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REVIEW ARTICLE **OPEN ACCESS**

Ardisia solanacea (Poir.) Roxb. – An Unexplored Medicinal Plant

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ABSTRACT
The growing awareness of the adverse effects of synthetic drugs in the modern era has led to exponential growth and interest in the field of natural medicines. Among these, Ardisia solanacea (Primulaceae), commonly known as Shoebutton Ardisia, stands out as a species within the Ardisia genus with a rich history of ethnomedicinal applications across the globe. All parts of the plant especially its leaves contain several secondary metabolites such as polyphenols, triterpenoid saponins, coumarins, quinones, flavonoids, and alkylphenols. The diverse array of phytochemicals provides the plant with a spectrum of pharmacological activities, including anthelmintic, antimicrobial, analgesic, anticonvulsant, antioxidant, antitumor, antiplatelet, cytotoxic, antifungal, pesticidal, and insecticidal properties. This review aims to compile current as well as past information on the morphology, chemical constituents, pharmacological activities, and traditional uses of this plant which will be helpful for researchers in the development of modern medicine.
Keywords: *Ardisia solanacea, Shoebutton Ardisia, Ethnobotany, Phytoconstituents, Natural medicines, Pharmacological activities.*

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INTRODUCTION

Since ancient times, medicinal plants have played a crucial role in human healthcare by offering an abundance of therapeutic agents that can be used to treat a variety of illnesses. Approximately 80% of the world's population still uses medicinal plants for a variety of medical reasons, according to the World Health Organization (WHO) (1). Even in the present era, there is still a persistent reliance on traditional medicine as people look for less expensive, safer alternatives with fewer side effects (2).

Numerous therapeutic plants can be found all over the world, and they all contain a vast array of possible bioactive ingredients. Over 45,000 plant species have been identified in India alone, a nation well-known for its wealth of traditional knowledge. Of these, thousands are said to have therapeutic qualities, and these species are the basis of medical systems such as Ayurveda (3). Herbal remedies are made from leaves, bark, seeds, berries, oil, and roots providing a wide range of therapeutic options (4). The rapid expansion of the global herbal medicine market, which is expected to reach $39.52 billion by 2026, is proof of the renewed interest in natural products as a healthier substitute for synthetic drugs (5). This change is explained by the perception that herbal products are safer and have better tolerance than synthetic alternatives. The fact that these products are made from a variety of plant components supports the idea that they are safe and effective (6).

Even though herbal remedies are commonly used, a significant amount of this plant resource is still unexplored because there is a lack of thorough scientific studies on their pharmacological properties and bioactive components (7). Herbal medications make up about 25% of all medications in developed nations, but in nations like China and India, this percentage climbs to about 80%. This emphasizes the necessity of thorough scientific validation to improve our knowledge of the therapeutic benefits provided by these plant-based remedies (8). As people become more aware of the adverse effects of synthetic drugs, there is a growing interest in natural product medicines in the modern era (9). The renewed surge of interest is demonstrated by the 7–15% annual growth rate of the medicinal plant-based industries. Despite the tremendous advancements in modern medicine, the creation of novel medications from natural sources is still an important and ongoing endeavour (1).

The species *Ardisia solanacea* (Poir.) Roxb., also referred to as Shoebutton Ardisia is a member of the genus Ardisia and is found throughout the world's tropical and subtropical regions. With more than 900 years of medical history, the Ardisia group is well-known in Chinese traditional medicine (10). Numerous compounds, such as polyphenols, triterpenoid saponins, coumarins, quinones, flavonoids, and alkylphenols, have been identified in the genus (11). The medicinal properties of *Ardisia solanacea* are noteworthy. Traditionally, fruits have been used to treat ailments like dysentery and diarrhoea. They also have antibacterial, antimicrobial, antioxidant, anti-spermatogenic, anti-steroidogenic, anti-inflammatory, antipyretic, stomachic, stimulant, astringent, diuretic, and anti-diabetic qualities. On the other hand, the leaves have anxiolytic, sedative, analgesic, and antibacterial qualities in addition to being hepatoprotective, anti-inflammatory, and insect-feeding (5).

