# A REVIEW OF THE POTENTIAL DRUG PLANT DODONAEA VISCOSE

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**Abstract**
*The chemical analysis of Dodonaea viscosa (Sapindaceae) found alkaloids, flavonoids, fixed oil and fat, steroids, phenolics, saponins, tannins, gums, mucillages, carbohydrates, reducing sugar, glycosides, and trace elements. Pharmacological investigations demonstrated that Dodonaea viscosa was antidiabetic, antimicrobial, insecticidal, antioxidant, cytotoxic, antifertility, wound, anti-inflammatory, analgesic, anti-ulcer, antispasmodic, anti-diarrheal, and detoxifying. This review discusses Dodonaea viscosa's chemicals and pharmacological effects.*
*Keywords: components, pharmacology, Dodonaea viscosa, and chemistry*

## I. INTRODUCTION:

Herbal medicine has grown exponentially in recent decades. Its natural nature and few negative effects are making it popular in emerging and developed nations. Two thirds of the novel compounds discovered each year came from higher plants. 75% of humanity utilized plants for treatment and prevention. 25% of US medications are plant-derived. Plants provide several medicinal secondary metabolites. The chemical analysis of Dodonaea viscosa (Sapindaceae) found alkaloids, flavonoids, fixed oil and fat, steroids, phenolics, saponins, tannins, gums, mucillages, carbohydrates, reducing sugar, glycosides, and trace elements. Pharmacological investigations demonstrated that Dodonaea viscosa was antidiabetic, antimicrobial, insecticidal, antioxidant, cytotoxic, antifertility, wound, anti-inflammatory, analgesic, anti-ulcer, antispasmodic, anti-diarrheal, and detoxifying. This review discusses Dodonaea viscosa's chemical ingredients and pharmacological effects.

**Synonyms:**

Arabica Herter, Dodonaea aspleniifolia var. arborescens Hook.f. Kunth, Dodonaea candolleana Blume, var. dodonaea cuneata var. rigida Benth. Roxb. ex DC., Dodonaea ehrenbergii Schltdl., Dodonaea eriocarpa Dodonaea eriocarpa var. amphioxea Dodonaea eriocarpa, var. Sherff, Dodonaea eriocarpa var. costulata & Sherff, Dodonaea eriocarpa f. decipiens. var. dodonaea eriocarpa var. Sherff, Dodonaea eriocarpa f. galapagensis var. dodonaea eriocarpa var. Dodonaea eriocarpa var. dodonaea eriocarpa var. lanaiensis var. Dodonaea eriocarpa var. oblonga Sherff, Dodonaea eriocarpa var. Sherff, Dodonaea pallida. O.Deg.& Sherff, Dodonaea eriocarpa f. pallida Dodonaea eriocarpa, var. sherffii O. & I. Deg., Dodonaea skottsbergii Sherff, Dodonaea vaccinioides. Sherff, Dodonaea varians. Dodonaea eriocarpa, var. waimeana Sherff, Dodonaea fauriei H. Lév., forsteri Montrouz., illita F.Muell. ex Regel, jamaicensis DC., kohautiana Schltdl., latifolia Salisb., linearifolia Turcz., lucida Moench, microcarya Small, ovata Dum. Cours., pallida Miq., and pauca Herrera. Dodonaea latifolia (Sherff) O.Deg. & Sherff, Dodonaea sandwicensis var. simulans Sherff, Dodonaea spatulata Sm., Dodonaea thunbergiana Radlk. var. linearis Sond., Dodonaea arborescens (Hook.f.) Dodonaea viscosa arborescens,

Sherff (Hook. f.) Sherff, Dodonaea viscosa var. aspleniifolia (Rudge) Hook.f., Dodonaea candolleana (Blume) Backer, f. ehrenbergii (Schltdl.) Sherff, Dodonaea viscosa f. elaeagnoides (Rudolphi ex Ledeb. & Adlerstam) Brizicky, Eriocarpoidea dodonaea viscosa Sherff, Dodonaea galapagensis (Sherff) Porter, Dodonaea viscosa f. hispidula Sherff, Dodonaea viscosa f. lilacina Kuntze, f. minor (Blume) Backer, Minor-variety Dodonaea viscosa Dodonaea viscosa var. C.L.Hitchc., Dodonaea viscosa f. repanda Radlk., Dodonaea viscosa var. spatulata (Sm.) Benth. J.G.West, Dodonaea viscosa var. stokesiana F. Br., Dodonaea viscosa viridula Kuntze and Ptelea viscosa L.

