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Review Article

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ANTIMICROBIAL ACTIVITY OF 1, 3, 4-THIADIAZOLE DERIVATIVES: A RECENT REVIEW

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ABSTRACT
A few five members' aromatic systems having three hetero-atoms at symmetrical positions, for example, thiadiazoles have been considered broadly attributable to their intriguing pharmacological properties. These thiadiazole derivatives are the heterocyclic compound which contains the five member ring along with nitrogen and sulfur atoms. This recent study covers the most dynamic thiadiazole subordinates that have demonstrated significant biological activities, for example, anti microbial, anti inflammatory, anti tubercular, ant-diabetic, diuretics, anti depressant, radio-protective, anti-leishmanial and cytotoxic activity.
This review likewise examines the structure-activity relationship (SAR) of the most powerful compounds. It can go about as an imperative tool for restorative scientists to create more current compounds having thiadiazole moiety that could be better operators regarding viability and safety.

INTRODUCTION

In all cases against disease block, the ascent of new pathogens despite the resurgence of old ones and the nonappearance of incredible new therapeutics compound the issues of antimicrobial obstruction [1].The need to structure new compounds to manage this opposition has turned out to be a standout amongst the most imperative regions of research today. Thiadiazole is an adaptable moiety that displays a wide assortment of biological action most likely uprightness of –N=C-S-gathering [2]. Thiadiazole moiety goes about as 'hydrogen restricting space' and 'two-electron contributor system'. It additionally goes about as a compelled pharmacophore. Numerous medications containing thiadiazole core are accessible in the market, for example, acetazolamide, methazolamide, sulfamethazole, and so forth.

Thiadiazole derivatives can likewise go about as the bio-isosteric substitution of the thiazole moiety. So it acts like third and fourth era cephalosporins, subsequently can be utilized in anti-microbial arrangements. Amid the second 50% of the twentieth century a wide range of subsidiaries were blended dependent on this structure.The late writing is enhanced with dynamic discoveries about the union of 1, 3, 4-thiadiazole

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moiety and their expansive range of pharmacological activities, for example, antibacterial [3], fungicidal [4], anti-inflammatory [5], antidepressant [6], antioxidant properties [7], anticancer [8], carbonic anhydrase inhibiting effect [9] and so on. 1,3,4-thiadiazole subsidiaries forces intriguing biological activity presumably gave to them because of solid aromaticity of the ring system which prompts incredible *in-vivo* dependability and for the most part, an absence of toxicity for higher vertebrates, including people when differing utilitarian gathering that collaborate with biological receptor are connected to aromatic ring [10]. Way to deal with routine with regards to therapeutic science has created from an observational one including synthesis of new organic compounds dependent on change of chemical compounds of realized organic exercises could be better investigated. It is entrenched that slight modification in the structure of specific compounds can convey extreme changes to yield better medication with less poisonous quality to the host it saw that concoction alteration modifies physiochemical properties as well as pharmacological properties [11].

Chemistry of Thiadiazole [12]**:**

An ongoing writing review uncovered that the 1, 3, 4-thiadiazole moiety has been generally utilized by the therapeutic scientific expert in the past to investigate its natural exercises. The advancement of 1, 3, 4-thiadiazole science is connected to the disclosure of phenylhydrazines and hydrazine in the late nineteenth century. The initial 1, 3, 4-thiadiazole was depicted by Fischer in 1882, yet the genuine idea of the ring framework was shown first in 1890 by Freund and Kuh. Thiadiazole is a five member ring framework containing sulfur and nitrogen atom. They happen in four isomeric forms viz., 1, 2, 3-thiadiazole (1), 1, 2, 4-thiadiazole (2), 1, 2, 5-thiadiazole (3), 1, 3, 4-thiadiazole (4). Their dihydro derivative gives greater part of writing on thiadiazole.

(1) (2) (3) (4)

The numbering of monocyclic azole framework starts with the heteroatom that is in the most noteworthy gathering in the periodic table and with the component of least atomic weight in that group.Hence, the numbering of 1, 3, 4-thiadiazole (Figure 1) is done in the following manner. This designated that one sulphur group is present in the ring.

