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Full Length Research Paper

Antibacterial properties of *Passiflora foetida* L. – a common exotic medicinal plant

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***Passiflora foetida* L. (stinking passion flower) is an exotic medicinal vine. The antibacterial properties of leaf and fruit (ethanol and acetone) extracts were screened against four human pathogenic bacteria *i.e. Pseudomonas putida, Vibrio cholerae, Shigella flexneri* and *Streptococcus pyogenes* by well-in agar method. The results showed the leaf extract having remarkable activity against all bacterial pathogens compared to fruits. This study supports, the traditional medicines (herbal extracts) to cure many diseases like diarrhea, intestinal tract, throat, ear infections, fever and skin diseases.**

Key words: *Passiflora foetida,* antibacterial activity, ethanol and acetone extracts, human pathogenic bacteria.

INTRODUCTION

Human infections particularly those involving micro-organisms i.e. bacteria, fungi, viruses, nematodes, they cause serious infections in tropical and subtropical countries of the world. In recent years, multiple drug resistance in human pathogenic microorganisms has been developed due to indiscriminate use of commercial antimicrobial drugs commonly used in the treatment of such diseases. Over the last three centuries, intensive efforts have been made to discover clinically useful antimicrobial drugs (Ahmed et al., 1998; Werner et al., 1999; Perumalsamy and Ignacimuthu, 2000). The increasing interest on traditional ethno medicine may lead to discovery of novel therapeutic agents. Medicinal plants are finding their way into pharmaceuticals, neutral-ceuticals, cosmetics and food supplements. The World Health Organization (WHO, 2000) estimated that 80% of the population of developing countries still relies on traditional medicines, mostly plant drugs, for their primary health care needs. Herbs are supposed to be safe but many unsafe and fatal side effects have recently been reported (Ikegami et al., 2003; Izzo, 2004). Hence, there is an urgent need to study the screening of antimicrobial properties of herbs, which will be helpful in the treatment of several diseases caused by microorganisms.

In this study, we concentrate on the antibacterial activity of Passion flower (*Passiflora species*), which is an exotic and fast-growing perennial, vine, occurring in west USA and extend to the Asian countries like India. Traditionally, the fresh or dried whole plants as well as their preparations are accepted for medicinal use in America, Germany, France, and other European countries for the treatment of nervous anxiety (Felter and Lloyd, 1898; Blumenthal, 1997; Speroni and Minghetti, 1988). The pharmacological studies of passionflower have antispasmodic, sedative, anxiolytic (allaying anxiety) and hypotensive activity (Weiss, 1988; Wolfman et al., 1994; Akhondzadeh et al., 2001; Dhawan et al., 2001a,b; Krenn, 2002; Dhawan et al., 2003; Abascal and Yarnell, 2004). Researchers have also found that one chemical component of passionflower (passicol) has antimicrobial activity (Nicolls, 1970; Birner and Nicolls, 1973; Nicolls et al., 1973). One of the most important and common species -*Passiflora foetida* was chosen in this study. The

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ethnobotanical views of *P. foetida*, reports the decoction of leaves and fruits to treat asthma and biliousness, leaves and root decoction is emmenagogue, used in hysteria (Ambasta et al., 1983) and leaf paste is applied on the head for giddiness and headache (Chopra et al., 1956). In Brazil, the herb is used in the form of lotions or poultices for erysipelas and skin diseases with inflammation (Chopra et al., 1944). The major phyto-constituents of this plant contain alkaloids, phenols, glycoside flavonoids and cyanogenic compounds (Dhawan et al., 2004) and passifloricins, polyketides and alpha-pyrones in *P. foeida* (Echeverri et al., 2001). The present research is focused on the antibacterial activities of *P. foetida* L. (Passifloraceae) a fast growing and spreading vine (*Mossukkattan, Poonaipudukku* (in tamil) and *stinking passion flower* (in English), found in riverbeds, dry forest floors, way side thickets, covering the top of thorny shrubs and also growing near hamlets.

MATERIALS AND METHODS

Collection of plant materials

The aerial parts (leaves and fruits) of *Passiflora foetida* L. (passion fruit) were collected from the roadside thickets and riverbed of Rasipuram, Taluk, Namakkal district, Tamil Nadu. The botanical nomenclature of the plants was duly identified by using standard floras and also cross-checked with Herbarium records (Rapinat Herbarium, Tiruchirappalli (RHT), India. All the plants were shade dried for 10 days.

Preparation of extracts and microbes tested

The dried plant material was crushed into fine particles (powder) using a mixer. About twenty-five grams of each plant (powdered material) was separately extracted with 100 ml of ethanol and acetone solvents. All the solvents were kept at room temperature, for 7 days to allow the extraction of compounds from plants. Each mixture was stirred every 24 h using sterile glass rod. The greenish extracts were obtained and passed through the Whatman filter paper No.1 and the respective solvents were evaporated (at 40°C) with the help of heating mantle. The sticky black substances were obtained and stored in refrigerator and were suspended in DMSO (dimethyl sulfoxide) prior to use. About four pathogenic bacterial strains were used in this study i.e. *Pseudomonas putida, Vibrio cholerae, Shigella flexneri* and *Streptococcus pyogenes.* The cultures were obtained from Microbial Type Culture Collection (MTCC), IMTECH, Chandigarh, India. A microbial loop was used to remove a colony of each bacterium from the pure culture and transferred into liquid broth (Nutrient broth) and incubated for 24 h at 37±1°C and maintained in sterile condition.

