3. EXPERIMENTAL


A series of fourteen 1-cyclopropyl-2-(2-fluorophenyl)-3,5-diphenylpentane-1,5-diones were synthesized by simple one-pot solvent free grinding technique. The equimolar mixture of respective cyclopropyl 2-fluorobenzyl ketone (2 mmol), acetophenone (2 mmol), bezaldehydes (2 mmol) and sodium hydroxide was ground together in mortar with pestle at room temperature for five minutes. The reaction mixture was kept aside for half an hour at room temperature. The completion of reaction was monitored by TLC and after the completion of the reaction; the reaction mixture was treated with ice cold distilled water. The solid that separated was filtered, dried and recrystallized from ethanol.

3.1.1. 1-cyclopropyl-2-(2-fluorophenyl)-3,5-diphenylpentane-1,5-dione (106).

Yield: 87%; M.P.: 152-154°C; FT-IR(KBr, cm⁻¹): 1690 (C=O), 3084-3031 (Aromatic C-H), 2920-2895 (Aliphatic C-H); ¹H NMR(CDCl₃, 400 MHz, ppm): δ = 4.75 (d, 1H, H₇₂), 4.18 (m, 1H, H₇₃), 3.25 (dd, 1H, H₇₄a), 2.91 (dd, 1H, H₇₄b), 1.72 (m, 1H), 0.44-0.79 (m, 4H), 7.06-7.68 (m, 14H); ¹³C NMR (CDCl₃, 100 MHz, ppm): δ = 208.06 (Carbonyl C-1), 198.31 (Carbonyl C-5), 55.62 (C-2), 43.18 (C-3), 42.29 (C-4), 21.78 (cyclopropyl C'-1), 11.20, 10.61 (cyclopropyl C'-2, C'-3), 162.45-115.48; Mass (m/z): 409 (M+Na), 387 (M+1).
3.1.2.1-cyclopropyl-2-(2-fluorophenyl)-3-(4-fluorophenyl)-5-phenylpentane-1,5-dione (107).

Yield: 82%; M.P.: 138-140°C; FT-IR (KBr, cm⁻¹): 1687 (C=O), 3058-2997 (Aromatic C-H), 2926-2854 (Aliphatic C-H); ¹H NMR(CDCl₃, 400 MHz, ppm): δ = 4.70 (d, 1H, H₇₂), 4.17 (m, 1H, H-3), 3.21 (dd, 1H, H₄a), 2.90 (dd, 1H, H-4b), 1.72 (m, 1H), 0.49-0.82 (m, 4H), 6.89-7.68 (m, 13H); ¹³C NMR (CDCl₃, 100 MHz, ppm): δ = 207.96 (Carbonyl C₁), 198.19 (Carbonyl C₅), 55.75 (C₂), 42.37 (C₃), 42.20 (C₄), 21.74 (cyclopropyl C'-1), 11.33, 10.77 (cyclopropyl C'-2, C'-3), 162.73-115.04; Mass (m/z): 427 (M+Na), 405 (M+1).

3.1.3.3-(4-chlorophenyl)-1-cyclopropyl-2-(2-fluorophenyl)-5-phenylpentane-1,5-dione (108).

Yield: 94%; M.P.: 146-148°C; FT-IR(KBr, cm⁻¹): 1695 (C=O), 3079-3004 (Aromatic C-H), 2928-2843 (Aliphatic C-H); ¹H NMR(CDCl₃, 400 MHz, ppm): δ = 4.69 (d, 1H, H-2), 4.16 (m, 1H, H-3), 3.20 (dd, 1H, H-4a), 2.91 (dd, 1H, H-4b), 1.72 (m, 1H), 0.53-0.82 (m, 4H), 7.08-7.68 (m, 13H); ¹³C NMR (CDCl₃, 100 MHz, ppm): δ = 207.79 (Carbonyl C₁), 198.00 (Carbonyl C₅), 55.63 (C₂), 42.36 (C₃), 42.05 (C₄), 21.68 (cyclopropyl C'-1), 11.38, 10.90 (cyclopropyl C'-2, C'-3), 162.44-115.64; Mass (m/z): 443 (M+Na), 421 (M+1).

3.1.4.1-cyclopropyl-2-(2-fluorophenyl)-3-(4-methoxyphenyl)-5-phenylpentane-1,5-dione (109).

Yield: 85%; M.P.: 150-152°C; FT-IR(KBr, cm⁻¹): 1697,1679 (C=O), 3055-3009 (Aromatic C-H), 2954-2835 (Aliphatic C-H); ¹H
NMR(CDCl₃, 400 MHz, ppm): δ = 4.70 (d, 1H, H-2), 4.13 (m, 1H, H-3), 3.20 (dd, 1H, H-4a), 2.88 (dd, 1H, H-4b), 1.72 (m, 1H), 0.50-0.79 (m, 4H), 6.76-7.68 (m, 13H), 3.74 (s, 3H, CH₃) ; ¹³C NMR (CDCl₃, 100 MHz, ppm): δ = 208.21 (Carbonyl C-1), 198.52 (Carbonyl C-5), 55.76 (C-2), 42.45 (C-3), 42.41 (C-4), 21.78 (cyclopropyl C'-1), 11.19, 10.60 (cyclopropyl C'-2, C'-3), 162.44-113.70, 55.17 (OCH₃); Mass (m/z): 439 (M+Na), 417 (M+1).

3.1.5.1-cyclopropyl-2-(2-fluorophenyl)-5-phenyl-3-p-tolylpentane-1,5-dione(110).

