filiformis*.)

2.2 Synonyms

- *Cassytha americana* var. brachystachya
- *Cassytha americana* var. brasiliensis
- *Cassytha americana* var. puberula
- *Cassytha aphylla* [7].

2.3 Taxonomical classification of *Cassytha filiformis*

- Kingdom: Plantae
- Sub kingdom: Tracheobionta
- Super division: Spermatophyta
- Division: Magnoliophyta
- Class: Magnoliopsida
- Subclass: Magnoliidae
- Order: Laurales
- Family: Lauraceae
- Genus: Cassytha
- Species: *Cassytha filiformis* [7].

2.4 Description on Morphological characteristics of *Cassytha filiformis*

Cassytha filiformis is a slender, vine-like plant with smooth, thread-shaped stems that range in color from green to orange. Its leaves are highly reduced and appear as tiny, scale-like points, roughly 1 mm long, and are usually visible near the ends of the stems. The plant bears small flowers that lack stalks (sessile) and are grouped in short, spike-like arrangements (spicate inflorescences) measuring about 1–2 cm in length. Each flower is backed by a single ovate bract and two similar bracteoles, which have fine, fringe-like edges (ciliolate).

Each flower consists of six petal-like parts called tepals, which are smooth and differ in size. The outer three tepals are egg-shaped and about 1 mm long, while the inner three are longer—about 2.5 mm—and more elliptical, with their tips gently bending inward. The flower also features nine functional stamens arranged in two main groups. The outer six are inward-facing (introrse), wide, hairless, and have short filaments ending in sharp points. The inner three stamens face outward (extrorse) and include two small gland-like structures at their base. Their tips are extended into a thin, beak-like form. Additionally, a fourth set of sterile stamens (staminodes) is present; these are smooth and do not play a reproductive role.

The ovary of the plant is spherical (globose) and smooth. As the fruit develops, it becomes enclosed in a floral tube that enlarges along with the fruit (accrescent), while the dried parts of the flower remain attached during the fruiting phase and seeds are about 3.5-6 mm diameter, radicle central, about 2 mm long, oily embryo.

2.5 Comparison between two species of Cuscuta and *Cassytha filiformis*

Most peopele gets confused between Cuscuta and *Cassytha filiformis* as they have bit smilar appearance, plant of genus Cusuta belongs to the family Cuscutaceae and plants of genus Cassytha belongs to familiy of Lauraceae Two species of Cuscuta (belonging to the Convolvulaceae family and commonly called dodders) look quite similar to *Cassytha filiformis* and share a comparable parasitic lifestyle. However, they can be distinguished mainly by differences in their flowers and fruits (As shown in fig 2).

Cuscuta flowers are tiny, about 2 mm in diameter, and grow one by one along the stem. Its fruit is dry, round, and has a thin outer shell containing several small black seeds.

In contrast, *Cassytha filiformis* produces flowers in small branched clusters called panicles. Its fruit is small, soft, and resembles a berry, usually containing a single round seed.

Another difference is in their life cycle and host preference: Cuscuta species are annual plants (completing their life cycle in one season), while *Cassytha filiformis* is a perennial (living for multiple years). *Cassytha filiformis* mostly parasitizes woody plants, whereas most Cuscuta species—except *Cuscuta exaltata*—typically grow on herbaceous (non-woody) plants [8, 9].

Figure 2 Differentiation in flower, fruit and seed of (A) Cuscuta and (B) Cassytha genus

3 Geographic distribution and habit

3.1 Habit

Mature Cassytha species are perennial and herbaceous in nature, lacking true roots. These plants possess chlorophyll and are obligate parasites, meaning they cannot survive without a host. They do not have tendrils; instead, they attach themselves to host plants through specialized structures called haustoria, which develop along their stems.

3.2 Distribution

This species is predominantly distributed across regions such as India (particularly Jammu and Kashmir), Pakistan, Sri Lanka, various parts of Africa, as well as Central America, the Caribbean, and South America.

