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Fungicidal Activity of Novel Synthesized 2-(N-Aryloxy Acetyl)-5-(2'-Hydroxy Phenyl)-1, 3, 4-Oxadiazole

Ashwini Kumar [1] *

1. Research Scholar, P.G. Dept. of Chemistry, Magadh University, Bodh Gaya, Bihar, India
kumarashwini121178@gmail.com

Abstract: After a novel set of 2-(N-aryloxy acetyl)-5-(2'-hydroxy phenyl)-1,3,4-oxadiazole derivatives were created, their fungicidal ability was evaluated. A mild condensation reaction of salicylic acid hydrazide with various aryloxyacetic acid chlorides produced the necessary heterocyclic molecules. The compounds' in vitro antifungal efficacy against a panel of phytopathogenic fungi, including Aspergillus niger, Rhizoctonia solani, and Fusarium oxysporum, was evaluated using the poisoned food technique. Numerous substances had significant inhibitory effects, with certain modifications enhancing the fungicidal efficacy. The results indicate that the 1,3,4-oxadiazole scaffold including hydroxyaryl and N-aryloxyacetyl groups has the potential to be used to make powerful agrochemical fungicides.

Keywords: Fungicidal Activity , Novel Synthesized, 2-(N-Aryloxy Acetyl)-5-(2'-Hydroxy Phenyl)-1, 3, 4-Oxadiazole

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INTRODUCTION

New advances in genome sequencing and bioinformatics have shed light on the intricate genetic architecture of fungus, revolutionizing our molecular understanding of these organisms. These discoveries aid in the search for genes responsible for critical traits including as pathogenicity, virulence, and treatment resistance. For instance, in order to develop effective treatment strategies, scientists can discover specific genetic variations that enable fungus to infect hosts or resist antifungal treatments.

Genomes, track fungi adapted to various ecological, shedding light on survival strategies in environments

Studies using comparative genomics help us better grasp the evolutionary links between various fungus species. Scientists can trace how fungus have evolved to different ecological niches by examining their genomes, which provides insight into how they have managed to survive in a variety of settings.

This information has applications in addition to enhancing our comprehension of fungal biology. We can better control and manage fungal infections that endanger human health and agriculture by developing tailored medicines based on our understanding of the genetic composition of fungal pathogens.

Apart from investigating genetic data, studies of fungal physiology and metabolism have illuminated the complex mechanisms that govern the growth, development, and responses of fungus to environmental stimuli.

These intricate regulatory networks are essential to the production of secondary metabolites by fungi, including poisons and antibiotics, which have drawn interest because to their possible uses in biotechnology, medicine, and agriculture. For example, medications made from fungi are crucial for treating bacterial infections, and some fungal toxins may be used to protect crops from pests..

Capabilities of fungi in both ecological balance and human advancement

Fungi also produce a wide range of enzymes that have application in manufacturing. For example, cellulases have the potential to convert plant biomass into renewable energy sources, while ligninases aid in bioremediation by degrading harmful compounds in contaminated places. The unique abilities of fungi offer sustainable solutions to pressing environmental issues, highlighting their importance for a healthy ecosystem and human advancement.

Hafez et al. (2008) detailed a systematic and efficient synthesis of many novel spiro-thioxanthene and spiro-xanthene-9',2-[1,3,4]thiadiazole derivatives, with an eye toward their potential as anti-inflammatory medicines.

A thorough evaluation of the structural changes and their impact on biological activity was carried out in the study. The derivatives that exhibited the most anti-inflammatory action were those that had an acetyl group at position 5 and a 4-nitro phenyl group at position 3, suggesting that these substituents play a significant role in enhancing the compounds' pharmacological properties.

Furthermore, spiro compounds that had two phenyl substituents at positions 3 and 5 also showed substantial biological efficacy, indicating that the aromatic nature of the substituents had a major impact on the activity profile.

An analysis of structural analogs revealed that the presence of other halogens, such chlorine or bromine, preserved a significant amount of activity when the 4-nitro substituent was removed electronic and steric contributions, halogen substituents may modify the biological interactions of these molecules, as this new finding highlights.

The findings provide important information about the structure-activity correlations (SAR) of spiro medicines and provide a foundation for optimizing future pharmacological potential.

