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TAMARIND PULP CATALYSED SYNTHESIS OF N, 7-BIS (SUBSTITUTED PHENYL)-4,7 DIHYDRO-5 ISOPROPYL [1,2,4] TRIAZOLO [1,5-A] PYRIMIDINE-6-CARBOXAMIDE DERIVATIVES AS ANTIMICROBIAL AGENTS

Jitendra Kumar*[1] Rajani Singh[2]

[1,2]Department of Chemistry, T.D.P.G. College, Jaunpur, Uttar Pradesh, India, jkfd.1560@gmail.com

Abstract

[1,2,4] triazolo [1,5-a] pyrimidine skeletons are widely used to design many antimicrobial agents. Therefore the synthesis of N-7 bis (substituted pheny) 4,7-dihydro-5-isopropyl –[1,2,4-triazolo-[1,5-a] pyrimidine-6-carboxamide (Pc-1 to Pc-10) was accomplished from 3-amino-1,2,4 triazole, N-(substituted p-chlorophenyl) 4-methyl-3-oxo. pentanamide and aldehydes in domestic micro woven for 10min. Synthesized aromatic compounds (Pc 1 to Pc10) were characterized by elemental analyses, M.P., I.R. and ^{1}HNMR spectroscopic studies. All newly synthesized compounds were assessed for their antibacterial and antifungal activity.

Keywords: *3-amino-1,2,4 triazole, N-(substituted p-chlorophenyl)-4-methyl-3-oxo-pentanamide, termarind juice, antibacterial, antifungal*

Introduction:

[1,2,4] triazolo [1,5-a] pyrimidine is an important class of bicyclic N-heteroarenes exhibits versatile bioactivities. Now days various research in medical science in pharmaceutical sector antimicrobial drugs remains the main backbone for cancer treatment. Triazolo pyrimidines and their structures corresponding with nucleoside analogus exhibit various pharmacological properties[1]. It was found that triazolo pyrimidines are purine isosteric analogus. Triazolo pyrimidines derivatives e.g. triazolo pyrimidines 2-sulphonamide is herbicides widely used as agrochemicals. Triazolo pyrimidines alter protein metabolism and it's biosynthesis e.g. Trapidil. Pyrimidines compounds are incorporate in pyrimidine monophosphates, serving as intrinsic metabolic intermediates and influencing intracellular biochemical transformations such as nucleic acid synthesis. It possesses many pharmacological properties such as antiviral[2], antitumor[3], antimicrobial[4], antiparkinsonism[5] and participates in synthesis of some new molecules[6]. A number of pyrimidines derivatives are act as anti-cancer agent[7-9] compounds [1,2,4]tirazo[4,3-a]pyrimidines ring system have anti-tumor activity[10-12]. Glucoside containing ring have significant anticancer activity[13].

Triazolo benzimidazole modified compound such as 1-acyl-2-alkyl-thio-1,2,4-triazolo benzimidazoles showed analgesic and anti-inflammatory activities[14]. New 1,2,4-triazole derivative such as 12-methoxy-13methyl-furochromeno[3, 2-c] [1,2,4] triazolo [1,5-c] pyrimidines act as good antimicrobial agent[15]. Multitude of fused ring 1,2,4-triazole derivatives exhibits anti-inflammatory activity along with other pharmacological properties. 3– (substituted-Phenyl)–6–(p-tolyl) –3, 3a–dihydro–2H–parazolo [3′, 4′, 4, 5] thiazolo [3, 2-b] [1, 2, 4] triazole shows good inflammatory activity. When pyrol or indole combines with 4-amino-1,2,4-triazole-3thiol produced 4-amino-5-heteryl-1,2,4-triazole-3-thiols which react with aryl carboxylic acid form [1,2,4] triazolo [3,4-b] 1,3,4-thiadiazole[16]. The series of 3-[2-bromo-4-methoxyphenyl)-6-subsituted [1,2,4] triazole [3,4-b] [1,3,4] thiadiazole showed significant antioxidant activity. This might be due to presence of strong electron with drawing group or p-substituted phenyl group[17]. Several thiofuran [2, 3-d] pyrimidine such as 3-phenyl-5-(thiophene-2-yl) thiofuran [3,2-e]1,2,4-triazolo[4,3-c] pyrimidine and thieno[3,2-e] triazolo [4,3-c] pyrimidine derivative have good antibacterial action in contrast to B.subtills and S. aureus from gram +ve series of bacteria[18]. Triazolo pyrimidines derivatives possessing improved biological activity and exist in four isomeric structures. Among them 1,2,4-triazolo [1,5-a] pyrimidines derivative are more stable against thermal changes. These compounds are more potent against various species of bacteria various and fungi[19].