3.3 Development and Spreading

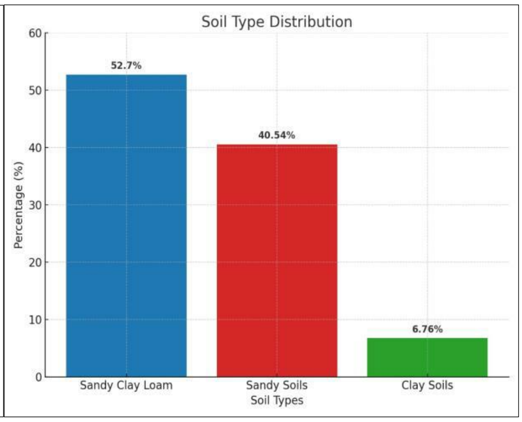
After *Cassytha filiformis* successfully makes contact with a suitable host plant, its connection to the soil begins to deteriorate. The base of the parasite dries out, causing it to lose its direct link with the ground. From this point forward, the plant relies entirely on its host for all essential resources such as water, nutrients, and food. Specialized structures called haustoria penetrate the tissues of the host—either the stem or the leaves—and begin to draw out these resources. Over time, the host plant becomes weakened due to this constant drain and, in many cases, may eventually die. As the parasite matures, it develops flowers and produces seeds. These seeds are then dispersed through various natural agents such as wind, water, or birds, allowing the plant to spread to new locations and infect new hosts [5, 10, 11].

3.4 Distribution and Abundance of *C. filiformis* Based on Soil and Vegetation types

Out of all the host plants studied, most were found growing in sandy clay loam soil—about 39 plants, which is 52.70% of the total. Around 30 plants (40.54%) were found in sandy soil, while only 5 plants (6.76%) grew in clay soil(shown in fig 1). The main types of vegetation in the study areas included farmland, grassy woodlands, cashew plantations, bushlands, regular woodlands, areas near rivers, dense shrubs, and wetlands or flood plains. [12]

Vegetation Types and Their Percentages

S/N	Vegetation Type	Percentage (%)
1	Cultivations	30.43
2	Roadside vegetation	23.19
3	Wooded grassland	13.04
4	Cashew plantation	10.14
5	Degraded area near the ocean	10.14
6	Bushland with scattered Coconuts and Cashew nuts	5.8
7	Reserved Woodlands	2.9
8	Flood plain	1.45
9	Riparian vegetation	1.45
10	Thickets	1.45



(A) **(B)**

Figure 3 A) The main vegetative type associated with *C. filiformis* host plant species B) Soil types preffered by *C.filiformis*

3.5 Worldwide Distribution of *Cassytha filiformis* :

Data from the CABI-Invasive Species Compendium reveals that *Cassytha filiformis* has a widespread global presence, (As shown in fig 4) being reported across most continents except Europe and Antarctica. This highlights the plant's adaptability and invasive potential across diverse ecosystems.

- Africa (35%): The plant is highly prevalent across 45 African countries, including Nigeria, Kenya, South Africa, Ethiopia, Ghana, Madagascar, and Tanzania. It thrives in various ecological zones, from arid regions to tropical forests.
- Asia (16%): In Asia, it has been recorded in 19 countries, including India, China, Indonesia, Sri Lanka, the Philippines, and Thailand. It is often found in agricultural lands, forest margins, and disturbed habitats.
- North America and Surrounding Territories (24%): The species is widely distributed in North America, including the United States, Mexico, and much of Central America and the Caribbean. Countries such as Cuba, Jamaica, Costa Rica, and Puerto Rico report frequent infestations, particularly in warm and humid regions.
- Oceania/Australia (19%): *Cassytha filiformis* is commonly found throughout Oceania, including Australia, Fiji, Papua New Guinea, Samoa, and several other Pacific Island nations. It is especially dominant in coastal zones and open woodlands.
- South America (6%): In South America, the plant has been documented in countries like Brazil, Colombia, Venezuela, and Bolivia. Although its spread is more limited here, it still poses threats to native vegetation and crops.
- Overall, the extensive geographic range of *Cassytha filiformis* underscores its ecological flexibility and the urgency for monitoring and control efforts in affected regions.[13]