Many novel imine derivatives based on the core structure of 5-amino-1,3,4-thiadiazole-2-thiol were synthesized by Yusuf et al. (2008). To determine if these compounds have antidepressant potential, they were compared to imipramine, a commonly used reference medication that is famous for its efficacy in treating depressive disorders. Two chemical byproducts exhibited strong antidepressant activity.

OBJECTIVES OF THE STUDY

1. To research the potential of fungus for maintaining ecological balance and advancing humankind
2. To investigate genomes and monitor fungi that have evolved to different ecological conditions, providing insight into environmental survival tactics

EXPERIMENT

The melting points found in the open capillaries might not have been corrected. A Perkin-Elmer 881 Infrared Spectrophotometer (cm^{-1}) was used to acquire the KBr IR spectra, and a Varian EM-360 (200 MHz) spectrometer using TMS as an internal reference was used to collect the 1H NMR spectra in $CDCl_3$.

These were made using the procedure outlined below..

Typical procedure for 3a:

Dissolve 1 gram of O-hydroxy benzoic acid (1) and 1 gram of triturated semi carbazide (2) in 50 milliliters of ethanol. As the concentrated H_2SO_4 (5 ml) was added dropwise over time, the mixture was kept cold between 2 and 5°C.

Refluxing the complete reaction mixture with cold water eliminated any unreacted H_2SO_4. The recrystallization process involved the use of ethanol.

N-[5-(2-hydroxy phenyl)-1,3,4-oxadiazol-2-yl] 2-(4a-e)-phenoxy acetamide

Typical procedure for 4a:

When a yellow solution was made by dissolving 2-amino -5-(2-hydroxy phenyl)-1,3,4-oxadiazole (3) in water and agitating, the contaminants that had precipitated out were filtered away.

This was followed by the addition of a small amount of a variety of aryloxy acetyl chlorides, followed by four to five hours of continuous shaking at 50 to 60 °C, followed by storage overnight.

For aqueous KOH removal, the precipitate was filtered, rinsed with cold water, and recrystallized from ethanol. In Table 1 you can see the elemental analyses, yields, and melting points of all the compounds that were made [4ae].

Antifungal screening

Applying the gold standard in commercial fungicides, dithane M-45. Collectorichum falcatum and Fusarium oxysporum were used as test fungi, and fungicidal activity was assessed at 1000, 100, and 10 ppm concentrations using standard agar-plate procedures. Three replications were performed in each case.

The fungal growth zone's diameter was assessed after 96 hours. By comparing the results to the control group's growth rate, the percentage of inhibition was calculated..

Thus,

$$\% \text{ inhibition} = (C - T) / 100$$

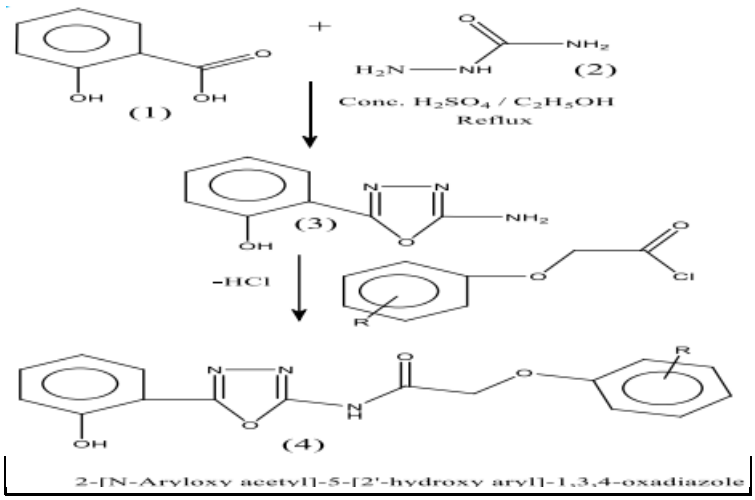
When C in millimeters represents the control plate fungal colony diameter. The treated plate's fungal colony diameter is T in millimeters..