Triazole compound showed anticancer potential and more strong blockers of HEPG2 & functional for human colon cancer cell culture[20]. When Derivative of piperidinium (Z)-N′-(4-aminic-5-(4-pyridyl)-4H-1,2,4-triazol-3-yl) carboamimidothioate react with substituted benzaldehyde produced Polycyclic system of (E)-1-(p-methoxy benzalidene amino)-2-(4-pyrimidyl)- 1H -[1,2,4] triazolo [1, 5-b] [1, 2, 4] thiazole-6-thiol[21]. The triazolopyrimidine analogs are produced through a single-step, three-component procedure involving heteroaromatic aldehyde, 3-amino-1,2,4-triazole, and 3-cyanoacetylindole. The reaction pathway proceeds via Knoevenagel condensation, Michael-type conjugate addition, and intramolecular cyclization, affording molecules exhibiting notable antiproliferative efficacy against tumor-derived cultures such as human colon cancer cells and breast adenocarcinoma cell line, with therapeutic ratios comparable to doxorubicin.

Compounds of triazolo pyrimidines are major constituents of blood pressure regulators[22], antibacterial agent[23], antidiabetic[24], protein kinase inhibitor[25] and macrophage activators[26]. [1,24]triazolo[1,5-d] pyridine were synthesized with various organic and inorganic catalyse resulting variable yields from 40% to 96%. 5-methyl-N7-diphenyl-4,7-(dihydro)-triazole[1,5-a] pyrimidine-6-carboxamide possess various biological activities[27]. N-7-bis(substituted phenyl)-4,7-(dihydro)-5-isopropyl-triazolo[1,5-a] pyrimidine-6-carboxamide exhibited good anti-bacterial and antifungal activities[28]. Phenyl-[1,2,4] triazolo [1, 5, A] pyrimidine-6-carboxamide molecules are best known for blood pressure regulator[29], antiproliferative agents[30]. Some derivatives of this compound inhibit DNA-gyrase/topoisomerase activities which other derivative interfere with bacterial protein synthesis.

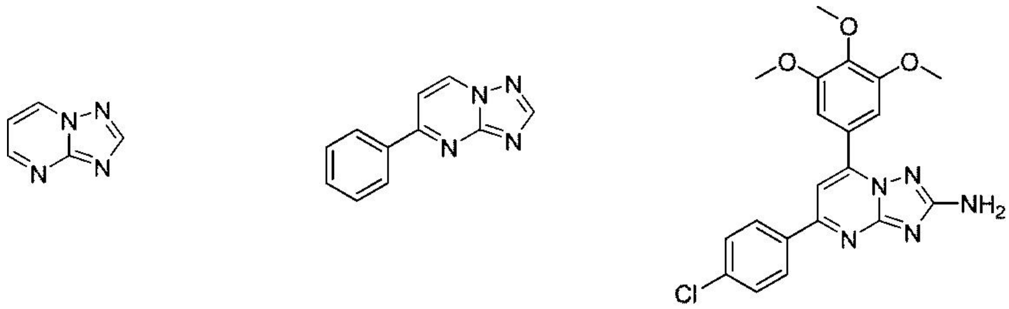


Fig. 1: Biologically active [1,2,4] triazolo [1,5-a] pyrimidine compounds

3,4 diamino-bis-1,2,4 triazole synthesized 1,2,4-triazoles molecule by condensation of terphthalic acid with ethyl alcohol which combined with $N_2H_4.xH_2O$ in EtOH provide Benzene-1,4-dicarbohydrazide[31]. Muna G. Dahee et al.[32] had synthesized poly fused heterocyclic compounds using lemon juice as catalyst (Biginelli reaction).

[1,2,4] triazolo [1,5-a] pyrimidine indole molecules shows anticancer & antiproliferative properties. These compounds behave as cytotoxic agent and inhibit the development of MCF-7 cells and HCT-116 cells[33]. N-7-bis (substituted phenyl)-4,7-(2H)-5-iso-propyl [1,2,4] triazolo [1,5-a] pyrimidine-6-carboxamide derivative shows strong potency against antibacterial and antifungal activity than standard drugs[34].

1,2,4-triazolo [4, 3-a] pyrimidines derivatives prepared on hard support reaction of 3-oxo-N-(N-(3-oxo morpholino) phenyl) butanamide, 5-amino-1,2,4 triazole with various substituted aldehyde through solid phase reaction procedure[35]. phenyl [1, 2, 4] triazolo [1, 5-a] Pyridine 6-carboxamide prepared using MC S of acetoaldehyde, 3-amino [1,2,4] triazole & Carbonyl compounds prepared via diverse catalytic systems e.g. p-toluene sulfonic acid[36], HCl[37], maltose[38] and triethylaminium-N. sulfonic acid tetrachloro aluminate[39].

Material & Method:

All reagents and chemical were synthetic grade (S.D. Fine Chemicals Ltd. Mumbai, India) and used without any purification/adultations. Fruits and biocatalyst were procured from fruit Mandi Jaunpur/Varanasi.