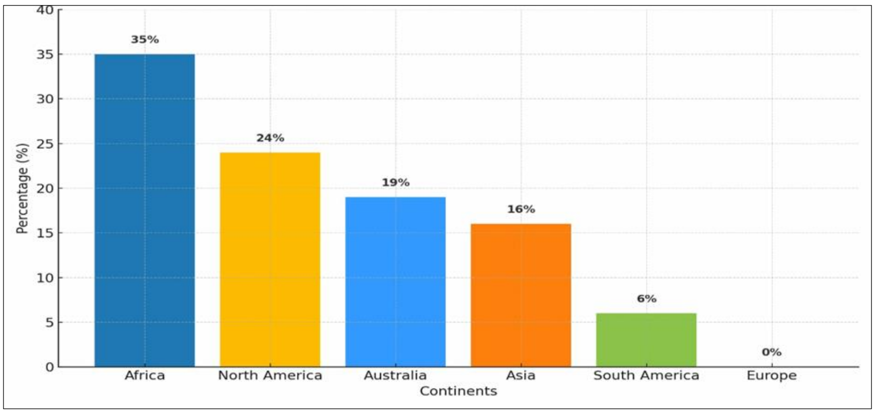


Figure 4 Worldwide Distribution of *C.filiformis*

3.6 Haustorial Development and Attachment Mechanisms of Cassytha species (*Cassytha filiformis*)

Cassytha plants can move their young stems on their own to find suitable host plants. It's still unclear if the attachment is triggered by chemicals released by the host, like in Cuscuta, which responds to smell signals from the host [14, 15]

Cassytha attaches to host plants using a special structure called a haustorium, and just one plant can produce hundreds of these [16, 17]. These haustoria usually grow on the young parts of host plants, like new shoots or the main stem of compound leaves [18].

The first important step in attachment is twining, where Cassytha wraps around the host. However, twining has not been studied as much as the haustorium. Light and plant hormones control this twining behavior in lab conditions. Blue light and a low far-red to red light ratio help trigger both twining and haustoria formation in *Cassytha filiformis*.

Hormones like auxin and cytokinin also play a big role. Under blue light, seedlings with either auxin or cytokinin can start twining and forming haustoria. With both brassinolide and cytokinin, Cassytha can twine even in the dark. However, brassinolide alone doesn't trigger twining [19]. This shows that auxin and cytokinin are key hormones that help Cassytha twine around the host and start forming haustoria.

The haustorium has two parts: the upper haustorium, which stays on the outside of the host, and the endophyte, which grows into the host tissue [20]. A vertical slice of *C. filiformis* haustorium on the leaves of *Canthium rheedii* shows different parts like a vascular core, an interrupted zone, a collapsed layer, and surrounding clasping tissue. Special cells containing small particles (granules) have been seen in the vascular core [21].

When *C. filiformis* touches a host stem, its outer layer (cortex) quickly starts dividing to form the upper haustorium. These cells grow and push into the host, forming finger-like cells called digitate cells. These break into the host's tissue by pressure and change into tube-like endophyte structures.

In the case of *C. filiformis* parasitizing *Morinda tinctoria*, the initial attachment was weak, but as the endophyte grew, it formed a strong bond with the host [22].

Li and Yao (1992) studied how haustoria formed on a *Salix purpurea* (willow) stem. They described four stages:

- Polarity starts
- Formation of a cushion-shaped haustorial plate
- Formation of early haustorium inside the outer host layer, and
- Development of water-carrying tissue (xylem) and its connection to the host's vessels.
- They didn't see development of sugar-carrying tissue (phloem). Instead, *C. filiformis* developed only xylem and dying phloem, suggesting that it mainly takes in water and minerals, not sugars, from hosts like *S. purpurea* [23].

It's been found that haustoria of Cassytha usually don't connect to the host's phloem, which is a key difference from Cuscuta, another parasitic plant [24]. However, in the case of *C. filiformis* and *M. tinctoria,* haustoria did reach the phloem to draw in sugars made through photosynthesis [22]. These differences might depend on the host plant or the stage of infection and need more research.

Besides the physical processes, chemical reactions are also important in helping Cassytha attach quickly and successfully to its host. For example, the haustoria of *C. filiformis* can release acid phosphatase (ACP), an enzyme that breaks down host cells along with mechanical pressure [25].

Also, when Cassytha starts twining around *S. purpurea*, starch grains build up at the point of contact. As the haustorium develops, the starch decreases and disappears, while protein levels rise in those same regions. This means starch is being broken down to give energy and materials for new cells, while proteins are being made to support growth [23].

In [25] also found that the hormone cytokinin (CTK) plays a major role in haustorium development. For example, when *C. filiformis* haustoria were attached to *Salix integra*, the levels of cytokinin forms like isopentenyl adenine (iPa) and zeatin riboside (ZR)were much higher during the early haustorial formation than during the twining or penetration stages.

3.7 Influence of genus Cassytha parasite on host growth, photosynthesis and development

Cassytha extracts water and nutrients from the host plant's xylem, which weakens the host, reduces its growth and reproduction, and lowers its overall biomass. In severe cases, heavy infestations can even kill the host plant [26, 27].