Yield: 93%; M.P.: 148-150°C; FT-IR(KBr, cm⁻¹): 1688 (C=O), 3057-3009 (Aromatic C-H), 2926-2860 (Aliphatic C-H); ¹H NMR(CDCl₃, 400 MHz, ppm): δ = 4.72 (d, 1H, H-2), 4.14 (m, 1H, H-3), 3.21 (dd, 1H, H-4a), 2.90 (dd, 1H, H-4b), 1.72 (m, 1H), 0.52-0.78 (m, 4H), 7.02-7.91 (m, 13H), 2.25 (s, 3H, CH₃) ; ¹³C NMR (CDCl₃, 100 MHz, ppm): δ = 208.14 (Carbonyl C-1), 198.41 (Carbonyl C-5), 55.66 (C-2), 42.76 (C-3), 42.44 (C-4), 21.74 (cyclopropyl C'-1), 11.14, 10.66 (cyclopropyl C'-2, C'-3), 162.46-115.49, 21.09 (CH₃); Mass (m/z): 423 (M+Na), 401 (M+1).

3.1.6.1-cyclopropyl-2-(2-fluorophenyl)-5-(4-fluorophenyl)-3-phenylpentane-1,5-dione (111).

Yield: 90%; M.P.: 118-120°C; FT-IR(KBr, cm⁻¹): 1691 (C=O), 3068-3002 (Aromatic C-H), 2924-2849 (Aliphatic C-H); ¹H NMR(CDCl₃, 400 MHz, ppm): δ = 4.74 (d, 1H, H-2), 4.16 (m, 1H, H-3), 3.20 (dd, 1H, H-4a), 2.90 (dd, 1H, H-4b), 1.71 (m, 1H), 0.46-0.80 (m,
4H), 6.97-7.71 (m, 13H); $^{13}$C NMR (CDCl$_3$, 100 MHz, ppm): $\delta$ = 208.00 (Carbonyl C-1), 196.78 (Carbonyl C-5), 55.66 (C-2), 43.28 (C-3), 42.13 (C-4), 21.75 (cyclopropyl C'-1), 11.23, 10.66 (cyclopropyl C'-2, C'-3), 166.81-115.35; Mass (m/z): 427 (M+Na), 405 (M+1).

3.1.7.1-cyclopropyl-2-(2-fluorophenyl)-5-(4-fluorophenyl)-3-phenylpentane-1,5-dione (112).

Yield: 94%; M.P.: 132-134°C; FT-IR(KBr, cm$^{-1}$): 1691 (C=O), 3063-2997 (Aromatic C-H), 2921-2849 (Aliphatic C-H); $^1$H NMR(CDCl$_3$, 400 MHz, ppm): $\delta$ = 4.73 (d, 1H, H-2), 4.15 (m, 1H, H-3), 3.18 (dd, 1H, H-4a), 2.90 (dd, 1H, H-4b), 1.72 (m, 1H), 0.46-0.80 (m, 4H), 7.06-7.83 (m, 13H); $^{13}$C NMR (CDCl$_3$, 100 MHz, ppm): $\delta$ = 207.95 (Carbonyl C-1), 197.19 (Carbonyl C-5), 55.66 (C-2), 43.29 (C-3), 42.20 (C-4), 21.75 (cyclopropyl C'-1), 11.23, 10.66 (cyclopropyl C'-2, C'-3), 162.44-115.53.

3.1.8. 1-cyclopropyl-2-(2-fluorophenyl)-3-(3-nitrophenyl)-5-phenylpentane-1,5-dione (113).

Yield: 92%; M.P.: 142-144°C; FT-IR(KBr, cm$^{-1}$): 1698, 1680 (C=O), 3084-3008 (Aromatic C-H), 2927-2849 (Aliphatic C-H); $^1$H NMR(CDCl$_3$, 400 MHz, ppm): $\delta$ = 4.76 (d, 1H, H-2), 4.30 (m, 1H, H-3), 3.29 (dd, 1H, H-4a), 3.00 (dd, 1H, H-4b), 1.74 (m, 1H), 0.51-0.84 (m, 4H), 7.11-8.20 (m, 13H); $^{13}$C NMR (CDCl$_3$, 100 MHz, ppm): $\delta$ = 207.41 (Carbonyl C-1), 197.44 (Carbonyl C-5), 55.55 (C-2), 42.31 (C-3), 41.77 (C-4), 21.58 (cyclopropyl C'-1), 11.58, 11.16 (cyclopropyl C'-2, C'-3), 162.43-115.81; Mass (m/z): 454 (M+Na), 432 (M+1).
3.1.9. 1-cyclopropyl-2-(2-fluorophenyl)-3-(4-nitrophenyl)-5-phenylpentane-1,5-dione (114).

Yield: 93%; M.P.: 156-158°C; FT-IR(KBr, cm⁻¹): 1682 (C=O), 3085-3013 (Aromatic C-H), 2924-2854 (Aliphatic C-H); \(^1\)H NMR(CDCl₃, 400 MHz, ppm): δ = 4.76 (d, 1H, H₇₂), 4.32 (m, 1H, H₇₃), 3.31 (dd, 1H, H₇₄a), 3.01 (dd, 1H, H₇₄b), 1.75 (m, 1H), 0.58-0.88 (m, 4H), 7.12-8.12 (m, 13H); \(^{13}\)C NMR (CDCl₃, 100 MHz, ppm): δ = 207.26 (Carbonyl C-1), 197.40 (Carbonyl C-5), 55.52 (C-2), 42.54 (C-3), 41.70 (C-4), 21.46 (cyclopropyl C'-1), 11.54, 11.21 (cyclopropyl C'-2, C'-3), 162.43-115.80; Mass (m/z): 477 (M+Na), 455 (M+1).

3.1.10. 3,5-bis(4-chlorophenyl)-1-cyclopropyl-2-(2-fluorophenyl)pentane-1,5-dione (115).

