Antimicrobial Potential and Phytochemical Constituents of the Aerial part of *Cassia tora* L.

Madhulika Pandaw* & P.K. Saluja**
* Department of Botany, Govt. Naveen College Birgaon, Raipur (C.G.)
** Department of Botany, Govt. D. B. Girls P. G. (Auto.) College,Raipur (C.G.)

Received: December 12, 2018 Accepted: January 20, 2019

ABSTRACT: *Plants have been one of the important sources of herbal medicine. Most of the plants have ability to synthesize some bioactive compounds which acts as defense against fungi, bacteria and insects etc. Cassia tora L. is a wild plant, grows as a weed. Leaves of Cassia tora were subjected for extraction in four different solvents viz. methanol, chloroform, aqueous and petroleum ether. The present investigation is carried out to determine the antimicrobial activity ofCassia tora L. leaves extracts. Agar well diffusion method is used to determine antimicrobial activities.The phytochemical analysis was carried out to screen the presence of phenol, terpenoids, tannins, saponins, alkaloids, cardiac glycosides and anthraquinone, so as to establish its relation with antimicrobial activity.The phytochemical analysis of extracts revealed the presence of of phenol, terpenoids, tannins, saponins, alkaloids, cardiac glycosides and anthraquinone.. The antimicrobial activity of leaves extract produced significant inhibitory zones against tested organisms i.e. Escherichia coli (CGSC 4312) and Bacillus cereus(ATCC 9634). Methanolic and chloroform extract showed maximum inhibition against E. coliand chloroform extract showed maximum against B. cereus. The present investigation shows that leaf extract possess antimicrobial property against both type of bacteria indicated broad spectrum of secondary metabolites. Hence it can be used as a therapeutic drug to inhibit bacterial pathogens.*

Key Words: *Cassia tora L., Escherichia coli, Bacillus cereus, phytochemical tests, Antibacterial activity, agar well diffusion*

Introduction:

The nature contains all theremedies for the mankind. The origin of todays novel chemotherapeutics comes from traditional medicines which are an important source for their development. Majority of people in developed and developing countries prefer to use plant based medicines due to their efficiency. *Cassia tora* L. (Leguminosaes: sub family- Caesalpinioideae) is a wild crop and grows in most part of India as a weeds. (Sharma,Sarika *et al;* 2010). It is an ayurvedic plant with several medicinal benefits and ethnomedicinal value. The herb grow 1-2m in height, leaves compound, paripinnate, leaflet 3 pair, flowers bright yellow, usually in pairs, axillary, pods long, slender, obliquely septate, 15-23 cm long. Leaves, roots and seeds are main useful part of *Cassia tora*. It has been reported to contain many active substances like chrysophenol, emodin, anthraquinone, quarcetin, isoquercitin etc. (Pandya, Mithilesh P*et al;* 2017). In the Indian traditional system of medicine, various medicinal properties of this plant have been mentioned as a laxative, antiseptic, antioxidant activity, antiperiodic and useful in treatment of leprosy, ringworm, bronchitis, cardiac disease, hepatic disorders, liver tonic, hemorrhoids and skin diseases. (Bhandirge Sonali K*et al;*2016).Phytochemical compounds are found in plants which provide extra benefits on health and play an active role in amelioration of disease. Natural phytochemical are known for synthesizing novel drugs and certain substances they contain are used for healing purposes. The organic compounds present in plants have been classified in two categories i.e. primary and secondary metabolites. Compounds like amino acids, carbohydrates, vitamins, proteins are primary metabolites whereas terpenoids, alkaloids and phenolic compounds, etc are included in secondary metabolites. Secondary metabolites have large variety of antimicrobial properties thus raising the requirementfor the evaluation of herbs so that their scientific uses can be made existing for the treatment of contagious disease.(Pai, Chitra *et al;* 2011).Secondary metabolites have a defence mechanism by which they provide protection against microbial infections. They are also used as commercials such as dyes, glues, fibres, waxes, oils, perfumes,drugs as well as they are considered as sources of new natural drugs, antibiotics, insecticides and herbicides. (Sabyasachi C*et al*; 2016). Due to the natural ability of medicinal plants against pathogenic microorganism the researchers are investigating the mechanism of exploit and isolation of active compounds. Ayurveda, one of the oldest medicinal practices, still co-exist with the modern day system of medicine and accepted worldwide.