One of the main reasons for this damage is a drop in the host plant's ability to perform photosynthesis. Infected *C. scoparius* plants showed lower photosynthetic activity, reduced transpiration, and less efficient use of sunlight energy [28]. *C. pubescens* also decreased the photosynthetic efficiency and electron transport in *U. europaeus* across different field conditions. This was linked to reduced levels of nitrogen (N) and potassium (K), and higher levels of iron (Fe) and aluminum (Al) in infected plants—likely caused by soil changes due to the parasite (rhizosphere acidification). These changes lead to reduced photosynthesis and eventually cause ongoing light damage known as photoinhibition [29].

3.8 Metabolities and molecular translocation

Metabolites often move and change between parasite plants and their host plants before and after the parasite attaches, usually from the parasite to the host [30]. The energy charge—calculated from ATP (adenosine triphosphate), ADP (adenosine diphosphate), and AMP (adenosine monophosphate)—in young *C. filiformis* plants was low before they parasitized, but increased a lot after attaching to *Ipomoea pes-caprae* because of improved energy production. This allowed Cassytha seedlings to grow and develop more. However, the energy charge in the host plant *I. pes-caprae* did not change, suggesting it could handle the loss of water and nutrients to Cassytha. The types of steroids found in both *C. filiformis* and *I. pes-caprae* didn't change due to parasitism, but the total amount of these steroids did decrease after parasitism. Likewise, most water-soluble compounds (like fructose, glucose, sucrose, and galactitol) in *C. filiformis* went down after parasitism, likely due to water intake from the host and the hardening of tissues, which increases weight. For the host *I. pes-caprae*, the levels of fructose, glucose, and sucrose also went down, while galactitol went up, and pinitol, quinate, and organic acids stayed the same after being parasitized by Cassytha [15]. These results show that parasitism didn't cause major disease-like effects in *I. pes-caprae*, even though its growth and ability to reproduce were affected. It's still unclear if this pattern applies to other Cassytha–host pairs, so more research is needed.

Cassytha can also take in and store chemical compounds from its host plants. For example, toxic gelsemium alkaloids were found in *C. filiformis* when it grew on the poisonous plant *Gelsemium elegans* (also called "heartbreak grass") and absorbed the toxins from the host's sap [31]. This shows the need to check which hosts Cassytha is growing on, especially when the plant is collected for making medicine.

Parasitic plants can also take in big molecules like mRNA, viruses, proteins, and phytoplasmas from their host plants. This has been observed in parasites like Cuscuta, Cytinus, members of the Convolvulaceae, and Santalales [32], where they take these macromolecules from their hosts. For example, Cuscuta can spread viruses and phytoplasmas between different host plants, which is why it's often called a "Cuscuta bridge" [33, 34]. Another example of sharing between parasite and host is horizontal gene transfer. It's not yet confirmed if Cassytha can take in viruses or other large molecules from its hosts, but there is some evidence showing that horizontal gene transfer happens between Cassytha and its hosts [35].

3.9 Benificial and harmfull of Cassytha host interaction for natural ecosystem and humans

3.9.1 Cassytha filiformis infestation: Damage and control

Weeds are a big natural problem that lower crop production [36]. Cassytha species are parasitic plants that grow above the ground and are considered a type of weed [37]. In tropical regions, the parasitic plant *C. filiformis* damages many important crops like Acacia, Azadirachta, Mangifera, and plants from the Myrtaceae and Theaceae families [6, 38, 39]. For example, in Tanzania, *C. Filiformis* affected 20% of cashew trees and 16% of orange trees. In that region, pests and diseases cause about 30–40% of total crop loss [12, 40]. In southeastern China, more than 15% of forests were damaged by *C. filiformis*, and in young *Camellia oleosa* forests in Guangxi Province, damage went as high as 50–60% [41].

In Odisha, India, this parasite was found on 51 plant species from 24 families. It was most commonly seen on *Chromolaena odorata, Vitex negundo,* and *Azadirachta indica*, spreading widely in forests, farmlands, and wastelands [42].

Even though parasitic plants like Cassytha make up less than 5% of the total plant mass in an area, they can greatly affect plant communities. They can lower overall plant growth, change how different plant species are balanced, and affect the way plants grow and recycle nutrients in the environment [43]. On the Paracel Islands in the northern South China Sea, *C. filiformis* was found to reduce the balance and total mass of plants but increased the number and variety of plant species growing above ground. It also changed the types of soil animals and microbes in the area [44]. This shows that Cassytha may cause both good and bad effects in nature and might even play an important role in the ecosystem. For example*, C. ciliolate* does well in areas with many host plants, like the Cunonia plant community in South Africa's Cape Floristic Region [45].

