IJPSR (2020), Volume 11, Issue 11 (Review Article)

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 12 February 2020; received in revised form, 30 April 2020; accepted, 19 October 2020; published 01 November 2020

A REVIEW ON THE ANTIBACTERIAL POTENTIAL OF INVASIVE WEEDS USED FOR THE TREATMENT OF CARBUNCLE IN PURULIA DISTRICT OF WEST BENGAL INDIA

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Keywords:

Invasive weeds, *Staphylococcus aureus*, Carbuncle, Tribal

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ABSTRACT: Carbuncle is a serious skin disease that affects tribal communities very quickly. The disease is generally caused by *Staphylococcus aureus*, *Escherichia coli*, or *Streptococcus pyogens*. Due to increasing drug resistance in these bacterial strains, it has become very difficult to treat carbuncle with modern antibiotics. The information about tribal peoples using invasive weeds to treat carbuncle is empirical due to the lack of scientific validation. In this review, we focused on the antibacterial potential of invasive weeds used for the treatment of carbuncle in Purulia district of West Bengal, India. Studies by many researchers showed that those invasive weeds strongly inhibited *Staphylococcus aureus*, *Escherichia coli*, and many other pathogenic bacterial strains. So, this review work scientifically validates the use of invasive weeds for the treatment of carbuncle by tribal peoples of Purulia. This review work will also help in the discovery of new antimicrobial agents from invasive weeds and introducing them to the modern day's medicine.

INTRODUCTION: Plants have been used as a source of healthcare products since ancient times [1]. Plants contain several bioactive chemical compounds, and these compounds are often utilized to produce herbal medicine. Invasive weeds are those plants that establish, persist, and spread widely in natural ecosystems outside the plant's native range. Although invasive weeds are considered a threat to biodiversity still they contain a large number of phytochemicals, which can be a source of herbal medicine. Carbuncle is a skin disease commonly caused by *Staphylococcus aureus* or *Streptococcus pyogens* [2]. The disease is characterized by the presence of several boils in cluster [3].

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.11(11).5425-33

The article can be accessed online on www.ijpsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.11(11).5425-33

The boils are generally filled with purulus exudates. The disease spread very quickly to other areas of the body or to other peoples living together. Due to high resistance in *Staphylococcus aureus* to a lot of antibiotics, the disease has become very difficult to treat. Carbuncle is one of the most common skin diseases that occurs among the tribal peoples of Purulia.

The disease frequently occurs among the tribal peoples due to poor hygiene and poor sanitation facility. The tribal peoples of Purulia use traditional herbal medicines to treat skin diseases like carbuncle4. Mahato, in 2019, reported 59 herbal plants used by the tribal peoples of Purulia to treat carbuncle [4]. Among 59 herbal plants, 5 were invasive weeds. In the present review, we studied the antibacterial potential of those five invasive weeds, which will give scientific validation to the information about the ethno botanicals.

***Ageratum conyzoides* Linn:** *Ageratum conyzoides* L. is an annual herb belonging to family

Asteraceae. Leaves are simple, opposite, pubescent, dark green in colour. Pinkish flowers are arranged in corymb inflorescence. The leaves of the plant are mixed with Clarified butter of cow milk, honey and other plant parts to form a mixture. The mixture is taken before breakfast for 4-5 days to treat carbuncle [4].

The essential oil of *Ageratum conyzoides* exhibited antibacterial potential against *V. cholerae, S. pyogens, S. shigae* and *S. typhi* [5, 6] but failed to inhibit pathogenic bacteria of potato7. The essential oil was also reported to inhibit both gram-positive and gram-negative bacteria. Essential oils obtained from the flowers and stems of *Ageratum conyzoides* showed promising antibacterial potential against *Staphylococcus aureus* ATCC 25923, *Klebsiella pneumoniae* USSURMI 444C/13, *Enterococcus faecalis* USSURMI 469C/13, *Staphylococcus aureus* USSURMI 524C/13, Shigella sp. USSURMI434C/13, *Escherichia coli* ATCC 25922, *Citrobacter koseri* USSURMI 745C/13, *Enterobacter aerogens* USSURMI 746C/13. Total of 48 compounds in the flower oil and 44 compounds in the stem oil were identified by GC-MS [8].