Melting points of synthesized compounds were recorded by open capillary tube method and are uncorrected. Infrared spectra (FT-IR) were studied on Shimudzu-FT-IR 8300 spectrophotometer in KBr disc which value are presented in cm^{-1}. Proton nuclear magnetic resonance spectra were acquired using a Bruker AC 40w-MHz instrument with tetramethylsilane serving as the reference compound in deuterated dimethyl sulfoxide[40].

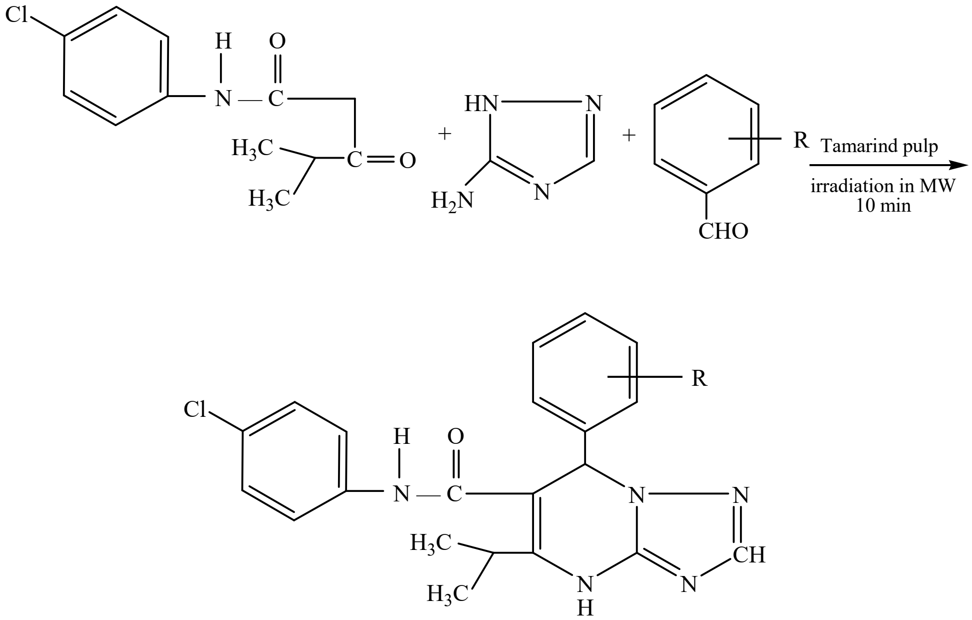
Preparation of tamarind pulp:

Fresh (Tamarindus indica) unripe mature fruits were obtained from Jaunpur fruit mandi (U.P.). It was wash thoroughly water and surface water removed with cotton cloths. Fruit cut into small pieces and kept in bowl. Along with appropriate quantity of hot water kept in 30 min at 40-50ºC on water bath. Mash the fruit piece with hand palm to release pulp and seed. Filter pulp with fine mesh sieve and stored pulp at 4ºC for synthesis of compounds.

Synthesis Procedure:

3-amino-1,2,4-triazole (0.01M), N-(substituted p-chlorophenyl) 4-methyl-3-oxo-pentanamide (0.01M) & different aryl aldehyde (0.01M) mixed with 9.5 ml tamarind pulp extract into 250ml conical flask. Conical flask kept into domestic micro oven and irradiated for 10 min. Progress of reaction checked by TLC. After completion of reaction, 10ml ethanol pours into cooled reactant after 12hrs cooling. Reaction mixture was filtered and recrystallized with ethenol and obtain target compound and their derivatives. Previously these compounds were prepared with DMF. We have used fruit juice under MW irradiation which minimize reaction duration and better yield of product resulted. The synthesized compounds were characterized by their M.P., yield elemental analysis (table 2) and spectral studies (table 3).

The synthesis of N-7-(bis)(substituted phenyl)-4,7 dihydro-5 isopropyl [1,2,4] triazolo [1,5-a] pyrimidine-6-carboxamide is presented in scheme 1.



Scheme 1: Synthesis of N-7(bis)(substituted phenyl)-4,7 dihydro-5 isopropyl [1,2,4] triazolo [1,5-a] pyrimidine-6-carboxamide

For standardization of catalyst potency optimization of tamarind pulp performed as shown in table 1.

Table-1: Optimisation of Reaction (R = 4 Cl) with catalyst

S.No.	Catalyst	Quantity used (ml)	Duration of reaction (min.)	Reaction condition	Yield (%)
1	Tamarind pulp	2	30	Refluxed MW	–
2	Tamarind pulp	4	30	Refluxed MW	–
3	Tamarind pulp	6	20	Refluxed MW	25
4	Tamarind pulp	8	15	Refluxed MW	42

5	Tamarind pulp	10	10	Refluxed MW	77
6	Tamarind pulp	12	10	Refluxed MW	76
7	Tamarind pulp	14	10	Refluxed MW	71

M.P. yield and elemental analysis of synthesized compounds performed which statistics has offered in table 2.