It's important to control parasitic weeds to protect crops. In places with small infections, *C. filiformis* can be removed by hand, especially when the plants are young and before they produce flowers or fruits. In areas with a lot of infestation, specific herbicides like Bentazon, used in the right amount, can help remove *C. filiformis* [38].Overall, more studies are needed to understand how Cassytha spreads and how it affects farming and natural ecosystems.

3.10 *Cassytha filiformis* role in ecological pest management:

Allelopathy is a natural process in which one plant releases chemicals that can affect the growth and survival of other nearby plants [46]. *Cassytha filiformis* has shown harmful allelopathic effects on three test plants: *Oryza sativa* (rice), *Echinochloa crus-galli* (barnyardgrass), and *Vigna radiata* (mung bean). These effects were proven by applying Cassytha extracts in both powder and water forms during lab experiments, greenhouse trials, and field studies [47]. For example, the dry weight of barnyard grass was reduced by 76.7% in the greenhouse and 42.7% in the field when treated with powdered Cassytha extract. This suggests that *C. filiformis* could be used as a natural herbicide for controlling weeds in non-rice crops. However, it is still unknown whether it affects other weed species.

Similar to Cuscuta, native Cassytha species can also be used to control invasive plant species [48, 49]. For instance, in Florida, the local *C. filiformis* was part of a strategy to manage the invasive tree *Schinus terebinthifolius*. When combined with the leaflet-rolling moth *Episimusunguiculus,* it significantly reduced the growth of the invasive tree for at least two months after the moths were removed [50].

4 Phytochemical properties of *Cassytha filiformis*

The physical and chemical characteristics of *Cassytha filiformis* have been analyzed and assessed by various researchers.

4.1 Qualitative analysis for phytochemicals:

In [7, 10, 51], different solvent extracts of *Cassytha filiformis* were tested using qualitative methods to detect the presence of phytochemicals such as alkaloids, flavonoids, saponins, tannins, carbohydrates, phenols, and others. The findings are summarized in the below table.

Table 1 Qualitative analysis:

Phytochemicals	**MF**	**AF**	**NF**
Glycosides	Strong	Very Strong	Absent
Steroids	Absent	Absent	Moderate
Terpenoids	Mild	Absent	Moderate
Alkaloids	Mild	Strong	Absent
Acidic compounds	Absent	Mild	Absent
Carbohydrates	Mild	Moderate	Absent
Resins	Absent	Absent	Strong
Tannins	Moderate	Strong	Absent
Saponins	Absent	Absent	Absent
Flavonoids	Absent	Absent	Moderate
Proteins	Absent	Absent	Absent
Fat and oils	Absent	Absent	Mild

MF is Methanolic extract of *Cassytha filiformis* aerial parts, AF is Hot water extract of *Cassytha filiformis* aerial parts, NF is n-Hexane extract of *Cassytha filiformis* aerial parts.

4.2 Quantitative analysis of Phytochemicals [4, 13]:

Quantitative analysis of phytoconstituents of Cassytha filiformis had been performed, concentration of each constituent is mentioned in the table.

Table 2 Quantitative analysis

Phytochemical Compound	Concentration
Saponin	3.48%
Flavonoid	3.70%
Tannin	10.47%
Phenol	5.233 mg/l
Phytate	1.160 mg/l
Cardiac Glycosides	2.65%
Oxalate	0.132 mg/l
Haemagglutinin	12.495 mg/l
Alkaloid	3.18%

4.3 Physical content

The physical properties (ash value, moisture content, acid-insoluble ash value, swelling index, bitterness value, crude fiber, fixed oil) were evaluated in [52] and are presented in below table.

Table 3 Physical content

Numerical Standards	*C. filiformis*
Swelling index	165.00±10.00
Total tannins	27.30±6.81
Crude fibre	22.40±0.10
Water soluble extractive value	20.60±0.77
Ash value	17.00±1.08
Ethanol soluble extractive value	13.60±0.69
Fixed oil	1.60±0.16
Moisture content	5.50±0.82
Acid insoluble ash	1.00±0.41
Bitterness value	0.23±0.01

4.4 Phytochemistry

Phytochemical studies and the isolation of compounds from *Cassytha filiformis* are still being actively researched. Aporphine alkaloids like Cassythine, Neolistine, Dicentrine, and others have been identified in [53, 54, 55] and are shown in the table.

