STRUCTURE ACTIVITY ANALYSIS OF ANTIBACTERIAL AND ANTIFUNGAL ACTIVITIES OF SOME SUBSTITUTED CHROMONES

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Received-16.07.2015, Revised-23.07.2015

Abstract : Bacteria and fungi are causes of numerous diseases in plants as well as animals . How anti-bacterial and anti-fungal activities change in chromonyl chalcones as well as heterocycally substituted chromones with structural variation in compounds is described in present study. Both chromonyl chalcones as well as heterocycally substituted chromones derived from 3-formylchromones have been found to be good antimicrobials. It is found that electron rich aryl groups on chalcone backbone increase antibacterial activities; whereas, heteroaromatic substituent like 2-furyl group favour antifungal characteristics in chromonyl chalcones. Electron releasing alkyl group like methyl group at C_6-position of chromone moiety causes decrease in antimicrobial action; but, electron withdrawing – Cl substituent at the same position results in enhanced activity.

Keywords: Antibacterial activity, Antifungal activity, Chromonyl chalcones, Heterocycally substituted chromones , Filter paper disc method

INTRODUCTION

Chromones [benzopyran-4-ones] are integral ingredients of a number of flora; for instance, Querecetin , Khellin etc. Khellin isolated from Khella plant (*Ammi visnaga L.*) was herbal treatment for stomach disorders [Bansal, 2001] till its toxicity was discovered. Substituted chromones have been found to be antimicrobial too. Ethyl ester of chromon-3-carboxylic acid is effective against *Pricularia oryze* [Ellis, 1977]. Analytes of chromon-3-carboxylic acid are also antimicrobial. Some of the chromones show anti-viral properties [Ellis, 1977]. Antibacterial and antifungal activities have been found in some heterocycally substituted chromones [El-Shaaer *et al*., 1998; Bhalekar *et al*., 2008]. Chalcones are also associated with antimicrobial activities [Asiri et al., 2011; Hasen *et al.*, 2007; Nowakowska, 2007 and Saini *et al.*, 2007].
During present study trends in antibacterial and antifungal activities have been studied in some chalcones derived from 3-acetylchromones and some heterocycally substituted chromones obtained from 3-formylchormones.

MATERIAL AND METHOD

Compounds were synthesized by author & co-workers [Sharma *et al*., 2010, 2011, 2013 and 2014]. For testing antibacterial and antifungal activities filter paper disc method was used.
For chromonyl chalcones and 3-acetylchromones antibacterial screening was done *in vitro* against *Escherichia coli and Pseudomonas aeruginosa* ; whereas antifungal activity was tested against *Aspergillus niger and Aspergillus flavus* by measuring zone of inhibition in mm. using filter paper disc plate method at the concentration 100 μg/ml and results are reported in Table – 1 and Table – 2 , respectively . Muller Hinton agar and Sabouroud dextrose agar were used as culture medium whereas dimethyl sulphoxide [DMSO] was solvent control for antibacterial and antifungal screening. Streptomycin and Fluconazole were employed as standards for antibacterial and antifungal testing, respectively.
Among heterocycally substituted chromones obtained from 3-formylchrmones compound 6-chloro-2,3-dihydrobenzopyran-4-one[3,2-b]benzoxazepin was screened against *Aspergillus niger*; but 2,3-dihydrobenzopyran-4-one[3,2-b]benzoxazepin was tested against *Salomonella* . 3-[2-benzothiazolyl imino methyl]-6-methylchromone was screened for antifungal activity versus *Aspergillus niger*. 3-[Dihydro-1, 3-benzoxazin-4-one-3-yl]-6-methylchromone and 3-[Dihydro-1, 3-benzoxazin-4-one-3-yl]-6-chlorochromone were tested against *Streptomyces*. All the testing of heterocycally substituted chromones derived from 3-formylchromones were done at 0.25 % , 0.50 % and 0.75 % w/v concentrations using dimethylformamide [DMF] as solvent as well as solvent control by filter paper disc method .

RESULT AND DISCUSSION

6-Acetyl-2-phenylchromone [i.e. 6-acetylflavones] **(1)** ; 1-(2-phenylchromon-6-yl)-3-(2-furyl)-2-propen-1-one **(4)** ; 1-(2-phenylchromon-6-yl)-3-(p-chlorophenyl)-2-propen-1-one **(5)** and ; 1-[2-(2-furyl)chromon-6-yl]-3-phenyl-2-propen-1-one **(6)** have shown inhibition zone of 10 , 10 , 12 and 10 , respectively against *Pseudomonas aeruginosa* as compared to 18 mm. for streptomycin . Thus they have mild to medium antibacterial activity. 1-(2-Phenylchromon-6-yl)-3-phenyl-2-propen-1-one **(3)**