**Taxonomic classification:**

The kingdom of the Plantae, Subkingdom: Viridiplantae, Streptophyta is the kingdom, Embryophyta is the superkingdom, and Tracheophyta is the division. Subdivision: Spermatophytina, and Spermatophytina Class: Magnoliopsida, Superorder: Rosanae, Order: Sapindales, Family: Sapindaceae, Genus: Dodonaea, Specie: Dodonaea viscosa.

**Common names:**

English: broad leaf hopbush, candlewood, giant hopbush, narrow leaf hopbush, sticky hopbush, native hop bush, soapwood, switchsorrel, wedge leaf hopbush, and native hop; Afrikaans: Gansies, Kankerbos; Arabic: Dodonia, Daidon, Dodanaia, Shath; Australian: broad leaf hopbush, candlewood, giant hopbush; Brazil: faxina-vermelha, vassouro-vermelho, vassoura-do- campo, vassoura-vermelha; broadleaf hopbush, Florida hopbush, gigantic hopbush, hopshrub, sticky hopbush; English: broadleaf hopbush; Pakistan: Sanatha.

**Distribution:**

It is thought that Australia is the place where Dodonaea viscosa first appeared, although nowadays you can find it all throughout the tropics and subtropics. The plant may be found in the southern regions of Africa, Australasia, and America.

**Description:**

5 meter-tall shrubs or young trees. Simple, alternating, spiral, and twig-end-clustering leaves. The base of the 0.2-centimeter petiole is thick and bulging. Petioles are planoconvex. The lamina is 2.5–6.5 centimeters long and 0.5–1.2 centimeters broad with an acuminate to sharp tip. Blooms: Terminal or axillary panicled cymes up to 7 centimeters long with small polygamous flowers on a 0.5-centimeter pedicel. Three-winged capsule holds one to two black seeds. Produced.

**Traditional used:**

Traditional medicine prescribed dodonaea viscosa for the treatment of rheumatism, skin infections, diarrhoeas, stomachaches, hepatic or splenic pains, uterine colic, smooth muscle issues, antipruritic skin rashes, dermatitis, hemorrhoids, and sore throats. Rheumatism, gout, hemorrhoids, fractures, and snake bites were all treated using infusions made from the leaves.

**PHYSICOCHEMICAL CHARACTERISTICS AND CHEMICAL CONSTITUENTS:**

**Physicochemical characteristics:**

Rheumatism, skin infections, diarrhoeas, stomachaches, hepatic or splenic pains, uterine colic, smooth muscle issues, antipruritic skin rashes, dermatitis, hemorrhoids, and sore throat were treated with Dodonaea viscosa. Leaf infusions healed rheumatism, gout, hemorrhoids, fractures, and snake bites.

**Chemical constituents:**

The early phytochemical screening found alkaloids, flavonoids, fixed oil and fat, steroids, phenolics, saponins, tannins, gums, mucillages, carbohydrates, reducing

sugar, and glycosides in Dodonaea viscosa [56, 61-66]. Water-soluble polysaccharide from Dodonaea viscosa seeds was 5:2 molar D-glucose:D-mannose. D-glucopyranose and D-mannopyranose monosaccharides showed α- and β-linkages, respectively.

The plant had many flavonoids, including aliarin (5,7,4'-trihydroxy-3'-(3hydroxymethylbutanol) 3,6-dimethoxy flavone), pinocembrin (5,7-dihydroxy flavanone), penduletin (5,4'–Dihydroxy-3,6,7-trimethoxy flavone), viscosol (3'-(,,-dimethyalllyl)-5,7-dihydroxy-3,6,4'-trimethoxy flavone), sakuranetin ((S)-5,4'-dihydroxy-7-methoxyflavone), and isokaempferide (3,5,7,4'-tetrahydroxyl-3',6,7 Dodoviscins A-J; 5,7-dihydroxy-3'-(4"-acetoxy-3"-methylbutyl)-3,6,4'-trimethoxy flavones; C-alkylated flavonoids 5,7-dihydroxy-3'-(3-hydroxymethylbutyl) -3,6,4'-trimethoxyflavone, 5,7,4'-trihydroxy-3'-(3-hyroxy methyl butyl)-3,6-dimethoxyflavone, 5,7-dihydroxy-3'- (2-hydroxy-3-methyl-3-butenyl) -3,6,4'-trimethoxyflavone(4),5,7,4'-trihydroxy-3,6-dimethoxy-3'-isoprenyl-flavone; 5,7-Dihydroxy-3,6-dimethoxy-2-(4-methoxyphenyl)-4H-chromen-4-one; Kaempferol methyl ethers, 3, 5, 7-trihydroxy-4'-methoxyflavone; 5, 7, 4'-trihydroxy strihydroxy-3, 6-dimethoxyflavone; 5, 7-dihydroxy-3, 6, 4'-trimethoxyflavone (santin); 5-hydroxy-3, 7, 4'-trimethoxyflavone; 3,4',5,7-tetrahydroxy flavones (kaempferol); 5,7,4'-trihydroxy-3',5'-di(3-methylbut-2-enyl)-3,6-dimethoxyflavone and 5,7,4'-trihydroxy-3',5'-di(3-methylbut-2-enyl)-3,6-dimethoxyflavone (4-hydroxy-3-methylbutyl)