An isolated compound (AC1) from the leaves of *Ageratum conyzoides* showed significant antibacterial activity against gram-positive and gram-negative bacterial strains [9]. The ethanolic extract from *A. conyzoides* is reported to inhibit the growth of *Staphyloccus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, and *Shigella dysenteriae* [10]. A. Okwori, in 2006, studied on the antibacterial activity of *A. conyzoides* using three different solvents (Hexane, Water, Methanol). The result showed that the hexane extract completely inhibited all bacterial isolates used, but the aqueous showed 75% susceptibility and the methanol extract showed 50% susceptibility [11].

In another work, the antimicrobial potential of methanol and ether extract from leaves of *A. conyzoides* was investigated against 697 bacterial strains. Ciprofloxacin was used as a standard antibiotic in this investigation. A total of 214 (24.1%) strains were susceptible to methanolic extract, whereas 551 (79.05%) strains were susceptible to ciprofloxacin [12]. Dichloromethane extract of the leaves of A conyzoides exhibited strong antibacterial activity against highly resistant enteropathogenic organisms [13]. In Shelly's work, the antibacterial potential of methanol, acetone, and aqueous extract of *A. conyzoides* leaves was evaluated against *Escherichia coli*, *Yersinia pestis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus cereus,* and *Listeria monocytogens*. The methanolic extract showed the strongest antibacterial potential against all tested bacterial strains except *E. coli* [14] but in another investigation, the methanolic extract of leaves inhibited diarrhea-causing *E. coli* [15].

Methanol extract and fractions of the whole plant are reported to have antibacterial potential against Heliobacter pylori [16]. Crude extract and essential oil of *Ageratum conyzoides* showed antibacterial activity against uropathogenic bacterial strains [17]. The work of Etinosa in 2015 revealed synergistic action of leaf extract of *A. conyzoides* with antibiotics against Pseudomonas aeruginosa and *Staphylococcus aureus*. So, *A. conyzoides* can be used with antibiotics to treat wound infections caused by *Pseudomonas aeruginosa* and *Staphylococcus aureus* [18]. The antiacne potential of the ethanolic leaf extract and antistaphylococcal activity of the methanolic leaf extract is also reported [19, 20].

According to Omole's study, the root extract of *A. conyzoides* has higher antibacterial potential than the leaf extract against clinically isolated bacterial strains [21]. The work of Arnab in 2019 revealed that the methanolic leaf extract has moderate antibacterial activity against Bacillus cereus and *Vibrio parahaemolyticus* but no activity against methicillin-resistant *Staphylococcus aureus* [22].

***Datura metel* Linn:** *Datura metel* Linn. Belonging to the family Solanaceae, Is a perennial herb having oval-shaped alternate leaves and violet-colored stem. Flowers generally grow in a solitary and axillary cyme. The leaf of the plant is used by the tribal peoples of Purulia District for the treatment of Carbuncle. Leaves are burnt to form ash, and the ash is applied to the mouth of Carbuncle4. The plant is investigated by many researchers for its antimicrobial properties and bioactive compounds. A new antibacterial agent (51, 71 dimethyl 6 1-hydroxy 31, phenyl 3 α - amine β - yne sitosterol 1) was isolated and identified from the ethanolic

extract of leaf of *Datura metel* using 13C, 1H NMR, IR, and MS spectroscopic data. The isolated compound showed antibacterial activity against multiple disease-causing microorganisms (*Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Salmonella typhi*, *Klebsiella pneumoniae*) except *E. coli* [23].

In an investigation, the antimicrobial potential of ethyl acetate and methanol extract from leaf, stem, and root of *D. metel* was assessed against bacterial pathogens, which cause opportunistic infection associated with HIV. The outcomes uncovered that the methanol extract posses higher antibacterial activity than the ethyl acetate extract. The presence of alkaloids, phenols, tannins, saponins, carbohydrates, proteins, amino acids, glycosides, fixed oil, and fats in the extract was revealed by phytochemical analysis [24].