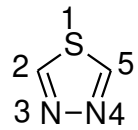
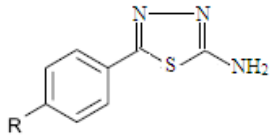


Fig.1. Structure of Thiadiazole moiety

ANTIMICROBIAL ACTIVITY

Upadhyay and Mishra *et. al*., integrated the 5-(4-substituted phenyl)- 1, 3, 4-thiadiazol-2-amine subordinates 8 and performed in-vitro antibacterial movement against *S. aureus*, *Bacillus subtilis*, *Escherichia coli* and *Pseudomonas aeruginosa*; antifungal movement against *Aspergillus niger* and *Candida albicans* by disk diffusion technique. Pretty much every one of the compounds, Fluorinated and chlorinated mixes 8a and 8b indicated great inhibitory impacts (hindrance somewhere in the range of 81% and 91%) with minimum inhibitory concentration (MIC) estimations of 20-28 µg/mL (controlled to ciprofloxacin, MIC =18-20 µg/mL) for *S. aureus* and *B. subtilis*. Moreover, halogenated compounds 8a-8c and hydroxyl derivative 8d demonstrated moderate inhibitory impacts (hindrance somewhere in the range of 58% and 79%) with MIC estimations of 24-40 µg/mL (controlled to ciprofloxacin, MIC =20-24 µg/mL) for *E. coli* and *P. aeruginosa*. Huge antifungal action against *A. niger* and *C. albicans* was shown by subsidiaries 8d and 8e bearing oxygenated substituents at phenyl ring (hindrance somewhere in the range of 58% and 66% and MIC =32-42 µg/mL contrasted with fluconazole, MIC =24– 26 µg/mL). It creates the impression that the halogen joined to the phenyl-1, 3, 4-thiadiazol moieties expands the antibacterial movement with inclination against Gram-positive microbes, while the oxygenated substituent gives antifungal action [13].

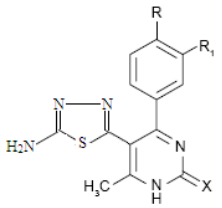


(8)

R=F (a), Cl (b), Br (d), OH (d), OCH_3 (e)

Andrews *et al*., synthesized 2-amino-1, 3, 4-thiadiazole derivatives and were evaluated for *in- vitro* antibacterial activity at a concentration of 10 µg/mL by measuring the inhibition area on agar plates (disk diffusion method). However nitro derivatives **36c-36d,** were shown moderate activity against *E. coli* by using ciprofloxacin as standard drug. Hydroxyl derivatives **36a-36b** exhibited moderate to good

inhibitory activity against *P. aeruginosa*, *S. aureus* and *E. coli* [14].



(36)

X=O, S

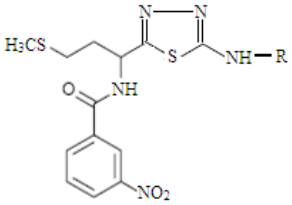
R=OH, R_1=H (a, b)

R=H R_1=NO_2 (c, d)

The *in-vitro* antimicrobial action of some new 1,3,4-thiadiazole derivatives, for example, 12 having a D, L-methionine moiety has been assessed against a few bacterial strains by Pintilie *et. al* [15]. From the discoveries, the authors uncovered that 1, 3, 4-thiadiazole derivatives have great action against *Bacillus anthracis* and *Bacillus cereus*, the most dynamic compound 12c having a 4-methylphenyl moiety on the heterocyclic ring. The compounds demonstrated an extremely feeble movement against *S. aureus* and *E. coli* strains and were idle against *Sarcina lutea* strain.

The antimicrobial movement of some thio-ethers got from 2-amino-5-mercapto-1, 3, 4-thiadiazole was observed to be subject to the substitution at the mercapto grouping. Despite the fact that all the tried compounds indicated moderate antibacterial action against gram-positive and gram-negative bacterial strains and moderate to great antifungal action against *C. albicans*, the discoveries uncovered that the antimicrobial movement was enhanced by the presentation of a 1-arylethanone moiety at the mercapto gather [15].

Rad et al., found that the unsubstituted and halogenated aryl derivatives 13 turned out to be the most dynamic compound against *Salmonella typhimurium* and *C. albicans* [16].



