

## Study on the antimicrobial activity of ethanolic extract of the fruits of *Solanum torvum* and its phytochemical analysis by GC-MS

M.S. MOHAMED JAABIR\*, R. VIGNESHWARAN,  
T. MD. EHTISHAM UL HASSAN and S. SENTHIL KUMAR

Department of Biotechnology, Jamal Mohamed College (Auto), Tiruchirappalli - 620 020 (India).

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### ABSTRACT

The objective of the study is to screen for antimicrobial activity of the ethanolic extract of *Solanum torvum* and to study its phytochemical composition. The ethanolic extract of the fruit of *Solanum torvum* was tested against six bacterial (*Klebsiella pneumoniae*, *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus*, *Salmonella typhi*, *Pseudomonas aeruginosa*) and two fungal (*Aspergillus niger* and *Candida albicans*) species. Results reveal significant levels of antibacterial activity on the four tested bacteria but there was no antifungal activity among the fungus tested. GC-MS analysis of the extract revealed the presence of alkaloids, flavonoids and certain fatty acids like palmitic and oleic acids.

**Key words:** *Solanum torvum*, antimicrobial activity, GC-MS, phytochemical analysis.

### INTRODUCTION

Plants have great potential for producing new drugs of great benefit to mankind. There are many compounds used in medicine today whose original derivatives were of plant origin. Many of the natural products in plants of medicinal value offer us new sources of drugs which have been used effectively in traditional medicine. Phytochemical progress has been aided enormously by the development of rapid and accurate methods of screening plants for particular chemicals. To date, several alkaloid, steroidal glycosides and long chain hydrocarbons and steroids have been previously isolated from *Solanum torvum*<sup>1</sup>. The plant has been used in traditional medicine for the treatment of cough, asthma and bronchial infections<sup>2,3</sup>. The focus of this study is to screen the ethanolic extract for the antimicrobial activity against clinical isolates and to study the phytochemical constituents responsible for the observation.

### MATERIAL AND METHODS

#### Preparation of the extract

The fruits of *Solanum torvum* were cleaned, cut into bits and rinsed with distilled water, and shade - dried. The dried plants were then powdered. In order to obtain the plant extracts, 20g of powdered plant material was soaked in 30 ml of ethanol overnight and then filtered through Whatmann filter paper (No.41) along with 2g of sodium sulphate to remove the sediments and traces of water in the filtrate. The filtrate was then concentrated by bubbling nitrogen gas into the solution and the volume was reduced to 1 ml. The extract contains both polar and non-polar phytochemicals of the plant material used. Extracts were then weighed and stored at -20°C till further use.

### Antimicrobial screening

Clinical isolates used in the screening study were *Klebsiella pneumonia*, *Bacillus subtilis*, *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi* and *Pseudomonas aeruginosa* among the bacteria and *Aspergillus niger* and *Candida albicans* among the fungi. Antimicrobial activity was performed by disc diffusion method as described elsewhere<sup>4,5</sup>, with Mueller Hinton Agar as the medium for bacteria and PDA for Fungi at three different concentrations such as 25, 50 and 100 mg/well.

### Phytochemical analysis

The ethanolic extract of the fruit of

*Solanum torvum* was filtered through 0.2 micron syringe filter and the filtrate was injected into the GC-MS column. The scanning was performed for 36 minutes and the chromatogram was obtained with retention time in the abscissa and percentage of the peak in the ordinate. The compounds were analyzed from the mass spectral data.