-5'-(3-methylbut-2-enyl)-3,6-Dimethoxyflavone; acacetin-7-Me ethers; flavonol-3-methyl ethers 4',5,7-trihydroxy-3,6-dimethoxyflavone, penduletin; 3, 6, 4'-trimethoxy-5,7-dioxyflavone; kaempferol 3,7-di-methyl ether and kaempferol-3,4',7-trimethyl ether were isolated from aerial parts. D viscosa root bark yielded isorhamnetin and quercetin. Dodonaea viscosa var. angustifolia leaves yielded catechin or chromene groups, trimethoxyphenyl chalcones, and tannin with 4-O-β-D-xylopyranoside.

The ethanol extract of Dodonaea viscosa roots yielded two antiproliferative oleanane-type triterpenoid saponins, dodoneasides A and B (I and II). Triterpenoidal sapogenin 3β, 15α,21β,22α,28-pentahydroxy-16α-angeloyloxy-12-oleanene was isolated from seeds ethanolic extract77. Dodonaea viscosa flowers yielded doviscogenin (3β,15α, 21β,22α,18-pentahydroxy-16α-angeloyloxy-12-oleanene). The stem of Dodonaea viscosa yielded stigmasterol, 21,22-diangeloyl barringtogenol C, R1-barringenol, and cleomiscosin. R1-barrigenol, jegosapogenol, and two new prosapogenins, 21,22-diangelate and 21-(2,3-dihydroxy-2-methylbutyroyl) 22-angelate, were isolated from Dodonaea viscosa stem bark.

Dodonaea viscosa flowers produced pentanol, β-pinene, myrcene, limonene, p-cymene, citronellal, linalool, linalyl acetate, -terpineol, geraniol, α-spinasterol, 4-hydroxy-3,5-diprenylbenzaldehyde, β-sitosterol, stearic acid, syringic acid, fraxetin, cleomiscosin A, C, and β-D-glucoside.

Dodonaea viscosa has various minerals and trace elements: Aluminum 6.93-7.44, Calcium 11683.98-12054.90, Copper 6.48-9.69, Iron 83.85-120.08, Magnesium 2711.53-2965.67, Manganese 11.42-14.25,

Phosphorous 167.37-224.11, Sulphur 213.66-222.31, Zinc 55.30-59.45 mg/Kg.

## II. PHARMACOLOGICAL EFFECTS:

**Antidiabetic effect:**

Dodonaea viscosa leaves extracts (A-M) were evaluated in normal and alloxan-diabetic rabbits. Blood glucose levels were determined after oral administration of 250 and 500 mg/kg of Dodonaea viscosa leaves extracts. These doses of the leaves significantly reduced blood glucose in normal and in alloxan-diabetic rabbits. It was also found that blood glucose levels of rabbits treated with aqueous: methanolic extract of Dodonaea viscosa leaves 500 mg/kg body weight, was decreased significantly at 2, 4 and 6 h. Oral glucose tolerance test was carried out in rabbits treated orally with aqueous: methanolic extract (500 mg/kg). Blood glucose of aqueous: methanolic extract treated rabbits was significantly decreased after oral glucose load. In addition, simultaneous administration of aqueous: methanolic extract and human insulin (3 units/kg body weight) reduced more potently the blood glucose levels of treated diabetic rabbits than those treated with the aqueous: methanolic extract only. Furthermore, oral administration of aqueous: methanolic extract of Dodonaea viscosa (250 and 500 mg/kg) continuously for 30 days produced significant reduction of blood glucose levels in diabetic rabbits compared with controls.

The methanolic extract of leaves of Dodonaea viscosa was evaluated for antidiabetic activity. The antidiabetic activity was studied using the glucose uptake by isolated rat hemi-diaphragm in vitro model. The value of glucose uptake by rat hemi-diaphragm for Dodonaea viscosa was 13.80 ± 0.1697 compared to control (5.34 ± 0.12) and insulin 15.45 ± 0.12 mg/g/min.