Table 4 List of Phytochemicals

Sr. No.	Name of the Phytochemicals	Phytochemicals type
1	Cathafiline	Aporphine alkaloid
2	Cathaformine	Aporphine alkaloid
3	Actinodaphnine	Aporphine alkaloid
4	Predicentrine	Aporphine alkaloid
5	Ocoteine	Aporphine alkaloid
6	Cassyfiline	Aporphine alkaloid
7	Neolistine	Aporphine alkaloid
8	Dicentrine	Aporphine alkaloid
9	Quercetin 3-O-robinobioside	Flavonoid
10	Quercetin 3-O-rutinoside	Flavonoid
11	Quercetin 3-O-galactoside	Phenolic compound
12	Kaempferol 3-O-robinobioside (Biorobin)	Flavonoid
13	Isohamnetin 3-O-rutinoside (Narcissin)	Flavonol glycoside
14	Isohamnetin 3-O-robinobioside	Flavanol
15	9,12-Octadecadienoic acid (Z, Z)-2,3-dihydroxypropyl ester, acid (Z,Z)-2,3-dihydroxypropyl ester	Ester
16	Didodecyl phthalate	Hydrocarbon
17	5-Stigmastan-3,6-dione	Steroidal Saponin
18	Hexatriacontane	Steroidal Saponin
19	Campesterol	Steroidal Saponin

4.5 Elemental analysis of powder *Cassytha filiformis* [52]

Elemental analysis of *Cassytha filiformis* was studied and concentration of each coumpounds are mentioned in below table.

Table 5 Elemental analysis

Sl. No	Element	Concentration (ppm)
1	Pb	0.0568
2	Ni	2.7933
3	Ca	84.3993
4	Mn	14.4093
5	Na	5.1735
6	Cr	7.7940
7	Co	0.4621
8	K	0.8313
9	Fe	165.4279
10	Zn	0.1094
11	Cu	0.0535

5 Ethanobotanical and traditional use

5.1 Ornamental purpose

Cassytha filiformis holds significant ornamental value in various cultures. In particular, it plays an important role in the traditional attire and customs of the Gilbert Islands. The slender, smooth strands of this vine—characterized by their vibrant orange-yellow coloration—are commonly used in decorative applications. Dancers from the Gilbert Islands adorn themselves with these vines during performances, utilizing them in a variety of creative and symbolic ways. The vines are artistically crafted into necklaces and head wreaths, enhancing the aesthetic appeal of the dancers. Additionally, they are often draped across the chest and coiled around the arms, contributing to an elaborate and culturally meaningful appearance.

Beyond their ornamental use, the vines also hold cultural significance in other contexts. It has been documented that men in the region use *Cassytha filiformis* in practices associated with love magic. Meanwhile, women make use of the vine's extracts for practical and artistic purposes. These extracts are specifically applied as a dye to achieve a rich black color on fabrics, indicating the plant's value in textile coloration [56, 57].The whole plant paste can be used for paper making [13].

5.2 Medicinal Values of Cassytha filiformis

An increasing number of ethnobotanical studies and traditional medicinal reports emphasize the broad therapeutic potential of *Cassytha filiformis,* a parasitic vine widely utilized in various cultural practices [8, 58]. Across several countries and island communities, this plant has earned a place in natural medicine due to its diverse healing properties.

In the Pacific Islands, particularly Fiji, *C. filiformis* is traditionally used as a remedy for jellyfish stings. The application of the plant to affected areas is believed to help reduce pain, inflammation, and the spread of venom, serving as an accessible, natural first-aid treatment for marine injuries.

In Taiwan, the medicinal usage of the plant is far more extensive. Here, it is commonly used to treat sexually transmitted infections such as gonorrhoea, and it is also administered in cases of kidney ailments where it is thought to support renal function. In addition, *C. filiformis*is recognized for its diuretic effects, promoting urination and aiding in the elimination of toxins and excess fluids from the body. Its role in detoxification suggests potential in supporting general health and wellness.

Modern midwifery practices have also adopted the plant's extract for use in maternal care. It is recommended that expectant mothers consume the juice daily for approximately four weeks prior to childbirth. This regimen is believed to not only ease labor pain but also to expedite the delivery process and enhance natural lubrication of the birth canal, thereby minimizing complications during childbirth. This practice reflects a growing interest in herbal solutions for women's reproductive health.