Yield: 95%; M.P.: 140-1420°C; FT-IR(KBr, cm⁻¹): 1689 (C=O), 3063-3008 (Aromatic C-H), 2923-2854 (Aliphatic C-H); \(^1\)H NMR(CDCl₃, 400 MHz, ppm): δ = 4.75 (d, 1H, H₂₋₇), 4.29 (m, 1H, H₇₃), 3.27 (dd, 1H, H₄₋₇), 2.99 (dd, 1H, H₄₋₇), 1.73 (m, 1H), 0.57-0.86 (m, 4H), 7.12-8.12 (m, 12H); \(^{13}\)C NMR (CDCl₃, 100 MHz, ppm): δ = 207.66 (Carbonyl C-1), 196.82 (Carbonyl C-5), 55.63 (C-2), 42.40 (C-3), 41.94 (C-4), 21.62 (cyclopropyl C'-1), 11.38, 10.92 (cyclopropyl C'-2, C'-3), 159.85-115.63; Mass (m/z): 477 (M+Na), 455 (M+1).

3.1.11. 3-(4-bromophenyl)-1-cyclopropyl-2-(2-fluorophenyl)-5-phenylpentane-1,5-dione (116).

Yield: 94%; M.P.: 134-136°C; FT-IR(KBr, cm⁻¹): 1682 (C=O), 3064-3010 (Aromatic C-H), 2926-2865 (Aliphatic C-H); \(^1\)H
NMR(CDCl₃, 400 MHz, ppm): δ = 4.68 (d, 1H, H-2), 4.15 (m, 1H, H-3), 3.20 (dd, 1H, H-4a), 2.90 (dd, 1H, H-4b), 1.71 (m, 1H), 0.54-0.82 (m, 4H), 7.08-7.66 (m, 12H); ¹³C NMR (CDCl₃, 100 MHz, ppm): δ = 207.73 (Carbonyl C-1), 197.95 (Carbonyl C-5), 55.56 (C-2), 42.40 (C-3), 41.99 (C-4), 21.65 (cyclopropyl C'-1), 11.36, 10.90 (cyclopropyl C'-2, C'-3), 162.43-115.62; Mass (m/z): 487 (M+Na), 465 (M+1).

3.1.12. 1-cyclopropyl-2-(2-fluorophenyl)-3-(3-methoxyphenyl)-5-phenylpentane-1,5-dione (117).

Yield: 95%; M.P.: 158-160°C; FT-IR(KBr, cm⁻¹): 1688 (C=O), 3079-3008 (Aromatic C-H), 2924-2855 (Aliphatic C-H); ¹H NMR(CDCl₃, 400 MHz, ppm): δ = 4.76 (d, 1H, H-2), 4.20 (m, 1H, H-3), 3.26 (dd, 1H, H-4a), 2.92 (dd, 1H, H-4b), 1.77 (m, 1H), 0.55-0.83 (m, 4H), 3.75 (s, 3H, OCH₃) 6.67-7.69 (m, 12H); ¹³C NMR (CDCl₃, 100 MHz, ppm): δ = 207.99 (Carbonyl C-1), 198.25 (Carbonyl C-5), 55.55 (C-2), 55.20 (OCH₃) 43.15 (C-3), 42.30 (C-4), 21.74 (cyclopropyl C'-1), 11.20, 10.71 (cyclopropyl C'-2, C'-3), 167.44-111.99; Mass (m/z): 439 (M+Na), 417 (M+1).

3.1.13. 1-cyclopropyl-2-(2-fluorophenyl)-3,5-bis(4-fluorophenyl)pentane-1,5-dione (118).

Yield: 94%; M.P.: 126-128°C; FT-IR(KBr, cm⁻¹): 1690 (C=O), 3058-3035 (Aromatic C-H), 2923-2854 (Aliphatic C-H); ¹H NMR(CDCl₃, 400 MHz, ppm): δ = 4.70 (d, 1H, H-2), 4.19 (m, 1H, H-3), 3.21 (dd, 1H, H-4a), 2.92 (dd, 1H, H-4b), 1.75 (m, 1H), 0.53-0.84 (m, 4H), 6.91-7.71 (m, 12H); ¹³C NMR (CDCl₃, 100 MHz, ppm): δ = 207.84
(Carbonyl C-1), 196.59 (Carbonyl C-5), 55.81 (C-2), 42.45 (C-3), 42.04 (C-4), 21.68 (cyclopropyl C'-1), 11.31, 10.78 (cyclopropyl C'-2, C'-3), 166.88-114.72; Mass (m/z): 445 (M+Na), 423 (M+1).

3.1.14.3-(4-chlorophenyl)-1-cyclopropyl-2-(2-fluorophenyl)-5-(4-fluorophenyl)pentane-1,5-dione (119).

Yield: 93%; M.P.: 128-130°C; FT-IR (KBr, cm⁻¹): 1696 (C=O), 3079-3019 (Aromatic C-H), 2926-2849 (Aliphatic C-H); \(^1\)H NMR (CDCl₃, 400 MHz, ppm): δ = 4.68 (d, 1H, H72), 4.13 (m, 1H, H73), 3.46 (d, 1H, H-4a), 3.25 (dd, 1H, H-4b), 1.94 (m, 1H), 0.75-1.08 (m, 4H), 6.84-7.94 (m, 12H); \(^{13}\)C NMR (CDCl₃, 100 MHz, ppm): δ = 208.77 (Carbonyl C-1), 196.57 (Carbonyl C-5), 55.66 (C-2), 43.96 (C-3), 42.52 (C-4), 21.34 (cyclopropyl C'-1), 11.85 (cyclopropyl C'-2, C'-3), 166.98-115.38; Mass (m/z): 461 (M+Na), 439 (M+1).