The ethyl acetate extract (DEA) and methanolic extract (DME) of Dodonaea viscosa leaves were administered orally at different doses (200 and 400mg/kg bw) to normal as well as STZ-diabetic rats. DME produced significant hypoglycemic effect in normal rats after 6h of administration. After acute treatment, DME 400mg/kg produced marked fall (30.87%) after 6h of administration. Both DME 200mg/kg and 400mg/kg showed improvement in glucose tolerance. Treatment of diabetic rats for 28 days with DME reduced the fasting glucose level by 43.81% than their pretreatment level. It brought about fall in level of total cholesterol by 36% and 38.89%and HbA1c by 29.44% and 35.6%. The increase in glycogen level was found to be 68.97% after treatment with DME 400mg/kg bw. It also normalized the elevated level of MDA in diabetic rats. DME 200mg/kg and 400mg/kg brought about the decreased level of GSH to near normal. The level of SGOT, SGPT were also found to be decreased which was comparable to the standard. The different extracts of the Dodonaea viscosa were tested for anti-diabetic activity by glucose tolerance test in normal and alloxan induced diabetic rats. Aqueous ethanol and butanol extracts had shown significant protection and lowered the blood glucose levels to normal limit in glucose tolerance test. In alloxan induced diabetic rats, the maximum reduction in blood glucose was observed after 3h at a dose of 250 mg/kg of bw. The percentage of glucose reduction by aqueous ethanol and butanol extracts were 30 and 48% respectively. Methanol and chloroform extract of Dodonaea viscosa were administered to alloxan induced diabetic albino rats. Blood glucose, triglycerides, cholesterol, protein, urea, creatinine, SGPT, SGOT were

checked. Histological changes in pancreas and liver of the animal were also examined. Extract treated groups showed reduction in blood glucose level to normal limit. Increased levels of all other biochemical parameters like SGPT, SGOT, triglycerides, cholesterol, protein, creatinine and urea with alloxan treatment have been significantly reduced by extracts. Histological changes associated with alloxan induction was also attenuated by extracts.

**Antimicrobial effects:**

Streptococcus mutans and its biofilm were tested for resistance to Dodonaea viscosa var. angustifolia (DVA) leaf extract's growth inhibitory effects. The results showed that exposure duration and concentration both had an impact on how much Streptococcus mutans grew. At concentrations as low as 0.1 mg/ml and as high as 25 mg/ml, the crude extract killed 100% of S. mutans after 6 hours. After 6, 24 and 30 hours of exposure to the sub-inhibitory dose of crude extract, the production of biofilms was decreased by 95, 97, and 99%, respectively. The crude extract was bactericidal against Streptococcus mutans at high concentrations, but at sub-inhibitory concentrations, it considerably inhibited the growth of planktonic cells and prevented the development of biofilms [68].

In vitro testing was done on Dodonaea viscosa var. angustifolia (PLE), chlorhexidine gluconate (CHX), and triclosan (TRN) to determine the minimal inhibitory concentration and the time required to kill Candida albicans. Twenty Candida albicans strains from HIV-positive patients, twenty from HIV-negative individuals, and one Candida albicans ATCC 90028 were among the 41 strains tested. Using a microtitre twofold dilution method, the MICs of an acetone extract of PLE, CHX, and TRN were assessed, and the time needed to kill 99.5% of the strains was calculated. The relative MICs for PLE, CHX, and TRN were 6.25–25, 0.008–0.16, and 0.0022–0.009 mg/ml. In only 30 seconds, PLE eliminated every test strain, while in just one minute, CHX eliminated 40% of the isolates from HIV-positive patients and 20% of strains from HIV-negative participants. TRN destroyed isolates from HIV-positive and HIV-negative individuals at the same time at rates of 55% and 35%, respectively [96]. The antimicrobial potential of Dodonaea viscosa was examined against four Gram positive bacteria, including Bacillus subtilis (MRL M 1), Bacillus cereus (MRL 52), Micrococcus luteus (ATCC 10240), and Staphylococcus aureus (ATCC 6538), as well as three Gram negative bacteria, including Escherichia coli (ATCC 25922), Salmonella typhi (Cl. I. 140), and P (Cl. I. 4043). Against S. aureus, M. luteus, B. subtilis, E. coli, P. aeruginosa, and C. albicans, extracts exhibited antibacterial action. However, the clerodanefuranolactone 15, 16-epoxy-cis-cleroda-3, 13(16),14-trien-18-oic acid-18,6-olide, which was isolated from the n-hexane fraction of the crude ethanolic extract of Dodonaea viscosa, demonstrated antibacterial effects against both Gram positive and Gram negative bacteria. Its MICs against S. aureus (NCIMB 6571) and E. These organisms have MBCs of 128 g/ml and 256 g/ml, respectively.