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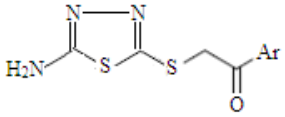
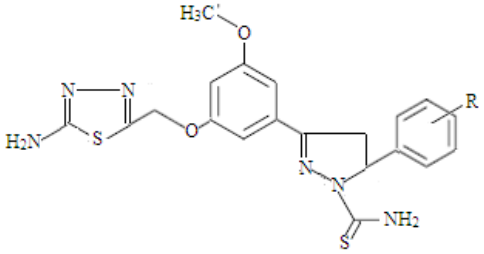


(13)

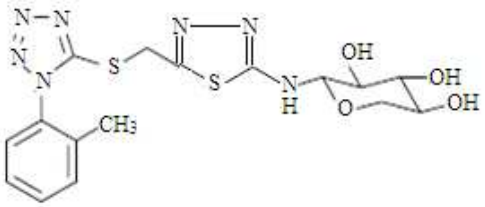
R= CH_3 (a), C_6H_5 (b) , 4-$CH_3C_6H_5$ (c) , Ar = napthyl , 4-ClC_6H_4, C_6H_5 4-Br C_6H_4 (d), H_2C=$CHCH_2$ (e)

Noolvi *et. al*., 2016, were synthesized a series of 1, 3, 4-thiadiazole derivatives of [2-(4-formyl-2-methoxyphenoxy) acetic acid] (6a-6s) by cyclization of carboxylic acid group of [2-{2-methoxy-4-(3-oxo-3-substituted phenylprop-1-enyl) phenoxy} acetic acid] (4a-4s) with thiosemicarbazide in presence of $POCl_3$ or PPA [17]. The structures of all the tested compounds were confirmed by IR, ^{1}H NMR and mass analysis. The synthesized compounds have been evaluated for their *in-vitro* antimicrobial activities against several strains of microbes and showed significant microbial activity.



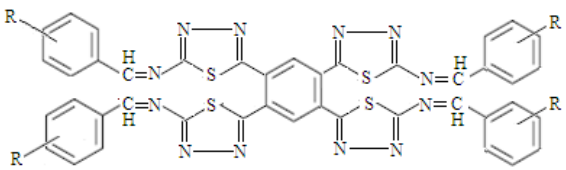
R= H, 2-OCH_3, 2,4-di-Cl, 3-NH_3, 3-NO_2, 4-OCH_3, 4-F, 4-NO_2, 4-Br, 4-CH_3, 3-OH, 4-Cl, 2-NH_2, 2, 4-di-OH, 4-NH_2, 2-Cl, 4-OH, 3-CH_3

A new series of substituted 1, 3, 4-thiadiazoles were synthesized by Rezki *et. al*., combining the xylosyl moiety and the aryltetrazole ring gave compound **27** which exhibiting *S. aureus* inhibitory activity.It is notable that furan derivatives bearing a nitro gather in the 5th-position and a grouping of the general type −C=N−N=C−, which might be consolidated in a heterocycle, have in-vivo antibacterial properties [18].



(27)

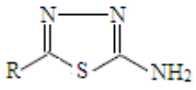
Some novel tetra Schiff bases were synthesized by Yousif *et al*., condensation of [1, 2, 4, 5- tetra (5-amino-1, 3, 4-thiadiazole-2-yl) benzene] with different aromatic aldehydes [19]. All tested compounds **(2a-2h)** were screened for their antibacterial (*Staphylococcus aureus*, *Staphylococcus epidermidis*, *icrococcus luteus*, *Bacillus cereus*, *Escherichia coli*, and *Pseudomonas aeruginosa*) and antifungal (*Aspergillus niger* and *Aspergillus fumigatus*) activities. Among the synthesized compound 2g and compound 2h were found promising compounds of the series.



2(a-h)

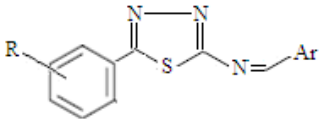
R=H, *p*-CH_3, *p*-OH, *p*-OH, *o*-OH, *p*-NO_2, *p*-Br, *p*-OCH_3, *p*-Cl

Eight different 2, 5-disubstituted 1, 3, 4-thiadiazoles were prepared by Nayak *et. al*., using different aromatic or aliphatic carboxylic acids (**1**) and thiosemicarbazide (**2**) by conventional and microwave irradiation (MWI) methods. All the synthesized compounds were evaluated for their antimicrobial activity against *Staphylococcus aureus. Escherichia coli,* and *Pseudomonas aeugenosa.* Some of the synthesized compounds were shows mild to moderate activity, but not comparable with the Oflaxacin (standard).