A study focusing on the antibacterial activity of aqueous extracts from different parts of *D. metel* revealed that the aqueous leaf extract possesses highest antibacterial potential against *Bacillus megaterium*, *Bacillus cereus*, *Escherichia coli*, *Salmonella typhi*, and *Staphylococcus aureus* [25]. A study of Akharaiyi in 2011 uncovered the antibacterial activity of leaf and stem of *D. metel* against Streptococcus β hemolytic, *Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Bacillus cereus*, *Campylobacter jejunum*, *Shigella dysenteriae*, and *Salmonella typhi*. The ethanolic extract showed the highest potential to inhibit methicillin-resistant *Staphylococcus aureus* [26].

In the investigation of Shakti, the antibacterial activity of ethanol and ethyl acetate extract of leaves of *Datura metel* was tested against human pathogenic bacterial strains such as *B. subtilis*, *E. coli*, S. aureus. The highest inhibition zone was showed by ethyl acetate extract against *E. coli* [27].

Gachande, in 2013, reported the antimicrobial activity of ethanolic extract of *D. metel* leaf against resistant bacterial strains [28]. The antimicrobial potential of the aerial parts of *Datura metel* L. was investigated against 16 disease-causing pathogens such as *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus mutans*, *Pseudomonas syringe*, *Erwinia caratovara*. Chloroform, methanol, and hexane were used as solvents for the extraction of the bioactive compounds from the aerial parts. The chloroform and methanol extract showed the highest antimicrobial activity against *Erwinia caratovara* and *Pseudomonas syringe* [29].

In a study of A. Muthusamy, three different solvents (Acetone-Chloroform-Distilled Water) were used for the extraction of phytochemicals from leaves. The extracts were mixed with 1 ml of DMSO, and the antimicrobial activity was determined using agar well diffusion and agar disc diffusion method. Results revealed that the acetone extract possesses promising antimicrobial activity than chloroform and hexane extract [30].

The antimicrobial potential of seed oil of *Datura metel* is also investigated. The investigation was done against four gram-positive (Lactobacillus plantarum MTCC 2621, *Lactobacillus delbrueckii* subsp lactis MTCC 911, *Staphylococcus aureus* subsp aureus MTCC 737 and *Enterococcus faecalis* MTCC 439) and five gram-negative bacteria (*Escherichia coli* MTCC 443, Salmonella typhi MTCC 531, *Shigella flexneri* MTCC 1457, *Vibrio vulnificus* MTCC 1145 and *Pseudomonas aeruginosa* MTCC 424). The seed oil exhibited antimicrobial activity against all the tested microorganisms except *Enterococcus faecalis* MTCC 439 and *Escherichia coli* MTCC 424 [31].

A study focussing on the antibacterial activity of five different solvents (Petroleum ether, Ethyl acetate, Acetone, Methanol, and Ethanol) extracts of *Datura metel* leaves revealed that the ethanolic extract has better antibacterial activity than the other solvent extracts [32]. Silver nanoparticles synthesized from *Datura metel* leaf extract is reported to have antibacterial activity against Pseudomonas sp and *E. coli* [33].

***Calotropis procera* (Ait.) R. Br:** Calotropis procera, commonly known as "AKANDA" in Bengali, is an evergreen shrub belonging to the family Apocynaceae. Leaves are greyish green in color and contain milky sap. Flowers are purplish white in color. The leaves of *C. procera* is used by tribals of Purulia district for the treatment of Carbuncle [4]. In the work of Kareem, the antimicrobial effect of ethanol, aqueous and chloroform extracts of leaf and latex of *Calotropis*

procera was evaluated against pathogenic microorganisms such as *Staphylococcus aureus*, *Escherichia coli*, *Aspergillus niger*, *Candida albicans*. The results showed that the ethanol was the best extractive solvent for antimicrobial properties of leaf and latex of *C. procera* followed in order by chloroform and aqueous (P<0.05)34. Methanolic leaf extract of *C. procera* inhibited the growth of *Corneybacterium diptheri* and *Bacillus subtilis*, but the bark extract was active against *Salmonella typhi* and *Bacillus subtilis*. The root extract showed antibacterial activity against *E. coli* [35].