3.2. General procedure for preparing (E)-3-[4-(Difluoromethoxy)-3-hydroxyphenyl]-1-phenylprop-2-en-1-ones

Conventional method:

A mixture of appropriate acetophenone (2 mmol), 4-(difluoromethoxy)-3-hydroxybenzaldehyde (2 mmol) and sodium hydroxide were stirred at about (0-5)°C for 3h. The reaction mixture was neutralized with dilute HCl and kept in the refrigerator overnight. The product was filtered and washed with cold water. The solid that separated was filtered, dried and the crude chalconewas recrystallized from ethanol.
Grinding method:

A mixture of 4-(difluoromethoxy)-3-hydroxybenzaldehyde (2mmol), respective substituted acetophenones (2mmol) and sodiumhydroxide was ground together in mortar with pestle for 5 min and left to harden at room temperature for 30 min. The solid was dissolved in cold distilled water and acidified with dilute HCl and kept in the refrigerator overnight. The solid that separated was filtered, dried and recrystallized from ethanol.

3.2.1. (E)-3-[4-(Difluoromethoxy)-3-hydroxyphenyl]-1-phenylprop-2-en-1-one (120).

Yield: 86%; M.P.: 152-154°C; FT-IR(KBr, cm⁻¹): 3294 (OH), 3068-3013 (Aromatic C-H), 2969-2844 (Aliphatic C-H), 1653 (C=O); ¹H NMR (DMSO-d₆, 400 MHz, ppm): δ = 10.16 (broad singlet, 1H, OH), 7.15 (t, 1H, H-7), 7.64 (d, 1H, H-9), 7.79 (d, 1H, H-8), 8.13-7.18 (aromatic); ¹³C NMR (DMSO-d₆, 100 MHz, ppm): δ = 189.10 (Carbonyl C-10), 122.59 (C-9), 143.45 (C-8), 116.42 (C-7), 117.40-184.74 (aromatic); Mass (m/z): 291 (M+1).

3.2.2. (E)-3-(4-(Difluoromethoxy)-3-hydroxyphenyl)-1-(4-fluorophenyl)prop-2-en-1-one (121).

Yield: 88%; M.P.: 114-116°C; FT-IR(KBr, cm⁻¹): 3338 (OH), 3063-3013 (Aromatic C-H), 2920-2849 (Aliphatic C-H), 1657 (C=O); ¹H NMR (CDCl₃, 400 MHz, ppm): δ = 5.64 (broad singlet, 1H, OH), 6.59 (t, 1H,
H-7), 7.71 (d, 1H, H-9), 7.43 (d, 1H, H-8), 8.06-7.09 (aromatic); $^ {13}$C NMR (DMSO-$d_6$, 100 MHz, ppm): $\delta = 188.65$ (Carbonyl C-10), 122.08 (C-9), 143.69 (C-8), 115.97 (C-7), 115.75-167.00 (aromatic); Mass (m/z): 307 (M-1).

3.2.3. (E)-1-(4-chlorophenyl)-3-(4-(difluoromethoxy)-3-hydroxyphenyl)prop-2-en-1-one (122).

Yield: 90%; M.P.: 162-164°C; FT-IR(KBr, cm$^{-1}$): 3413 (OH), 3095-3063 (Aromatic C-H), 2915-2834 (Aliphatic C-H), 1674 (C=O); $^1$H NMR(CDCl$_3$, 400 MHz, ppm): $\delta = 5.59$ (broad singlet, 1H, OH), 6.59 (t, 1H, H-7), 7.72 (d, 1H, H-9), 7.50 (d, 1H, H-8), 7.97-7.16 (aromatic); $^{13}$C NMR (DMSO-$d_6$, 100 MHz, ppm): $\delta = 188.07$ (Carbonyl C-10), 121.69 (C-9), 143.72 (C-8), 116.39 (C-7), 117.41-148.69 (aromatic); Mass (m/z): 325 (M+1).

3.2.4. (E)-3-(4-(difluoromethoxy)-3-hydroxyphenyl)-1-(4-methoxyphenyl)prop-2-en-1-one (123).

Yield: 92%; M.P.: 132-134°C; FT-IR(KBr, cm$^{-1}$): 3348 (OH), 3063-3013 (Aromatic C-H), 2924-2849 (Aliphatic C-H), 1657 (C=O); $^1$H NMR(CDCl$_3$, 400 MHz, ppm): $\delta = 5.71$ (broad singlet, 1H, OH), 6.58 (t, 1H, H-7), 7.72 (d, 1H, H-9), 7.47 (d, 1H, H-8), 3.89 (s, 3H, OCH$_3$), 8.04-6.92 (aromatic); $^{13}$C NMR (DMSO-$d_6$, 100 MHz, ppm): $\delta = 188.49$ (Carbonyl C-10), 122.45 (C-9), 142.58 (C-8), 116.03 (C-7), 113.94-163.60 (aromatic), 55.55 (OCH$_3$); Mass (m/z): 321 (M+1).
3.2.5. 

(E)-3-[(4-(difluoromethoxy)-3-hydroxyphenyl)-1-(4-nitrophenyl)prop-2-en-1-one (124).

Yield: 87%; M.P.: 134-136°C; FT-IR(KBr, cm⁻¹): 3321 (OH), 3123 (Aromatic C-H), 2922-2853 (Aliphatic C-H), 1657 (C=O); ¹H NMR(CDCl₃, 400 MHz, ppm δ = 5.65 (broad singlet, 1H, OH), 6.60 (t, 1H, H-7), 7.75 (d, 1H, H-9), 7.41 (d, 1H, H-8), 8.37-7.18 (aromatic); ¹³C NMR (DMSO-d₆, 100 MHz, ppm): δ = 188.34 (Carbonyl C-10), 121.82 (C-9), 144.77 (C-8), 116.39 (C-7), 117.60-149.80 (aromatic); Mass (m/z): 334 (M+1).