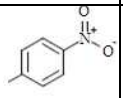
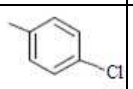
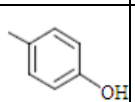
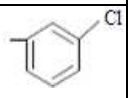


R=H, -CH_3, C_6H_5, 4-NO_2 C_6H_4, 4-CH_3 C_6H_4,
2-OH C_6H_4, 4-NH_2 C_6H_4, 2-$OCOCH_3$ C_6H_4

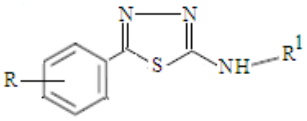
Baghel *et. al*., were synthesized new series of thiadiazole derivatives and all the newly synthesized compounds were screened for their antibacterial activity against gram positive species [*Bacillus subtilis*, *Staphylococcus aureus*], gram negative species [*Pseudomonas aeruginosa*, *E. coli*] and antifungal activity *against Candida albicans*, *A. niger* . Among the synthesized compound **5c** and **5e** were shows potent activity against the test organisms. Test compounds having substituted phenyl ring were found to be more biological active and as well as substituted with electron withdrawing groups gives highest antimicrobial activity [21].



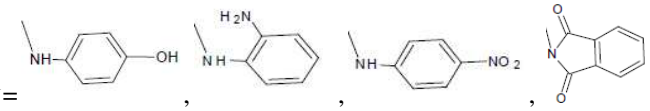
5(a-e)

	5a	5b	5c	5d	5e
Ar					
R	H	-Cl	-OH	-NO_2	-OH

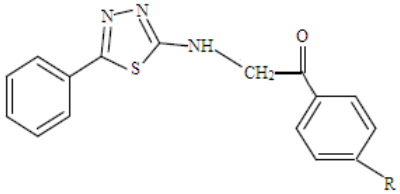
Raj *et. al.,* were synthesized novel thiadiazole derivatives by reaction of substituted aromatic benzoic acid and 2-hydroxybenzoic acid with thiosemicarbazide to synthesize [5-phenyl-1, 3, 4-thiadiazol-2-amine] (**A**) and [2-(5-amino-1,3,4-thiadiazole-2-yl) phenol] (**B**). From these compounds various derivatives of 1, 3, 4-thiadiazole derivatives (A1-A4 and B1-B4) have been synthesized [22]. All the synthesize compounds were screened for their antibacterial (*Staphylococcus aureus , Becillus Cereus , Escherichia coli, Pseudomonas aeruginosa* and anti-fungal (*Aspergillus niger* and *Aspergillus fumigatus*) activity by paper disc diffusion technique.



R=H, OH

R^1= 

A series of α bromoketones and thiadiazole derivative were synthesized by Mendhe *et. al*., in 2012, [23]. The structure of all the synthesized compounds were confirmed by physical parameters like Melting point solubility etc, chromatographic methods (TLC) and spectroscopic methods such as IR, NMR. All the test compounds were screened for their antibacterial and antifungal activity by zone of inhibition method. Substituted thiadiazole derivatives (IIa, IIb, IIc and IId) showed significant activities compared to the standards ciprofloxacin for significant activity against *E. coli* and *S. aureus* at 50, 100,300 and 500 mcg/mL and Miconazole significant activity against *Candida albicans* at 50, 100, 300,500 mcg/mL.



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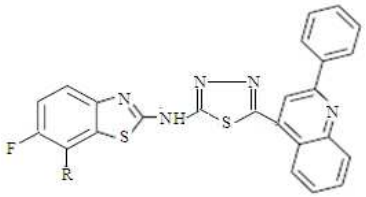
R = H, Cl, Br, NO_2

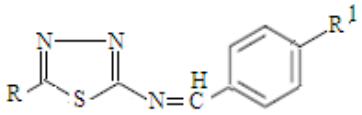
New 1, 3, 4-thiadiazole derivatives such as **46** incorporating a fluorobenzothiazole moiety have been synthesized by Vedavathi et.al [24]. From the results of antimicrobial assessment it has been found that some of the studied compounds (eg, morpholine and piperazine derivatives) showed significant antibacterial and antifungal activity.