In Palau, a culturally significant remedy involves mixing the vine's juice with coconut milk to treat gonorrhoea, indicating the use of plant-based compounds in combination for enhanced therapeutic effect. Among women, *Cassytha filiformis* is also employed in reproductive health management. The juice extracted from the stems is traditionally consumed to induce menstruation, accelerate labor (parturition)[62], and even suppress milk production in cases of stillbirth, offering emotional and physiological support in difficult circumstances.

Additionally, the stems of the plant are crushed and used as a vermifuge to expel parasitic worms from the digestive tract—a practice common in communities without access to pharmaceutical deworming agents. The preparation of a decoction from the stems is also used to relieve skin irritations, especially the intense itching associated with eczema. Such use highlights the anti-inflammatory and soothing nature of the plant's compounds [8, 58, 59, 60, 61].

This wide spectrum of medicinal uses underscores the importance of *Cassytha filiformis* in traditional healing systems, encouraging further scientific investigation into its pharmacological properties and potential incorporation into modern herbal medicine.

6 Reported pharmacological actions shown by *Cassytha filiformis*

6.1 Anti-inflammatory, antipyretic, and analgesic effects

The analgesic, antipyretic, and anti-inflammatory effects of chloroform and methanol extracts were studied in rats. For evaluating analgesic activity, the tail immersion and Haffner's tail clip methods were utilized, revealing that the extract and diclofenac sodium exhibited similar levels of effectiveness. In terms of antipyretic potential, the extract showed a significant ability to lower elevated body temperature in a paracetamol-induced fever model. Regarding anti-inflammatory action, carrageenan was used to induce paw edema, and treatment with both diclofenac sodium and the extract resulted in a marked reduction of swelling and inflammation [7].

6.2 Anti-hypertensive activity

The antihypertensive effect of ethanol extracts from *Cassytha filiformis* was examined in rats with experimentally induced hypertension. Two types of hypertensions were induced: endocrine hypertension, using a combination of prednisone and salt, and oxidative stress-related hypertension, caused by the same combination along with L-Nitro Arginine Methyl Ester. Treatment with a 5 mg/kg dose of *Cassytha filiformis* ethanol extract significantly reduced systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP), indicating notable antihypertensive activity [63].

1.1 Antioxidant activity:

The antioxidant capacity of methanol, ethyl acetate, and hexane extracts was evaluated using the DPPH assay, with Butylated Hydroxytoluene as the standard reference. Among the tested extracts, *Cassytha filiformis* methanolic extract demonstrated the highest antioxidant activity. Similarly, in [64], methanol extracts of *Cassytha filiformis* were examined through both DPPH and FRAP assays, using ascorbic acid as the control. The greatest antioxidant response was recorded at a concentration of 400 µg/mL.

1.2 Anti-diabetic activity

The study conducted by researchers in [64] investigated the anti-diabetic effect of an 80% methanolic extract of *Cassytha filiformis* in albino mice. Diabetes was induced using alloxan monohydrate, and Glibenclamide was used as the reference drug. A dose of 600 mg/kg of the extract significantly decreased fasting blood glucose levels. Additionally, the extract exhibited oral safety up to a dose of 2000 mg/kg.

1.3 Vasorelaxing activity

The study in [65] explored the vasorelaxing properties of *Cassytha filiformis* extracts using isolated aortas from Sprague-Dawley rats. The extracts were found to suppress phenylephrine-induced contractions, with their potency quantified through IC50 values, demonstrating significant vasorelaxant effects.

1.4 Anti-malarial activity

Study [66] investigated the anti-malarial potential of ethanolic extracts of *Cassytha filiformis* in mice infected with Plasmodium berghei. The evaluation involved monitoring RBC and WBC counts, hemoglobin (Hb) levels, and packed cell volume (PCV) to assess parasite burden and anemia. Treatment with *Cassytha filiformis*, particularly at a 400 mg/kg dose in the p-Alaxine standard form, led to marked improvement in these blood parameters, effectively alleviating the anemia caused by the malarial infection.

1.5 Diuretic activity

In [67], a comparative study was performed to evaluate the diuretic properties of *Cassytha filiformis* and *Cuscuta reflexa* using alcoholic and aqueous extracts in Wistar rats. The investigation revealed an enhanced excretion of sodium and potassium ions, with *Cassytha filiformis* extract exhibiting a more pronounced diuretic effect compared to *Cuscuta reflexa*.