The aqueous leaf extract of *C. procera* leaf showed anti-HIV 1 activity. Dose-dependent inhibition of p24 antigen was observed by Mohonrajet al. (2010). In this investigation, the ethyl acetate extract from leaf of *C. procera* significantly inhibited the growth of *Salmonella typhi* MTCC 734, *Salmonella paratyphi* A MTCC 3220, *Vibrio cholera* MTCC 3904, and *Klebsiella pneumonia* MTCC 10936.

Nenaah and Ahmed in 2011 investigated on the antimicrobial activity of aqueous and organic solvent extract of leaf, latex, and flower of *C. procera*. Streptomycin (200 µg/ml) and ciprofloxacin (60 µg/ml) was taken as a positive control for bacteria. In the case of fungi, Clotrimazole (10 µg/ml) and Nystatin (10 µg/ml) were taken as a positive control. Negative control was taken by using discs soaked in respective solvents. The leaf and latex methanolic extract showed the strongest antimicrobial activity against bacteria but in the case of fungi only the methanolic extract of latex showed strongest antimicrobial activity. When the methanolic latex extract was added with standard tested antibiotics (Ciprofloxacin and Clotrimazole), the MIC of the standard antibiotics were lowered, which indicates synergistic interaction between the methanolic latex extract and the standard antibiotics [37].

Evaluation of antibacterial activity of leaf and latex of *Calotropis procera* against five gram negative (*Neisseria lactamica* ATCC 23970, *Salmonella typhi* ATCC 19430, *Shigella fleneri* ATCC 12022, *Enterococcus faecalis* ATCC 29212, *Escherichia coli* ATCC 25922) and two gram positive bacteria (Methicillin resistant *Staphylococcus aureus* MRSA ATCC 43300, *Staphylococcus aureus* CONS ATCC 29213) was carried out by Salem et al. (2014). Chloramphenicol (25 mg/ml) was used as a standard antibiotic. 70% ethanol extract of leaf and latex exhibited the highest antibacterial potential *38*.

Ethanolic extract, cold water extract and fractions of *C. procera* leaf exhibited antibacterial activity against vancomycin and methicillin-resistant bacteria isolates. The active fractions were analyzed by Fourier Transform Infrared Spectroscopy (FT-IR). The FT-IR analysis revealed the presence of five important functional groups (phenols, hydroxyl, carbon-hydrogen, carbonyl, and aromatic) in the active fractions [39].

Silver nanoparticles synthesized from the latex serum of *C. procera* showed promising antimicrobial activity against *Escherichia coli*, *Pseudomonas aeruginosa*, Serratia sp, *Trichophyton rubrum*, *Candida albicans*, *Aspergillus terreus* [40]. Shetty *et al.*, (2015), investigated the antibacterial potential of *C. procera* leaves against four bacterial isolates (*B. subtilis* NCIM 2045, *M. aureus* NCIM 2802, *P. aeruginosa* NCIM 2036, and *E. coli* NCIM 2832). The leaf extract significantly inhibited all the tested microorganisms [41].

In a study by Naser, the dried leaves of *C. procera* were extracted with 95% ethanol and 70% ethanol to produce the ethanolic and hydroalcoholic extract. The antibacterial activity was evaluated against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa* using the agar disc diffusion method. The hydroalcoholic extract of leaf showed better antibacterial activity than the ethanolic extract. Thirty-five compounds were identified in both ethanolic and hydroalcoholic extract of *C. procera* leaf by GC-MS42.