Table 1: Taxonomic Classification of *Ardisia solanacea* (Poir.) Roxb. (12)

Kingdom	Plantae
Subkingdom	Viridiplantae
Division	Tracheophyta
Subdivision	Spermatophyta
Class	Magnoliopsida
Order	Ericales
Family	Primulaceae
Subfamily	Myrsinoideae
Genus	Ardisia Sw.
Species	*Ardisia solanacea* (Poir.) Roxb.

Table 2: Vernacular Names of *Ardisia solanacea*

Language / Region	Name	References
Bengali	Banja	(13)
Hindi	Dhan-Priya	(14)
Kannada	Bode, Bodhina Gida, Shuli, Sore	(15)
Malayalam	Kakanjara, Kaka-Njara, Kolarakku, Kuzhimundan, Molakka	(10)
Marathi	Bugadi, Dikna	(16)
Nepali	Damaai Phal	(10)
Odia	Banajamu, Kakajambu, Tinkoli	(16,17)
English	Shoebutton Ardisia, Elliptical-leaf Ardisia, China Shrub	(16,18)
Tamil	Kozhikkotai, Kozhikkottai, Manipudbam, Narikandam	(15)
Telugu	Adavi Mayuri, Kaashi Neredu, Konda Mamidi, Konda Pogada	(16,18)
Tulu	Bode	(16)
Great Nicobar Island	Kanheyo	(19)
Chinese	Ai Zi Jin Niu	(20)
French	Ardisie Elliptique, Ati Popa'a	(12)
Thailand	Langphisa	(12)
Uttarakhand	Bisi	(21)
Bihar	Gulanchi, Garda, Gadhichi	(22)
Andaman group of islands	Chakapum	(23)

Morphology

Ardisia solanacea, an evergreen shrub or small tree, reaches heights of 1.5 to 6 meters, exhibiting thick branches with a distinctive red colour. Its bark is brown and smooth in appearance (Figure 1). The glabrous leaves, measuring 7.5 to 17 cm in length and 2.5 to 7 cm in width, exhibit variations in shape ranging from oblanceolate to obovate-elliptical or elongated (Figure 2). Tapering down to a pointed base, these leaves may feature blunt or short points toward the front, and their veining, after drying, takes on a translucently dotted and somewhat reticulated pattern (15,24,25).

The inflorescences of *Ardisia solanacea,* reaching up to 3 cm (occasionally up to 6.5 cm) in length, are arranged in axillary, corymb-like racemes that are shorter than the leaves. Pedicels vary in length from 1 to 3 cm (Figure 3). The sepals, distinct from each other, display a depressed ovate shape, showcasing ciliated and dotted characteristics reminiscent of kidneys or nearly perfect circles. The corolla lobe, asymmetrical and either ovate-elliptical or elongated elliptical, features tiny, dispersed glands. The petal introduces a spectrum of colours, ranging from lavender to dark pink (Figure 4). Turning attention to the fruits, the berries of *Ardisia solanacea* are depressed-globose, initially measuring 8 mm long and 11 mm wide, and assume a pink hue before transitioning to black. Each fruit houses a single seed, relying on persistent sepals for support (Figures 5 and 6). The flesh is white, and the juice extracted from these berries exhibits a distinctive purple tint (15,26).


Figure 1: Stem of *A. solanacea*


Figure 2: Leaves of *A. solanacea*


Figure 3: Inflorescences of *A. solanacea*


Figure 4: Flowers of *A. solanacea*


Figure 5: Raw berries of *A. solanacea*


Figure 6: Ripe berries of *A. solanacea*

Phenology

The fruiting period is from April to August, while the flowering period is from July to March (27).

Distribution

Ardisia solanacea is native to Bangladesh, India, Nepal, China, Sri Lanka, Pakistan, and various Pacific Islands. This botanical specimen exhibits widespread distribution in Southeast Asia. Within the Indian subcontinent, it can be found throughout the eastern region to Assam, the Himalayan foothills, central India, the Konkan and Kanara coasts, and southern parts of India (28,29).

Ecology

The large evergreen shrub exhibits a height range of 1.5 to 4 meters and thrives within an elevation span of 100 to 1100 meters above sea level. Preferring partial shade, this species flourishes in tropical environments, particularly in moist deciduous forests. Additionally, it shows a preference for marshy or moist-rich soil conditions. The adaptability of *Ardisia solanacea* to these specific ecological factors contributes to its successful growth and development in its natural habitat. (26,30).

