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# Antibacterial and antifungal activity of some newly substituted benzoxazoles

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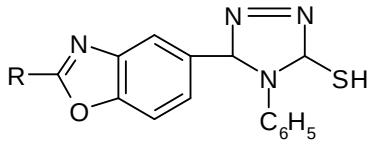
**Abstract:** In continuation of our earlier studies, the antifungal and antibacterial activities of some newly substituted benzoxazoles were evaluated. Type-IV, V and VI were found to posses moderate antibacterial activity against both the gram (+) and gram (-) bacteria employed. All the compounds of type-IV showed good antifungal activity against *A. niger* and *A. flavus* Mild activity was seen against *F. oxysporum* and *C. lunata* Type-V and type-VI showed moderate antifungal activity against *A. niger* and *A. flavus* Significance of the above results are discussed in this communication.
**Key words:** Benzoxazoles, antibacterial activity, antifungal activity.

## Introduction:

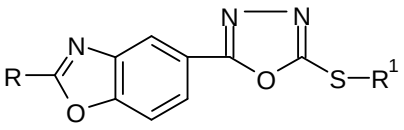
Benzoxazoles have been reported to show a broad spectrum of biological activities. Heterocycles bearing nitrogen, sulphur, oxygen and thiazole moieties constitute the core structure of a number of biologically interesting compounds. Some of them are tetrazoles, fused thiazoles, thiadiazoles, oxadiazoles, triazoles, which are structural subunits of several biologically active compounds[1-3]. 1,3,4-Oxadiazoles are known to exhibit diverse pharmacological activities like antimicrobial[4-6], antihistaminic[7], anticancer[8,9], anti-inflammatory[10-12] and antihypertensive activities[13]. Similarly 2,5-disubstituted-1,3,4-oxadiazole derivatives possess broad spectrum of activities like antifungal[14], anticonvulsant[15] anticancer[16]. Many 1,3,4-thiadiazole and 1,2,4-triazole derivatives have biological activity, with their antibacterial[17-19], antimycobacterial[20,21], antimycotic[22] antifungal[23,24], antidepressive[25], and cardiotonic[26] action being notable. Recent research has also established for these heterocyclics as analgesic[27] and anti-inflammatory[28, 29] activities. 2-Substituted benzoxazoles which posses a broad spectrum of biological activities have gained wide acceptance in clinical practice. Due to their biological applications the 2-substituted benzoxazole and their derivatives have been investigated for their antibacterial and antifungal activities.

**iv. 5-(2-Substituted-1,3-benzoxazol-5-yl)-4-phenyl-4,5-dihydro-3H-1,2,4-triazole-3-thiols (IV a-c)**



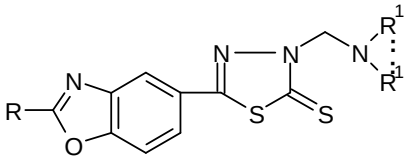

**IV (a-c)**

**v. 2-Substituted-5-[5-(substituted sulfanyl)-1,3,4-oxadiazol-2-yl]-1,3-benzoxazoles (V a-d)**



**V (a-d)**

**vi. 3-(Substituted amino) methyl-5-(2-substituted-1,3-benzoxazol-5-yl)-1,3,4-thiadiazole-2(3H)-thiones (VI a-e)**



**VI (a-e)**

## Material and Methods:

All these tested compounds have been screened for the biological properties by adopting standard protocols available in the literature.

**Anti bacterial activity by Cup-plate method:** The anti bacterial activity of synthesized compounds was evaluated against two gram positive bacteria viz.,- *Bacillus subtilis* and *Staphylococcus aureus* and two gram negative bacteria viz.,- *Escherichia coli* and *Proteus vulgaris* by using cup plate method. Ampicillin sodium was employed as standard drug to compare the results. The test organisms were subcultured using nutrient agar medium. The tubes containing sterilized medium were inoculated with respective bacterial strain. After incubation at 37 $^0$C ±1 $^0$C for 24 hours, they were stored in refrigerator. The stock culture was maintained. Bacteria inoculum was prepared by transferring a loopful of stock culture to nutrient broth (100 ml) in conical flasks (250 ml). The flasks were incubated at 37 $^0$C ±1 $^0$C for 48 hours before the experimentation. Solution of the tested compounds was prepared by dissolving 10 mg in dimethyl formamide. A reference standard for both gram positive and gram negative bacteria was made by dissolving accurately weighed quantity of ampicillin sodium in sterile distilled water. The nutrient agar medium was sterilized by autoclaving at 121 $^0$C (15 lb/sq. inch) for 15 min. The petriplates, tube and flasks plugged with cotton were sterilized in hot-air oven at 160 $^0$C for an hour. Into each sterilized petriplate (10 cm), about 27 ml of molten nutrient agar medium was poured and inoculated with the respective strain of bacteria (6 ml of inoculum to 300 ml of nutrient agar medium) was transferred asceptically. The plates were left at room temperature to allow the solidification. In each plate, the cups of 6 mm dia. were made with sterile borer. Then 0.1 ml of the test solution was added to the respective cups asceptically and labeled accordingly. The plates were kept undisturbed for at least 2 hours in refrigerator to allow diffusion of the solution properly into nutrient agar medium. After incubation of the plates at surrounding each of the cups 37 $^0$C ±1 $^0$C for 24 hours, the diameter of zone of inhibition surrounding each of the cups was measured with the help of scale. All the experiments were carried out in triplicate.