The aim of present study is to determine the phytochemical analysis and antibacterial activity of various extracts of *Cassia tora* L. leavesagainst some pathogenic bacteria.

Material and Method:

Plant Material

Cassia tora leaves were collected from Simga block of Baloda bazaar district (C.G.).
Fresh young leaves were collected for extraction.

Preparation of Extracts

The leaves of *Cassia tora*were dried under the shade at room temperature and grinded in homogenizer to coarse powder. 20 gm of dried plant powder was extracted with methanol, chloroform, Petroleum ether, aqueous successively each solvent taken in amounts 200 ml each and separated using a soxhlet extractor. The solvent present in extract was evaporated at 50^0C in water bath.The residual powder after solvent extraction was dissolved in DMSO and stored at4^0C.

Phytochemical analysis:

The qualitative phytochemical analysis of the crude extracts was performed by following standard methods decribed by Harbon J (1998).

Antimicrobial activity:

Antimicrobial activity of the methanol, petroleum ether,chloroform and aqueous extract of the *Cassia tora* plant was determined by measuring the diameter (mm) of growth inhibition zone by agar well diffusion method. The microbial inoculums were inoculated aseptically and spread consistently on surface of pre solidifiednutrient agar plate.By using the sterile cork borer, 6 wells of about 6.0 mm diameter were aseptically punctured. Different concentrations of plant extract were poured in each well. Streptomycin was used as a positive control whereas DMSO was used as negative control. The plates were incubated at 37^0 C for 24 hrs and antimicrobial activity was observed and calculated.

Microbial Strain:

The microbial strain *E. coli* (CGSC 4312), *Bacillus cereus* (ATCC 9634) were used. These strains were constantly sub-cultured and maintained in nutrient agar. The diameter of zone of inhibition (expressed in mm) was determined to test the sample of antibacterial activity. The procedure was repeated thrice and the mean of the three experiments was recorded. For complete inhibition of bacterial growth MIC test was conducted to find out the lowest concentration of the plant extract.

Result & Discussion:

In the present study the four different crude extract of *Cassia tora* were investigated for phytochemical and antimicrobial activity. *Cassia tora* is well known ayurvedic medicine.The different microorganisms have developed resistance to treatment with existing antibiotics (Silver & Bostian, 1993).

Phytochemical analysis:

Phytochemical screening of different *Cassia tora* extracts i.e., methanol, chloroform,petroleum ether, and aqueous extracts showed difference in their phytoconstituents due to use of different solvents. Secondary metabolites such as alkaloids, phenol, terpanoids, tannin, flavonoids, anthraquinones, saponins and cardiac glycosides were detected in above extracts. In the phytochemical screening of methanol extract, evidences of phenols, terpenoids, tannins, anthraquinone,saponin and alkaloids were found. The extracts of chloroform showed the presence of tannins and saponins while in petroleum ether extract only saponins were found and cardiac glycoside, alkaloids were absent in aqueous extracts (Table 1).

Table 1: Phytoconstituents present in different extracts of *Cassia tora* L.leaf.

S.No.	Phytoconstituents	Methanol extract	Chloroform extract	Petroleum ether extract	Aqueous extract
1.	Phenol	+	-	-	+
2.	Terpanoids	+	-	-	+
3.	Flavanoids	-	-	-	+
4.	Tannins	+	+	-	+
5.	Anthraquinone	+	-	-	+
6.	Saponins	+	+	+	+
7.	Alkaloids	+	-	-	-
8.	Cardiac glycosides	-	-	-	-

Antimicrobial activity:

Antimicrobial activity of the methanol, petroleum ether, chloroform and aqueous extract of *Cassia tora* plant was studied by agar well diffusion method and the result were characterized by recording diameter (mm) zone of inhibition around the well (Table 2). The extracts were tested against both the bacteria.However the highest inhibitory effect was showed by chloroform extract against *B. cereus*. The inhibition zone being 23 mm and the methanol extract showed the least zone of inhibition of 7mm against the same. Similarly against *E.coli* methanol and chloroform extract showed maximum zone of inhibition of 15mm each and aqueous extract showed least zone of 12mm.

Table 2: Antibacterial activity of different extracts of *Cassia tora* L.