Reproduction

Shoebutton ardisia blooms sporadically throughout the year. The species is insect-pollinated and self-fertile (25).

Ethnobotanical Uses

Several species of Ardisia have been used as decorative and medicinal plants; in addition, they serve as a source of food for natives (10,31). In early 1900, *A. solanacea* was brought to Florida for ornamental use (32). Its leaves are used as a vegetable and analgesic in Tamil Nadu, where its seed paste is externally applied to treat fungal infections, eye pain, and fits (33,34). *A. solanacea* leaves are used in funeral rituals in Kerala. In addition to being used as cattle feed, leaves are also used to make medicinal oil (35). The plant produces edible fruits. The plant is typically consumed as a leafy vegetable (36). Traditional fabric dyeing has made use of *A. solanacea* berries, with yellow being the most common colour produced (6). In

Meghalaya, ripe fruits are eaten raw by tribal groups, while ethnic groups in Uttarakhand use roots to make dye (18,21). In Odisha, the fruits of *A. solanacea* are used to make juice (27). In some parts of Southeast Asia, the plant is used as fuel wood, and fodder, and its leaves are eaten as a salad (25).

Traditional Medicinal Uses

The genus Ardisia contains many species that are used in traditional medicine to treat a variety of conditions, including stomach aches. It is also known from folklore to treat fever, rheumatism, scabies, snakebites, cholera, and intestinal worms. Menstrual cramps, liver disorders, diarrhoea, pains, bacterial infections, rheumatic arthritis, swelling, earache, cough, fever, inflammation, respiratory tract infection, traumatic injury, broken bone, snake and insect bite, gout, asthma, mental disorder, skin sore, vertigo, birth complications, and to improve general blood circulation are just a few of the medical conditions for which it is used (10,11,31,37). Indigenous people still use it to prevent gas formation in the gastrointestinal tract, which fights flatulence and lowers acidity. It has carminative, antacid, and stimulant properties (38,39).

The root and bark of *A. solanacea* have wound-healing properties and its boiled water is used to clean sores (40,41,42). Folk people in Orissa use the plant as a narcotic and internally administer the root and bark decoction to treat fever (43,44). Fresh leaf paste is used to treat boils and itching due to impure blood (45,46). After childbirth, the root is boiled in water and used to wash the uterus; a decoction of the root is also taken orally to treat internal haemorrhage and remove blood clots (47). Leaf decoction is given to women with complaints of frequent abortion (48). Leaf paste is mixed with coconut oil and used externally to cure mumps. Roots are boiled in water and vapour is inhaled (23,49). Leaf extract is administered orally to cure facial and leg swelling (50). In Kerala, the fruits of *Piper nigrum* L. var. nigrum, the tuber of *Plumbago zeylanica* L., and the bark of *Zyzyphus trinervia* Roxb are ground together with the bark of *A. solanacea* to relieve toothache (18). Powders of stem and bark are used to treat gonorrhoea and piles, while infusions of root and bark are given as tonic after delivery (22). Root decoction is given internally to cure blood dysentery (17).

Nutritional information

The minerals and vitamins found in plants are essential for controlling a wide range of physiological functions in the bodies of the animals that consume them, including skeletal structure, neuromuscular irritability, blood clotting, and enzyme activity regulation. *A. solanacea* leaves are a poor source of phosphorous, but they are rich in macronutrients such as calcium, magnesium, sodium, and potassium. Additionally, the leaf contains adequate amounts of microelements like zinc and copper. A few important vitamins, including ascorbic acid, beta-carotene, and tocopherol, as well as amino acids, can be found in leaves (6).

