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Antibacterial and Antifungal Activity of 3-(2-Hydroxy-5-Methylphenyl)-5,5-dialkyl/5,5-Diaryl/5-Aryl/4-Aroyl-5-Aryl Isoxazolines

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Fourteen different isoxazolines **II(a)–II(g)** and **IV(a)–IV(g)**, synthesised from chalcones, 3-aroylflavanones and 3-aroylchromanones, were tested for antibacterial activity against *Staphylococcus aureus, Escherichia coli, Proteus vulgaris, Bacillus megatherium* and antifungal activity against *Candida albicans, Candida guillermondii, Candida tropicalis* and *Candida crusei.* It was observed in case of **II(c), II(f), II(g)** that the antibacterial spectrum was highest against *E. coli.* 3-(2-Hydroxy-5-methylphenyl)-5-aryl isoxazolines **II(b), II(g)** and 3-(2-hydroxy-5-methylphenyl)-4-aroyl-5-aryl isoxazolines **IV(a)–IV(e)** exhibited highest antifungal spectrum against *Candida crusei.* Majority of compounds were moderately effective towards *Candida albicans* and *Candida tropicalis.*

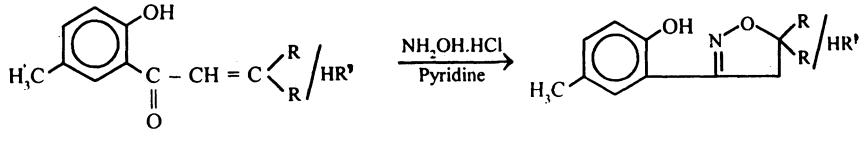
Key Words: Antibacterial, Antifungal, 3-(2-Hydroxy-5-methyl-phenyl)-5,5-dialkyl/5,5-diaryl/5-aryl/4-aroyl-5-aryl isoxazolines.

INTRODUCTION

Isoxazolines can be effectively used as antibacterial[1], antitubercular, antiviral, antifungal, herbicidal and insecticidal agents[2–4].

The structures of the compounds have been supported by elemental analysis, spectral IR and NMR data.

The experimental, synthesis, physical data, spectral data for compounds **(IIa–IIg)**[5] and **(IVa–IVg)**[6] are as described earlier.



I(a)-I(g) **II(a)-II(g)**

where C(R)(R)HR′ as given in Tables 1 and 3.

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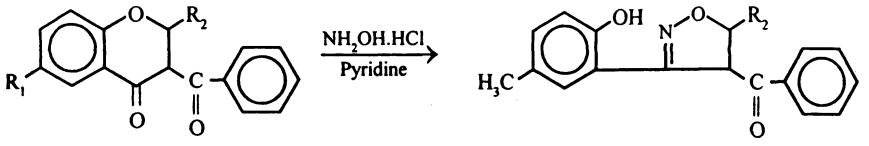


III(a)-III(g) **IV(a)-IV(g)**

where $R_1 = CH_3$, R_2 = as shown in Tables 2 and 4.

The products have been screened for their antibacterial activity against bacterial species *Staphylococcus aureus, Escherichia coli, Proteus vulgaris* and *Bacillus megatherium.*

The antibacterial activity was carried out using the cup-plate method[7] by measuring the zones of inhibition in mm. Each well (size 8 mm) was loaded with 0.5 mL of 1000 μg/mL test compound solution in DMF solvent. Chloramphenicol was used as a standard drug for comparison. DMF was run as a control and the results were recorded at the end of an incubation period at 24 ± 2 h. The results of antibacterial activity are shown in Tables 1 and 2.

TABLE-1
ANTIBACTERIAL ACTIVITY FOR COMPOUNDS II(a)–II(g)

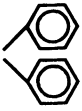
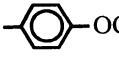
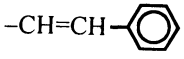
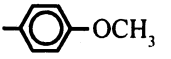
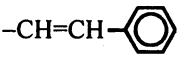
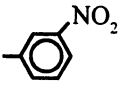
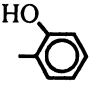
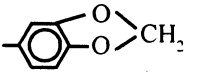
Sr. No.	Compd. No.	$C<^{R}_{R}$/HR′	m.f.	Zone of inhibition (mm)		
				S. aureus	*E. coli*	*P. vulgaris*
1.	II(a)	$<^{CH_3}_{CH_3}$	$C_{12}H_{15}NO_2$	—	—	20
2.	II(b)		$C_{22}H_{19}NO_2$	20	—	—
3.	II(c)		$C_{16}H_{15}NO_2$	20	26	—
4.	II(d)		$C_{17}H_{17}NO_3$	14	—	18
5.	II(e)		$C_{14}H_{13}NO_3$	—	—	16
6.	II(f)		$C_{18}H_{17}NO_2$	23	28	—
7.	II(g)		$C_{16}H_{14}N_2O_4$	22	28	—
	Chloramphenicol			25	12.5	28