RESULT AND DISCUSSION

All of the investigated drugs exhibited high to moderate action, according to the fungicidal findings. It is noteworthy that all of the examined compounds' antifungal results [4a–e] show substantial antifungal activity against Fusarium oxysporum and Collectorichum falcatum at 1000 ppm, however their activity decreases at lower dosages, such as 100 ppm and 10 ppm. It is noteworthy that the inclusion of additional electronegative oxophores (Cl and NO_2) improves the antifungal properties of all the title compounds. These chemicals damage the fungal cell wall, which has an impact on the fungi's metabolism.

With a yield of 58–72 percent, the title compounds [4a–e] were synthesized according to scheme 1. One molecule, 4e, was recognized by IR and 1H NMR analysis, whereas the other compounds [4a–e] were all identified by elemental analysis.

The antifungal activity of each of the compounds [4a–e] has been assessed and is listed in Table 2. It is evident from these screening results that the majority of the compounds exhibited notable antifungal activity against two fungus species, Fusarium oxysporum and Collectorichum falcatum, at 1000 ppm concentration. The compounds with a Cl or NO2 group are more fungitoxic, according to antifungal screening results.



Scheme 1. 2-(N-Aryloxy Acetyl)-5-(2'-Hydroxy Phenyl)-1, 3, 4-Oxadiazole

Table 1: the compounds' spectroscopic and physical characteristics

Compound	R	Yield (%)	M.P.	C Experimental (Calculated)	H Experimental (Calculated)	N Experimental (Calculated)
4a	H	72	172	59.57 (61.73)	3.89 (4.21)	12.97 (13.50)
4b	2-Cl	68	183	54.52 (55.58)	2.85 (3.50)	11.62 (12.15)

4c	2,4- Cl_2	65	188	49.97 (50.55)	2.13 (2.92)	10.11 (11.05)
4d	2-NO_2	62	193	47.80 (53.94)	2.78 (3.39)	14.67 (15.73)
4e*	2-CH_3	58	179	61.87 (62.76)	4.11 (4.65)	12.11 (12.92)

*1H NMR (DMSO-d6) ;2.10(s,3H, CH_3), 4.59(S,2H, CH_2), 6.81-7.10(m,4H, Ar-H), 6.90-7.16(m,4H, Ar-H), 9.57-(s,H,N-H), 9.31(s,H,-OH)

*IR(KBr) (cm^{-1} 3362(Ar-OH); 1690(C=O), 3016(N-H)

Table 2: N-[5-(2-hydroxy phenyl)-1,3,4-oxadiazol-2-yl] fungicidal screening data [4a–e] 2-Phenoxyacetamide

Average % inhibition against						
Compound No.	Collectorichum falcatum			Fusarium oxysporum		
	1000 ppm	100 ppm	10 ppm	1000 ppm	100 ppm	10 ppm
4a	63	34	26	61	36	29
4b	89	72	56	90	69	55
4c	93	79	61	91	74	59
4d	86	73	58	87	69	57
4e	66	36	29	68	41	33
Dithane M-45	100	86	70	100	85	66

This describes generating and testing various new 1,3,4-oxadiazole derivatives for antifungal activity. This study's semi carbazide (2) was cyclized with o-hydroxy aromatic acid (1), H_2SO_4, and ethanol to give 2-Amino-5-[2-hydroxy phenyl]-1,3,4-oxadiazole (3). Combining chemical (3) with aryloxy acetyl chloride yielded the corresponding N-[5-(2-hydroxyphenyl)-1,3,4-oxadiazol-2-yl]. the adenosyl-acetate phenoxy group (a-e). IR, 1H NMR, and elemental analysis validated compound structures..

CONCLUSION

All of the investigated drugs exhibited high to moderate action, according to the fungicidal findings. It is noteworthy that all of the examined compounds' antifungal results [4a–e] show substantial antifungal activity against Fusarium oxysporum and Collectorichum falcatum at 1000 ppm, however their activity decreases at lower dosages, such as 100 ppm and 10 ppm. It is noteworthy that the inclusion of additional electronegative oxophores (Cl and NO2) improves the antifungal properties of all the title compounds. These chemicals damage the fungal cell wall, which has an impact on the fungi's metabolism. Compound structures were verified by means of infrared (IR), nuclear magnetic resonance (1H NMR), and elemental analysis.

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