Phytoconstituents

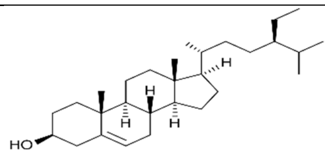
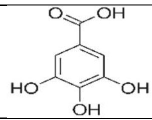
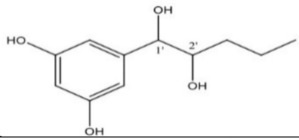
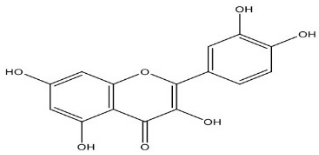
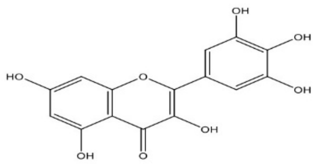
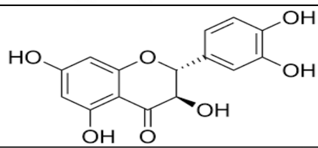
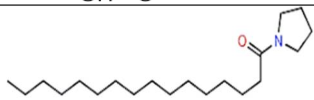
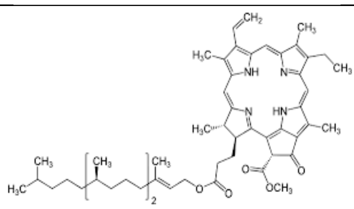
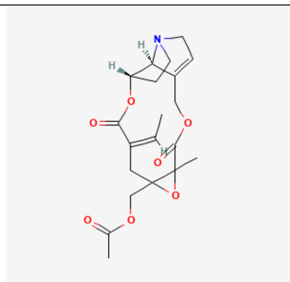
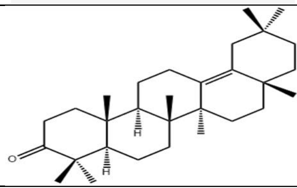
Leaves

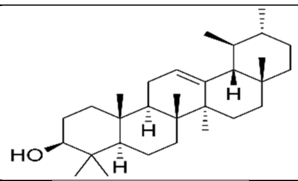
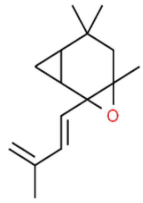
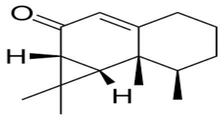
The ethyl acetate leaf extract of *A. solanacea* has been found to contain aristolone. Additionally, the leaves of *A. solanacea* have been reported to various compounds, including β-sitosterol, gallic acid, quercetin, myricetin, bauerenol, β-amyrin, and α-amyrin, along with (-)-5-(1,2-Dihydroxypentyl) benzene-1,3-diol. Triterpenoids and alcohols have also been identified in the leaves. Furthermore, the leaf extract was found to contain tannin, β-carotene, tocopherol, phenols, lectins, phytic acid, and ascorbic acid (51). Notably, aristolone was identified as the primary constituent, accompanied by 3-hydroxy-3,7,11,15-tetramethylhexadecanoic acid, silylat, α-amyrenone, espirosal (glycol salylate), squalene, heneicosane, and palmitic acid (33). Moreover, the methanolic extract of *A. solanacea* leaves exhibited the presence of amino acids such as alanine, glutamic acid, and valine (52).

Root and Stem

In the analysis of ethyl acetate root and stem extract, the predominant constituents identified were α-amyrenone and α-amyrin. A study revelled a presence of a diverse array of important phytoconstituents. Among the notable components identified were docosane, palmitic acid, 1-naphthelenol 5,6,7,8-tetrahydro-2,5-dimethyl-8-(-1-methylethyl), and 3-hydroxy-3,7,11,15-tetramethylhexadecanoic acid. Additionally, the extract contained minor components such as β-asarone, lithocholic acid, fumaric acid, neophytadiene, myristic acid, estradiol, 3-deoxy, cis, cis-linoleic acid, cis-vaccenic acid, phytol, squalene, β-stigmasterol, and gorgost-5-en-3-ol (18, 33).

Table 3: Isolated and identified phytochemicals from *A. solanacea*

Part Used	Extract solvent	Characterization	Phytochemicals	Structure	Ref
Leaves	Ethanol	IR, HREI-MS, ^{1}H-NMR, ^{13}C-NMR	β-sitosterol		(11)
Leaves	Ethanol	IR, HREI-MS, ^{1}H-NMR, ^{13}C-NMR	Gallic acid		(11)
Leaves	Ethanol	IR, HREI-MS, ^{1}H-NMR, ^{13}C-NMR	(-)-5-(1,2-dihydroxypentyl) benzene-1,3-diol		(11)
Leaves	Ethanol	IR, HREI-MS, ^{1}H-NMR, ^{13}C-NMR	Quercetin		(11)
Leaves	Ethanol	IR, HREI-MS, ^{1}H-NMR, ^{13}C-NMR	Myricetin		(11)
Leaves	Ethanol	Flash Chromatography, HPTLC, HRMS	Taxifolin		(5)
Leaves	Ethanol	Flash Chromatography, HPTLC, HRMS	1-Hexadecanoylpyrrolidine		(5)
Leaves	Ethanol	Flash Chromatography, HPTLC, HRMS	Pheophytin		(5)
Leaves	Ethanol	Flash Chromatography, HPTLC, HRMS	O-acetylerucifoline		(5)
Root	Ethyl acetate	GC-MS	α-Amyrenone		(18)