Using the agar well diffusion method, the antibacterial activity of crude and step gradient solvent of methanol and chloroform of whole Dodonaea viscosa was investigated against six bacterial human infections (S. typhi, S. flexneri E. coli, V. cholerae, M. tuberculosis, P.

fluorescens). The crude and step gradient extracts of Dodonaea viscosa suppressed the development of S. flexneri and V. cholerae. Methanol at an 80/20 ratio and chloroform at a 20/20 ratio were used to achieve the maximal inhibitory zone for the studied microorganisms.

Dodonaea viscosa leaf extracts in methanol and n-hexane were tested for their ability to inhibit a variety of Gram positive and Gram negative bacterial strains. The findings demonstrated that although methanolic extract of the plant was potent against all of the tested species, n-hexane extract of the plant was ineffective against Pseudomonas aeruginosa.

We examined Dodonaea viscosa leaf anti-biofilm properties against E. coli at successively higher concentrations. Dodonaea viscosa leaf extracts shown robust antibiofilm action.

The antibacterial activity of Dodonaea viscosa methanolic and hot aqueous extracts was investigated against Staphylococcus aureus ATCC 6538, Bacillus subtilis ATCC 6059, Micrococcus flavus SBUG 16, Escherichia coli ATCC 11229, Pseudomonas aeruginosa ATCC 27853, Candida maltosa SBUG, multiresistant Staphylococcus epider Escherichia coli, Pseudomonas aeruginosa, and Candida maltosa SBUG were the only bacteria that did not exhibit antibacterial activity when Dodonaea viscosa methanolic extract was used, while hot aqueous had activity only against multiresistant Staphylococcus epidermidis, Staphylococcus aureus, Bacillus subtilis, Micrococcus flavus, and Staphylococc

Using the disc diffusion technique, the antibacterial activity of Dodonaea viscosa leaf, stem, and root in aqueous, methanol, and chloroform solvents was investigated. All Dodonaea viscosa components, extracted using all three kinds of solvents, were effective in controlling Vibrio cholerae. The methanol extract of stem was shown to have the greatest zone of inhibition when used against Vibrio cholerae. Similar to how Bacillus subtilis was controlled, all extracts with the exception of the root's methanol extract were effective. The weed's root extract was ineffective against Proteus mirabilis and Escherichia coli. The methanol extract showed the highest level of antifungal effectiveness among the extracts tested from various plant sections. Other solvents including water and chloroform extract had little to no impact or had a weak zone of inhibition. The plant's leaf extract in methanol shown the greatest effectiveness against Curvularia lunata and Fusarium oxysporum. The plant's root extract in methanol had the highest level of efficacy against Aspergillus flavus. The plant's stem methanolic extract, however, had the highest level of efficacy against Penicillium citrinum. However, none of the extracts examined showed any discernible action against Aspergillus niger.

Using ethanol and diethyl ether solvents (0, 2.5, 5, 10, 20, 30, 40, or 50 mg/ml), the inhibitory effects of the aerial plant part (leaves and bark) extracts of Dodonaea viscosa were assessed before and during flowering against some pathogenic bacteria isolated from humans and plants (Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Streptococc The findings indicated that the investigated microorganisms were effectively inhibited by ethanolic extracts of the bark and leaves as well as diethyl ether extracts of the leaves. Bark ethanol extracts were more effective than leaf ethanol extracts in slowing the

development of Candida albicans. There were no discernible changes between values of 30, 40, or 50 mg/ml [102]. Using the well and disc diffusion experiment, the anti-Salmonella activity of Dodonaea viscosa aqueous and ethanol extracts was investigated. For well diffusion, the maximum inhibition zone measured (22 mm) and for disc diffusion assay, (15 mm). The findings showed that ethanol extract had a stronger antibacterial effect than aqueous extract. Using the disc diffusion assay, ethanol extract affected more bacterial isolates (71.19%) than aqueous extract (28.81%), while using the well diffusion assay, ethanol extract affected more bacterial isolates (88.13%) than aqueous extract (52.54%). The antibacterial potential of Dodonaea viscosa's crude ethanolic extract, as well as its fractions in n-hexane, dichloromethane, ethyl acetate, n-butanol, and water, was examined against four Gram positive bacteria (Bacillus subtilis, Bacillus cereus, Micrococcus luteus, and Staphylococcus aureus), and three Gram negative bacteria (Escherichia coli, Salmonella typhi and Pseudomonas aeruginosa). According to the findings, the zones of inhibition for the crud extract were between 11 and 13.3 mm for Staphylococcus aureus, Micrococcus luteus, Bacillus subtilis, Escherichia coli, and Pseudomonas aeruginosa. The findings also indicated that the ethyl acetate fraction was effective against five out of the seven tested species, followed by the n-butanol and n-hexane fractions, which each inhibited four and two organisms, respectively [104]. Dodonaea viscosa stem bark and leaf crude extracts were tested for their antibacterial and antifungal effects against two Gram positive bacteria (Bacillus subtilis and Staphylococcus aureus), one Gram negative bacterium (Escherichia coli), and two yeast strains using chloroform, ethanol, and methanol (Candida albicans, Sccharomyces cervisiae). The examined Gram positive and Gram negative bacteria were shown to be sensitive to ethanol and methanol extracts. Sccharomyces cervisiae and Candida albicans were unaffected by extracts. Chloroform extracts could not be used against any of the tested bacteria. However, compared to Gram negative bacteria, Gram positive bacteria were more susceptible to Dodonaea viscosa extracts.

