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# Bioactive Jasminum species – Mini Review.

Rajeev Rattan
*Associate Professor Chemistry, Government College,Haripur, Kangra, HPU-Shimla, India.*

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**ABSTRACT-**The genus Jasminum has been a source of various traditionally useful and pharmacologically active species. Many plants of this genus prominently feature white, yellow or pink flowers with sweet fragrance and others are unscented. The species are cultivated for flowers containing bioactive compounds especially iridoids, secoiridoids and essential oils. Three species Jasminum officinale, Jasminum mesnyi and Jasminum amlexicaule were selected to study on their traditional use, chemical composition and pharmacological effects reported in literature. The pharmacological effects evaluated from the crude extracts or pure isolated compounds from these species have been antimicrobial, antifungal, antiviral, insecticidal, antioxidant, anti-inflammatory antioxidant, antimicrobial, anthelmintic, antiulcer, antidiarrhoea and analgesic activities. The chemical compounds isolated from J. officinale- six triterpenoidal saponins, six iridoids glycosides, seven secoiridoids glucosides and thirty essential oils, from J. mesnyi- essential oils, secoiridoids, phenolic glycosides, flavonoids and steroids from J. amlexicaule- Jasamplexosides A, B and C, 10- hydroxyligstroside and Jasminoside secoiridoid glucosides. As such these species has emerged as good source of traditional medicines. The chemical compounds isolated from these species have been reported for their pharmacological effects. Although, few experimental studies validated their traditional claim, but uncharacterized crude extracts were employed in most of the activities. Such species need to be explored properly for their bioactive principle and exploited as potential drug. The review will help the researchers to select medicinally potential species of Jasminum for future research.

## I. INTRODUCTION

Herbal plants are pioneer for new drug discovery and development, not only for plant constituents used directly as therapeutic agents, but also as precursor for half of the clinical drugs available in the market [1]. The herbal plants are used for the prevention and treatment of various ailments in the developing countries due to their availability to the native people and heavy cost factor of clinical drugs. The herbs have long history of their use in traditional medicines and latter as clinical candidate. It is estimated that about 25% of drugs prescribed are derived from plants. The WHO essential medicine list contains 252 drugs out of which 11% is exclusively from plant origin. Jasminum genus with about 200 species belonging to family Oleaceae are distributed throughout tropical and sub-tropical countries and commercially grown for their flowers and essential oil production [1]. The plants of these species are shrub or bush form, vines and trees. Many Jasminum plants prominently feature white, yellow or pink flowers with sweet fragrance and others are unscented[2].The chemical constituents isolated from these species are alkaloids, coumarins, flavonoids, tannins, terpenoids, glycosides, emodine, steroids, anthocyanins, essential oil, saponins and characteristically known for their iridoids, secoiridoids and jasmine oil. Jasminum species is used to treat many conditions such as amenorrhoea, ringworm, leprosy, skin diseases and also as an analgesic, antidepressant, anti-inflammatory, antiseptic, aphrodisiac, sedative, expectorants, diuretics and among others. Three species Jasminum officinale, Jasminum mensyi and Jasminum amplexicule are selected for study with main focus on their traditional use, chemical compounds isolated and pharmacological activities evaluated. The data was withdrawn from Google Scholar, PubMed, Scopus, Krishikosh and Shodhganga.

**Ethnobotanical uses-**

**Jasminum officinale**- The species is native to Asia continent including the countries Georgia, China, Tajikistan, Afghanistan, Iran, Iraq, Turkey, Bhutan, India, Nepal and Pakistan [3]. The plants of Jasminum officinale have been widely preserved and cultivated for the attractive and fragrent flowers in Mediterranean, Caucasus, Northern Persia, Eastern Afghanistan, Hindukush, India, China and Pakistan [4]. Leaves are chewed for the treatment of aphthous, stomatitis,

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toothache and ulcer in the mouth. Leaf juice or oil has been used dropped into the ear. The fresh juice from the leaves is used to cure sort corns between the toes, for ulceration in the mouth, throat and gums [5]. Jasminum officinale was also used traditionally for the treatment of the urinary tract infections [6], as CNS depressant, sedative, mild anesthetic and astringent agents [7]. In addition, it was used in depression, nervous exhaustion and stress related conditions. In folklores, the whole plant is used to produce the feeling of optimism, confidence, euphoria, and it was good in cases of apathy, indifference or listlessness. The species has also been used to treat catarrh, coughs, laryngitis, dys- menorrhoea, labor pains, uterine disorders, skin problem such as dry, greasy, irritated, sensitive skin, and for muscular spasms and sprains [8]. The buds of Jasminum officinale are used as a folk remedy for the treatment of hepatitis, dysmenorrhea, stomatitis, and duodenitis in South China[9].