1.6 Effect on Pregnancy and Fetal Development

Study [68] explored the influence of a butanol fraction of *Cassytha filiformis* on pregnancy and fetal development in fertilized mice. Administered doses ranged from 2.5 mg/kg to 10 mg/kg across all three trimesters. The results indicated that the extract induced infertility, impaired normal pregnancy progression, and caused fetal deformities.

1.7 Cytotoxicity studies

[58, 69] demonstrated that both the crude extract and specific isolated compounds of *Cassytha filiformis* showed cytotoxic effects against cancer cell lines (HeLa, Mel5, HL-60) and non-cancerous 3T3 fibroblasts, as evaluated using MTT and WST-1 assays.

1.8 Anti-Candidal efficacy

The study in [70] assessed the anti-Candidal properties of aqueous, methanol, and n-hexane extracts of *Cassytha filiformis* against *Candida albicans* using the Agar dilution method. The researchers observed that both the aqueous and methanol extracts exhibited notable anti-Candidal activity.

1.9 Toxicity Assessment

The defatted ethanolic extract of *Cassytha filiformis* has shown potential antihypertensive effects on research. In [72] was aimed to assess the acute and delayed toxic effects of the extract.A total of 90 mice were divided into six groups, each receiving a single dose of the extract at concentrations of 25, 50, 100, 200, 400, or 800 mg/kg. Probit analysis was used to calculate the lethal dose (LD50), while Two-Way ANOVA was applied to evaluate changes in body weight, as well as food and water intake.The LD50 values observed at 1, 2, 3, 24, and 48 hours were 0, 875.83, 313.63, 52.28, and 2.17 mg/kg, respectively, indicating increasing toxicity over time. Both the dosage and duration significantly affected the mice's food and water intake ($p<0.05$), with higher doses—particularly 400 mg/kg—causing a notable decrease in consumption lasting up to 15 days. This reduction led to a decrease in body weight.Despite these effects, there were no significant differences ($p>0.1$) in the relative weights of the heart, liver, or kidneys at the end of the 14-day observation period. Overall, the findings suggest that although the extract has potential therapeutic benefits, it also exhibits both acute and delayed toxic effects, especially at higher doses.

The investigation detailed in [71] explored the acute, delayed, sub-chronic, and subacute toxicity of *Cassytha filiformis.* Acute toxicity of defatted ethanolic extracts was tested in mice, with toxicity measured by LD50 values and symptoms such as reduced motor activity, diarrhea, and changes in breathing following a single administration. The findings confirmed that *Cassytha filiformis* possesses toxic characteristics. Delayed toxicity was assessed through variations in food and water consumption and body weight reduction, further supporting its toxic nature. In a separate sub-chronic toxicity study using rats, an aqueous extract of *Cassytha filiformis* was administered. Researchers evaluated toxicity by monitoring body and organ weights, blood profiles, and biochemical markers in plasma. The results indicated that typical dosage levels did not cause major toxic effects, though some animals showed increased cholesterol levels and slightly elevated heart and lung weights.

Subacute toxicity was studied in rats using a hydroethanolic extract of *Cassytha filiformis* as mentioned in [71]. While no structural damage to the liver or kidneys was found, high doses (800 mg/kg) led to moderate irregularities in blood and biochemical parameters, suggesting possible mild functional disturbances.

7 Conclusion

Cassytha filiformis exhibits significant pharmacological potential owing to its rich phytochemical composition, including flavonoids, alkaloids, and tannins. These compounds have been linked to various biological activities such as antioxidant, anti-inflammatory, and antimicrobial effects. Its traditional use in treating diverse ailments supports current scientific findings and highlights its relevance in ethnomedicine. Despite promising *in vitro* and *in vivo* studies, clinical validation through human trials remains limited. Additionally, toxicological evaluations are crucial to ensure its safety for therapeutic use. The variability in phytochemical content across different geographic locations presents challenges for standardization and formulation. Advances in extraction techniques and delivery systems may help enhance its bioavailability and pharmacological efficacy. Combining traditional knowledge with modern pharmacological research could uncover new therapeutic applications. Overall, *Cassytha filiformis* stands out as a promising candidate for natural drug development. However, further comprehensive studies are needed to fully explore and validate its medicinal potential.

Compliance with ethical standards

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No conflict of interest to be disclosed.

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