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A CRITICAL REVIEW ON PHARMACOLOGICAL ACTIONS AND POTENTIAL USES OF *COLDENIA PROCUMBENS* LINN.

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ABSTRACT:

Introduction: *Coldenia procumbens* Linn. (Boraginaceae); *Tripakshi;* widely used in the codified Indian systems of medicine namely Ayurveda and Siddha; a procumbent, deeply rooted, hairy herb growing as a weed in damp areas all throughout India as well as warmer places of the world has been narrated as a folklore medicine and has been used to treat various ailments like rheumatic swelling, leucorrhoea, menorrhagia, diabetes, immature abscesses, leucorrhoea, menorrhagia, arthritis and hypertension. **Material and method:** Data was retrived from online sources, book and from some electronic media. **Results and Discussion:** Taking into account the *Tripakshi's* historical use, the current study is conducted using the investigation of various pharmacological actions of this historically significant plant that have been documented. These actions can be used as a key resource for expressing the plant's enormous medicinal significance. **Conclusion:** This focused the investigator's attention on this plant and after studying modern

literature it is concluded that traditional knowledge or folklore/ethano-botanical claims are true and proved by various in-vivo and in- vitro study.

KEYWORDS: Ayurveda, *Coldenia Procumbens* Linn., Review, Ethano Botanical.

INTRODUCTION:

Long before the prehistoric era, people employed plants for medical purposes. The use of medicinal herbs is seen to be quite safe because there are rarely any negative side effects. The major benefit is that these treatments work in harmony with nature. The most important fact is that using herbs as a type of treatment is appropriate for people of all ages and genders. Additionally, throughout the past 50 years, interest in ethno-medical study has episodic in nature. Herbs with medicinal properties offer logical methods for treating a variety of illnesses that are otherwise thought to be challenging to treat.

India has a rich history of codified medical systems, including Ayurveda, Unani, and Siddha. These systems mostly employ the (1) folk stream and (2) classical stream. The former is practised by villages and tribal communities and is based on oral traditions.[i] The tribes that live in forests or other less-evolved (primitive) settings are like living archaeological museums, preserving centuries-old customs and cultural history that add to the colour and lustre of humanity.[ii] Numerous unexplored folklore medicines are in great demand for research workers. *Coldenia procumbens* Linn. (Boraginaceae), is one such reported folklore plant having tremendous medicinal values.[iii] The plant is locally called as *Tripakshi*[iv,v] and *Basariyo okhrad* and is found all-over India.[vi] The plant due to its valuable folklore claim is widely used by Saurastra region of Gujarat. Moreover, this plant is widely used in traditional medicines in India, Africa and Malaysia.[vii]

Considering the indigenous uses of the *Tripakshi*, the present study has been conducted with the investigation of reported numerous pharmacological activities of this traditionally important plant which can be used as key resource for conveying its tremendous medicinal significance.

Coldenia procumbens Linn.

Coldenia procumbens Linn. (Boraginaceae) is a procumbent, deeply rooted, hairy herb that grows as a weed in damp areas all throughout India.[viii] As a folklore medicine, it has been used to treat rheumatic swelling[ix], immature abscesses, menorrhagia, leucorrhoea, arthritis, diabetes and hypertension.[x] The literature further specified the use to cure fever, piles and scorpion bite. Additionally, the whole plant extract is administered along with cow's milk in the Sidhha system of medicine to cure Perumpaadu[xi], i.e menorrhagia.

The qualitative chemical tests of *Coldenia procumbens* Linn. revealed the presence of carbohydrates, tannins, flavonoids and phenolic compounds in 50% ethanol extract and 90% ethanol extract and presence of carbohydrates, flavonoids, tannins, proteins and amino acids, and phenolic compounds in aqueous extract.[xii]

PHARMACOLOGICAL ACTIVITIES:

- **Antimicrobial Activity: [xiii]**

- According to M Boominathan and V Ramamurthy (2009), the leaf extract had the greatest inhibitory efficacy against both fungi and bacteria (Staphylococcus aureus, 22 mm) (Candida albicans - 24 mm). Selected active extracts' cytotoxicity and therapeutic index were also assessed. All of the extracts underwent phytochemical examination, which demonstrated that the presence of phenolic chemicals is what gives the plant material its antibacterial effect.