3.2.6. 

(E)-1-(4-bromophenyl)-3-[(4-(difluoromethoxy)-3-hydroxyphenyl)prop-2-en-1-one (125).

Yield: 90%; M.P.: 142-144°C; FT-IR(KBr, cm⁻¹): 3338 (OH), 3056 (Aromatic C-H), 2923-2849 (Aliphatic C-H), 1656 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 10.43 (broad singlet, 1H, OH), 7.07 (t, 1H, H-7), 7.71 (d, 1H, H-9), 7.61 (d, 1H, H-8), 8.03-7.16 (aromatic); ¹³C NMR (DMSO-d₆, 100 MHz, ppm): δ = 188.23 (Carbonyl C-10), 121.67 (C-9), 143.73 (C-8), 116.40 (C-7), 117.48-148.70 (aromatic); Mass (m/z): 369 (M+1).

3.2.7. 

(E)-3-[(4-(difluoromethoxy)-3-hydroxyphenyl)-1-(3-nitrophenyl)prop-2-en-1-one (126).

Yield: 85%; M.P.: 118-120°C; FT-IR(KBr, cm⁻¹): 3385 (OH), 3084 (Aromatic C-H), 2922-2860 (Aliphatic C-H), 1660 (C=O); ¹H NMR(CDCl₃, 400 MHz, ppm δ = 5.65 (broad singlet, 1H, OH), 6.61 (t, 1H, H-7), 7.80 (d, 1H, H-9), 7.45 (d, 1H, H-8), 8.83-7.17 (aromatic);
\[13C\text{ NMR (DMSO-}d_6, 100 \text{ MHz, ppm): } \delta = 187.79 \text{ (Carbonyl C-10), 123.30 (C-9), 145.34 (C-8), 115.90 (C-7), 116.11-148.47 (aromatic); Mass (m/z): 334 (M-1).}\]

3.2.8. (E)-3-(4-(difluoromethoxy)-3-hydroxyphenyl)-1-p-tolylprop-2-en-1-one (127).

Yield: 88%; M.P.: 166-168°C; FT-IR(KBr, cm\(^{-1}\)): 3346 (OH), 3050 (Aromatic C-H), 2922-2857 (Aliphatic C-H), 1688 \text{ C=O}; \text{ }^1H\text{ NMR(CDC}_3, 400 \text{ MHz, ppm): } \delta = 5.91 \text{ (broad singlet, 1H, OH), 6.59 (t, 1H, H-7), 7.71 (d, 1H, H-9), 7.47 (d, 1H, H-8), 7.78-6.49 (aromatic), 21.15 (CH}_3); \text{ }^{13C\text{ NMR (DMSO-}d_6, 100 \text{ MHz, ppm): } \delta = 188.50 \text{ (Carbonyl C-10), 122.02 (C-9), 142.85 (C-8), 116.43 (C-7), 117.36-148.77 (aromatic), 21.15 (CH}_3); Mass (m/z): 305 (M+1).}\]

3.2.9. (E)-3-(4-(difluoromethoxy)-3-hydroxyphenyl)-1-(2,4-dimethoxyphenyl)prop-2-en-1-one (128).

Yield: 90%; M.P.: 144-146°C; FT-IR(KBr, cm\(^{-1}\)): 3310 (OH), 3019 (Aromatic C-H), 2920-2843 (Aliphatic C-H), 1650 (C=O); \text{ }^1H\text{ NMR(CDC}_3, 400 \text{ MHz, ppm): } \delta = 5.81 \text{ (broad singlet, 1H, OH), 6.56 (t, 1H, H-7), 7.59 (d, 1H, H-9), 7.46 (d, 1H, H-8), 7.78-6.49 (aromatic), 3.87 (OCH}_3), 3.91 (OCH}_3); \text{ }^{13C\text{ NMR (DMSO-}d_6, 100 \text{ MHz, ppm): } \delta = 190.39 \text{ (Carbonyl C-10), 121.24 (C-9), 140.83 (C-8), 116.04 (C-7), 98.66-164.51 (aromatic), 55.79 (OCH}_3), 55.61(OCH}_3); Mass (m/z): 351 (M+1).}
3.2.10. (E)-3-(4-(difluoromethoxy)-3-hydroxyphenyl)-1-(naphthalen-1-yl)prop-2-en-1-one (129).

Yield: 90%; M.P.: 136-138°C; FT-IR(KBr, cm\(^{-1}\)): 3394 (OH), 1671 (C=O); \(^1\)H NMR(DMSO-\(d_6\), 400 MHz, ppm): \(\delta = 10.15\) (broad singlet, 1H, OH), \(7.14\) (t, 1H, H-7), \(7.51\) (d, 1H, H-9), \(7.41\) (d, 1H, H-8), \(8.31-7.17\) (aromatic); \(^{13}\)C NMR (DMSO-\(d_6\), 100 MHz, ppm): \(\delta = 194.03\) (Carbonyl C-10), \(124.91\) (C-9), \(144.15\) (C-8), \(116.39\) (C-7), \(116.90-148.74\) (aromatic); Mass (m/z): 341 (M+1).

3.2.11. (E)-3-(4-(difluoromethoxy)-3-hydroxyphenyl)-1-(4-hydroxyphenyl)prop-2-en-1-one (130).