**Jasminum mensyi**:

The species is traditionally useful belongs to Oleacea family, native to China but distributed in India and Nepal. It is commonly known as Primrose Jasmine, Unnanobai in Japan, Pahari butti, Peeli chameli, Peeli malti in the villages of Himachal Pradesh, India. It is ever green rambling shrub with long and lean stems that scale up as rambling creeper. Leaves are trifoliolate, opposite and attached at the base of branchlets. Flowers are usually axillary or rarely terminal, solitary and yellow coloured and having 6-10 petals arranged in a semi double worls [10]. Leaves of this species are used in diabetes, pyorrhea, oral sores, muscular pain, gastric disturbance and CNS disorder. Branchlets are useful in migraine, spinal pain, joint displacement, and menstrual disorder and flowers are used to treat hepatic disorder. In veterinary, leaves are used as vermifuge, galactagogue and ruminant stomach problems. Flowers are used medicinally in aroma therapy for stress, anxiety, depression and are used to treat rashes and minor irritations [11]. The roots of the plant posses wound healing potential.

**Jasminum amlexicaule**:

Jasminum amplexicaule Buch.-Ham. belongs to the family Oleaceae, distributed in Sikkim, Bhutan, Khasia, South India to Hongkon. Leaves are opposite, simple, ovate-lanceolate, acuminate and flowers are scentless, calyx is pubescent, corolla is white, tinged with red outside[1].The powder of its twigs and leaves has been used as a hydragogue and a febrifuge and also has been used as a kind of traditional medicine for the treatment of dysentery, diarrhoea and bellyache in China. Its leaves are used to take care of the quadriplegia-gall and also mixed with other ingredients to cure dysentery and bellyache[12].

**Phytochemicals from Jasminum species-**

**Jasminum officinale**- The preliminary phytochemical analysis of the aqueous extract of Jasminum officinale leaves indicated the presence of alkaloids, coumarins, flavonoids, tannins, terpenoids, glycosides, emodine, leucoanthocyanins, steroids, anthocyanins, phlobatinins, essential oil and saponins[13].

Chemical analysis of the bud of the flowers of Jasminum officinale revealed the presence of six triterpenoid saponins [3-O-α-L-rhamnopyranosyl [1→2]-β-D-xylopyranosyl hederagenin28-O-β-D-galactopyranosyl[1→6]-β-D-galactopyranosyl ester; hederagenin-3-O-β-D-glucopyranosyl[1→3]α-L-arabino pyranoside; 2α,3β,23-trihydroxyolean-12-en-28-oic-O-β-D-glucopyranosyl ester; hederagenin-3-O-β-D-xylopyranosyl[1→3]-α-Lrhamnopyranosyl [1→2]-α-L-arabinopyranoside;2α,3β,23-trihydroxyolean-12-en-28-oic-O-α-L-rhamnopyranosyl [1→4]-β-D-glucopyranosyl[1→6]-β-D-glucopyranosyl ester and hederagenin-3-O-α-L-rhamnopyranosyl[1→2]-α-L-arabinopyranoside[14]. Six iridoid glycosides were identified from the buds of Jasminum officinale jasgranoside B, 6-O-methy-catalpol, deacetyl asperulosidic acid, aucubin, 8-dehydroxy shanzhiside and loganin[15]. Secoiridoid glucosides: [20R]-20-methoxyoleuropein, [20S]-20-methoxyoleuropein, oleuropein, ligstroside, demethyl- oleuropein. and oleoside dimethyl ester, a lignan, [2]-olivil and p-hydroxyphenethyl alcohol were isolated from the dried leaves of Jasminum officinale [16]. Six secoiridoids were identified in the flowers of Jasminum officinale L. var. grandiflorum included jasgranoside, jaspolyoside, 8-epi-kingiside, 10-hydroxy-oleuropein,10-hydroxy-ligstroside and oleoside-7, 11-dimethyl ester[17].

International Journal of Pharmaceutical Research and Applications
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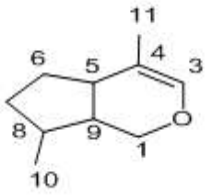
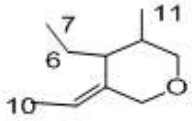
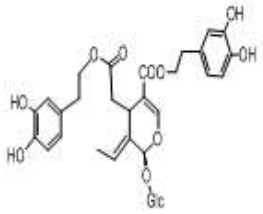