Dodonaea viscosa leaves and shoot solvent extracts were tested for their antifungal efficacy against fungi that cause skin illnesses such as Aspergillus niger, Aspergillus flavus, Paecilomyces varioti, Microsporum gypseum, and Trichophyton rubrum. All unprocessed extracts were found to be efficient against the fungus under test. In contrast to ethanol, methanol, ethylacetate, and aqueous extracts, chloroform has a substantial inhibitory effect on fungus. The ethanol extract had a high level of inhibitory action against P. variety, T. rubrum, and M. gypseum (81.82%, 80%, and 73.34%, respectively), a moderate level of inhibitory activity against A. flavus (65.72%), and a low level of inhibitory activity against A. niger (62.5%). The ethyl acetate extract had the highest levels of inhibitory action against T. rubrum, M. gypseum, and P. varioti at 80%, 73.34, and 63.64%, respectively. It had a moderate level of inhibitory activity against A. flavus at 57.15 and a low level of inhibitory activity against A. niger at 50%. The chloroform extract had a maximum level of inhibitory action against P. varioti, T. rubrum, and M. gypseum (90.91%, 80%, and 73.34%, respectively), a moderate level of inhibitory activity against A. flavus (71.41%), and a minimal level of inhibitory activity against A. niger

(50%) The methanol extract had the highest levels of inhibitory activity against P. varioti and T. rubrum (81.82 and 80%, respectively), moderate levels of inhibitory activity against A. niger and A. flavus (62.5% and 57.15%, respectively), and the lowest levels of inhibitory activity against M. gypseum (53.34%). The aqueous extract had the highest levels of inhibitory action against P. varioti, T. rubrum, and A. niger (81.82%, 80%, and 75%, respectively), whereas it had a moderate level of inhibitory activity against M. gypseum (60%) and a low level of inhibitory activity against A. flavus (57.15%).

The effects of the fractions made from the hydroalcoholic extract of Dodonaea viscosa leaves on Candida albicans were assessed (Cl. I.4043). All of the fractions, with the exception of the aqueous fraction, showed anticandidal activity (zone of inhibition 10 mm). The proportion of n-MIC hexane's was 62.5 g/ml.

Different extracts from Dodonaea viscosa leaves were tested for their in vitro antiviral efficacy against infections with coxackievirus B3 (CVB3) and rotavirus SA-11 (RV SA-11). Dodonaea viscosa had a therapeutic index (TI) of 0.3 to 25, with a decrease in viral titer of 0.25 to 5 log10 TCID 50/0.1 ml for CVB3, compared to 0.4 to 29.2 for RV SA-11, and a reduction in virus titer of 0.25 to 5.25 log10 TCID50. When crude extract binds to the viral capsid of CVB3 and the viral receptor of RV SA-11, it effectively inhibits both viruses' ability to replicate and enter host cells [107]. The anti-HIV-1 activity of aerial portions of Dodonaea viscosa extracted with petroleum ether, chloroform, and 80% methanol was evaluated using the syncytia formation assay. The Dodonaea viscosa petroleum ether extract was the most efficient anti-HIV-1 agent, whereas other extracts were less so. The scientists came to the conclusion that the -sitosterol and stigmasterol found in the petroleum ether extract of Dodonaea viscosa were responsible for the antiviral actions.