- **Antibacterial Activity:**[xiv-xv]
  - Mrs. AP Beena (2005) investigated the antibacterial activity of *Coldenia procumbens* Linn. in comparison with the standard drug ciprofloxacin. Despite being determined to be less active than the normal group, the drug nonetheless exhibited antibacterial activity, which may have been caused by the chemical components detected in the aqueous extract. These results provide credence to the plant's alleged utility in treating fever, piles, and scorpion stings in conventional medical systems. To promote them as a practical substitute for synthetic antibiotics, additional effort must be done to isolate and purify them.
  - G Ramakrishnan, R Kothai, B Jaykar, T Venkata Rathnakumar investigated the in vitro antibacterial activity of the plant using Agar well diffusion method against various gram positive and gram-negative bacteria and fungi. It was observed that the aqueous extract of leaves of *Coldenia procumbens* Linn. showed significant antibacterial activity against gram positive bacteria. Aqeous extract showed no antifungal action, according to the data.[27]

- **Anti-Viral Activity:**[xvi]
  - Dhanapal Venkatachalam (2018) reported anti-viral activity of aqueous extracts of two indigenous plants used in *Ayurveda* in India, like *Sphaeranthus indicus* and *Coldenia procumbens* Linn., against replication of HIV-1 (III B) and HIV-2 (Rod) in MT-4 cells. These extracts underwent testing and showed anti-HIV efficacy in an in vitro MTT assay while being reasonably harmless to human lymphocytic MT-4 cells. *Sphaeranthus indicus* aqueous extract suppressed HIV-1 reproduction with an IC50 of 52.35 g/ml, however it had no effect on HIV-2 replication in MT-4 cells. There was no cytotoxicity seen at 125 g/ml. This extract has a maximal inhibition of 110.5%. *Coldenia procumbens* Linn. aqueous extract. exhibited comparable IC50 values for HIV-1 and HIV-2 replication inhibition, 32.10 and 41.60, respectively. At 125 g/ml, no cytotoxicity was seen. The greatest inhibition of HIV-1 replication by this extract is 141%, and HIV-2 replication is inhibited by 114.5%. The aqueous extract of *Coldenia procumbens* Linn was demonstrated by the results above. has stronger anti-HIV effects than *Sphaeranthus indicus*.

- **Anti- Inflammatory Activity:**[xvii]
  - B Arul, R Kothai, K Sureshkumar investigated anti-inflammatory activity of the ethanolic extract of the aerial parts of *Coldenia procumbens* Linn. in Wister rats using the carrageenan induced left

hind paw oedema, carrageenan induced pleurisy and cotton pellet induced granuloma model. Rat paw oedema caused by carrageenan was inhibited by the ethanolic extract (150 mg/kg) of the plant. Additionally, it demonstrated an inhibitory effect on leukocyte migration, a decrease in pleural exudates, as well as a decrease in the weight of the granuloma created using cotton pellets. When compared to the standard and untreated control, the findings showed that the ethanolic extract produced considerable ($P < 0.001$) anti-inflammatory efficacy.

- **Anthelmintic Activity:**[xviii]
  - MA Aleemuddin, M Karthikeyan, PK Priya (2012) reported that the ethanolic and aqueous extract at dose 100mg/ml showed potent anthelmintic activity compared with Albendazole.
- **Analgesic Activity:**[xix-xx]
  - R Senthamarai, S Kavimani, B Jaykar, M Uvarani (2001) reported that the various extracts like benzene, chloroform, acetone and alcoholic extracts of the leaves of *Coldenia procumbens* Linn. exhibited significant analgesic activity when compared with standard drug Morphine sulphate (5 mg/kg). After being subjected to benzene and alcoholic extracts, the basal reaction time increased to levels comparable to morphine sulphate. The engagement of opioid receptors and the raising of the threshold for painful stimuli may be the potential mechanisms.
  - Santhosh Kumar Banoth, Krishna G Mohan, Sandhya M Rani, Fatima Saba (2015) reported that the extract at the dose of 200 mg/kg body weight showed significant ($p<0.001$) analgesic effect comparable to the standard drug Pentazocine at the dose of 10 mg/kg body weight. Mice were subjected to acetic acid-induced writhing test to evaluate the peripheral analgesic.
- **Anti-Oxidant Activity:**[xxi-xxii]
  - P Beena, S Purnima, R Kokilavani (2011) investigated in-vitro antioxidant activity of ethanolic extract of *Coldenia procumbens* Linn. by Diphenyl-1-picryl hydrazyl method (DPPH) and Nitric oxide radical scavenging inhibition activity method which gave significant results.[33]
  - R Ganesan, Mathuram Venkatanarasimhan, A Saraswathy, A.R. Shirolkar, A.V. Raskar, S.D. Pawar, S.N. Murthy, Jothi Pandian S Jega carried out the antioxidant potential of the alcoholic extract of the whole plant of *Coldenia procumbens* Linn. using DPPH Radical scavenging activity, FRAP assay, in-vitro anti-lipid peroxidation assay, ABTS radical cation scavenging activity, and Superoxide Scavenging Assay. The results further obtained suggest satisfactory antioxidant activity of alcoholic extract of whole pant of *Coldenia procumbens* Linn.
- **Anti-Oxidant, Anti-Inflammatory and Anti-Arthritic activities:**[xxiii-xxiv]
  - R Lavanya, S Uma Maheshwari, G Harish, J Bharath Raj, S Kamali, D Hemamalani, J Bharath Varma, C Umamaheswara Reddy (2010) investigated the possible antioxidant activity by DPPH, total antioxidant, anti-inflammatory by HRBC membrane Stabilization method, total phenolic