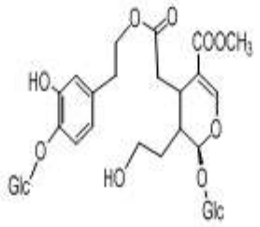

Iridane



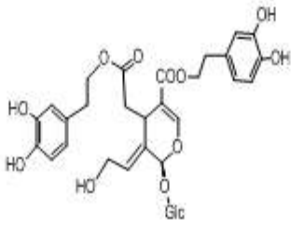

Secoiridane



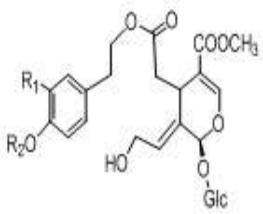

Jasmultiside



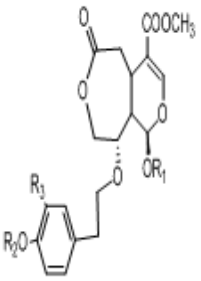

Multiroside



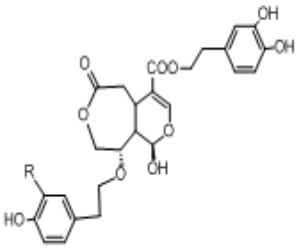

Multifloroside




$R_1$= OH, $R_2$= H 10-Hydroxyoleuropein
$R_1$, $R_2$= H 10-Hydroxyligustroside




R1=R2=R3=H Jasmolactone A
R1=R2=H, R3=OH Jasmolactone B




R=H Jasmolactone C
R=OH Jasmolactone D

**Fig-1 Structure of common iridoids and lactones from Jasminum species.**

Seven glycosides were isolated from the flower of Jasminum officinale included kaempferol-3-O-α-L- jasgranoside, jaspolyoside, 8-epi-kingiside,10-hydroxy-oleuropein, 10-jasgranoside, jaspolyoside, 8-epi-kingiside, 10-hydroxy-oleuropein, 10-hydroxy-ligstroside and oleoside-7, 11-dimethyl ester. Seven glycosides were isolated from the flower of Jasminum officinale included kaempferol-3-O-alpha-L-rhamnopyranosyl[1→3]-[alpha-L-rhamnopyranosyl [1→6]]-beta-D-galactopyranoside, kaempferol-3-O-rutinoside, 7-ketolo ganin, oleoside-11-methyl ester, 7-glucosyl-l1-methyl oleoside, ligstroside and oleuropein[18]. Thirty compounds were identified in the essential oil of Jasminum officinale. The major volatile components were phytol [25.77%], 3,7,11-trimethyldodeca-1,6,10-trien-3-ol [12.54%] and 3,7,11- trimethyldodeca-6,10-dien-3-ol [12.42%]. However, the compounds identified in the Jasminum officinale oil [%] were: benzyl

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**Chemical constituents from Jasminum species.**

| Species | Chemical compounds | Ref. |
|---|---|---|
| Jasminum officinale | Saponins-[3-O-α-L-Rha[1→2]-β-D-Xyl hed-28-O-β-D-Gal[1→6]-β-D-Gal- ester; hed-3-O-β-D-Glc[1→3]-α-L-Ara; 2α,3β,23-trihydroxyolean-12-en-28-oic-O-β-D-Glc ester; hed-3-O-β-D-Xyl[1→3]-α-L-Rha [1→2]-α-L-arabinopyranoside;2α,3β,23-trihydroxyolean-12-en-28-oic-O-α-L-Rha [1→4]-β-D-Glc[1→6]-β-D-glucopyranosyl ester and hederagenin-3-O-α-L-Rha[1→2]-α-L-arabinopyranoside.<br>Iridoids glycosides- jasgranoside B,6-O-methy-catalpol, deacetyl asperulosidic acid, aucubin, 8-dehydroxy shanzhiside and loganin.<br>Secoiridoids glucosides-[20R]-20-methoxyoleuropein, [20S]-20-methoxyoleuropein, oleuropein, ligstroside, demethyloleuropein and oleoside dimethyl ester. jasgranoside, jaspolyoside, 8-epi-kingiside, 10-hydroxy-oleuropein,10-hydroxy-ligstroside and oleoside-7, 11-dimethyl ester.<br>Thirty compounds of essential oil. | 18,19 |
| Jasminum mesnyi | Essential oil- coumarin, monoterpenol, linalool, α terpinol and geraniol.<br>Secoiridoids-jasmoside, jasmesooside, 9- hydroxy jasmesoside. 9-hydroxy jasmesosidic acid, Jasminum 10-α β-D glucoside, 2 hydroxy jasminin, iso jasminin, jasminin, 4 hydroxy isojasminin and jasmosidic acid<br>Phenolic glucoside- syringing and rutin.<br>Flavoniods and steroids-cerylalcohol, α amyrin, β sitosterol, ursolic acid, mannitol, quercetin, poliumoside and forsythoside. | 20,21,22 |
| Jasminum amlexicaule | Secoiridoid glucisides- Jasamplexosides A, B and C, 10- hydroxyligstroside and Jasminoside. | 23,45 |