Root	Ethyl acetate	GC-MS	α-Amyrin		(18)
Root	Ethyl acetate	GC-MS	4,6,6-trimethyl-2-(3-methylbuta-1,3-dienyl)-3-oxatricyclo [5.1.0.0(2,4)] octane		(18)
Leaves and Stem	Ethyl acetate	GC-MS	Aristolone		(33)

Pharmacological Activities

Cytotoxic Activity

With the potential to significantly influence cancer treatment challenges, phytochemicals offer promising and effective opportunities for research. The need for alternative, affordable, environmentally friendly, and more sustainable methods has been highlighted by the rising rate of cancer as well as the high costs, toxicity, and side effects of the anticancer medications currently on the market. Despite the traditional use of *Ardisia solanacea* in various medicinal applications, information regarding its traditional use for cancer treatment has not been widely reported (53). Recent scientific reports highlight the presence of potent anticancer agents, including flavonoids, tannins, and saponins, in *A. solanacea*.

The brine shrimp lethality test was conducted to assess the cytotoxic potential of different fractions of *A. solanacea*, including the methanolic extract, chloroform fraction, petroleum ether fraction, carbon tetrachloride fraction, and aqueous extract. The petroleum ether soluble fraction exhibited the highest cytotoxicity, with an LC_{50} value of 0.703 μg/mL, surpassing the standard vincristine (0.544 μg/mL). Plant extracts with elevated concentrations of bioactive compounds are believed to demonstrate increased cytotoxic activity (54). Another study involved the investigation of the ethanolic extract of the root and stem of *A. solanacea*, employing the brine shrimp lethality test to measure cytotoxic activity. The LC_{50} values for the stem and root extracts were 165.799 μg/mL and 185.485 μg/mL, respectively, compared to the standard vincristine sulphate (0.482 μg/mL). These findings suggest that *A. solanacea* extracts may be used as a drug with minimal cytotoxicity, as indicated by their slight activity in the brine shrimp lethality bioassay (13). Study of *Ardisia solanacea* bark as a potential prophylactic against colon cancer caused by dimethylhydrazine. The study utilized the MTT assay to assess in vitro anti-colon cancer activity using the HT-29 cell line. The hydroalcoholic extract of *Ardisia solanacea* demonstrated a dose-dependent increase in percentage inhibition in the HT-29 cell line, with a 50% inhibition concentration of 140.95 μg/mL, compared to 5-FU at 55.60 μg/mL. This suggests that the hydroalcoholic extract may possess anti-colon cancer properties due to its flavonoid content (55).

Thrombolytic Activity

In the investigation of the methanolic extract of *A. solanacea* and its soluble n-hexane fraction, various dosages were administered to assess their thrombolytic activity. Notably, both extracts demonstrated a substantial and statistically significant ($P<0.001$) capability for clot lysis in human blood. This observed effect exhibited a concentration-dependent pattern, emphasizing the potential of *A. solanacea* extracts to influence thrombolytic processes (56). Additionally, findings highlight the comparative effectiveness of beta-amyrin, derived from leaves, in preventing collagen-induced platelet aggregation when compared to aspirin. This suggests the promising role of natural compounds, such as beta-amyrin, in modulating platelet function and highlights potential alternatives to conventional antiplatelet agents (57).

Hypoglycaemic Activity

The impact of methanolic and n-hexane extracts derived from *A. solanacea* leaves on blood glucose levels was investigated. The findings revealed a significant reduction in blood glucose levels, particularly after a 90-minute interval. The methanolic extract demonstrated a notable decrease of 53.94%, while the n-hexane extract exhibited a substantial reduction of 48.15% (58).