**Anti fungal activity by Cup-plate method:** All those compounds screened for antibacterial activity were also tested for their antifungal activity. The fungi employed for screening were: *Aspergillus niger, Aspergillus flavus, Fusarium oxysporum* and *Curvularia lunata*. The test organisms were sub-cultured using potato-dextrose-agar medium. The tubes containing sterilized medium were inoculated with test fungi and after incubation at 37 $^0$C for 48 hours, they were stored at 4 $^0$C in refrigerator. Clotrimazole (10 µg) was employed as the standard drug.

## Results and Discussion:

The results of antibacterial activity of compounds of type-IV, V and VI were found to posses moderate antibacterial activity against the gram (+) and gram (-) bacteria employed. None of the compounds exhibited antibacterial activity comparable to standard Ampicillin used. All the compounds of type-IV showed good antifungal activity against *A. niger* and *A. flavus* with the zone of inhibition in the range of 10 to 12 mm. They exhibited mild activity against *F. oxysporum* and *C. lunata* with zone of inhibition from 4 to 7 mm. All the compounds among type-V and type-VI showed moderate antifungal activity against *A. niger* and *A. flavus* with

the zone of inhibition of 8 to 10 mm. They showed mild activity against *F. oxysporum* and *C. lunata* with the zone of inhibition of 4 to 6 mm. None of the compounds showed comparable antifungal activity with that of standard Clotrimazole employed.

**Table 1: Antibacterial activity of the compounds**

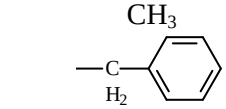
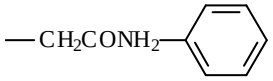
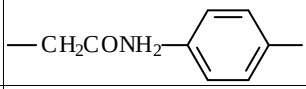
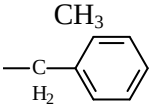
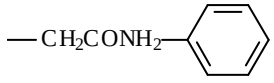
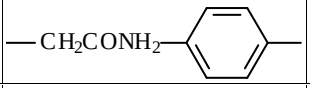
| Type | Compd | R | Ar | Zone of inhibition (mm) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Gram positive | | Gram negative | |
| | | | | *Bacillus subtilis* | *Staphylococcus aureus* | *Escherichia coli* | *Proteus vulgaris* |
| IV | IVa | H | -- | 10 | 9 | 9 | 9 |
| | IVb | $CH_3$ | -- | 9 | 10 | 9 | 9 |
| | IVc | $C_2H_5$ | -- | 9 | 9 | 9 | 8 |
| V | Va | H |  | 7 | 8 | 8 | 9 |
| | Vb | $CH_3$ | | 9 | 9 | 9 | 8 |
| | Vc | $CH_3$ |  | 8 | 8 | 8 | 8 |
| | Vd | $CH_3$ |  | 9 | 9 | 8 | 8 |
| VI | VIa | H | Diphenylamino | 9 | 8 | 7 | 8 |
| | VIb | $CH_3$ | N-methyl piperazino | 7 | 8 | 7 | 8 |
| | VIc | $CH_3$ | Morpholine | 8 | 8 | 7 | 8 |
| | VId | $CH_3$ | Piperidino | 9 | 9 | 8 | 7 |
| | VIe | $CH_3$ | Diphenylamino | 9 | 8 | 7 | 8 |
| Standard | | | Ampicillin | 19 | 18 | 18 | 15 |