***Calotropis gigantea* (L) Dryand:** *Calotropis gigantea* is a large shrub belonging to the family Apocynaceae. The plant is consist of white or lavender colored flowers which grows in the cluster. The leaves of the plant are oval in shape; stem contains milky latex. Leaf and latex of the plant are applied on the mouth of carbuncle by the tribals of Purulia [4]. In a study evaluating

antimicrobial activity of *Calotropis gigantea* L., various solvents on the basis of polarity were used for the extraction. Result recorded as methanol and chloroform extracts showed activity against *Sarcina lutea*, *Bacillus megaterium*, and *Pseudomonas aeruginosa*, petroleum ether extracts showed inhibitory action on *Bacillus subtilis*, *Shigella sonnei* whereas ethyl acetate extracts activity observed against *Pseudomonas aeruginosa* and *Escherichia coli*. MIC value for each fraction was estimated using serial dilution method [43].

The latex of the plant is investigated for antimicrobial activity by many researchers. The latex of *Calotropis gigantea* was evaluated against three gram-positive bacteria (*Staphylococcus aureus*, MTCC-740; *Bacillus subtilis*, MTCC-441 and *Staphylococcus epidermidis*, MTCC-3615) and three Gram-negative bacteria (*Escherichia coli*, MTCC-4437; *Shigella dysenteriae*, ATCC-1457 and Salmonella typhi, MTCC-733) by using well diffusion method. Results revealed as ethanolic extract of latex developed a significant zone of inhibition at concentration 1-5 mg, which is comparable with chloramphenicol [44]. In another study, antimicrobial activity of crude extract of latex of *Calotropis gigantea* was tested against some pathogens using agar well diffusion method. The result revealed that the inhibitory effect was observed on *Staphylococcus aureus*, *Bacillus cereus*, and *Escherichia coli*. The minimum inhibitory concentration was determined. The presence of a functional group on the latex composition was analyzed by Fourier Transform Infrared Spectroscopic method [45].

In a study, MIC value, the zone of inhibition, and relative percentage of inhibition measurement were performed to analyze the antibacterial activity *Calotropis gigantea*. The minimum relative percentage of inhibition was seen against Bacillus cereus (188.52%) followed by *E. coli*, *P. aeruginosa*, *K. pneumoniae*, *S. aureus*, and *M. luteus* respectively [46].

In the work of Bharathi, the antibacterial effect of leaf extracts of *Calotropis gigantea* with chloroform, ethyl acetate, dichloromethane was carried out. All the extracts exhibited significant inhibitory action against gram-positive and gram-negative bacteria in well diffusion assay [47]. An evaluation was done on the antimicrobial activity of flower extracts of *Calotropis gigantea* using the agar diffusion method. Ethyl acetate extracts showed significant antimicrobial activity against 4 pathogenic bacteria and 2 pathogenic fungi. The result was analysed by estimating the zone of inhibition and MIC value. Very low MIC value (2.5 µg/disc) observed in *C. gigantea* against *Pseudomonas aeruginosa*, *E. coli*, and *Tinea capitis* [48]. Rahman in 2013, observed antibacterial activity of *C. gigantea* against 4 pathogenic bacteria (*Staphylococcus aureus*, *Escherichia coli*, *Vibrio minicus*, *Vibrio parahemolytics*) by using disc diffusion method. The inhibition zones of the extract were compared with Standard antibiotic discs of Kanamycin (30 µg/disc) [49]. The result of a study revealed that aqueous and ethanolic extracts of root and latex showed antibacterial activity against *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* giving the significant zone of inhibition [50].

Shopna in 2014, evaluated the antioxidant, antimicrobial activity and phytochemical analysis of *Calotropis gigantea*. Various bioactive compounds were screened by GC-MS analysis. Different solvent extractions of the flower were prepared for antimicrobial activity against 3 pathogenic bacteria and 3 pathogenic fungi. Result revealed as chloroform extract gave a greater zone of inhibition than other extracts against *Staphylococcus aureus*. The minimum zone of inhibition was observed in methanol extract against *Aspergillus flavus* [51]. Sharma in 2015, studied on antimicrobial potential of ethanolic extract of Calotropis gigantea against *Streptococcus mutans* and *Lactobacillus acidophilus*. The result showed that the minimum zone of inhibition was found at concentration 1.25% against both bacteria [52].