Analgesic Activity
A study involving the evaluation of acetic acid-induced writhing test to determine the analgesic potential of the ethanolic extract derived from both the stem and root of *Ardisia solanacea*. The results indicated a noteworthy reduction in writhing behaviour in mice, suggesting significant analgesic activity. Notably, the efficacy of the extract at a dose of 500 mg/kg was comparable to that of the standard diclofenac sodium (13). The methanolic extract of *A. solanacea* and its chloroform fraction revealed significant peripheral analgesic effects at doses of 200 mg/kg and 400 mg/kg body weight. The chloroform fraction exhibited a remarkable prolongation of reaction time in the tail immersion method. Specifically, oral administration of 200 mg/kg and 400 mg/kg body weight doses resulted in a significant ($p<0.05$) 30-minute extension of the reaction time (58).
Anti-Diarrhoeal Activity
In a study assessing the antidiarrheal activity of ethanolic extracts from the stem and root of *Ardisia solanacea*, mice with castor oil-induced diarrhoea were employed. The extracts, administered at a dosage of 500 mg/kg, demonstrated notable efficacy in decreasing faecal output in these mice, resulting in a reduction of 47.2% and 53.1% for the stem and root extracts, respectively (59). Furthermore, when compared to the standard medication loperamide, the methanolic and n-hexane extracts, given at doses of 200 and 400 mg/kg, exhibited a significant reduction in defecation during the 4-hour testing period in mice with castor oil-induced diarrhoea (60).
Antioxidant Activity
Antioxidants play a crucial role in preventing the oxidation of molecules, and their natural sources offer greater benefits to the human body compared to synthetic molecules. Plants are particularly rich in natural antioxidants, with flavonoids being a key contributor to their potent free radical scavenging properties. Secondary metabolites found in plants, such as polyphenols and carotenoids, exhibit strong antioxidant characteristics by effectively neutralizing free radicals. Scientific studies have identified various plant-derived substances, including flavonoids, polyphenols, and alkaloids, as potent antioxidant agents that prevent oxidation in biological systems (61).
The evaluation of the in vitro antioxidant potential of the leaf extract through the metal chelating effect, reducing power, and DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging. The results indicated that the leaf extract exhibited superior capabilities in scavenging free radicals, demonstrating the highest reducing power and maximum metal chelating effect compared to standard antioxidants (62). Furthermore, the petroleum ether soluble fraction of the methanolic extract demonstrated noteworthy DPPH free radical scavenging activity, with an IC_{50} value of 40.04 μg/mL (31). The ethanolic extract of *A. solanacea* displayed the highest antioxidant potential, as evidenced by DPPH and H_2O_2 assays, with percentages of 74.21% and 83.16%, respectively (5). Additionally, the methanolic leaf extract exhibited significant reducing power in the ferric-reducing effect assay, with an IC_{50} value of 79.14 μg/mL, along with notable superoxide scavenging activity, presenting an IC_{50} value of 154.36 μg/mL (56). Leaves of *A. solanacea* were found to contain a moderate amount of flavonoids and phenols. The methanolic extract of the leaves demonstrated strong DPPH and hydroxyl radical scavenging activities, while the aqueous extract exhibited superior radical scavenging activity in the metal ion-chelating assay compared to the methanolic extract (63).
Anti-microbial Activity
The antibacterial and antifungal properties of leaf extracts were evaluated using the agar well diffusion method. The methanol cold extract exhibited the highest activity against *Bacillus cereus* (8 mm), *Klebsiella pneumoniae* (9 mm), *Pseudomonas aeruginosa* (10 mm), and *Vibrio parahaemolyticus* (8 mm). Notably, the aqueous hot leaf extract demonstrated increased antibacterial activity against *Staphylococcus epidermidis* (13 mm), *Escherichia coli* (12 mm), and *Xanthomonas campestris* (12 mm). Interestingly, the methanol hot extract exclusively displayed antifungal properties, specifically against *Aspergillus fumigatus, Fusarium oxysporum, Rhizoctonia solani,* and *Trichophyton rubrum* (10). In comparison to a standard antibiotic disc containing ciprofloxacin (5 μg/disc), the methanolic extract showed moderate activity against the growth of the test organisms (31). Additionally, another investigation focused on the antimicrobial potential of *A. solanacea* leaf extracts in ethyl acetate, ether, chloroform, and methanolic forms against Bacillus cereus, *Bacillus subtilis, Escherichia coli,* and *Staphylococcus epidermidis*. The methanolic extract displayed the most significant zone of inhibition, measuring 19 mm, specifically against *E. coli.* Furthermore, when assessing its antifungal properties against *Aspergillus niger,* the methanolic extract exhibited a maximum zone of inhibition of 10.5 mm in comparison to the standard drug ketoconazole (20 μg/ml) (64).
Anthelmintic Activity
The crude methanolic extracts of *A. solanacea* exhibited significant dose-dependent anthelmintic activity, comparable to the standard medication piperazine (54).