(46)

R= morpholinyl; piperazinyl

Kallur *et. al*., 2012, synthesized some thiadiazole derivatives,the majority of 1, 3, 4-thiadiazoles are based on the cyclisation of thiaosemicarbazide derivative incorporating this basic structural unit. All the derivatives were used for screening their antimicrobial activities against *Bacillus subtilis, Bacillus pumilus, E coli* and *Pseudomonas aureginosa* by disc diffusion method using ciprofloxacin as a standard. Compounds MY 3b, MY 3c, MY 3d, and MY 3I were exhibited a broad spectrum antibacterial activity. While other synthesized compounds of this series shown poor antibacterial activity [25].



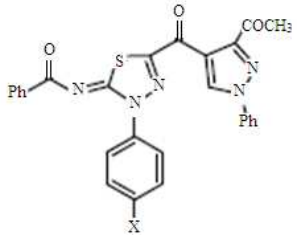
R= C_6H_5; p-ClC_6H_4; P-$CH_3C_6H_4$

R^1= C_6H_5; p-ClC_6H_4; P-$CH_3C_6H_4$

A new series of 1, 3, 4-thiadiazoles were synthesized *via* reaction of 1, 3, 4-thiadiazolenaminones (**1**) with *N*-phenyl 2-oxopropanehydrazonoyl chloride (**2**) in dioxane in the presence of triethylamine by Farghaly *et al*., [26]. Also, some new heterocycles incorporating 1, 3, 4-thiadiazole ring were obtained by reaction of 1, 3, 4-thiadiazolenaminones **1**with nitrogen-nucleophiles like hydrazine hydrate, 3-amino-1, 2, 4-triazole and 2-aminobenzimidazole.

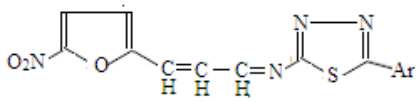
The relation between the structure of the products and their activity towards some microorganisms such as *Aspergillus fumigatus* , *P. italicum* , *Geotrichum candidum* , and *Candida albicans* as well as four bacteria species, namely, gram positive bacteria, *Staphylococcus aureus* and *Bacillus subtilis* , gram negative bacteria, *Pseudomonas aeruginosa* and *Escherichia coli* were studied and to get the promising results .

Among all the compounds, **4a** and **4b** have high potency towards *Staphylococcus aureus, Bacillus subtilis* and *Pseudomonas aeruginosa* respectively.



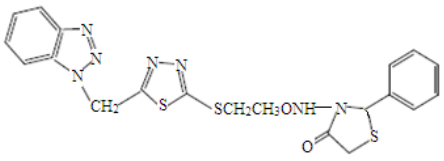
(4)

Salih *et. al*., were prepared [{5-(*p*-Substituted phenyl)-N-(3-(5-nitrofur-2-yl)-allylidene}-1, 3, 4-thiadiazol-2-amines] (10-17) by utilizing different *p*-substituted benzoic acid through two step reactions. Compound 2- amino-5-substituted-1, 3, 4-thiadiazoles (2-9) derivatives was prepared by the reaction between thiosemicarbzide and benzoic acid derivatives in the presence of phosphorus oxychloride and followed by 5-nitro-2-furanacrolein to yield the target products. The final structures of all the synthesized compounds were confirmed on the basis of their elemental analysis, spectral analysis (IR, ^{1}H NMR, ^{13}C NMR, mass spectra) and the synthesized compounds were screened for their antimicrobial activities [27]. From the preliminary results it has been found that some of the compounds exhibited promising antimicrobial activities.



Ar = C_6H_5, *p*-$CH_3C_6H_4$, *p*-CH_3O C_6H_4, *p*-OH C_6H_4,
p-NO_2 C_6H_4, *p*-Br C_6H_4 , *p*-I C_6H_4, *p*-Cl C_6H_4

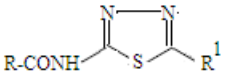
Sen *et. al.,* have been synthesized some new benzotriazole derivatives (6) by conventional as well as eco-friendly microwave irradiated synthesis method and followed by antimicrobial evaluation against *Escherichia coli*, *Staphylococcus aureus, Klebsiella pneumoniae* and *Bacillus substilis* [28].