Yield: 85%; M.P.: 184-186°C; FT-IR(KBr, cm\(^{-1}\)): 3293 (OH), 1657 (C=O); \(^1\)H NMR(DMSO-\(d_6\), 400 MHz, ppm): \(\delta = 10.15\) (broad singlet, 2H, OH), \(7.12\) (t, 1H, H-7), \(7.56\) (d, 1H, H-9), \(7.74\) (d, 1H, H-8), \(8.31-7.17\) (aromatic); \(^{13}\)C NMR (DMSO-\(d_6\), 100 MHz, ppm): \(\delta = 187.07\) (Carbonyl C-10), \(122.02\) (C-9), \(141.93\) (C-8), \(116.40\) (C-7), \(6.88-8.04\) (aromatic); Mass (m/z): 307 (M+1).

3.3. General procedure for preparing 6-(4-methoxyphenyl)-4,5-diphenyl-3,4-dihydropyrimidin-2(1H)-one / thiones.

A mixture of aromatic aldehydes (5mmol), 1,2-diaryl-1-ethanones (5mmol) and urea/thiourea (7mmol) with PTSA (20 mol%) without solvent in a beaker placing the reaction mixture at the center of the microwave oven (480 W) and irradiation for a period of 10 sec at
a time. After every irradiation, the reaction vessel was removed from the microwave oven for a period of 10 sec and stirred the reaction mixture. The completion of the reaction was checked by TLC. The reaction mixture was then extracted with ethyl acetate and the organic layer then washed with water and dried over anhydrous Na$_2$SO$_4$. Organic solvent was evaporated under reduced pressure and solid compound was crystallized from absolute ethanol to afford the pure corresponding dihydropyrimidin-2(1H)-one / thiones.

**3.3.1.6-(4-methoxyphenyl)-4,5-diphenyl-3,4-dihydropyrimidine-2(1H)-thione (131).**

Yield: 93%; M.P.: 238-240°C; FT-IR (KBr, cm$^{-1}$): 3419-3161 (NH), 3073-3024 (Aromatic C-H), 2943 (Aliphatic C-H), 1199 (C=S); $^1$H NMR(DMSO-$d_6$, 400 MHz, ppm): $\delta = 3.72$ (s, 3H, OCH$_3$), 5.07 (d, 1H, H-4), 9.32 (s, 1H, NH), 9.87 (s, 1H, NH), 6.79-7.42 (Ar-H); $^{13}$C NMR (DMSO-$d_6$, 100 MHz, ppm): $\delta = 173.31$ (C=S), 110.25 (C-5), 58.72 (C-5), 55.03 (OCH$_3$), 113.51-159.22 (Ar-C); Mass (m/z): 373 (M+1).

**3.3.2.6-(4-methoxyphenyl)-4,5-diphenyl-3,4-dihydropyrimidine-2(1H)-one (132).**

Yield: 95%; M.P.: 217-219°C; FT-IR (KBr, cm$^{-1}$): 3419-3224 (NH), 3082 (Aromatic C-H), 2926-2832 (Aliphatic C-H), 1690 (C=O); $^1$H NMR(DMSO-$d_6$, 400 MHz, ppm): $\delta = 3.70$ (s, 3H, OCH$_3$), 5.07 (d, 1H, H-4), 7.46 (s, 1H, NH), 8.53 (s, 1H, NH), 6.77-7.45 (Ar-H); $^{13}$C NMR (DMSO-$d_6$, 100 MHz, ppm): $\delta = 153.12$ (C=O), 108.63 (C-5), 59.22 (C-4), 55.01 (OCH$_3$), 113.41-158.93 (Ar-C); Mass (m/z): 357 (M+1).
3.3.3.4-(4-fluorophenyl)-6-(4-methoxyphenyl)-5-phenyl-3,4-dihydropyrimidine-2(1H)-thione (133).

Yield: 95%; M.P.: 213-215°C; FT-IR(KBr, cm⁻¹): 3426, 3316, 3073, 2926, 1200 (NH), 3073-3008 (Aromatic C-H), 2926-2849 (Aliphatic C-H), 1687 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 3.72 (s, 3H, OCH₃), 5.11 (d, 1H, H-4), 9.33 (s, 1H, NH), 9.90 (s, 1H, NH), 6.78-7.42 (Ar-H); ¹³C NMR (DMSO-d₆, 100 MHz, ppm): δ = 173.14 (C=S), 110.31 (C-5), 57.91 (C-4), 55.03 (OCH₃), 113.51-162.88 (Ar-C); Mass (m/z): 391 (M+1).

3.3.4. 4-(4-nitrophenyl)-5,6-diphenyl-3,4-dihydropyrimidin-2(1H)-one (134).

Yield: 97%; M.P.: 232-234°C; FT-IR (KBr, cm⁻¹): 3405, 3218 (NH), 3078-3008 (Aromatic C-H), 2929 (Aliphatic C-H), 1687 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 3.70 (s, 3H, OCH₃), 5.33 (d, 1H, H-4), 7.63 (s, 1H, NH), 8.66 (s, 1H, NH), 6.77-8.22 (Ar-H); ¹³C NMR (DMSO-d₆, 100 MHz, ppm): 153.14 (C=O), 107.85 (C-5), 58.66 (C-4), 55.01 (OCH₃), 113.38-159.01 (Ar-C); Mass (m/z): 402 (M+1).

3.3.5.4-(4-(difluoromethoxy)-3-hydroxyphenyl)-5,6-diphenyl-3,4-dihydropyrimidin-2(1H)-one (135).

Yield: 94%; M.P.: 221-223°C; FT-IR (KBr, cm⁻¹): 3347-3220 (NH), 3084 (Aromatic C-H), 2929-2839 (Aliphatic C-H), 1684 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 12.22 (s, 1H, OH), 5.02 (d, 1H, H-4), 8.63 (s, 1H, NH), 9.94 (s, 1H, NH), 6.76-7.46 (Ar-H); Mass (m/z): 408 (M-1).
3.3.6. 5,6-diphenyl-4-(4-(trifluoromethyl)phenyl)-3,4-dihydropyrimidine-2(1H)-thione (136).