**Table 2: Antifungal activity of the compounds**

| Type | Compd | R | Ar | Zone of inhibition (mm) | | | |
|---|---|---|---|---|---|---|---|
| | | | | *Aspergillus niger* | *Aspergillus flavus* | *Fusarium oxysporum* | *Curvularia lunata* |
| IV | IVa | H | -- | 12 | 10 | 6 | 5 |
| | IVb | $CH_3$ | -- | 10 | 11 | 4 | 4 |
| | IVc | $C_2H_5$ | -- | 12 | 11 | 7 | 4 |
| V | Va | H |  | 8 | 8 | 6 | 4 |
| | Vb | $CH_3$ | | 10 | 9 | 6 | 4<br>5 |
| | Vc | $CH_3$ |  | 8 | 8 | 6 | 4 |
| | Vd | $CH_3$ |  | 8 | 8 | 5 | 4 |
| VI | VIa | H | Diphenylamino | 7 | 8 | 5 | 4 |
| | VIb | $CH_3$ | N-methyl piperazino | 8 | 7 | 6 | 5 |
| | VIc | $CH_3$ | Morpholine | 9 | 8 | 5 | 6 |
| | VId | $CH_3$ | Piperidino | 10 | 9 | 6 | 4 |
| | VIe | $CH_3$ | Diphenylamino | 10 | 8 | 6 | 5 |
| Standard | | | Clotrimazole | 18 | 19 | 21 | 14 |

## References:


1. Yadav R, Srivastava S D, Srivastava S K, Ind J Chem, 44B, 2005, 1262.
2. Cacic M, Trkovnik M, Cacic F, Has-Schon E, Molecules, 11, 2006, 134.
3. Barsoum F F, Hosni H M, Girgis A S, Bio Med Chem, 14, 2006, 3929.
4. Zhang ZY, Chu C H, Hui X P, Ind J Chem, 41B, 2002, 2176.
5. Singh H, Srivastava M K, Singh B K, Singh S K, Dubey G, Ind J Chem, 40B, 2001, 159.
6. Mogilaiah K, Sakram S, Ind J Chem, 43B, 2004, 2014.
7. Ajitha M, Rajnarayana K, Sangarapani K, Pharmazie, 57, 2002, 796.
8. Bhat K S, Karthikeyan M S, Holla B S, Shetty N S, Ind J Chem, 43B, 2004, 1765.
9. Aboraia A S, Rahman H M R, Mahfouz N M, Gendy A E L, Bio Med Chem, 14, 2006, 1236.
10. Amir M, Shahani S, Ind J Heterocycl Chem, 8, 1998, 107.
11. Saxena S, Verma M, Ind J Pharm Sci, 54, 1992, 1.
12. Mullican D, Wilson M W, Cannor D T, Kostlan C R, Schirier D J, Dyer R D, J Med Chem, 36, 1993, 1090.
13. Mishra P, Joshi K, Ind J Physiol Pharmacol, 36, 1992, 347.
14. Adams S S, Cliffe E E, Lessel B, Nicholoson J S, J Pharm Sci, 56, 1967, 1986.
15. Omar A, Mohsen M E, Aboul W O M, J Heterocycl Chem, 21, 1984, 1415.
16. Bhat K S, Karthikeyan M S, Holla B S, Shetty N S, Ind J Chem, 43B, 1984, 1765.
17. Varvarason A, Tantili-Kakoulidou A, Siatra-Papastasikoudi T, Tiligada E, Arzneim Forsch, 50, 2000, 48.
18. Gokce M, Cakir B, Earl K, Sahin M, Arch Pharm, 334, 2001, 279.
19. Pintilie O, Profire L, Sunel V, Popa M, Pui A, Molecules, 12, 2007, 103.
20. Faroumadi A, Mirzaei M, Shafiee A, Pharmazie, 56, 2001, 610.
21. Mamolo M G, Falagiani V, Zanpier D, Vio L, Banfi F, Farmaco, 56, 2001, 587.
22. Zamani K, Faghifi K, Tefighi I, Sharlatzadeh R, J Med Chem, 28, 2004, 95.
23. Zan X I, Lai L H, Jin GY, Zhong Z X, J Agric Food Chem, 50, 2002, 3757.
24. Li Z, Han Y, J Agric Food Chem, 48, 2000, 5312.
25. Clerici F, Pocar D, Guido M, Loche A, Perlini V, Brufoni M, J Med Chem, 44, 2001, 931.
26. Onkol T, Cakir B, Sahin M F, Turk J Chem, 28, 2004, 461.
27. Shenone S, Bruno O, Ranise A, Bondavalli W, Falcone G, Giordano L, Vitelli M, Bio Med Chem, 9, 2001, 2149.
28. Labanauskas L, Kalcas V, Uderenaite E, Gaidelis P, Brukstus A, Dauksas V, Pharmazie, 56, 2001, 617.
29. Palaska E, Sahin G, Kelincen P, Durlu N T, Altionax G, Farmaco, 57, 2002, 101.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