acetate 0.33; nerolidol 0.11; methyl myristate 0.75; 7-tetradecene 0.20; benzyl benzoate 4.84; neophytadiene 0.23; perhydrofarnesyl acetone 4.85; phytol acetate 0.22; nonadecane 0.14; geranyl linalool 0.12; methyl palmitate 1.57; 3,7,11,15-tetramethyl -1-hexadecen-3-ol 12.42; hexadecanoic acid 9.16; 3,7,11-trimethyl-1,6,10-dodecatrien-3-ol12.54; 3, 7, 11, 15-tetramethyl hexadecanoicacid methyl ester 0.60; 9,12,15-octadecatrienoic acid methyl ester 1.33; heneicosane 3.12; Phytol 25.77; octadecanoic acid methyl ester 0.56;9,12,15-octadecatrienoic acid 4.82; docosane 0.25; tricosane 4.00; tetracosane 0.58; pentacosane 1.51; hexacosane 2.54; heptacosane 1.86; octacosane 1.26; squalene 0.46 and nonacosane 3.00[25]. The total phenolic contents of the aqueous extract of Jasminum officinale leaves was 104.02 ± 1.28 mg/g gallic acid equivalent, the total flavonoids content was 10.76 ± 0.83 mg/g quercetin equivalent and the total flavonols content was 5.65 ± 0.45 mg/g quercetin equivalent [19].

**Phytochemicals from Jasminum Mensyi**:

Secoiridoid glucoside, Caffeic glycoside and flavnoids are mainly isolated from the leaves. Numerous glucosides has been isolated from methanolic extract of leaves such as jasminin, jasmoside, jasmesoside, oleuropein, oleoside, secologanin, 9”hydroxyjasmesoside, 9”-hydroxyljasmesosidic acid, sambacoside, jasminin, 10”-O-β-D-glucoside[20], 2”-hydroxy jasminin, isojasminin, 4”-hydroxy isojasminin, jasmosidic acid and phenolic glucoside syringing[21]. The leaves also contain ceryl alcohol, α-amyrin, β -sitosterol, ursolic acid,

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 3 May-June 2023, pp: 209-220 www.ijprajournal.com ISSN: 2249-7781

mannitol, quercetin, rutin, poliumoside and forsythoside[22].

**Phytochemicals from Jasminum amlexicaule.**
Secoiridoid glucisides- Jasamplexosides A, B C, 10- hydroxyligstroside and Jasminoside [23, 45].

**Pharmacological activities from Jasminum species.**
**Jasminum officinale**
**Antimicrobial effect**: The anti-bacterial activity in vitro of ethanolic extracts of flowers, stems plus leaves and roots of Jasminum officinale was evaluated against four reference bacteria Staphylococcus aureus, Enterococcus faecalis, Escherichia coli and Pseudomonas aeruginosa. The MIC of the extracts of flowers and stems plus leaves against all the tested bacteria was 2 mg/ml and the MIC of roots extract against S. aureus, E. faecalis and E. coli was 4 mg/ml, while the MIC of root extract against P. aeruginosa was 2 mg/ml[24]. In antibacterial study, the n-butanol fraction displayed antibacterial activity more than the standard drug ampicillin against Pseudomonas aeruginosa, Staphylococcus aureus, Klebsiella pneumoniae, Bacillus pumilis, P.vulgaris and E.coli with zone of inhibition of 19.2±0.8, 20.1±1.2, 20.1±1.5, 22.0±1.2, 19.4±1.0 and 24.0±0.8mm respectively, on the other hand, chloroform faction displayed significant antibacterial activity with zone of inhibition of 14.8±1.3, 16.2±1.4, 16.2±1.9, 17.4±1.3, 14.2±1.2 and 18.2±1.6 respectively, while n-hexane fraction displayed very low activity[25].
**Antifungal activity**: The Jasminum officinale flowers extracts were evaluated for antifungal activity against Candida albicans and Aspergillus niger. In antifungal effect, n-butanol fraction showed more activity than the standard drug with zone of inhibition of 20.9 ±1.2mm for Candida albicans and almost equal to the effect of the standard drug against Aspergillus niger with zone of inhibition of 18.2±1.1mm. Chloroform fraction showed moderate activity against both organism Candida albicans, Aspergillus niger with zone of inhibition of 13.1±1.3 and 12.3±0.6mm respectively, and n-hexane fraction showed very poor antifungal activity 2.1±1.3 3.2±1.8mm.