Table 2: Physical data of synthesized derivatives

Comp. Code	R	Molecular formula	Yield %	M.P. °C		Elemental Analysis	
						N	C
						Calcd. (Found)	Calcd. (Found)
				Obs.	Rep.		
PC1	4-Cl	$C_{29}H_{19}ClN_5O$	76	203	202[34]	16.40 (16.35)	71.23 (71.27)
PC2	4-CH_3	$C_{22}H_{22}ClN_5O$	69.5	181.6	181[34]	16.38 (16.35)	64.78 (64.77)
PC3	2-OCH_3	$C_{22}H_{22}ClN_5O_2$	79.5	258	257[34]	16.50 (16.52)	63.33 (63.31)
PC4	2-NO_2	$C_{21}H_{19}ClN_6O_3$	73	221.6	222[34]	19.18 (19.15)	57.46 (57.45)
PC5	4-F	$C_{21}H_{19}ClFN_5O$	84	262.1	261[34,30]	17.03 (17.0)	61.23 (61.22)
PC6	3-NO_2	$C_{21}H_{19}ClN_6O_3$	73	202	201[34,30]	19.18 (19.15)	57.46 (57.44)
PC7	3-Cl	$C_{21}H_{19}Cl_2N_5O$	61	244.6	244[34]	16.41 (16.35)	59.01 (59.02)
PC8	2-NO_2	$C_{21}H_{19}ClN_6O_3$	66.2	217.2	216[34]	19.18 (19.15)	57.46 (57.47)
PC9	4-OH	$C_{21}H_{20}ClN_5O_2$	68	199.5	199[34]	17.11 (17.09)	61.53 (61.51)
PC10	3-Br	$C_{21}H_{19}BrClN_5O$	74	183.5	183[34]	14.80 (14.81)	53.33 (53.35)

Table 3: Spectral characterization of synthesized compounds

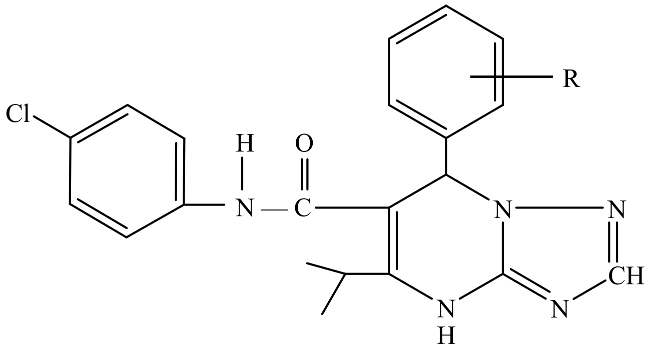


Fig. 2

Where,R = 4-CH_3, 4-Cl, 2-NO_2, 2-OCH_3, 3-NO_2, 4-F, 3-Cl, 4-OH, 3-Br, 2-NO_2,

Comp. Code	R	IR (KBr) cm^{-1}	^{1}H-NMR (DMSO-d_6) ppm
PC1	4-Cl Ph	3346 (–NH), 3075 (–CH aromatic), 2905 (–CH symmetrical CH_3), 2810 (–CH asymmetrical CH_3), 1691 (C=O amide), 1595 (C=N), 1530 (N–H), 1496 (C=C aromatic), 1384 (C–H unbalanced CH_3 group), 1315 (C–H balanced C-H_3) 1250 (CN), 1095 (C–H plane aromatic), 830 (C–H out of plane), 664 (C–Cl)	1.14-1.16 (d, 3H, H_a), 1.26-1.28 (d, 3H, H_b) 3.21-3.28 (m, 1H, H_c), 6.52 (s, 1H, H_d), 7.12-7.16 (m, 2H, H_{ee}), 6.19-6.23 (m, 2H, H_{ff}), 6.28-6.31 (d, 2H, H_{gg}), 6.50-6.49 (d, 2H, H_{hh}), 7.65 (s, 1H, H_i), 9.03 (s, 1H, H_j), 9.08 (s, 1H, H_k)