**Insecticidal effects:**

Four insect models that were pests of economically significant crops (Epilachna paenulata, Spodoptera littoralis, Myzus persicae, and Rhopalosiphum padi) were used to test the insecticidal activity of the ethanolic extracts of the leaves of Dodonaea viscosa. The isolation of effective insecticidal chemicals was achieved using bioguided fractionation and supercritical fluid extraction. A labdane diterpene, stigmast-7-en-3-ol, stigmasterol, and lupeol were identified and shown varying degrees of insecticidal action [109]. Dodonaea viscosa leaf, stem, and root larvicidal efficacy was investigated against Artemia salina larvae using water, methanol, and chloroform solvents. Incubated in saline water, the eggs of Artemia salina cysts hatched after 24 hours. The 48-hour development of the newly born larvae was employed for the larvicidal activity test. 10ml of saline water were used to dissolve one gram of dry extract (master dilution). From the master dilution, four distinct concentrations (0.5, 1, 1.5, and 2) were created. Each test sample received ten nauplii, which were then cultured for 24 hours at room temperature. The vulnerability of the nauplii was seen after 24 hours. The leaf extract alone demonstrated a notable amount of mortality among the various Dodonaea viscosa components. At 1% concentration, the leaf's aqueous extract demonstrated 100% lethality against the larvae. Only the methanol extract of the stem at the concentration of 2% exhibited 100%

mortality of larvae, whereas the aqueous extract of the plant's root showed 100% lethality of larvae at the concentration of 1.5%.

**Antioxidant effect:**

Dodonaea viscosa demonstrated very efficient free radical scavenging at a concentration of 50 g/ml (50.72%), and this activity increased concentration-dependently, peaking at 92.45% at 1000 g/ml. Only a little antioxidant was present in the water extract. At the greatest concentration of 1000 g/ml, the free radical scavenging capacity of water extract was 31.8 percent.

Dodonaea viscosa extract was tested in three different concentrations: 100, 200, and 300 l. The results revealed that 300 l of the extract had the highest level of scavenging activity, with an inhibition of 82.09 0.15%, followed by 200 l with an inhibition of 81.02 0.11%, and 100 l with an inhibition of 79.91 0.16%.

**Cytotoxic effect:**

Dodonaea viscosa extracts' cytotoxic effects on a breast cancer cell line were investigated (MCF7). The results revealed that the 80% ethanolic extract of Dodonaea viscosa had much higher cytotoxic activity than the reference medication (cisplatin), with an IC50 of 19.4 g/ml.

**Antifertility effect:**

The anti-fertility action of the methanolic extract of Dodonaea viscosa leaves was examined in female rats. When supplied orally, it was shown that the extract considerably (P 0.01) decreased the amount of liters. In a dose-dependent way, it also had an anti-fertility impact, and the contraceptive effect persisted for a predetermined amount of time. Significant anti-implantation and early abortifacient action was also shown by the extract. In male rats, Dodonaea viscosa leaf extracts had antifertility effects. With the development of necrotic alterations in the seminiferous tubules of the testis, the number of sperm and the weight of the reproductive organs dropped. In comparison to the control group, the treated rats had lower amounts of total protein and glycogen. The likely mechanism of the toxic effects on the male reproductive system was the depletion of glycogen in the testis and liver when Dodonaea viscosa leaf extracts were administered.

**Wound healing effect:**

On a streamlined in vitro wound healing research, the effects of ethanol extract and the flavonoid-rich fraction of Dodonaea viscosa were examined. For 48 hours, ethanol extract and a flavonoid-rich fraction were applied to cultured keratinocytes at various doses. After 48 hours, the MTT test was used to measure the subsequent cellular growth and compute it relative to the control. When compared to the control group, the Dodonaea viscosa's flavonoid-rich fraction significantly increased cell proliferation after 48 hours of treatment. The Dodonaea viscosa fraction rich in flavonoids is more effective than the ethanol extract in promoting cell proliferation. Rat excised and incised wounds treated with an ethanol extract of dried leaves demonstrated wound healing activity. Excision wounds treated with 10% extract had a quicker rate of contraction and epithelization. In order to counteract the anti-healing effects of dexamethasone, ethanol extract suspension and ointment significantly increased the wound response (breaking strength of skin, granuloma, and wound contraction).

**Anti-inflammatory and analgesic effects:**

Dodonaea viscosa leaf hydroalcoholic extract, administered orally at a dosage of

300 mg/kg, greatly reduced the paw edema brought on by carrageenin injection.

When applied at doses of 0.25, 0.5, and 1.0 mg/ear, respectively, Hautriwaic acid (HA), a diterpene extracted from Dodonaea viscosa leaves, exhibited good anti-inflammatory activity in 12-O-tetradecanoylphorbol 13-acetate (TPA) mice ear edema models (60.2, 70.2, and 87.1% inhibition); in addition, Dodonaea viscosa dichlor While HA at dosages of 15 mg/kg decreased edema to 64% compared with indomethacin 40%, several administrations of DvDE at doses of 100 mg/kg on TPA mice ear edema prevented the edema-associated inflammation by 71.8%.