and reducing power, and anti-arthritic activity by the inhibition of Protein denaturation method. When compared to quercetin (87.74%), the percentage inhibition by the DPPH technique was determined to be 76.26% at a concentration of 500 g/0.1 ml. The reducing properties of leaf extract of *Coldenia procumbens* Linn. was discovered to be dose-dependent when compared to conventional quercetin. The total antioxidant activity was found to be 0.2 mg equivalents of ascorbic acid. It was discovered that the total phenolic content was 31.9 mg of Pyrocathecol equivalent/g of extract. The maximum membrane stabilization of Coldenia procumbens Linn. L was found to be at 98.09% and protein denaturation inhibition was discovered to be at 52.84%. Thus, the investigations are in favour of using the active components from *Coldenia procumben*s Linn. in the management of rheumatism and inflammation.

- M Palanivelu, S Palanisamy, M Mallika, V Alagarsamy investigated in-vitro anti-arthritic activity and anti-inflammatory of whole plant extracts of *Coldenia procumbens* Linn. by inhibition of protein denaturation method and human red blood corpuscles [HRBC] membrane stabilization method respectively. All test fractions of ethanolic extract Of *Coldenia procumbens* Linn. demonstrated notable anti-arthritic and anti-inflammatory effects at a dosage of 250 microg/ml.

- **Hepatoprotective Activity:**[xxv]
  - R. Ganesan, Mathuram Venkatanarasimhan , Sharad Pawar, G Pramod Reddy, T Anandan, G Masilamani(2013) studied hepatoprotective activity of *Coldenia procumbens* Linn. The entire plant was shade-dried, ground into a coarse powder, and (1 kg) was extracted with methanol and chloroform in succession in a Soxhlet device. Rats were then given 200 mg/kg of D-galactosamine (D-GalN) orally to test for antihepatotoxic action. The parameters evaluated were serum levels of Serum Glutamic Pyruvate (SGPT), Trasaminase (SGOT), Alkaline Phosphatase (ALP), Serum Glutamic Oxaloacetate Trasaminase (SGOT), total protein, total cholesterol, total bilirubin, albumin, globulin, and blood sugar changes in liver. Chloroform extract treatment significantly reversed the biochemical alterations caused by D-galactosamine administration in rats, indicating potential hepatoprotective action.
- **Anti-Colon Cancer Activity:**[xxvi]
  - K Ramachandran, R Venketnarayanan reported that DCP (Dichloromethane extract of *Coldenia procumbens* Linn.) i.e., a plant extract, at a dose of 200 and 400 mg/kg was found to decrease aberrant crypt foci (ACF) significantly (P< 0.001). Individual organ weights and haematological indicators have considerably risen (P 0.001) when compared to disease control (DMH), indicating weight growth. The total cholesterol level, another biochemical measure, was also found to be significantly lower (P 0.01), leading researchers to draw the conclusion that the dichloromethane extract of *Coldenia procumbens* Linn. had strong anti-cancer action.