The antimicrobial activity of methanol extract was evaluated against both Gram positive strains [Staphylococcus aureus, Bacillus pumilus, Streptococcus pneumoniae] and Gram negative strains [Escherichia coli, Citrobacter freundii and Klebsiella pneumoniae] and two fungal species [Candida albicans, Aspergillus niger]. Whole plant extract showed significant antimicrobial activity with relative percentage of inhibition [mm] of 83.60 [G +ve], 70.25 [G-ve] and 61.15 [fungi], while flowers extract showed 64.30, 51.88 and 51.97 relative percentage of inhibition against G +ve, G-ve and fungi respectively. The diameters of growth inhibition were 11.00-15.15, 9.90-11.95 and 10.95-11.95mm against G+ve, G-ve and fungi for DCM flowers extract, and 13.35-16.35, 10.45-12.50 and 11.45-12.25mm against G+ve, G-ve and fungi for methanol flowers extract respectively, whereas, the diameters of growth inhibition were 18.00-20.00, 14.10-16.80 and 15.45-16.60 mm against G+ve, G-ve and fungi for DCM whole plant. [4].The antibacterial effect of different extracts of leaves of Jasminum officinale were studied against E. coli, Bacillus sp., Streptococcus sp., Salmonella sp.,Pseudomonas sp., Serratia marcescens, Klebsiella pneumonia and Staphylococcus aureus. Methanol extract exhibited the maximum activity against Klebsiella pneumonia, chloroform extract against Bacillus subtillis and Staphylococcus aureus, and hexane extract against Serratia marcescens and E. coli, while minimal activity was recorded for the ethanol extract against Staphylococcus aureus, for chloroform extract against Salmonella and pseudomonas aeruginosa, and for diethyl ether extract against Streptococcus sp[26].

Jasminum officinale extracts of flowers powder macerated in ethanol, were tested against Propionibacterium acnes and Staphylococcus epidermidis, as pus-forming bacteria triggering an inflammation in acne, using disc diffusion and broth dilution methods. MIC and MBC against Propionin bacterium acnes was 5 and >5 mg/ml respectively and MIC and MBC against staphylococcus epidermidis was >5 mg/ ml[24].

The antiviral effect of oleuropein derived from the flowers of Jasminum officinale was studied on hepatitis B virus [HBV] replication in HepG2 2.2.15 cell line in vitro and duck hepatitis B virus [DHBV] replication in ducklings in vivo. Oleuropein blocked effectively HBsAg secretion in HepG2 2.2.15 cells in a dose-dependent manner [$IC_{50}$ =23.2 microg/ml]. Oleuropein [80 mg/kg, intraperito neally, twice daily] also reduced viremia in DHBV-infected ducks[27]. The effect of 8-epi-kingiside [8-Epik] derived from the buds of Jasminum officinale was evaluated on hepatitis B virus [HBV] replication in HepG2 2.2.15 cell line

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 3 May-June 2023, pp: 209-220 www.ijprajournal.com ISSN: 2249-7781

in vitro and duck hepatitis B virus [DHBV] replication in ducklings in vivo. 8-Epik effectively blocked HBsAg secretion in HepG2 2.2.15 cells in a dose-dependent manner [IC50 = 19.4 ± 1.04 µg/ml]. 8-Epik [40 or 80 mg/kg, ip, twice daily] also reduced viremia in DHBV-infected ducks [28].

**Insecticidal effect**:

Jasminum officinale were tested for the larvicidal efficacy against the third instar larvae of Culex quinquefasciatus at concentrations of 62.5, 125, 250, 500, 1000, 2000, 4000 and 8000 mg/l. Mortality was recorded after 24 and 48 h. The hexane and chloroform extract possessed 14 and 13.3% mortality at 4000 mg/l after 24 h, and 18.66 and 18% mortality at 4000 mg/l after 48 h. LC50 was 3136.68 after 24 h and 6231.08 after 48 h[29]. The crude chloroform, methanol and aqueous flower extracts of Jasminum officinale, were