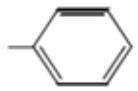
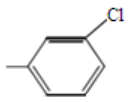
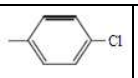
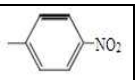
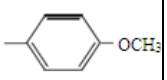
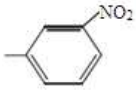
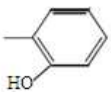


(6)

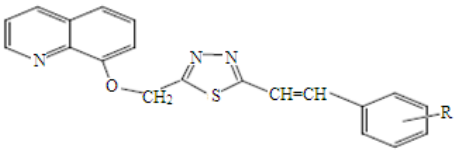
Singh *et. al.,* [29] have been synthesized some 2, 5-Disubstituted 1, 3, 4-thiadiazoles from different acids. All newly synthesized compounds were evaluated by the antimicrobial activity using *Staphylococcus aureus* (Gram+ve), *B.Subtilis* (Gram+ve), *P.aeuroginosa* (Gram-ve) and *Escherichia coli* (Gram-ve) by cup plate agar diffusion method

by measuring the inhibition zone in mm. From this study, it has been found that substituted 1, 3, 4- thiadiazole derivatives played a vital role as antibacterial agents.



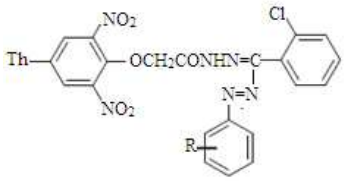
R				
R^1				

Madhav and his colleagues were synthesized some new series of 1, 3, 4-thiadiazole derivatives (8) and further screened for their antimicrobial activity [30] against different gram positive and gram negative bacteria as well as some fungal strain.



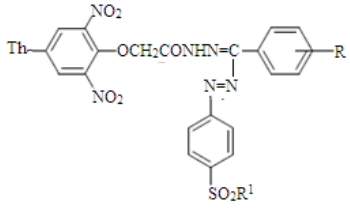
(8)

Sah *et al*., [31] were synthesized a series of 5-(4-chlorophenyl amino)-2-mercapto-1, 3, 4- thiadiazole derivatives. The compounds **(1a-1g)** were tested for their *in vitro* antimicrobial activity against the two pathogenic bacterial strains eg., *Escherichia coli* and *Salmonella typhi*, three fungal strains eg., *Aspergillus niger*, *Penicillium species* and *Candida albicans*. The results of the antimicrobial evaluation have been revealed that some of the synthesized compound showed moderate activity.



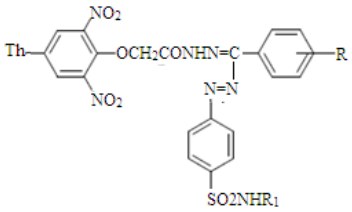
1(a-b)

R=4-NO_2, 2-CH_3-4-NO2



1(c-e)

R=2-Cl; R1=OH, NH_2, guanidine

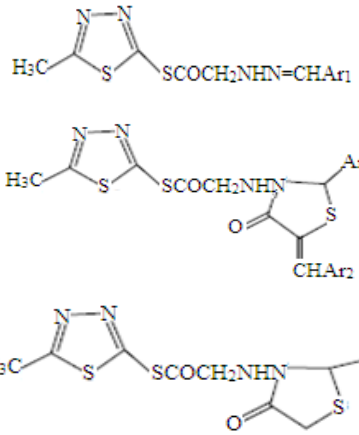


1(f-g)

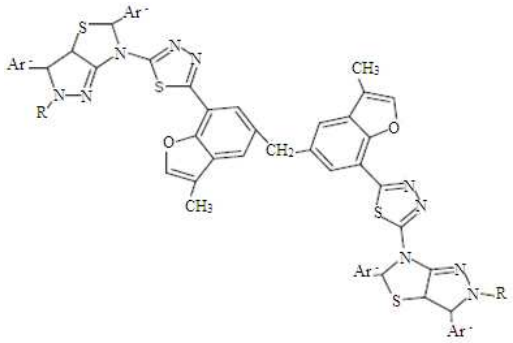
R= 3-OCH_3, 4-OH;

R_1=pyrimidine, 4, 6-dimethyl pyrimidinyl

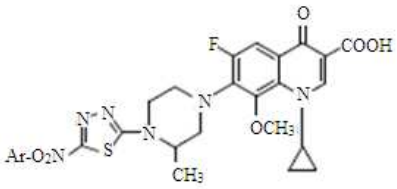
1, 3-thiazolidin-4-one derivatives of 2-mercapto-5-methyl 1, 3, 4-thiadiazole (11) and their derivatives were synthesized by Srivastava *et. al*., and further evaluated for their antimicrobial activity against *B. substilis*, *E. coli*, *K. pneumonia* and *S. aureus* bacteria and antifungal activity against *A. niger*, *A. flavus*, *F. oxisporium* and *T. viride* fungi respectively [32]. Some of the tested compounds displayed marked antifungal activity against *A. niger*.