- **Anti-Colorectal Cancer Activity:**[xxvii]
  - K Ramachandran, R Venketnarayanan, Rajesh Yadav, R Suresh, Sumitra Devkota (2019) investigated the anti-cancer potential of the plant *Coldenia procumbens* Linn. and he anti-cancer moiety was synthesised, and the results indicated that the plant *Coldenia procumbens* Linn. has anti-colorectal cancer action.
- **Central Nervous System Effects:**[xxviii]
  - MA Nagarani, V Vijayasekaran, Kameswaran Lalitha (1991) investigated that A considerable lengthening of the pentobarbitone sleep period was obtained by the Alcoholic extract of whole plant *Coldenia procumbens* (AECP). Additionally, when examined using the tail clip method or the acetic acid writhing reflex or by radiant heat method, AECP did not show any discernible analgesic effects. Additionally, it has no anticonvulsant properties, does not change body temperature, and does not eliminate the conditioned avoidance response.
- **Acute Oral Toxicity Study:**[xxix]
  - K Ramachandran, R Venketnarayanan, Rajesh Yadav, R Suresh, Sumitra Devkota(2019) reported that the plant *Coldenia procumbens* Linn. and *M. maderaspatana* possess chemical moeities which show antioxidant and anticancer activity. Prior to the drug's clinical use, the drug's safety was confirmed by determining the toxicological profile on both isolated compounds and crude extracts. When compared to the control group, the animal's responses, including motor activity, pupil size, urination, salivation, and skin colour, are all normal when DCP and MCP were administered at varied concentrations of 5 mg/kg, 50 mg/kg, 300 mg/kg, and 2000 mg/kg. And this research showed that both of the examined extracts had non-toxic potential.
- **Anti-diabetic activity:** [xxx,xxxi,xxxii]
  - Nita Patel, Sunant Raval, Harshad Goriya, Mayur Jhala, Bhola Joshi (2007) researched on Diabetes induced in Groups II, III and IV rats by alloxan monohydrate at the rate of 180 mg/kg body weight. Following *Coldenia procumbens* Linn. treatment, there was a significant ($p < 0.05$) rise in body weight. Additionally, when compared to the diabetic control group of rats, there was a substantial (p 0.05) decrease in blood glucose levels from 394.17 ± 10.52 (mg/dl) to 152.83 ± 2.15 (mg/dl) in the rats of *Coldenia* treated rats. In *Coldenia procumbens* Linn. -treated rodents, serum triglyceride levels dropped dramatically ($p<0.05$) from 152.33 ± 2.75 (mg/dl) to 109.17 ± 1.74 (mg/dl). Rats' blood cholesterol levels were decreased considerably (p 0.05) from 59.83 ± 1.01 (mg/dl) to 44.33 ± 1.96 (mg/dl) with *Coldenia procumbens* Linn. treatment. Data analysis reveals that the test medication has a positive hypoglycaemic impact in diabetic rats.
  - Omanakuttan Soumya (2016) evaluated the antidiabetic potential of *Coldenia procumbens* Linn. using 18 hr fasting glucose model, oral glucose tolerance test and streptozotocin induced diabetes

model. Studies on *Coldenia procumbens* Linn's aqueous, 50% ethanol, and 90% ethanol extracts for the treatment of diabetes were conducted following a streptozotocin-induced diabetes model, an oral glucose tolerance test, and a fasting glucose model. In the fasting glucose paradigm, extracts of 90% ethanol, 50% ethanol, and aqueous extracts at a dosage of 250 mg/kg showed no hypoglycaemic action. In an oral glucose tolerance test, extracts of 90% and 50% ethanol at a dosage of 250 mg/kg both demonstrated antihyperglycemic action. In an oral glucose tolerance test, 50% ethanol extract was found to be more effective than 90% ethanol extract.

- Ganesan Rethinam, Mathuram Venkatanarasimhan(2020) reported that methanolic extract of *Coldenia procumbens* Linn. decreased glucose levels in serum and enzymes levels. The histopathology of pancreas demonstrated good healing from the harm caused by streptozotocin. Consequently, the substances found in *Coldenia procumbens* Linn. were discovered to have notable anti-diabetic, insulin mimicking, and insulin secretory actions, and their whole processes have already been thoroughly explored. Also, the methanolic extract of *Coldenia procumbens* Linn. demonstrated notable anti-hyperglycaemic efficacy.

- **Veterinary signified Anti- diabetic effect on diabetic rat and dog:[xxxiii]**
  - N.R. Patel investigated the clinical manifestations, biochemical profile and histopathological changes of *Tripakshi* in alloxan induced diabetic rat and dog. The other standard drug utilised as an oral hypoglycaemic was glibenclamide. Alloxan monohydrate was used to induce diabetes in animals in Groups II, III, and IV at doses of 180 mg/kg body weight in rat after an overnight fast and 70 mg/kg body weight in dog after an overnight fast. Group-I animals served as the control group, Group-II animals as the diabetic group, Group-II animals received *Tripakshi* (at 100 mg/kg body weight orally once daily in rats and at 150 mg/kg body weight orally once daily in dogs), and Group-IV animals received glibenclamide (at 5 mg/kg body weight orally once daily in rats and dogs for the first week and at 10 mg/kg body weight orally twice daily in mice) as the treatment in divided doses in dog after one week. According to an assessment of the test data, the test medication shows good hypoglycaemic effects in diabetic rats and dogs as well. Additionally, in rats and dogs, *Tripakshi* reduced the levels of blood total protein, ALT, triglycerides, ALT, cholesterol, and creatinine.

CONCLUSION:

The reviewed research confirms the well-known scientifically investigated various activities and uses like antimicrobial- antibacterial, anti-viral, anti-arthritic, analgesic activity of its leaves, hepatoprotective, anticancer activity of whole plant, anti-diabetic activity of leaves, anti-inflammatory activity of aerial parts, anti-oxidant, anthelmintic, anti-cancer activity and Acute Oral Toxicity study of the whole plant and convincing ethno-veterinary anti- diabetic effect on diabetic rat and dog, etc.

The observed pharmacological properties may be attributed to the presence of a high concentration various other phytochemicals of diverse chemical structure. Also, this review aims to highlight the main medicinal properties of *Coldenia procumbens* Linn. with a view to focus future studies on this plant.

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