Yield: 95%; M.P.: 288-290°C; FT-IR (KBr, cm\(^{-1}\)): 3397, 3321 (NH), 3024 (Aromatic C-H), 2958-2860 (Aliphatic C-H), 1202 (C=S); \(^1\)H NMR (DMSO-\(d_6\), 400 MHz, ppm): \(\delta = 5.34\) (d, 1H, H\(_7\)) , 9.43 (s, 1H, NH), 10.08 (s, 1H, NH), 6.79-7.71 (Ar-H); Mass (m/z) : 411(M+1).

3.3.7. 5,6-diphenyl-4-(4-(trifluoromethyl)phenyl)-3,4-dihydropyrimidin-2(1H)-one (137).

Yield: 96%; M.P.: 228-230°C; FT-IR (KBr, cm\(^{-1}\)): 3397, 3321 (NH), 3063 (Aromatic C-H), 2931-2838 (Aliphatic C-H), 1645 (C=O); \(^1\)H NMR (DMSO-\(d_6\), 400 MHz, ppm): \(\delta = 5.33\) (d, 1H, H\(_7\)) , 7.66 (s, 1H, NH), 8.71 (s, 1H, NH), 6.77-7.62 (Ar-H); Mass (m/z) : 395 (M+1).

3.4. General procedure for preparing 6-phenyl-4-(4-(trifluoromethyl)phenyl)-3,4-dihydropyrimidine-2(1H)-thione.

A mixture of 4-(Trifluoromethyl)benzaldehyde (5mmol), acetophenone (5mmol) and urea/thiourea (7mmol) with PTSA (10 mol\%) without solvent in a beaker (capacity 50 mL) placing the reaction mixture at the center of the microwave oven (480 W) and irradiation for a period of 10 sec at a time. After every irradiation, the reaction vessel was removed from the microwave oven for a period of
10 sec and stirred the reaction mixture. The completion of the reaction was checked by TLC. The reaction mixture was then extracted with ethyl acetate and the organic layer then washed with water and dried over anhydrous Na$_2$SO$_4$. Organic solvent was evaporated under reduced pressure and solid compound was crystallized from absolute ethanol to afford the pure corresponding dihydropyrimidin-2(1H)-thiones.

### 3.4.1. 6-phenyl-4-(4-(trifluoromethyl)phenyl)-3,4-dihydropyrimidine-2(1H)-thione (138).

Yield: 92%; M.P.: 210-212°C; FT-IR (KBr, cm$^{-1}$): 3168 (NH), 1170 (C=S), 3100-3033 (Aromatic C-H), 2976 (Aliphatic C-H), 1573 (C=C); $^1$H NMR (DMSO-$d_6$, 400 MHz, ppm): $\delta = 5.26$ (s, 1H, H$_{74}$), 5.46 (s, 1H, H$_{75}$), 9.21 (s, 1H, NH), 10.00 (s, 1H, NH), 7.37-7.66 (m, Ar-H); $^{13}$C NMR (DMSO-$d_6$, 100 MHz, ppm): $\delta = 175.38$ (C=S, C$_{72}$), 53.92 (C$_{74}$), 100.46 (C$_{75}$), 145.27 (C$_6$), 122.78-134.86 (Ar-C); Mass (m/z): 335 (M+1).

### 3.4.2. 6-(4-fluorophenyl)-4-(4-(trifluoromethyl)phenyl)-3,4-dihydropyrimidine-2(1H)-thione (139).

Yield: 94%; M.P.: 216-218°C; FT-IR (KBr, cm$^{-1}$): 3175 (NH), 1163 (C=S), 3102 (Aromatic C-H), 2970-2853 (Aliphatic C-H), 1573 (C=C); $^1$H NMR(CDCl$_3$, 400 MHz, ppm): $\delta = 5.25$ (s, 1H, H$_{4}$), 5.41 (s, 1H, H$_{5}$), 9.20 (s, 1H, NH), 10.00 (s, 1H, NH), 7.18-7.64 (m, Ar-H); $^{13}$C NMR (DMSO-$d_6$, 100 MHz, ppm): $\delta = 175.28$ (C=S, C$_2$), 53.93 (C$_4$), 100.45 (C$_5$), 145.13 (C$_6$), 115.13-163.60 (Ar-C); Mass (m/z): 353 (M+1).
3.4.3. 6-(4-chlorophenyl)-4-(4-(trifluoromethyl)phenyl)-3,4-dihydropyrimidine-2(1H)-thione (140).

Yield: 96%; M.P.: 232-234°C; FT-IR (KBr, cm⁻¹): 3162 (NH), 1165 (C=S), 3016 (Aromatic C-H), 2971-2861 (Aliphatic C-H), 1571 (C=C);¹H NMR(DMSO-dma, 400 MHz, ppm): δ = 10.01 (s, 1H, NH), 9.20 (s, 1H, NH), 5.26 (s, 1H, H₇₄), 5.48 (s, 1H, H₇₅), 7.40-7.63 (m, Ar-H); ¹³C NMR (DMSO-d₆, 100 MHz, ppm): δ = 175.25 (C=S, C-2), 53.91 (C-4), 101.08 (C-5), 144.98 (C-6), 122.67-144.98 (Ar-C); Mass (m/z): 369 (M+1).

3.4.4. 6-(4-methoxyphenyl)-4-(4-(trifluoromethyl)phenyl)-3,4-dihydropyrimidine-2(1H)-thione (141).