S.No.	Name of Bacteria	Diameter of zone of inhibition in mm (well size 6 mm)				
		Cassia tora extracts				Positive control
		Methanol extract	Chloroform extract	Petroleum ether extract	Aqueous extract	Streptomycin
1.	*Bacillus cereus*	7 mm	23 mm	17 mm	12.5 mm	27 mm
2.	*E.coli*	15 mm	15 mm	13 mm	12 mm	23 mm

All the extracts of *Cassia tora* showed significant antimicrobial activity at different concentrations against tested organisms(Table 3). Methanolic extract was effective against both *B.cereus* and *E.coli* at concentration of 40mg/ml and 60mg/ml respectively. Chloroform extract showed zone of inhibition against*B.cereus* at 35mg/ml concentration and inhibited *E.coli* at concentration of 50mg/ml. Petroleum ether inhibited the growth of both the organism at the same concentration of 60mg/ml. Aqueous extract inhibited *B. cereus, E. coli* at concentration of 120mg/ml and 100mg/ml respectively.

Table 3: Minimum Inhibitory Concentration of various extracts of *Cassia tora* L.

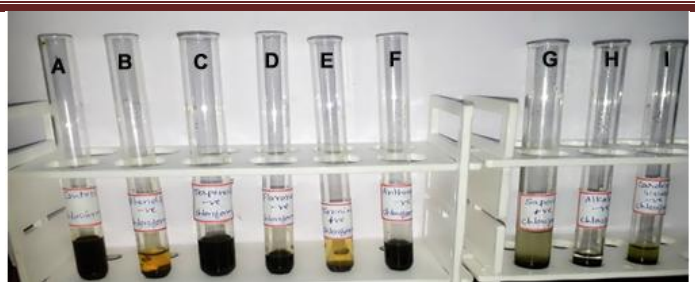
S.N	Name of bacteria	Minimum inhibitory concentration (MIC)			
		Methanol extract (mg/ml)	Chloroform extract (mg/ml)	Petroleum extract (mg/ml)	Aqueous extract (mg/ml)
	Bacillus cereus	40 mg	35 mg	60 mg	120mg
	E.coli	60 mg	50 mg	60 mg	100 mg

Phytochemicals are non nutritive and useful chemicals which are considered beneficial to human health because of their disease preventing properties. (Mercy, Gospel Ajuru *et al* 2017). Phytomedicine can act as a base for manufacturing medicines and natural drugs. It can be used as a treatment of diseases like Ayurvedic and Unani system. (Didry, N. *et al* 1998). A study (Sathya, A. *et al* 2012) have reported aqueous extract of *Cassia occidentalis* L. showed significant antimicrobial activity against *E. coli, Pseudomonas aeroginosa, Staphylococcus* sps.Another study demonstrated very good activity of ethanolic and aqueous extracts of *Cassia tora* against *P. aeruginosa, S. typhi, P. vulgaris, B. subtilis, S. aureus, S. pneumonia, E. coli, Lactobacillus, Enterobacter* (Bharathirajan R. and Prakash M. 2013). Literature also reveals that compared to other extracts aqueous extracts showed the best result against tested organism. Aqueous extract showed the best result against tested organism (Nadkarni, 1982, Drowv & Dattner, 1998, Grover & Yadav, 2004 and Christopher, 2005, Roopashree *et al* 2008). But in present study all the four extracts i.e., petroleum ether, methanol, chloroform and aqueous extracts showed satisfactory inhibition.

Figures

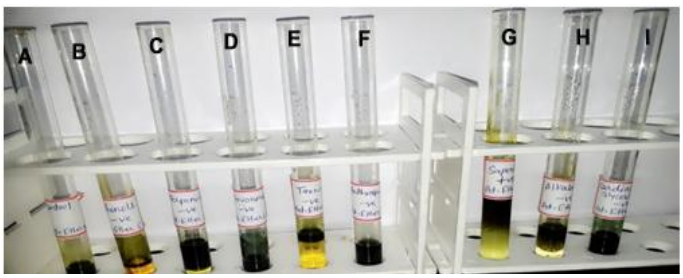
A-Control, B- Phenol +ve,C- Terpenoids +ve, D- Flavonoids –ve,E- Tannin +ve F- Anthraquinone +ve, G- Saponin +ve, H- Alkaloides +ve, I- Cardiac glycoside –ve

Fig. 1 Phytochemical analysis of Methanol extract of *Cassia tora* L.