Antimicrobial activity of different parts of the plant is also reported. Various solvent extraction followed by disc diffusion assay was performed against pathogenic and non-pathogenic micro-organism. As a result, maximum antimicrobial activity was observed in methanol extract of root against *S. aureus*. The minimum zone of inhibition was observed in ethanol extract of the flower against *Aspergillus niger* [53]. Pattanaik demonstrated antimicrobial activity of *Calotropis gigantea* leaf extract along with GC-MS chemomatric profiling

of the ethanol extract. The ethanolic leaf extract showed maximum antibacterial activity against Klebsiella. A high inhibitory zone was found in leaf extract against *Aspergillus niger* (15 mm) compared to other species of Calotropis 54.

***Cuscuta reflexa* Roxb:** *Cuscuta reflexa* is a parasitic leafless twined vine. It consists of a white bell-shaped flower with the yellow filament. Whole plants are used by tribal peoples of Purulia to treat carbuncle [4]. Pal in 2006, evaluated antimicrobial activity of *Cuscuta reflexa* stem. Various solvent (petroleum ether, chloroform, and methanol) extractions were used in antimicrobial screening against the pathogenic organisms. A significant antibacterial activity of methanolic extract was observed in a concentration of 125 µg/ml against *S. aureus*, *S. boydii*, *P. aeruginosa*, *S. dysenteriae*, *E. coli* with a zone of inhibition from 16-24mm. chloramphenicol (10 µg/ml) was used as standared [55]. Chhabra in 2010, demonstrated about anti-microbial potential of different extracts of Cuscuta reflexa growing on 2 host plant (*Acacia arabica*, *Zizyphus jujube*). Antimicrobial activities were evaluated against gram-positive bacteria (*Staphylococcus aureus*, *Streptococcus epidermidis*), gram negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa*), and fungus (*Aspergillus niger*). Various solvent fraction viz. benzene acetone, ethanol, and methanol were used in the well diffusion method. By measuring the diameter of the zone of inhibition, it was proved that ethanol and methanol extract showed antimicrobial activity, whereas aqueous extract of *C. reflexa* (Z. jujube) showed very little effect [56].

The work of Inamdar in 2011 evaluated the antimicrobial activity of ethanolic extract of *C. reflexa* Roxb. This was prepared by the Soxhlet extraction method. In vitro antimicrobial activity of stem extract was studied by agar cup plate technique against gram-positive bacteria (*B. subtilis*, *S. aureus*), gram-negative bacteria (*E. coli*, *P. aeruginosa*), and fungi (*P. citrium*, *A. niger*). Antimicrobial activity was determined by measuring the diameter of the zone of inhibition. The result revealed that ethanolic extract has greater antimicrobial activity against fungi and gram-negative bacteria than gram-positive bacteria [57].

A comparison of antimicrobial activity between *C. reflexa* and *A. indicum* against various pathogenic bacteria revealed that ethanol and chloroform extract of *C. reflexa* has the strongest antimicrobial activity. Antimicrobial activity was estimated as IC_{50} value range 16.93-55 mg/ml [58]. In 2013, Parveen reported about antimicrobial potential of *C. reflexa* compare to other species along with antioxidant potential and mineral contents of the plant. The antimicrobial activity was evaluated against bacterial strains like *B. subtilis*, *Pasteurella multocida* and *Staphylococcus aureus* and fungal strains like *Aspergillus niger*, *Asperllus flavus*. Methanol and n-hexane extracts were used in the well diffusion method. Larger zones were observed in methanol extract [59]. Bais in 2014, evaluated antimicrobial activity of ethyl acetate extract of *C. reflexa* grown on a different host. The antimicrobial analysis experimented against various pathogenic bacteria. Extracts of *C. reflexa* grown on *Cassia fistula* were given maximum zone of inhibition range 14.18-22.5 mm at 100 mg/ml concentration in all bacteria except *Salmonella typhi*. The study was concluded as the antibacterial activity of *C. reflexa* is host-dependent [60].