PC2	4-CH_3 Ph	3381 (–NH), 3025 (–CH aromatic), 2973 (–CH asymmetrical CH_3), 2870 (–CH asymmetrical CH_3), 1670 (C=O amide), 1548 (C=N), 1522 (N–H PYri), 1490 (C=C aromatic), 1400 (C–H asymmetrical CH_3 group), 1345 (C–H symmetrical CH_3) 1240 (C–N), 1135 (C–H plane aromatic), 830 (C–H out of plane), 663 (C–Cl)	1.00-1.18 (d, 3H, H_a), 1.27-1.29 (d, 3H, H_b) 2.24 (st, 3H, H_c), 3.25-3.31 (m, 1H, H_d) 6.49 (s, 1H, H_e), 7.04-7.09 (m, 4H, $H_{ff\text{-}gg'}$), 7.30-7.32 (d, 2H, H_{hh}), 7.54-7.56 (d, 2H, H_{ii}), 7.66 (s, 1H, H_j), 9.95 (s, 1H, H_k), 9.09 (s, 1H, H_l)
PC3	2-OCH_3 Ph	3295 (H–N), 3072 (C–H Ar), 2998 (H–C asymmetrical CH_3), 2871 (H–C asymmetrical CH_3), 2997 (C–H asymmetrical CH_3), 2870 (C–H asymmetrical C–H_3), 1635 (C=O amide), 1596 (CN triazole), 1560 (N–H PYri), 1487 (C=C aromatic), 1392 (asymmetrical CH_3 group), 1341 & 1301 (C–NO_2) 1240 (C–O–C OCH_3) 1239 (C–N), 1210 (C–O–C), 1336 (C–H aromatic plane), 1017 (C–O–C for OCH_3) 830 (C–H out of plane), 665 (C–Cl)	1.11-1.16 (d, 3H, H_a), 2.30-2.32 (d, 3H, H_b), 3.30-3.32 (m, 1H, H_c), 3.66 (s, 3H, H_d), 5.51 (s, 1H, H_e), 5.85-6.88 (d, 2H, H_{ff}), 6.12-7.14 (d, 2H, H_{gg}), 6.55-7.59 (d, 1H, H_h), 6.66 (s, 1H, H_i), 6.87-6.91 (m, 2H, H_{jk}) 7.56 (s, 1H, H_j), 9.04 (s, 1H, H_m), 9.39 (s, 1H, H_n)
PC4	2-NO_2 Ph	3310 (H–N), 3079 (H–C Ar), 2910-2800 (H–C asymmetrical CH_3), 1682 (O=C), 1590 (N=C), 1532 (H–N), 1256 (C–N), 669 (C–Cl)	0.10-0.15 (d, 3H, H_a), 1.22-1.24 (d, 3H, H_b), 3.25-2.26 (m, 1H, H_c), 6.54 (s, 1H, H_d), 6.10-6.14 (m, 2H, H_{ee}), 6.16-6.21 (m, 2H, H_{ff}), 6.28-6.30 (d, 2H, H_{gg}), 6.46-6.48 (d, 2H, H_{hh}), 7.68 (s, 1H, H_i), 9.07 (s, 1H, H_j), 10.06 (s, 1H, H_k),
PC5	4-F Ph	3362 H–N), 3055 (H–C Ar), 2918-2807 (H–C asymmetrical CH_3), 1652 (O=C), 1969 (N=C), 1528 (H–N), 1241 (C–N), 653 (C–Cl)	0.97-1.14 (d, 2H, H_a), 1.22-1.24 (d, 3H, H_{bb}), 3.22-2.26 (m, 1H, H_c), 6.54 (s, 1H, H_d), 6.14-6.18 (m, 2H, H_{ee}), 6.17-6.21 (m, 2H, H_{ff}), 6.25-6.27 (d, 2H, H_{gg}), 7.51-7.52 (d, 2H, H_i), 09.07 (s, 1H, H_j), 10.12 (s, 1H, H_k),
PC6	3-NO_2 Ph	3296 (H–N), 3056 (H–C Ar), 2995 (H–C asymmetrical CH_3), 1640 (O=C amide), 1601 (C=N triazole), 1566 (N–H pyrimidines), 1315-1296 (C–NO_2), 1206 (C–O–C), 690 (C–Cl)	0.98-1.11 (d, 2H, H_a), 1.20-1.23 (d, 3H, H_{bb}), 3.25-3.28 (m, 1H, H_c), 5.56 (s, 1H, H_d), 6.16-7.20 (m, 2H, H_{ee}), 7.21-7.24 (m, 2H, H_{ff}), 7.26-7.28 (d, 2H, H_{gg}), 7.50-7.51 (d, 2H, H_h), 10.06 (s, 1H, H_i), 10.14 (s, 1H, H_j),
PC7	3-Cl Ph	3291 (H–N), 3071 (H–C Ar), 2900-2788 (H–C asymmetrical CH_3), 1670 (O=C amide), 1579 (C=N), 1528 (N–H), 672 (C–Cl), 649 (C–Cl),	1.08-1.11 (d, 3H, H_a), 1.19-1.21 (d, 3H, H_{bb}), 3.19-3.22 (m, 1H, H_c), 5.49 (s, 1H, H_{dd}), 6.06-6.10 (m, 2H, H_{ee}), 6.12-6.16 (m, 2H, H_{ff}), 6.21-6.23 (d, 2H, H_g), 6.40-6.42 (d, 2H, H_{hh}),