Screening for antibacterial properties

Antibacterial activities of plant extracts were tested by well-in-agar method with some modifications. The culture plates were prepared by pouring 20 ml of Mueller Hinton Agar medium into sterile petriplates. The inoculum suspension was spread uniformly over the agar medium using sterile cotton swabs to get uniform distribution of bacteria. Using a flamed cork borer, well of 5 mm diameter was made in the media at a distance of 1-2 cm from the periphery of the plates. These plates were labeled and 0.2 ml of each plant extract (at different concentration of extracts i.e. 100, 200, 300 and 400 mcg) was added aseptically into the well. Then the plates were incubated for 24 h at 37ºC. The effectivity of these extracts was recorded by measuring the diameter of inhibition zone. Triplicate was performed and the experiment was repeated thrice and the average values were recorded.

RESULTS AND DISCUSSION

The results of antibacterial screening of ethanol and acetone leaf and fruit extracts of *P. foetida* are presented in Table 1. The ethanol leaf extracts exhibited variable degrees of antibacterial activity against *Ps. putida*, *V. cholerae* and the moderate activity was noted in *S. flexneri* and *St. pyogenes* respectively. The result indicates that all the organisms were found to be more susceptible to the higher concentration of the extract. The acetone extracts exhibited strong to moderate activity against *V. cholerae* followed by *Ps. putida, S. flexneri* and *St. pyogenes.* The ethanol fruit extracts showed moderate activity against the bacterial pathogens namely *V. cholerae, Ps. putida, St. pyogenes* and *S. flexneri*. Similarly, the acetone extracts, too exhibited moderate to mild activity against *V. cholerae* and *Ps. putida* according to the varying concentration of the extracts. *St. pyogenes* and *S. flexneri* exhibited very poor activity even at higher concentration of extracts.

The present investigation reveals the antibacterial properties of ethanol and acetone extracts of *P. foetida*, which exhibited better antibacterial activity against *Ps. putida, V. cholerae* and *S. flexneri.* The acetone extract showed an excellent antibacterial activity against *V. cholerae* followed by *Ps. putida, S. flexneri* and *St. pyogenes*. But in case of ethanol extract showed higher spectrum of antibacterial activity in *Ps. putida, V. cholerae, S. flexneri* and *St. pyogenes*. Among the two parts tested, the leaf extracts exhibited better antibacterial activity than the fruits.

The results of present study conclude that the plants and their extractions (solvent) have broad spectrum and magnitude of activity in higher concentrations of the extract. Similar conclusions were drawn by Afolayan and Meyer (1997), who proved that antimicrobial activity of acetone extract from the aerial parts of *Helichrysum aureonitens,* had significant activity against gram-positive bacteria and considerable result in fungal species depending on the concentration of extracts. Likewise, Balakrishna et al. (2000) worked on the antibacterial and antifungal activities of alcoholic extract of the aerial parts of *Solanum trilobatum* and concluded that the higher concentration of the extracts exhibited better activity. The ethanol extract from *Terminalia macroptera* (Silva et al., 1997) and Siberian medicinal plants (Kokoska et al., 2002) were screened for activity against seven bacterial strains including *Bacillus cereus, Escherichia coli, Staphylococcus aureus* and *Pseudomonas aeruginosa.*

Table 1. Antibacterial activity of organic solvent (ethanol and acetone) extracts of leaf and fruits of *Passiflora foetida* L. by well-in agar method.

Plant parts	Solvent used	Extract (mcg/ml)	Diameter of inhibition zone (mm)			
			Pseudomonas putida	***Vibrio cholerae***	***Shigella flexneri***	***Streptococcus pyogenes***
Leaf	Ethanol	100	14	16	17	20
		200	12	15	19	20
		300	11	12	13	15
		400	7	8	10	10
	Acetone	100	11	12	12	13
		200	13	15	16	17
		300	11	13	14	15
		400	10	11	12	13
Fruit	Ethanol	100	9	11	11	12
		200	10	12	13	14
		300	9	10	11	12
		400	9	10	10	12
	Acetone	100	10	11	11	13
		200	10	10	12	14
		300	-	-	-	-
		400	9	10	11	13
Standard Antibiotic	Streptomycin mcg/ml	25	13	18	20	23
control	-	-	-	-	-	-

Sterile disc soaked in solvents

The earlier reports focused on the antibacterial properties of *Passiflora* species by different methods. The crude materials of *Passiflora* were separated into several fractions; passicol was obtained, which had antimicrobial activity (Birner and Nicolls, 1973). On the other hand, Perry et al. (1991) reported the antibacterial activity of *Pseudomonas tetrandra,* which has got activity against *E. coli, B. subtilis* and *P. aeruginosa,* the potential plant derived antibiotic.

The results of present research highlights, the fact that the organic solvent extracts exhibited greater antimicrobial activity because the antimicrobial principles were either polar or non-polar and they were extracted only through the organic solvent medium (Britto, 2001). The present observation suggests that the organic solvent extraction was suitable to verify the antimicrobial properties of medicinal plants and they supported by many investigators (Krishna et al., 1997; Singh and Singh 2000; Natarajan et al., 2003, 2005). The present study justifies the claimed uses of *Passiflora foetida* L. in the traditional system of medicine to treat various infectious diseases caused by the microbes. This study also encourages cultivation of the highly valuable plant in large-scale to increase the economic status of cultivars in the country.

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