**Table-2 Pharmacological activities from Jasminum species.**

| Species | Activity | Extract/ Fraction Isolate/ | Dose tested | Positive control | Animals tested | Experimental Model | Ref. |
|---|---|---|---|---|---|---|---|
| Jasminum Officinale | Anti micrrobial | Ethanol ext | 2 mg/ml | Eugenol | Bacterial strains | agar dilution and agar diffusion methods | 24, 26 |
| | Antifungal | n-Butanol Ext | 2 mg/ml | Standard Antifungal drugs | Fungal strains | Disc diffusion and broth dilution model | 25 |
| | Antiviral | Oleuropein | $IC_{50}$ 80 mg/kg | - | [HBV] HepG2 2.2.15 cell line in vitro and [DHBV] in vivo | well diffusion method | 27 |
| | | 8-epi-kingiside | 40 or 80 mg/kg | - | [HBV] HepG2 2.2.15 cell line [DHBV] | well diffusion method | 28 |
| | Insecticidal | Hexane Chloroform | 62-8000 mg/l | | larvae of mosquitoes | Force feeding methods | 29 |
| | Anti oxidant | Aqueous Ext | $IC_{50}$ 41.16,30.29, 20.19,29.48 µg/ml | Ascorbic acid | DPPH, NO, superoxide and ABTS radicals | In Vitro | 31 |
| | Anti-inflammatory | Jasminol A,B,G,H | $IC_{50}$ 20.56, 30.12, 30.35, 31.60 µM | - | LPS-RAW264.7 cells | Lipo-polysaccharide (LPS) - RAW264.7. | 34 |
| Jasminum mesnyi | Antioxidant | Ethyl acetate F n-Butanol F | $IC_{50}$ µg/ml 153.45 6.22 | Ascorbic acid, Rutin | DPPH, NO | In Vitro | 35 |

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 3 May-June 2023, pp: 209-220 www.ijprajournal.com ISSN: 2249-7781

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Anti microbial | Ethanol | MIC 50-100 µg/ml | | Bacterial strains | In Vitro | 35 |
| | Anthelmintic | Ethanol | 20,40 mg/ml | Albendazole | Eisenia fetida (earthworm) | Petri Dish Expt. | 36 |
| | Antiulcer | Ethanol | 200, 400 mg/kg | Aspirin | Wister rats | Aspirin induced ulcer model | 37 |
| Jasminum amlexicaule | Anti diarrhoea | Methanol Ext | 100-400 mg/kg | Barberenine | Swiss albino rats | Oral Administration | 39, 40 |
| | Analgesic | Methanol Ext | 100-400 mg/kg | Aspirin | Swiss albino rats | Hot Plate Test, Writhing and Formalin test | 42 |

tested for the larvicidal efficacy against the third instar larvae of Aedes aegypti at concentrations of 62.5, 125, 250, 500, 1000, 2000, 4000 and 8000 mg/l. Mortality was recorded after 24 and 48 h. The crude methanolic flower extracts of Jasminum officinale caused 20% mortality after 48 h at concentration of 8000 mg/l[30].

**Antioxidant effect**:

The antioxidant potential of the aqueous extract of Jasminum officinale leaves was evaluated in vitro using free radical scavenging assays for DPPH, NO, superoxide and ABTS radicals in addition to reducing power assessment. The extract possessed significant antioxidant potential. The IC50 values for DPPH, NO, superoxide and ABTS radicals were 41.16, 30.29, 20.19 and 29.48 µg/ml respectively as compared to the standard, ascorbic acid, which showed 42.79, 36.74, 38.22, and 45.57 µg/ml for the same radicals. The antioxidant property of Jasminum officinale methanol and ethanol extracts was determined by hydrogen peroxide method. Both extracts possessed antioxidant activity, but the ethanolic extract showed the more potent activity[31]. The antioxidant activity of Jasminum officinale methanol and ethanol extracts was analysed using DPPH scavenging compared with a standard compound, ascorbic acid. The antioxidant activity in both methanolic and ethanolic extracts showed increase in activity with increase in sample concentration. The ethanolic extract showed better antioxidant activity when compared to the methanolic extract[32].

**Antifertility effect**:

The antifertility effect of an aqueous extract of fresh floral buds of Jasminum officinale var. grandiflorum was studied in female rats. The extract at oral doses of 250 and 500 mg/kg produced a dose dependent significant antiimplantation effect, but didn't produce complete infertility. Treatment of animals during day 8 to day 12 to day 20 of pregnancy did not produce any significant abortifacient activity. There was no significant change in the weight and length of the fetuses delivered by rats treated with extract and no abnormalities were seen in the organs of the offspring. The extract produced a significant decrease in serum rogesterone levels on day 5 of pregnancy which may be responsible for the antiimplantation effect[33].

**Anti-inflammatory activity**:

The anti-inflammatory activity of isolated compounds from J. officinale such as four new sesquiterpenoids, including three nor-cinalbicane type sesquiterpenoids, named Jasminol A, G, H and one eremophilene-type sesquiterpenoid, named Jasminol B were evaluated using lipopolysaccharide (LPS)-induced murine macrophage RAW264.7. The half maximal inhibitory concentration ($IC_{50}$) values of 20.56 ± 1.31, 30.12 ± 0.89, 30.35 ± 2.72 and 31.60 ± 1.69 µM, respectively, these compounds were exhibited a moderate inhibition of LPS-induced nitric oxide (NO) production in RAW264.7 cells [34].The ethanolic extract of 11 traditionally used Jordanian plants including J. officinale were studied for anti-nociceptive effect by using acetic

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 3 May-June 2023, pp: 209-220 www.ijprajournal.com ISSN: 2249-7781

acid-induced writhing and hot-plate test in mice. The result showed that the anti-nociceptive and antiinflammatory effects were dose dependent and J. officinale has an anti-inflammatory activity against acute (xylene-induced ear oedema) and chronic (cotton-pellet granuloma) inflammation.