TABLE-2
ANTIBACTERIAL ACTIVITY FOR COMPOUNDS IV(a)–IV(g)

Sr. No.	Compd. No.	R_2	m.f.	Zone of inhibition (mm)		
				S. aureus	*E. coli*	*P. vulgaris*
1.	**IV(a)**		$C_{23}H_{19}NO_3$	18	18	—
2.	**IV(b)**		$C_{24}H_{20}NO_4$	16	—	14
3.	**IV(c)**		$C_{21}H_{17}NO_4$	—	—	12
4.	**IV(d)**		$C_{25}H_{21}NO_3$	12	14	—
5.	**IV(e)**		$C_{23}H_{18}N_2O_5$	16	—	14
6.	**IV(f)**		$C_{23}H_{19}NO_4$	12	—	—
7.	**IV(g)**		$C_{24}H_{19}NO_5$	—	—	10
	Chloramphenicol			25	12.5	28

The antifungal activity was carried out using Sabouraud dextrose agar (with chloramphenicol) medium. The zones of inhibition were recorded at the end of an incubation period of 48 h. Organisms used for antifungal activity included the pathogenic yeast species *Candida albicans, Candida guillermondii, Candida tropicalis* and *Candida crusei.* The results of antifungal activity are shown in Tables 3 and 4.

Compounds **II(c), II(f), II(g)** show highest antibacterial activity against *E. coli.* Similarly, **IV(a)** and **IV(d)** were also showing moderate antibacterial activity against *E. coli* using chloramphenicol as a standard drug for comparison, whereas, **II(b), II(c), II(f), II(g)** show moderate antibacterial activity against *S. aureus.* Compounds **II(a), II(d), II(e)** were showing moderate activity towards *P.*

vulgaris. No compound from **IV(a)–IV(g)** was found to be inhibitory to *B. Megatherium*. Compounds **IV(a)** and **IV(d)** were more effective than choramphenicol against *E. coli*. Other compounds were effective against *S. aureus* and *P. vulgaris* moderately.

All compounds **IV(a)–IV(g)** showed antifungal properties against pathogenic yeasts. The antifungal spectrum for **II(b), II(g)** and **IV(a)–IV(e)** was highest in *Ca. crusei* with inhibition zones of 25–30 mm. Other compounds **II(a)–II(g)** showed moderate antifungal activity against *Ca. albicans* and *Ca. tropicalis* except **II(b)** showing higher antifungal spectrum. The compounds **IV(a)–IV(g)** showed moderate activity against *Ca. albicans* and *Ca. tropicalis*. Compounds **IV(c)–IV(e)** were effective against *Ca. guillermondii*

TABLE-3
ANTIFUNGAL ACTIVITY FOR COMPOUNDS II(a)–II(g)

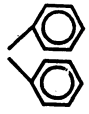
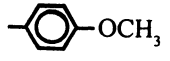
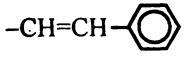
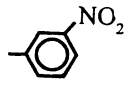
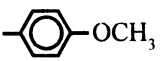
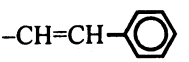
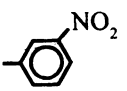
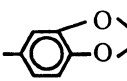
Sr. No.	Compd. No.	$C<^{R}_{R}$/HR′	m.f.	Zone of inhibition (mm)			
				Ca. guillermondii	*Ca. albicans*	*Ca. tropicalis*	*Ca. crusei*
1.	**II(a)**	$<^{CH_3}_{CH_3}$	$C_{12}H_{15}NO_2$	20	15	18	—
2.	**II(b)**		$C_{22}H_{19}NO_2$	—	22	26	28
3.	**II(c)**		$C_{16}H_{15}NO_2$	—	17	18	—
4.	**II(d)**		$C_{17}H_{17}NO_3$	18	13	16	—
5.	**II(e)**		$C_{14}H_{13}NO_3$	18	14	20	—
6.	**II(f)**		$C_{18}H_{17}NO_2$	—	18	19	—
7.	**II(g)**		$C_{16}H_{14}N_2O_4$	18	14	20	28

TABLE-4
ANTIFUNGAL ACTIVITY FOR COMPOUNDS IV(a)–IV(g)

Sr. No.	Compd. No.	R_2	m.f.	Zone of inhibition (mm)			
				Ca. guillermondii	*Ca. albicans*	*Ca. tropicalis*	*Ca. crusei*
1.	IV(a)		$C_{23}H_{19}NO_3$	—	22	16	25
2.	IV(b)		$C_{24}H_{20}NO_4$	—	20	16	28
3.	IV(c)		$C_{21}H_{17}NO_4$	16	13	13	28
4.	IV(d)		$C_{25}H_{21}NO_3$	15	20	18	25
5.	IV(e)		$C_{23}H_{18}N_2O_5$	17	22	18	30
6.	IV(f)		$C_{23}H_{19}NO_4$	—	12	16	18
7.	IV(g)		$C_{24}H_{19}NO_5$	—	13	14	16

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