Dodonaea viscosa's viscosine was isolated, and it exhibited notable lipoxygenase inhibitory activity (IC50: value 39 0.17), which inhibits the metabolism of fatty acids and the production of their metabolites, which causes inflammatory reactions in the body. The main mechanism behind viscosine's strong lipoxygenase inhibitory activity seems to be hydrogen bonding interactions between molecules of viscosine and the catalytic triad (His523, His518, Ile875) within the active region of lipoxygenase.

Dodonaea viscosa leaf extracts were tested for antinociceptive efficacy using several experimental pain models (glacial acetic acid induced writhing, hot plate and tail flick and). Dodonaea viscosa leaf extracts in their whole demonstrated antinociceptive efficacy in rats and mice. The most active substance was an extract of ethyl acetate.

**Anti-ulcer effect:**

Wistar rats used two separate models (ethanol and indomethacin-induced stomach ulcers) to examine the gastroprotective efficacy of Dodonaea viscosa. By assessing the ulcer index, gastric glutathione test, alkaline phosphate assay, and histological examinations, stomach protection was assessed. In comparison to hexane extract, water and ethanol extract (500 mg/kg body weight) shown modest activity. Dodonaea viscosa hexane extract inhibited ethanol-induced gastric lesions in a dose-dependent manner, resulting in 90% protection at 500 mg/kg, 81% protection at 250 mg/kg, and 70% protection at 125 mg/kg. It also inhibited indomethacin-induced gastric lesions in a dose-dependent manner, resulting in 92% protection at 500 mg/kg, 77% protection at 250 mg/kg, and 52% Statistics showed that the different levels of inhibition were significant (p 0.05). The total quantity of acid in gastric juice was likewise lowered by a Dodonaea viscosa hexane extract (500 mg/kg).

**Antispasmodic effect:**

Four potent spasmolytic principles were isolated using bioassay-directed fractionation of the chloroform-methanol (1:1) extract of Dodonaea viscosa: sakuranetin, 6-hydroxykaempferyl 3,7-dimethyl ether, hautrivaic acid, and ent-15. Epoxy-16-9 alpha H-labda-13(16) 3 beta-diene-14, 8 alpha-diol. The guinea-pig ileum's spontaneous and electrically induced contractions were all inhibited by all of the isolated chemicals in a concentration-dependent manner. Acetylcholine, histamine, and barium chloride all caused ileum contractions that were suppressed by sakuranetin and the ent-labdane.

**Anti-diarrheal effect:**

By using castor oil-induced diarrhea in mice, the anti-diarrheal efficacy of the alcohol and aqueous extracts of the roots of Dodonaea viscosa was examined. The total number of mice's diarrheal episodes and the average weight of their stools were calculated. The findings showed that the

mice's diarrhea was greatly decreased by alcohol and aqueous extracts, along with a drop in stool weight.

**Detoxification effect:**

Researchers looked at the preventive effects of Dodonaea viscosa crude leaves on lead acetate-induced sialic acid and glycoprotein production in the liver and plasma. In the liver and plasma of the lead acetate-poisoned rats, higher amounts of glycoproteins (protein-bound hexose and protein-bound hexosamine) and sialic acid were discovered. Dodonaea viscosa crude leaves (100 mg/100 g bw orally) efficiently reduced the production of glycoproteins and sialic acid in the liver, consequently regulating plasma levels. The researchers came to the conclusion that Dodonaea viscosa prevented lead acetate-induced glycoprotein and sialic acid production, which is how it protected membranes.

**Toxicity:**

Rats were used in an acute toxicity investigation of Dodonaea viscosa. Rats given a higher dosage of 1250 mg/kg did not exhibit any toxicological symptoms. Up to 5000 mg/kg orally, the hydroalcoholic extract did not cause any toxicity or death in mice. After the first 4 hours, the animals were continuously observed for 14 days. In a rabbit study, the potential dermatotoxicity of an 80% methanol extract from Dodonaea viscosa leaves was examined. The test for cutaneous irritation found very little irritation. In the dosage range of 12 to 30 mg/ml, the sensitization tests performed on mice using the mouse ear swelling test showed no sensitization. Repeated testing for dermal toxicity on rats failed to detect any signs of harm.

## III. CONCLUSION:

The review covered the Dodonaea viscosa's chemical components, physiological properties, and therapeutic significance as a potential herbal medication due to its efficacy and safety.

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