**Pharmacological activities of Jasminum mensyi.**

**Antioxidant and Antidiabetic activity**: The methanolic extract of Jasminum mesnyi Hance leaves was subjected to fractionation to obtain antioxidant and antidiabetic rich fraction. Different concentrations of ethyl acetate and n-butanol fractions were subjected to antioxidant assay by DPPH method, nitric oxide activity and reducing power assay. The fractions showed dose dependent free radical scavenging property in all the models but n- butanol fraction showed a good reducing potetial and better free radical scavenging activity as compared to ethyl acetate fraction. The n-buatnol fraction contained secoiridoid glycoside which might be responsible for both antioxidant and antidiabetic activity[35].

**Antihelminitic activity**: Antihelminitic activity of ethanolic extract of leaves of Jasminum mesnyi has potent antihelminitic activity at the concentration of 40 mg/ml than the concentration 20 mg/ml of extract. It took 24 min to paralyse the worm in case of drug extract 40 mg/ml and 92 min to paralyze the worm in case of drug extract of 20mg/ml concentration[36].

**Antiulcer activity**: The ethanolic extract of Jasminummesnyi and Triticum aestivum leaves showed significant ulcer protective action at the dose of 200 and 400 mg/kg body weight individually as well as in combined doses in the animal models. The antiulcer property of tests extracts was attributed due to presence of flavonoids and tannins[37].

**Wound healing activity**: The roots of Jasminum mesnyi Hance in diabetic rats. The effect was studied on the streptozotocin-induced diabetic rat model for 21 days. The glucose levels in the blood of rats were measured by using glucose oxidase method by blood glucose measuring strips. According to the obtained statistics, the ethanol and ethyl acetate extract of Jasminu mesnyi roots at 400 mg/Kg was found to hold a high antidiabetic and wound healing potential[38].

**Pharmacological activities of Jasminum amplexicaule.**

The powder of twigs and leaves of Jasminum amplexicaule has been used as a hydragogue and a febrifuge and are also used as a kind of traditional medicine for the treatment of dysentery, diarrhoea and bellyache in China. Its leaves are used to take care of the quadriplegia-gall and also mixed with other ingredients to cure dysentery and bellyache. The traditional use of Jasminum amplexicaule to cure dysentery and bellyache has been investigated through their pharmacological activities in various experimental methods.

**Anti-diarrhoea Activity**

The methanol extract of twigs and leaves of Jasminum amplexicaule was administered to the castor oil-induced diarrhoea mice. The anti-diarrhoea activity was tested for the doses of 100, 200 and 400 mg/kg. Dose at 400 mg/kg exerted a significant and dose-dependent inhibition on diarrhoeic drops compared to the control group (Table-2). The methanol extract also reduced the total number of faeces as well as of diarrhoeic faeces in a dose-dependent manner. All of the fractions of chloroform, ethyl acetate, n-butanol and residual methanol fraction at the dose of 200 mg/kg, also exhibited prominent anti-diarrhoea activity. It is well known that the active component of castor oil is the ricinoleic acid, which is liberated from the action of lipases on castor oil. The precise mechanism of action of castor oil is through elevated prostaglandin biosynthesis[39. The remarkable dose-dependent reduction in castor oil-induced diarrhoea in mice is a demonstration of the efficacy of Jasminum amplexicaule as an anti-diarrhoea medicine. The extract and its fractions also significantly inhibited the castor oil-induced intestinal fluid accumulation and weight of intestinal content. It has been well known that castor oil causes motility and secretory diarrhoea [40]. The mechanism has been associated with dual effects on gastrointestinal motility as well as on water and electrolyte transport across the intestinal mucosa (Rouf et al., 2003). Four hours after magnesium sulphate administration, all the mice in control group produced copious diarrhoea. Pre-treatment of mice with the ME (100-400 mg/kg) caused a dose-dependent and significant ($P < 0.05$) decrease of the total number of faeces as well as of diarrhoeic faeces. The standard antidiarrhoeal drug, berberine (40 mg/kg) produced a significantly ($P < 0.05$) inhibitory effects. Among the fractions, the chloroform, ethyl acetate, and residual