## RESULTS AND DISCUSSION

The ethanolic extract from the fruits of *Solanum torvum* was assayed for its antimicrobial activity against six bacterial (*Klebsiella pneumoniae*, *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus*, *Salmonella typhi*, *Pseudomonas*

**Table 1: Antimicrobial activity of *Solanum torvum* fruits extract**

S. No	Name of the organism	Zone of inhibition (mm)		
		25mg	50mg	100mg
1	<i>Klebsiella pneumoniae</i>	08	09	11
2	<i>Bacillus subtilis</i>	08	10	12
3	<i>Escherichia coli</i>	10	12	13
4	<i>Staphylococcus aureus</i>	12	13	15
5	<i>Salmonella typhi</i>	-	-	-
6	<i>Pseudomonas aeruginosa</i>	-	-	-
7	<i>Aspergillus niger</i>	-	-	-
8	<i>Candida albicans</i>	-	-	-

**Table 2: Phytochemicals identified in the ethanolic extract of the plant fruit *Solanum torvum***

No	R <sub>t</sub>	Name of the compound	Molecular Formula	MW	Peak Area %
1	4.06	Benzeneethanamine, a-methyl-	C <sub>9</sub> H <sub>13</sub> N	135	0.63
2	5.0	Propane, 1, 1, 3-triethoxy-	C <sub>9</sub> H <sub>20</sub> O <sub>3</sub>	176	0.69
3	5.69	Maltol	C <sub>6</sub> H <sub>6</sub> O <sub>3</sub>	126	2.35
4	6.16	4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl-	C <sub>6</sub> H <sub>8</sub> O <sub>4</sub>	144	3.17
5	9.62	3-[N'-(3H-Indol-3-ylmethylene)-hydrazino]-5-methyl-[1,2,4]triazol-4-ylamine	C <sub>12</sub> H <sub>13</sub> N <sub>7</sub>	255	0.88
6	12.59	(1R,3R,4R,5R)-(-)-Quinic acid	C <sub>7</sub> H <sub>12</sub> O <sub>6</sub>	192	29.04
7	17.47	n-Hexadecanoic acid	C <sub>16</sub> H <sub>32</sub> O <sub>2</sub>	256	7.92
8	17.85	Hexadecanoic acid, ethyl ester	C <sub>18</sub> H <sub>36</sub> O <sub>2</sub>	284	0.91
9	19.92	Phytol	C <sub>20</sub> H <sub>40</sub> O	296	2.84
10	20.27	Oleic Acid	C <sub>18</sub> H <sub>34</sub> O <sub>2</sub>	282	3.31
11	20.63	Octadecanoic acid	C <sub>18</sub> H <sub>36</sub> O <sub>2</sub>	284	2.17
12	26.42	1,2-Benzenedicarboxylic acid, diisooctyl ester	C <sub>24</sub> H <sub>38</sub> O <sub>4</sub>	390	46.09

Table 3: Phyto-components identified in the ethanolic extract of the plant fruit *Solanum torvum*

No	R <sub>t</sub>	Name of the compound	Molecular Formula	MW	Peak Area %	Compound Nature	**Activity
1	4.06	Benzeneethanamine, a-methyl-	C <sub>9</sub> H <sub>13</sub> N	135	0.63	Alkaloid	Antimicrobial Anti-inflammatory
2	5.0	Propane, 1, 1, 3-triethoxy-	C <sub>9</sub> H <sub>20</sub> O <sub>3</sub>	176	0.69	Ether compound	No activity reported
3	5.69	Maltol	C <sub>6</sub> H <sub>6</sub> O <sub>3</sub>	126	2.35	Sugar alcohol	Cancer preventive Antioxidant, Flavor, Fungistat, Pesticide, Sedative, Sweetener, Anticonvulsant, Antifatigue
4	6.16	4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl-	C <sub>6</sub> H <sub>8</sub> O <sub>4</sub>	144	3.17	Flavonoid compound	Antimicrobial Anti-inflammatory
5	9.62	3-[N'-(3H-Indol-3-ylmethylene)-hydrazino]-5-methyl-[1,2,4]triazol-4-ylamine	C <sub>12</sub> H <sub>13</sub> N <sub>7</sub>	255	0.88	Alkaloid	Antimicrobial Anti-inflammatory
6	12.59	(1R,3R,4R,5R)-(-)-Quinic acid	C <sub>7</sub> H <sub>12</sub> O <sub>6</sub>	192	29.04	Acidic compound	No activity reported
7	17.47	n-Hexadecanoic acid	C <sub>16</sub> H <sub>32</sub> O <sub>2</sub>	256	7.92	Palmitic acid	Antioxidant Hypocholesterolemic Nematicide, Pesticide Anti androgenic Flavor, Hemolytic 5-Alpha reductase, inhibitor
8	17.85	Hexadecanoic acid, ethyl ester	C <sub>18</sub> H <sub>36</sub> O <sub>2</sub>	284	0.91	Fatty acid ester	-do-
9	19.92	Phytol	C <sub>20</sub> H <sub>40</sub> O	296	2.84	Diterpene	Antimicrobial Anti-inflammatory Anticancer Diuretic
10	20.27	Oleic Acid	C <sub>18</sub> H <sub>34</sub> O <sub>2</sub>	282	3.31	Oleic acid	
11	20.63	Octadecanoic acid	C <sub>18</sub> H <sub>36</sub> O <sub>2</sub>	284	2.17	Stearic acid	No activity reported
12	26.42	1,2- Benzenedicarboxylic acid, diisooctyl ester	C <sub>24</sub> H <sub>38</sub> O <sub>4</sub>	390	46.09	Plasticizer compound	Antimicrobial Anti fouling