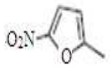
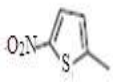
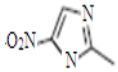
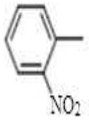
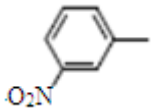
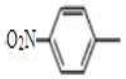
S. Cherkupally *et. al*., synthesized a series of *bis*-[thiadiazol-2-yl-tetrahydro-2-hpyrazolo-[3, 4-*d*] [1, 3]-thiazole] methanes and evaluated for *in vitro* antibacterial activity against some Gram positive viz. Bacillus subtilis, Staphylococcus aureus and Micrococcus *luteus*, and Gram negative bacteria *Proteus vulgaris*, *Salmonella typhimurium* and *Escherichia coli* [33]. The compounds showed significance antimicrobial activity against above bacterial and fungal strain.



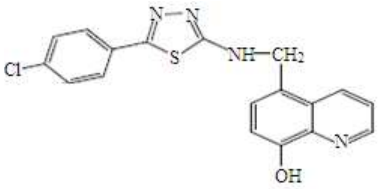
A variety of nitroaryl-1, 3, 4-thiadiazole derivatives(**8a-8f**) have been successfully synthesized by Jazayeri *et al*., [34] in appreciable yields and screen for their antimicrobial evaluation against both gram positive and gram negative bacteria including *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus pneumonia*, *Bacillus subtilis*, *Enterococcus faecalis*, *Micrococcus luteus* and Gram-negative including *Escherichia coli*, *Salmonella typhi*, *Shigella flexneri*, *Klebsiella pneumonia*, *Serratia marcescens* and *Pseudomonas aeruginosa*.All the synthesized compound give good to moderate antimicrobial response against the selected organisms.



8(a-f)

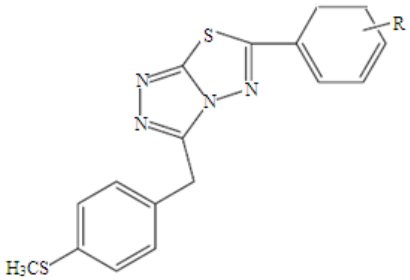
Cpd. No.	8a	**8b**	**8c**	**8d**	**8e**	**8f**
Ar-NO_2						

Patel *et. al.*, have been synthesize metal chelates of {5-[4-chlorophenyl-(1, 3, 4)-thiadiazol-2-ylaminomethylene]-8-hydroxy quinoline} (7) and evaluated for their anti-microbial activity [35] agains some gram positive and gram negative microorganisms. All the tested compound exhibited pronounced antibacterial activity against the gram-(+) ve bacteria and moderate poor activity against gram-(-) ve bacteria.

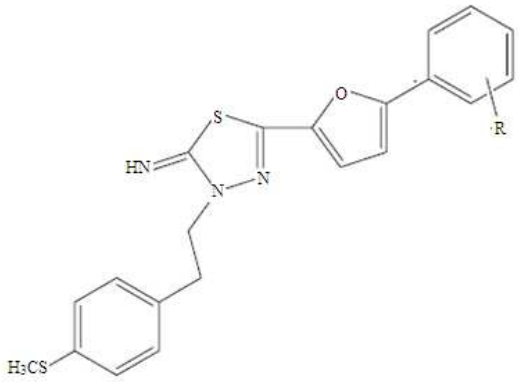


(7)

Various substituted triazolo-thiadiazoles (**36-37**) were synthesized by Prasad *et. al.,* and evaluated for their antibacterial and antifungal activity against the gram-(+)ve bacteria and moderate poor activity against gram-(-) ve bacteria. The preliminary results revealed that some of the compounds exhibited promising antimicrobial activities [36]



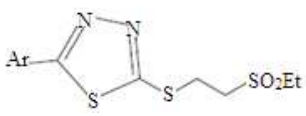
(36)



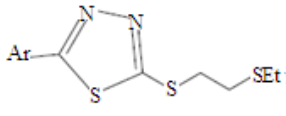
(37)

R= 2, 3, 4-Cl-C_6H_2, 4-OH-C_6H_4, 4-Br-C_6H_4, 4-F-C_6H_4, 4-NO_2-C_6H_4, CH_2-C_6H_4

Foroumadi *et. al.*, have been synthesized a series of 5-(nitroaryl)-1, 3, 4-thiadiazoles **(3-4)** bearing certain sulfur containing alkyl side chain similar to pendent residue in tinidazole molecule and evaluated for their antibacterial, antifungal and cytotoxic effects respectively. Test compounds were found to be more potent against both gram positive and gram negative as well as fungal strain due to presence of 2-[2 (ethylsulfonyl) ethylthio]- side chain [37].