Anti-inflammatory Activity
Study involving evaluation of the in-vitro anti-inflammatory activity of ethyl acetate root extract. Findings suggested that the extract possesses potential as an active anti-inflammatory agent, as indicated by an IB_{50} value of 1.79±0.13 μg/mL (62). In comparison with diclofenac sodium, the ethyl acetate leaf extract exhibited a significant in vitro anti-inflammatory effect with an IB_{50} value of 3.3±0.21. However, the ethyl acetate stem extract demonstrated the least amount of anti-inflammatory activity, specifically with protein denaturation, with an IB_{50} value of 3.33±0.211 μg/mL (33).
Antifeeding Activity
The antifeeding activity of the ethyl acetate root extract of *A. solanacea*, specifically concerning *S. obliqua* (Bihar Hairy Caterpillar), was investigated using the no-choice/non-preferential leaf dip method. The assessment involved evaluating the antifeeding index, with a higher index indicating a diminished rate of feeding by the insect. The findings suggest a potential dose and time-dependent antifeeding action, implying that the extract may influence feeding behaviour in a manner that corresponds to the dosage and duration of exposure (18). The ethyl acetate leaf extract of A. solanacea demonstrated notable efficacy, with a remarkable 98.50% inhibition of feeding activity (33).
Miscellaneous
Apart from the pharmacological activities mentioned earlier, *A. solanacea* has been reported to have multiple other medicinal uses (58). Evaluation of the methanolic leaf extract of *A. solanacea* demonstrated anxiolytic and sedative properties, suggesting potential applications in the field of mental health. The hypolipidemic and hepatoprotective properties of *A. solanacea* leaf extract highlighted its potential benefits for lipid regulation and liver protection (65,66). Additionally, the root extract of *A. solanacea* has been found to possess herbicidal and insecticidal properties, indicating its potential use in safeguarding pulse crops from pest-related damage. This aspect presents *A. solanacea* as a promising candidate for crop protection (67). Aqueous and methanolic leaf extract of *A. solanacea* showed promising anti-arthritic properties. These findings collectively highlight the diverse medicinal potential of *Ardisia solanacea* across various health and agricultural applications (68).

Table 4: Antioxidant Activity of different parts of *A. solanacea*

Part of the Plant Used	Extract	Method	IC_{50}	References
Root	Ethyl Acetate	DPPH	190.78±0.14 μg/mL	(69)
		Reducing Power	277.74±1.09 μg/mL	
		Metal Chelating Activity	2.79±0.01 μg/mL	
Whole Plant	80% Methanol	DPPH	40.04 mg/mL	(31)
Stem	Ethyl Acetate	DPPH	170.72±0.93 μg/mL	(33)
		Reducing Power	249.02±2.13 μg/mL	
		Metal Chelating Activity	3.64±0.01 μg/mL	
Leaves	Methanol	Ferric Reducing Effect Assay	79.14 μg/mL	(56)
		Superoxide Scavenging Activity Assay	154.36 μg/mL	
Leaves	Methanolic Extract	DPPH	198.43±1.30 μg/mL	(63)
	Aqueous Extract	DPPH	378.67 ± 2.5 μg/mL	
Leaves	Methanolic Extract	DPPH	10.05 μg/mL	(70)
		ABTS	8.13μg/mL	

CONCLUSION
The review emphasizes the importance of *Ardisia solanacea* as a valuable medicinal plant, demonstrated by the variety of phytoconstituents that contribute to its therapeutic properties. Different parts of the plant, such as the leaves, fruits, bark, and roots, are used to treat different diseases. The review highlights possible therapeutic uses of *A. solanacea* by offering an in-depth summary of the key pharmacological research done on the plant. It also covers phytochemical studies and the extraction of important biomarkers from the plant. The findings highlight the necessity of conducting systematic research and development projects for therapeutic and economic advantages to produce goods that will increase the plant's use in both commercial and medical settings.

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