*aeruginosa*) and two fungal (*Aspergillus niger*, *Candida albicans*) pathogens by disc diffusion method, measuring the diameter of the inhibition zone with 25, 50, 100 mg of plant extract. The result showed that the plant extract possesses antibacterial activity tested against the bacterial strains. The maximum inhibition was observed at 100 mg concentration on *Klebsiella pneumoniae* (11 mm), *Bacillus subtilis* (12 mm), *Escherichia coli* (13 mm). No inhibitory effect was found against *Aspergillus niger*, *Salmonella typhi*, *Candida albicans* and *Pseudomonas aeruginosa* (Table 1). Screening of phytochemicals from the fruits of *Solanum torvum* by GC-MS study showed 12 different types of active constituents (Table 2) like volatile oils, phenolic, alkaloids, flavonoid, acidic compounds, palmitic and oleic acid etc.<sup>6,7,8</sup>. Oleic acid is known with pronounced antimicrobial properties<sup>9</sup> and it has been shown to exhibit antimicrobial activity against *Staphylococcus aureus* and *Micrococcus kristinae*. Benzene ethanamine,  $\alpha$ -methyl, 3-[N'-(3H-Indol-3-ylmethylene)-

hydrazino]-5-methyl-[1,2,4]triazol-4-ylamine were the alkaloids and 4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl- was the flavonoid compound found in this plant at 4.6, 9.62, 6.16 R<sub>t</sub> respectively (Fig. 1). Maltol was the compound of sugar alcohol was detected at 5.89 R<sub>t</sub> n-Hexadecanoic acid was the palmitic acid compound detected at 17.41 R<sub>t</sub> Oleic acid and Hexadecanoic ethyl esters were the fatty acid ester compounds detected at an R<sub>t</sub> of 17.85. Phytol was the diterpene compound and Octadecanoic acid was the stearic acid compound were found in the extract at R<sub>t</sub> 19.92 and 20.63 respectively. These compounds are among those which are reported to have antimicrobial, anti-inflammatory, anti-fatigue, hypocholesterolemic, nematocidal, antiandrogenic, anticancer and hemolytic activities (Table 3) [10, 11]. The outcome of the study provides a means to understand the potential use of the fruits of *Solanum torvum* and its contribution to latest developments in the pharmacology and phytochemistry if investigated into the details further.