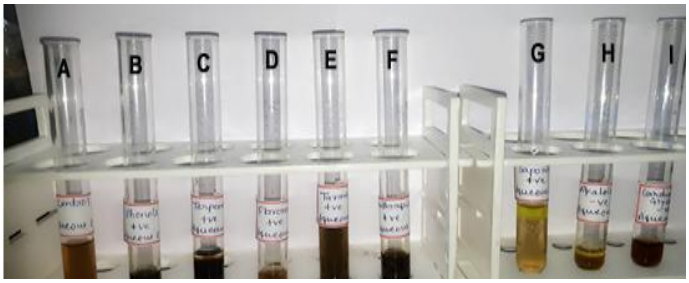
A-Control, B- Phenol -ve,C- Terpenoids -ve, D- Flavonoids –ve,E- Tannin +ve F- Anthraquinone -ve, G- Saponin +ve, H- Alkaloides -ve, I- Cardiac glycoside –ve

Fig. 2 Phytochemical tests of Chloroform extract of *Cassia tora* L.



A-Control, B- Phenol -ve,C- Terpenoids -ve, D- Flavonoids –ve,E- Tannin -ve F- Anthraquinone -ve, G- Saponin +ve, H- Alkaloides -ve, I- Cardiac glycoside –ve

Fig. 3 Phytochemical tests of Petroleum ether extract of *Cassia tora* L.



A-Control, B- Phenol +ve,C- Terpenoids +ve, D- Flavonoids +ve,E- Tannin +ve F- Anthraquinone +ve, G- Saponin +ve, H- Alkaloides -ve, I- Cardiac glycoside –ve

Fig. 4 Phytochemical tests of Aqueous extract of *Cassia tora* L.

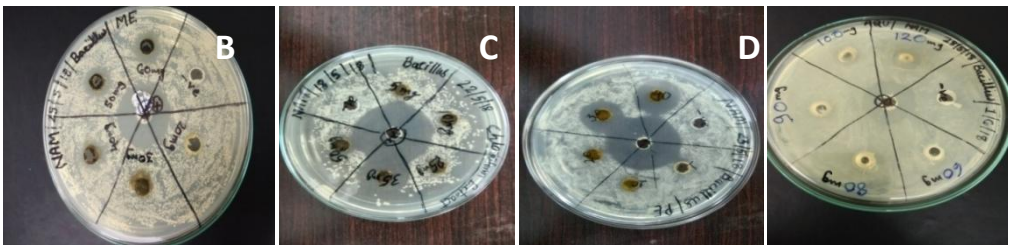


Fig. 5 Antibacterial activity of different extracts of *Cassia tora* L. against *Bacillus cereus.*A-Methanol extract,B- Chloroform extract, C- Petroleum ether extract, D- Aqueous extract.

Fig. 6 Antibacterial activity of different extracts of *Cassia tora* L. against *E.coli* .A-Methanol extract,B- Chloroform extract, C- Petroleum ether extract, D- Aqueous extract.

Conclusion:

On the basis of above study it can be concluded that leaf extracts of *Cassia tora*can be classified as a beneficial medicinal value plant for the treatment against pathogenic microbes. Different extracts of *Cassia tora*showed significant antimicrobial properties at various concentrations against tested organisms.

Acknowledgement:

We are grateful to Department of Botany and Biotechnology, Govt. D.B. Girls P.G. (Auto.) college, Raipur (C.G.) for providing required conveniences for conducting research work.

References:

1. Acharya Padma and Sarma Anirudh.(2014): Antimicrobial Activity of Compounds Isolates from Artimisia caruifolia.Asian Journal of Biochemical and Pharmaceutical Research Issue. 4 (4): 60-65.
2. Bhandirge, Sonali k, Patel Vijay, Patidar Arjun, Pasi Anil and Sharma Vimukta (2016): An Overview on Phytochemical and Pharmacological Profile of Cassia tora Linn. International Journal of HerbalMedicine, 4 (6): 50-55.
3. Bharadwaj Poonam, Iquabal Mohammad Kashif, Shuaib Mohammad, Iqubal Ashif,Singh Rajni (2015): A Pervasive Annotation on Indian Traditional Plant having Antimicrobial Efficacy. World Journal ofPharmacy and Pharmaceutical Sciences, 4 (10): 517-522.
4. Bharathirajan R and Prakash M. (2013): In Vitro Antibacterial Activity and Phytochemical Screening of Cassia tora leaves. International Journal of Current Microbiology and Applied Sciences, 2 (11): 463- 465.
5. Brown DJ and Dattner AM. (1998): Arch Dermatol, 134: 1401-04.
6. Christopher W. (2005): Phcog Mag, 1 (1): 7-8.
7. Didry N, Dubreuil L, Trotin F,Pinkas M (1998): Antimicrobial Activity of the Aerial Parts of Drosera pellata Smith on Oral Bacteria. J. Ethnopharmacol., 60: 91-96.
8. Harbone J. (1998): Method of Extraction and Isolation In : Phytochemical Method, Chapman and Hall, London, 60-66.
9. Jahan Khursid, Kundu Sukalyan Kumar, Bake Md Abdul (2014): Evaluation of Antimicrobial and Cytotoxic Activities of the Methanolic and Petroleum Ether Extract of Blumea lacera Burm. F. in Bangladesh. Journal of Pharmacognosy and Phytochemistry, 2 (6): 104-108.
10. Keshebo, Degulere; Washe, Alemayehu P, Alemu, Fikadu. (2016): Determination of Antimicrobial and Antioxidant Activities of Extracts from selected Medicinal Plants. American Scientific Research Journal forEngineering, Technology and Science, 16 (1): 212-222.
11. Mercy, Gospel Ajuru,Light Femi, Williams, Gospel Ajuru. (2017): Qualitative and Quantitative Phytochemical Screning of Some Plants Used in Ethnomedicine in the Niger Delta Region of Nigeria. Journal of Food and Nutrition Sciences, 5 (5): 198-205.
12. Nadkarni KM (1982): The Indian Materia Medica, Popular Prakashan, Bombay, 3 (1): 1292-1294.
13. Pai Chitra,Kulkarni Ujjwala, Borde Manjusha, Murali Sowmya, Mrudula P And Deshmukh Yashwant (2011): Antibacterial Activity of Tridax procumbens with Special Reference to Nosocomial Pathogens. British Journal of Pharmaceutical Research, 1 (4): 164-173.
14. Pandya, Mithilesh P, Sameja, Krunal D,Patel, Dixita N, Bhatt, Keyur D (2017): Antimicrobial Activity and Phytochemical Analysis of Medicinal Plant Cassia tora.International Journal of Pharmacy and Chemistry, 3 (4): 56-61.
15. Roopashree, TS, Dang, RamanRH, Shobha Rani and C. Narendra (2008): Antibacterial Activity of Antisporiatic Herbs: Cassia tora, Momordica Charantia and Calendula officinalis.International Journal ofApplied Research in Natural Product, 1 (3): 20-28.
16. Sabitha, Rani A and Suryanarayana Murty, U. (2005): Evalution of Antimicrobial Activity of Spilanthes acmella Flower Head Extract. Journal of Natural Remedies, 5 (2): 170-171.
17. Sabyasachi C, Kaniz WS, Anupam B, Manas B (2016): Phytochemical Study, Antimicrobial and Anticancerous Activity of Cassia tora Linn. Research & Reviews:Research Journal of Biology, 4 (2): 21-23.
18. Sathya A, Ambikapathy V and Panneer Selvam A (2012): Studies on the Phytochemical, Antimicrobial Activity and Antioxidant Properties of Cassia occidentalis L. Asian Journal of Plant Science and Research, 2 (4): 530-533.
19. Shanmugapriya Kaminidevi, Thayumanavan Thangavelu, Jinu Udayabhanu, Senthil, Murugan Thangavel.(2015): Antimicrobial Activity of Methanolic Extract of Indigenous Traditional Indian Folk Medicinal Plant Gnaphalium polycaulon. International Journal of Green Pharmacy. IP: 223.30.225.254: 39-44.
20. Sharma Sarika, Dangi Man Singh, Wadhwa Shailendra, Daniel Vivek, Tiwari Akhilesh (2010): Antibacterial Activity of Cassia tora Leaves. International Journal of Pharmaceutical & Biological Archives, 1 (1): 84-86.
21. Silver, Lynn L and Bostian Keith A (1993): Discovery and Development of New Antibiotics: The Problem of Antibiotic resistance. Antimicrobial Agents and Chemotherapy, 37 (3): 377-383.
22. Sukanya S.L, Sudisha J, Prakash HS and Fatima S K (2011): Isolation and Characterization of Antimicrobial Compound from Chromolaena odorata. Journal of Phytology, 3 (10): 26-32.