			6.61 (s, 1H, H_j), 09.01 (s, 1H, Hj) 09.08 (s, 1H, H_k),
PC8	2-NO_2 Ph	3109 (N–H), 3060-3039 (CH asymmetrical C–H_3), 1628 (CO amide), 1595 (CN triazole), 1554 (NH pyrimidines), 1463 (C=C aromatic) 1310-1286 (C–NO_2) 1202 (C–O–C), 654 (C–Cl),	0.99-1.10 (d, 2H, H_a), 1.21-1.23 (d, 3H, H_{bb}), 3.23-3.28 (m, 1H, H_{cc}), 6.52 (s, 1H, H_d), 6.11-6.15 (m, 2H, H_{ee}), 7.17-7.22 (m, 2H, H_{ff}), 6.24-6.26 (d, 2H, H_{gg}), 6.49-6.50 (d, 2H, H_h), 10.04 (s, 1H, H_i), 10.16 (s, 1H, H_j),
PC9	4-OH Ph	3313 (H–N), 3082 (H–C Ar), 2905-2806 (H–C asymmetrical CH_3), 1675 (O=C amide), 1581 (C=N triazole), 1526 (N–H), 1241 (C–N), 661 (C–Cl)	1.13-1.16 (d, 3H, H_a), 1.22-1.24 (d, 3H, H_b), 3.19-3.24 (m, 1H, H_c), 6.53 (s, 1H, H_d), 6.11-6.15 (m, 2H, H_{ee}), 6.19-6.21 (m, 2H, H_{ff}), 6.23-6.25 (d, 2H, H_{gg}), 6.50-6.51 (d, 2H, H_h), 10.02 (s, 1H, H_i), 09.09 (s, 1H, H_j),
PC10	3-Br Ph	3190 (N–H), 3047-2991 (C–H asymmetrical CH_3), 1645 (C=O amide), 1590 (C=N triazole), 1565 (N–H pyrimidines), 1476 (C=C aromatic) 1310-1292 (C–NO_2) 1209 (C–O–C), 813 (C–Br) 693 (C–Cl),	1.06-1.09 (d, 3H, H_a), 1.16-1.18 (d, 3H, H_{bb}), 3.14-3.17 (m, 1H, H_c), 6.38 (s, 1H, H_{dd}), 6.09-6.13 (m, 2H, H_{ee}), 6.10-6.14 (m, 2H, H_{ff}), 6.19-6.21 (d, 2H, H_g), 6.41-6.43 (d, 2H, H_{hh}), 6.59 (s, 1H, H_j), 10.07 (s, 1H, H_j) 10.13 (s, 1H, H_k),

Antibacterial Activity:
Antibacterial activity was tested using cup-plate diffusion technique[41] using Agar as nutrient. Gram +ve *B. subtilis* & Gram –ve *Proteus mirabilis* microbes selected for this study. The DMF was used to prepare the solution of compounds and control (std. drug)

The antibacterial properties of each synthesized compounds and the control (ciprofloxacin) were tested at concentration of 25 50 and 100 in µg/mL. Agar nutrient media was melted and transferred into petri-dishes in inverted condition in the incubator for 2.5hrs. Prepared solutions of concentration 25, 50 and 100 in µg/mL of each synthesized compounds and control. Sub-cultured bacterial organisms were spread on surface of medium petri dishes sterilized triangular loop. The cavities were bored with sterilized borer (8mm dia). The solutions of difference concentrations of all synthesized compounds and control were placed serially in cavities with the help of micro pipett. The plates were incubated at 37^{0}C for 34 hrs. after it zone of inhibition around each cup was measrured in mm (table 6).

All compounds PC_1 to PC_{10} were assessed for their antibacterial efficacy against gram positive B.subtilis & gram negative Proteus mirabilis microbes. The results are given in Table 4.

Table 4: Antibacterial screening of synthesized derivative

Compound Code	**Zone of inhibition (mm)**					
	Bacillus subtilis			***Proteus mirabilis***		
	Concentration used (g mL^{-1})			**Concentration used (g mL^{-1})**		
	25	50	100	25	50	100
PC_1	15	18	25	13	16	22
PC_2	17	10	28	16	19	26
PC_3	16	21	30	16	20	28
PC_4	21	27	35	18	24	32
PC_5	23	29	36	21	27	34
PC_6	22	28	36	20	26	35
PC_7	14	18	24	12	16	22
PC_8	16	21	32	16	20	31
PC_9	14	20	29	13	17	27

PC$_{10}$	16	25	37	15	24	36
Ciprofloxacin (Standard drug)	**22**	**31**	**42**	**20**	**29**	**38**

It is concluded from above result compound containing NO$_2$, F and Br substituted in aromatic ring exhibit potent zone of inhibition incomparision to other substituents. Thus compound PC$_4$, PC$_5$, PC$_6$, PC$_8$ and PC$_{10}$ exhibit strong antibacterial properties than other derivatives.