In a study, the antimicrobial screening of the whole plant of *C. reflexa* was done against gram-positive bacteria (*B. subtilis*, *S. aureus*) and gram-negative bacteria (*E. coli*, *S. typhi*). Different concentrations of ethanolic extracts were produced in a range of 200-500 µg/ml. In agar well diffusion assay, the result showed that all 3 bacteria were inhibited except S. *typhi*. Maximum zone of inhibition found in *E. coli* at conc. 500 µg/ml (24.6 ± 0.24). Amoxicillin and kanamycine were used as positive control [61]. Gulati and Mishra, in 2016, evaluated for antimicrobial activity of methanolic extract of stem of *C. reflexa* Roxb. Against gram-positive bacteria (*B. subtilis*, *S. aureus*) and gram-negative bacteria (*E. coli*, *P. Aeruginosa*). In well diffusion assay, antimicrobial activities of various concentrated extracts were analyzed. Penicillin and methanol were used as a positive and negative control, respectively. A maximum zone of inhibition was found against gram-negative bacteria as compared to the gram-positive bacteria. The result was revealed by measuring the diameter of the zone of inhibition± standard error means [62].

Some isolated compounds (CR1-CR5) in arial part of *C. reflexa* showed antibacterial activity. Those 5 phytochemicals were namely, 2,3-dihydro-3,5,7-trihydroxy-2-(3-hydroxy4methoxyphenyl)chromen-4-one (CR-1), 2,3-dihydro-3,7 dihydroxy-2-(3,4dihydroxyphenyl) chromen-4-one (CR-2) and 6-methoxy -2H-chromen-2-one (CR-3), N-(4-methoxyphenethyl)3(3,4dihydroxyphenyl)acrylamide (CR-4) and N-(4-butylphenethyl)-3-(4-hydroxy-3-methoxyphenyl) acrylamide (CR-5). The anti-bacterial test was done by using disc diffusion method on sterilized nutrient agar.

Different concentrations of compounds were prepared by dissolving the compound in dimethyl sulphoxide solvent against the bacteria like *Staphylococcus aureus* (SA/221-14), *Bacillus subtilis* (BS/222-14), *Escherichia coli* (EC/223-14), and *Pseudomonas aeruginosa* (PA/224-14). The result showed maximum antimicrobial activity observed by the compound CR5 against *E. coli* (15.9 mm) and medium activity found in CR3 and CR5 against *E. coli*, *B. subtilis*, and *P. aeruginosa* [63].

Kumar in 2019, evaluated the antibacterial activity of stem and flower of *C. reflexa*. Various solvent extraction (cold and hot water, methanol, ethyl acetate, acetone) were used for phytochemical analysis along with antimicrobial screening against *E. coli* and *B. cereus*. The diameter of the zone of inhibition, minimum inhibitory concentration, and minimum bacterial concentration was estimated to analyze the antibacterial activity of *C. reflexa*. The result revealed that methanolic extract of Cuscuta stem developed zone of inhibition against *B. cereus*, but acetone extract were inhibited both the organism [64].

CONCLUSION: From the above review, it is clear that several works have been done by many researchers regarding antibacterial properties of above mentioned invasive weeds. The result of all those studies indicates that these weeds have the potential to inhibit drug-resistant bacterial strains. From this review, the utilization of invasive weeds for the treatment of carbuncle by tribal peoples of Purulia district gets scientifically validated. Further work and information on toxicity and in vivo studies are required to produce cheap ointments or herbal drugs from these invasive weeds.

ACKNOWLEDGEMENT: Nil.

CONFLICTS OF INTERESTS: No conflicts of interest.

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How to cite this article:
Bera A, Maiti S and Banerjee N: A review on the antibacterial potential of invasive weeds used for the treatment of carbuncle in Purulia district of West Bengal India. Int J Pharm Sci & Res 2020; 11(11): 5425-33. doi: 10.13040/IJPSR.0975-8232.11(11).5425-33.