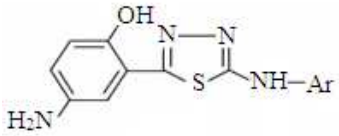
(3)



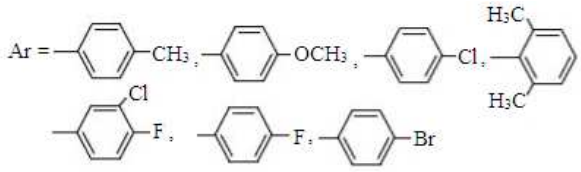
(4)

Ar = 5-nitrothiophene-2-yl; 5-nitrofuran-2-yl; 1-methyl-5-nitroimidazol-2-yl; nitrophenyl

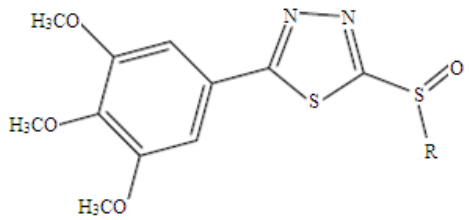
Different 4-amino-2-{5-[(4-substituted phenyl) amino]-1, 3, 4-thiadiazole-2-yl} phenol (38a-38g) were incorporated and screened for their antibacterial and antifungal action by Hussain *et.al*. The tested compounds demonstrated huge antibacterial action against *S. aureus* (gram+ve) and *E.coli* (gram-ve) microscopic organisms and antifungal action against *A. niger* growths utilizing cup plate method. Compounds 38c, 38e and 38f were observed to be great antibacterial progress against *S. aureus* (gram+ve) and *E.coli* (gram-ve) microbes and antifungal movement against *A. niger* (MIC value 25µg/mL) [38].



38a-38g

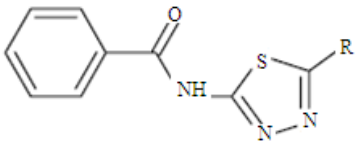


Liu *et al.,* have been synthesized some novel sulfoxide derivatives containing trimethoxyphenyl substituted 1, 3, 4-thiadiazole moiety (**32**) and evaluated for their antimicrobial activity. The bioassay results revealed that synthesized compounds were possessing greater antifungal activities with EC50 values ranging from 19.91 µg/mL to 63.97 µg/mL respectively [39].



R=$C_6H_5CH_2$-, $CH_3CH_2COOCH_2$-, $OCH_3C_6H_4CH_2$-, $NO_2C_6H_4CH_2$-, $FC_6H_4CH_2$-,-$CH_2CH_2OCH_2CH_3$

A new 2-benzamide-5- alkenyl/hydroxyalkenyl-1, 3, 4-thiadiazoles (**21**) have been synthesized from fatty acid hydrazides by Banday *et. al*. All the synthesized compounds were screened for their antimicrobial activity and the bioassay results displayed the marked antibacterial activity [40] against preferred organisms.



R= CH_2= CH $(CH_2)_8$, CH_3 $(CH_2)_7$CH=CH$(CH_2)_7$, CH_3 $(CH_2)_5$ CH (OH) CH_2CH= CH $(CH_2)_7$, CH_3 $(CH_2)_4$CH= CH $(CH_2)_2$ CH (OH) $(CH_2)_7$

CONCLUSION

The plenty of research bought in this review demonstrates a wide range of pharmacological exercises displayed by 1, 3, 4-thiadiazoles derivatives. The organic profiles of these new ages of thiadiazoles would speak to a productive lattice for further advancement of better therapeutic specialists.

ACKNOWLEDGMENT

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FINANCIAL ASSISTANCE

NIL

CONFLICT OF INTEREST

The authors declare no conflict of interest

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