Antifungal activity:

All the synthesized compounds were evaluated for their antifungal activities against Aspergillus fumigatus and Botrytis fabae by cup plate agar diffusion technique[41] using sabouraud's dextrose agar media. The synthesized compounds were tested at different concentration 25 50 and 100 in µg/mL. The results were compared with the standard drug Griseofulvin tested under similar conditions. The solutions were prepared in DMF solvent.

The sterilized dextrose agar media was melted and poured in sterilized petri dishes to solidify. The fungal suspension were spread on the surface of dextrose media taken in petri dishes with the help of triangular loop. The cavities were bored. The solutions of different concentration of synthesized compounds and standard drug were placed in cavities serially with micro pipette. The dishes were incubated at 38^0C for 48 hrs. The zone of inhibition around each cup were measured in mm (table 5).

Table 5: Antifungal screening of synthesized derivative

Compound Code	**Zone of inhibition (mm)**					
	Aspergillus fumigatus			***Botrytis fabae***		
	Concentration used (g mL^{-1})			**Concentration used (g mL^{-1})**		
	25	50	100	25	50	100
PC$_1$	20	31	43	21	29	39
PC$_2$	14	24	30	15	22	28
PC$_3$	16	26	31	14	23	29
PC$_4$	15	21	30	16	20	31
PC$_5$	22	29	38	21	30	40
PC$_6$	16	21	29	17	21	32
PC$_7$	23	30	41	19	29	38
PC$_8$	17	22	30	14	18	27
PC$_9$	21	26	39	22	31	39
PC$_{10}$	20	28	38	21	30	38
Griseofulvin (Stand. drug)	**26**	**34**	**48**	**23**	**32**	**42**

It was observed that compound code PC$_1$, PC$_5$, PC$_7$ and PC$_{10}$ are more potent against propagation of *A. fumagatus* and *B. fabae* fungi. Mostly these compound possess halogen substituted in aromatic ring[41].

Conclusion

Synthesis of triazolopyrimidines derivatives with eco-friendly methods is multicomponent one pot synthesized through MW irradiation in presence of tamarind pulp. Application of biocatalyst is unique effort for this synthesis which produced better yield of synthesized compounds. Synthesized derivatives exhibited more potent antimicrobial properties. Some synthesized compounds are building blocks for preparation of new molecules.

References

1. Gouda, M.A., A.A. Abu-Hasem, H.A.R. Hussein, A.S. (2020). Lett. Org. Chem. 17(29), 897-925.
2. Al-Mohizea A.M., Al-Omax M.A., Abdalla M.M. Amr, A.G. (2012). Int. J. Biol. Macromol. 50, 171-179.