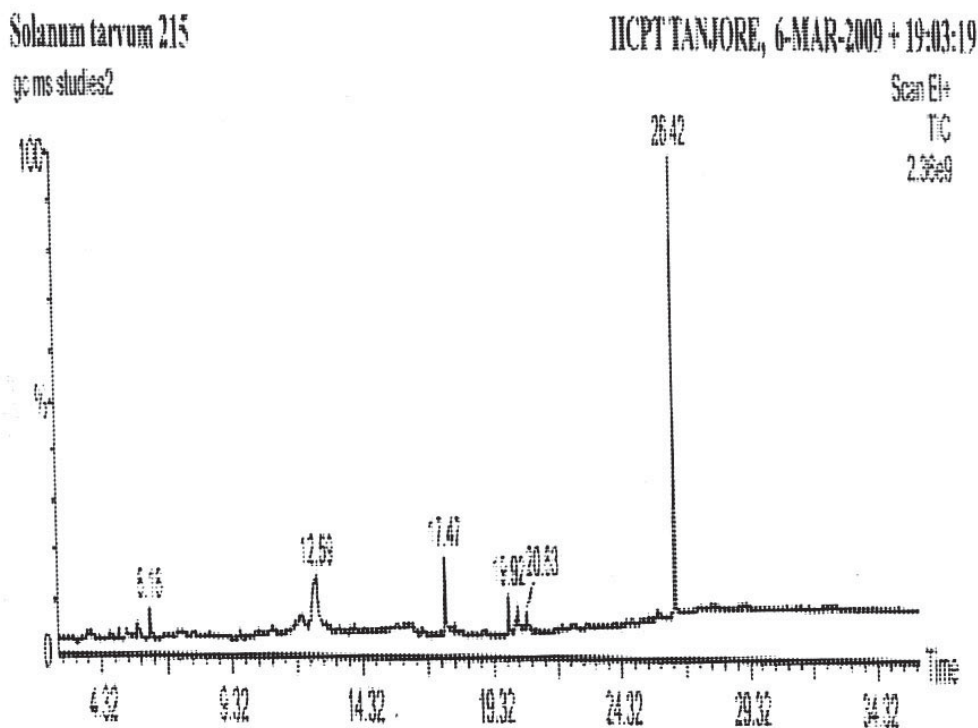


Fig. 1: GC-MS chromatogram of the ethanolic extract of the fruits of *Solanum torvum*

## REFERENCES

1. Arthan D. Esen A. Kittakoop P. and Svasti J., Fuvostanol glycoside 26-O- $\beta$ -glycosidase from the leaves of *Solanum torvum*. *Phytochemistry*, **59**: 459-463 (2006).
2. Agra M. F. and Bhattacharya M. J., Comparative phytochemical and phytochemical investigation of *Solanum species* in Northeast of Brazil, *Royal Botanic Gardens*, 341--343 (1999).
3. Chah K.F. Muko K.N. and Oboeghulem S.I., Antimicrobial activity of methanolic extracts of *Solanum torvum* fruits, *Fitoterapia*, **71**, 187-189 (2000).
4. Berghe D.A.V. and Vlietinck A.J., Screening methods for antimicrobial and antiviral agents from higher plants, *Methods in Plant Biochemistry*, Vol 6, Academic Press, London, 47-69 (1991).
5. Cappuccino G. and Sherman N., *Microbiology - A laboratory manual*, Benjamin Cumming Science Publishing, California, 254 (1998).
6. Dopke W. and Nogueiras C., The steroid, alkaloid and sapogenin content of *Solanum torvum*, *Pharmazie*, **30**: 755 (1975).
7. Moroles Mondez A. Cazeves R. and Romo J., Components of *Solanum torvum*. *Rev Latinoam Quinn*, 1: 1-6 (1970).
8. Perez Amador MC. Garcia Castafieda JM. and Gonzalez Esquina AR., Alkaloid in *Solanum torvum*, *Phyton*, **76**: 39-45 (2007).
9. Dilika F. Bremner P. D. and Meyer J. J. M., Antibacterial activity of linoleic and oleic acids isolated from *Helichrysum pedunculatum*: a plant used during circumcision rites, *Fitoterapia*, **71**(4): 450-452 (2000).
10. Sarmiento de Silva and De Carvelbo M.G., Occurrence of flavones, flavonoids and glycosides in species of the genus *Solanum*, *Quim Nova.*, **85**: 121-122 (2003).
11. Wollen Weher E. Dorsan M. Dorr M. and Roitmon J.N., Chemo diversity of surface flavonoids in Solanaceae, *Naturforsch*, **60**: 661-670 (2005).