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has exhibited antibacterial activity of 12 mm. against *Escherichia coli* which may be interpreted as medium. Compound **(4)** and 1-[2-(2-furyl) chromon-6-yl]-3-(p-chlorophenyl)-2-propen-1-one **(8)** have inhibition zone of 12 mm. against *Aspergillus niger* as compared to 14 mm. for standard Fluconazole ; hence they are excellent antifungal agents . From the observations of the Tables it is inferred that phenyl and p-chlorophenyl groups at 3- position of chalcone backbone increase antibacterial activity against *Pseudomonas aeruginosa* and 2-furyl substituent at this position increases activity against *Aspergillus niger*. Antifungal activity is not remarkable in 3-acetylchromones but their conversion into chalcone enhances it. 2-Furyl substituent favors antifungal activity as **(4)** is excellent antifungal and **(7)** with two furyl substituents though does not show any antibacterial activity but is good antifungal agent.

Among heterocycally substituted chromones obtained from 3-formylchrmones compound 6-chloro-2,3-dihydrobenzopyran-4-one[3,2-b]benzoxazepin tested against *Aspergillus niger* (a fungi that causes food poisoning) has shown 96 % inhibition of growth at 0.75 % w/v concentration in DMF . Fungi toxicity decreases with number of days. 2,3-Dihydrobenzopyran-4-one[3,2-b]benzoxazepin tested against *Salomonella* bacteria exhibited 92.71 % inhibition of bacterial growth at 0.75 % w/v concentration in DMF . 3-(2-Benzothiazolyl imino methyl)-6-methylchromone has shown 90 % inhibition of growth at 0.75 % w/v concentration in DMF

Against *Aspergillus niger*. 3-[Dihydro-1, 3-benzoxazin-4-one-3-yl]-6-methylchromone and 3-[Dihydro-1, 3-benzoxazin-4-one-3-yl]-6-chlorochromone were tested against *Streptomyces*. They exhibited 88.95 % and 90.80% growth inhibition at 0.75 % w/v concentration, respectively. Thus it is inferred that heterocycally substituted chromones obtained from 3-formylchromones are excellent antimicrobials.

CONCLUSION

It is revealed from this study that chromonyl chalcones with aryl substituents at C_3- position of chalcone backbone have enhanced antibacterial activity. But, 2-furyl ring at the same position favors antifungal activity. Heterocycally substituted chromones obtained from 3-formylchrmones are excellent antimicrobials. Chalcone formation is an excellent way to introduce antimicrobial activity in 3-acetylchromones.

Table 1. Antibacterial activities of Chromonyl chalcones

S. No.	Name of compound	Antibacterial Activity (E.c.)	Antibacterial Activity (P.a.)
1.	6-Acetyl-2-phenyl chromone	08	10
2.	6-Acetyl-2-furyl chromone	06	09
3.	1-(2-Phenyl chromon-6-yl)-3-phenyl-2-propen-1-one	12	09
4.	1-(2-Phenyl chromon-6-yl)-3-(2-furyl)-2-propen-1-one	09	10
5.	1-(2-Phenyl chromon-6-yl)-3-(p-chlorophenyl)-2-propen-1-one	08	12
6.	1-(2-(2-furyl) chromon-6-yl)-3-phenyl-2-propen-1-one	08	10
7.	1-(2-(2-furyl) chromon-6-yl)-3-(2-furyl)-2-propen-1-one	-----	-----
8.	1-(2-(2-furyl) chromon-6-yl)-3(p-chlorophenyl)-2-propen-1-one	-----	09

E.c = *Escherichia coli and P.a =Pseudomonas aeruginosa* ; Inhibition zone in mm.

Table 2. Antifungal activities of Chromonyl chalcones

S. No.	Name of compound	Antifungal Activity (A.n.)	Antifungal Activity (A.f.)
1.	6-Acetyl-2-phenyl chromone	06	----
2.	6-Acetyl-2-furyl chromone	07	----
3.	1-(2-Phenyl chromon-6-yl)-3-phenyl-2-propen-1-one	06	08
4.	1-(2-Phenyl chromon-6-yl)-3-(2-furyl)-2-propen-1-one	12	08
5.	1-(2-Phenyl chromon-6-yl)-3-(p-chlorophenyl)-2-propen-1-one	04	04
6.	1-(2-(2-furyl) chromon-6-yl)-3-phenyl-2-propen-1-one	09	07
7.	1-(2-(2-furyl) chromon-6-yl)-3-(2-furyl)-2-propen-1-one	08	09
8.	1-(2-(2-furyl) chromon-6-yl)-3(p-chlorophenyl)-2-propen-1-one	12	08

A.n = *Aspergillus niger and A.f = Aspergillus flavus* ; Inhibition zone in mm.

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