3. Mohamed, A.M., El-Sayed W.A., Alsharari, M.A., Al-Qalawi, H.R., Germoush, M.O. (2013). Arch. Pharm. Res. 36, 1055-1065.
4. Hassan A.S., Abu-Melha, H.M., Al-Omar M.A., Amr-Ad G. (2012). Molecules 17, 13642-13655.
5. Al-Harbi N.O., Bahashwan, S.A., Fayed, A.A., M.S. Amr A.G. (2013). Int. J. Biol. Macromol. 57, 165-173
6. Wannberg, J., Dallinger, D., Kappe, C.O., Larhed, M. (2005). J. Comb. Chem. 7, 574-583.
7. Vander Wel, S.N., Harvey, P.J., McNamara, D.J., Repine, J.T., Keller, P.R., Quin, J., Booth, R.J., Elliott, W.L., Dobrusin, E.M., Fry, D.W., Toogood, P.L. (2005). J. Med., Chem., 2371-2378.
8. Toogood, P.L., Harvey, P.J., Reipine, J.T., Sheehan, D.J., Vander Wel, S.N., Zhou, H., Keller, P.R., McNamara D.J., Sherry, D., Zhu, T., Brodfuehrer, J., Choi, C., Barvian, M.R., Fry, D.W. (2005). J. Med., Chem., 2388-2396.
9. Palmer, B.D., Smaill, J.B., Rewcastle, G.W., Dobrusin, E.M. Kraker, A, Moore, C.W., Steinkampf, R.W., Denny, W.A. (2005). Bioorgan. Med. Chem. Letter. 15, 1931-1935.
10. Janaki, S. Chauhan & Haresh K. Ram (2019). IJSRSET 6(3), 390-396.
11. Zhao, X.L., Zhao, Y.F., Guo, S.C., Song, H.S., Wang, D., Gong, P. (2007). Molecules, 12, 1136-1146.
12. Hafez, H.N., El-Gazzar, A.B.A. (2009). Bioorg., Med., Chem., Lett., 19, 4143-4147.
13. Shawali, A.S., Sherif, S.M., Darwish, M.A.A., El-merzabani, M.M. (2010). Arch. Pharm. Res., 33, 55-60.
14. Mohamed, B.G., Ahm, AAMA, Hussein, M.A. (2006). Acta Phamaceutical, 56, 31-48.
15. Ameen Ali, Abu-Hashem, Sami, A., Al-Hussain (2022). Pharmaceuticals 15(10), 1232.
16. Andrey Gotsulya, Yevhen Zaika and Tetiana Brytanova (2002). J. Fac. Pharm. Akara 46(2), 308-321.
17. Chidananda N. Poojary, B. Sumangala V., Kumari N.S., Shetty, P., Arulmoli, T. (2012). Eur. J. Med. Chem. 51, 124-136.
18. Virupakshi Prabhakar, Sudhakar B. Kandra, Srinivasula R. Maddula, Parandhana G and Latha J. (2016). Org. Chem. Curr. Res. 5(3), 1-12.
19. Sagar P. Gami, Kalpesh V. Vilapara, Hasmukh R.K. Jayesh S.B., Yogesh T. Naliapara (2014). International Lett. of Chem. Phys. and Astronomy, 30, 127-134.
20. Farghaly, T.A.E., Abdullah, M.A. and Mohammad, H.K. (2015). Turk, J. Chem. 39, 955-969.
21. Mukhlif, M. Slaihim, Fouad, S.R. Al-Suede, Melati Khairuddean, Siti, B.H. Sultan, *et al.* (1945). https//orcid.org/0000-0003-1816-6722.
22. Y. Sato, Shimoji, H., Fujita, H. Nishino, H. Mizuro, S. Kobayashi and s. Kumakura (1980). J. Med. Chem. 23, 927.
23. H.M. Abdel, Rahman, N.A. El. Koussi and H.Y. Hassan (2009). Arach. Pharm. Chem. Life Sci., 342, 94.
24. R. Kakavand, S. Cobra A., U.G. Jolodar, F. Shivini and H. Tajik (2022). J. Iran Chem. Soc. 19, 2929-2948.
25. M. Fraley, W. Hoffman and R. Rubino (2002). Bioorg. Med. Chem. Lett., 12, 2767.
26. B. Adrom, N. Hazeri, M. Lashkari and M.T. Maghsoodlou (2016). J. Chem. Res. 40(8), 458-460.
27. Ahmad Reza M Zare, Raha Najofi, Hamid G.Z. (2024). RSC Advances 14, 19167-19173.
28. Ahmad Reza M Zare, Raha Najofi, Hamid G.Z. (2024). RSC Advances 14, 19167-19173.
29. Y. Sato, Y. Shimoji, H., Fujita, H., Nishino, H., Mizuno, S.Kobayashi and S. Kumakura (1980). J. Med. Chem. 23, 927.
30. X. Huo, Y. Ma, Z. Chen, L. Yuan, X. Zheng, X. Li, F. Liang, W-You & P. Zhao (2021). Chemistry select, 6, 4562-4565.
31. Khalid Mahmod Daoud, Mahanad Yakdhan Saleh and Shaima Samer Ismael (2017). Diyala J. for Pure Science 13(3), 72-87.
32. Muna, G. Dahee, Shaymaa, K. Younis (2024). Iraqi National J. of Chem. 24(1), 47-55.
33. Guang Xi Yu, Ying Hu, Wei Xin Zhang, Xin Y.T., Sai, Y.Z., Yan Zhang, Shuo Yuan and Jian Song (2022). Molecules 27, 4996.
34. Janaki H. Chauhan, Haresh K. Ram (2019). I.J.S.R.S.E.T. 6(3), 390-396.
35. Shobhana, A. Gadara & Kartik D. Ladra (2020). Asian J. Chem. 32(9), 2298-2302.
A. Shaabani M., Seyyedhamzeh, N. Ganji, M.H. Sangachin and M. Armaghan (2015). Mol. Diversity 19, 709-715.
36. V.P. Gilava, P.K. Patel, H.K. Ram and J.H. Chauhan (2020). Rasayan, J. Chem. 13(4), 2249-2255.
37. B. Adrom, N. Hazeria, M. Lashkarib and M.T. Maghsoodlou (2016). J. Chem. Res. 40, 458-460.
A. Kargar, S.S. Sajadikhan and A. Zare (2019). Org. Chem. Res. 5(1), 105-111.
38. Pal, R.A. (2013). Int. J. Chem. Tech. Appl., 2, 26-40.
39. Mounyr Balouiri, Moulay Sadiki, Saad Koraichi Ibnsouda (2016) Journal of Pharmaceutical Analysis, 6, 71–79.