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 3 May-June 2023, pp: 209-220 www.ijprajournal.com ISSN: 2249-7781

methanol fraction exhibited a significantly greater inhibitory effect than the n-butanol. The magnesium sulphate has been reported to induce diarrhoea by increasing the volume of intestinal content through prevention from reabsorption of water. Magnesium sulphate-induced diarrhoea has been demonstrated that it is to be by osmotic properties and cholecystokinin production [41]. In the gastrointestinal motility test, the methanol extract, at the dose of 100, 200 and 400 mg/kg, retarded the intestinal transit of charcoal meal in a dose-dependent manner in mice as compared with the control group, and the results were statistically significant (Table 2). Among the fractions, chloroform, ethyl acetate, and residual methanol fraction at the dose of 200 mg/kg, significantly delayed the intestinal transit of charcoal meal in test animals (Table 2).

**Analgesic activity**:

In the hot-plate test, the results showed that methanol extract significantly increased pain threshold of mice in a dose dependent manner. The analgesic effect of methanol extract become stronger and stronger in 60 min after drug administration, with higher pain inhibition intensity than that of aspirin at 50 mg/kg. However, chloroform, ethyl acetate and residual methanol fraction at the dose of 200 mg/kg exhibited prominent analgesic activity. In the acetic acid-induced writhing mice, the methanol extract at the doses of 100, 200 and 400 mg/kg, inhibited the frequency induced abdominal constrictions by acetic acid in a dose-dependent manner, and the results were statistically significant[42]. The fractions of chloroform, ethyl acetate, n-butanol and residual methanol, at the dose of 200 mg/kg, exhibited prominently analgesic activities. These fractions reduced the frequency induced abdominal constrictions by acetic acid in test animals. The methanol extract and its fractions significantly reduced the licking times at the first phase of observation, respectively. Aspirin inhibited this first phase by 64.63%. During the second phase of observation, the animals treated with extracts at both doses, which did not show any sign of pain. Aspirin inhibited this pain by 82.29. The methanol extract and its fractions showed analgesic activity in hot-plate test. The hot-plate test is a central analgesic test, thus the extract and its fractions may act via central mechanisms. In acetic acid-induced abdominal writhing which is the visceral pain model, arachidonic acid is released via cyclooxygenase, and prostaglandin biosynthesis plays a role in the nociceptive mechanism [43]. The methanol extract produced significant analgesic effect and this effect may be stem from its ability to interfere with the synthesis or release of those endogenous substances or desensitization of the nerve fibers involved in the pain transmission pathway. Formalin test involves two phases: neurogenic with release of substance P and inflammatory with release of serotonin, histamine, bradikynin and prostaglandins [44].

## II. CONCLUSION:

The genus Jasminum has been a source of various traditionally useful and pharmacologically active comprising of around 200 species. The leaves, stems and flower parts of the plants are used in traditional medicines for the treatment of the urinary tract infections, depressant, sedative, mild anesthetic and astringent agents. The buds of Jasminum officinale are used as a folk remedy for the treatment of hepatitis, dysmenorrhea, stomatitis, and duodenitis. In veterinary, leaves of Jasminum mensyi are used as vermifuge, galactagogue and ruminant stomach problems. The powder of its twigs and leaves of Jasminunm amplexicaule has been used as a hydragogue and a febrifuge and also has been used as a kind of traditional medicine for the treatment of dysentery, diarrhoea and bellyache. The pharmacological effects evaluated from the crude extracts or pure isolated compounds from Jasminum officinale have been antimicrobial, antifungal, antiviral, insecticidal, antioxidant, anti-inflammatory from Jasminum mesnyi- antioxidant, antimicrobial, anthelmintic, antiulcer and from Jasminum amlexicaule- antidiarrhoea and analgesic activities. The pharmacological effects justified the traditional claim in various species. The diarrhoea usually accompanied by bellyache has been treated by the twigs and leaves of J. amplexicaule. The antidiarrhoea and analgesic activities evaluated form this species was in comparison to the berbarine. The chemical compounds isolated from J. officinale- six triterpenoidal saponins, six iridoids glycosides, seven secoiridoids glucosides and thirty essential oils, from J. mesnyi- essential oils, secoiridoids, phenolic glycosides, flavonoids and steroids from J. amlexicaule- Jasamplexosides A, B and C, 10- hydroxyligstroside and Jasminoside secoiridoid glucosides[45]. The study on these species revealed that few patents have been reported from J. officinale, further investigation is

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 3 May-June 2023, pp: 209-220 www.ijprajournal.com ISSN: 2249-7781

needed to isolate new compounds and to evaluate pharmacological effects responsible for their traditional claims. These species are potential herbal medicines rich in iridoids, secoiridoids and flavonoids may be explored further for their pre-cinical and clinical studies.

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