Yield: 95%; M.P.: 188-190°C; FT-IR (KBr, cm⁻¹): 3232 (NH), 1175 (C=S), 3002 (Aromatic C-H), 2972-2836 (Aliphatic C-H), 1572 (C=C);¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 9.87 (s, 1H, NH), 9.16 (s, 1H, NH), 5.23 (s, 1H, H₄), 5.36 (s, 1H, H-5), 3.76 (s, 3H, OCH₃), 6.91-6.67 (m, Ar-H); Mass (m/z): 365 (M+1).

3.4.5. 6-(4-bromophenyl)-4-(4-(trifluoromethyl)phenyl)-3,4-dihydropyrimidine-2(1H)-thione (142).

Yield: 96%; M.P.: 228-230°C; FT-IR (KBr, cm⁻¹): 3393-3179 (NH), 1167 (C=S), 3062 (Aromatic C-H), 2968 (Aliphatic C-H), 1557 (C=C);¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 10.04 (s, 1H, NH), 9.21 (s, 1H, NH), 5.26 (s, 1H, H-4), 5.50 (s, 1H, H-5), 7.45-7.68 (m, Ar-H); Mass (m/z): 413 (M+1).
3.4.6. 6-(p-tolyl)-4-(4-(trifluoromethyl)phenyl)-3,4-dihydropyrimidine-2(1H)-thione (143).

Yield: 93%; M.P.: 218-220°C; FT-IR (KBr, cm\(^{-1}\)): 3199 (NH), 1168 (C=S), 3096-3033 (Aromatic C-H), 2970 (Aliphatic C-H), 1562 (C=C); \(^1\)H NMR(DMSO-\(d_6\), 400 MHz, ppm): \(\delta = 9.91\) (s, 1H, NH), 9.17 (s, 1H, NH), 5.25 (s, 1H, H-7), 5.42 (s, 1H, H-5), 2.30 (s, 3H, CH\(_3\)), 7.17-7.67 (m, Ar-H); Mass (m/z): 349 (M+1).

3.4.7. 6-(2',4'-difluoro-[1,1'-biphenyl]-4-yl)-4-(4-(trifluoromethyl)phenyl)-3,4-dihydropyrimidine-2(1H)-thione (144).

Yield: 91%; M.P.: 192-194°C; FT-IR (KBr, cm\(^{-1}\)): 3253 (NH), 1175 (C=S), 3092-3035 (Aromatic C-H), 2974-2886 (Aliphatic C-H), 1582 (C=C); \(^1\)H NMR(DMSO-\(d_6\), 400 MHz, ppm): \(\delta = 10.04\) (s, 1H, NH), 9.22 (s, 1H, NH), 7.29 (s, 1H, H-4), 5.55 (s, 1H, H-5), 7.20-7.69 (m, Ar-H); \(^13\)C NMR (DMSO-\(d_6\), 100 MHz, ppm): \(\delta = 175.34\) (C=S, C-2), 53.96 (C-4), 100.85 (C-5), 145.13 (C-6), 104.20-163.07 (Ar-C); Mass (m/z): 447 (M+1).

3.4.8. 6-(Naphthalen-1-yl)-4-(4-(trifluoromethyl)phenyl)-3,4-dihydropyrimidine-2(1H)-thione (145).

Yield: 90%; M.P.: 207-209°C; FT-IR (KBr, cm\(^{-1}\)): 3157 (NH), 1166 (C=S), 3058-3018 (Aromatic C-H), 2970 (Aliphatic C-H), 1569 (C=C); \(^1\)H NMR(DMSO-\(d_6\), 400 MHz, ppm): \(\delta = 10.24\) (s, 1H, NH), 9.27 (s, 1H, NH), 5.22 (s, 1H, H-4), 5.35 (s, 1H, H-5), 7.45-7.97 (m, Ar-H); \(^13\)C NMR (DMSO-\(d_6\), 100 MHz, ppm): \(\delta = 175.70\) (C=S, C-2), 54.27 (C-4), 103.04 (C-5), 145.62 (C-6), 122.85-134.36 (Ar-C).
3.5. **General procedure for preparing 2-oxo-6-phenyl-4-(4-(trifluoromethyl)phenyl)-1,2-dihydropyridine-3-carbonitriles.**

A mixture of acetophenone (5 mmol), 4-trifluoromethyl benzaldehyde (5 mmol), ethyl cyano acetate (5 mmol) and ammonium acetate (20 mmol) in 20 mL of ethanol was refluxed for 6 hours. The reaction was monitored by TLC. After completion of the reaction, the reaction mixture was quenched with ice cold distilled water. The solid that separated was filtered, dried and recrystallized from ethanol.

3.5.1. **2-oxo-6-phenyl-4-(4-(trifluoromethyl)phenyl)-1,2-dihydropyridine-3-carbonitrile (146)**

Yield: 78%; M.P.: 296-298°C; FT-IR (KBr, cm⁻¹): 3438-3143 (NH), 3077-3039 (Aromatic C-H), 2950 (Aliphatic C-H), 2222 (C≡N), 1648 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 12.95 (s, 1H, NH), 6.94 (s, 1H, H-5), 7.55-8.10 (m, 9H, ArH); ¹³C NMR (DMSO-d₆, 100 MHz, ppm): δ = 161.87 (Carbonyl C-2), 116.19 (C=Q), 106.32 (C-5), 119.80-158.17 (aromatic); Mass (m/z): 341 (M+1).

3.5.2. **6-(4-fluorophenyl)-2-oxo-4-(4-(trifluoromethyl)phenyl)-1,2-dihydropyridine-3-carbonitrile (147)**

Yield: 83%; M.P.: >300°C; FT-IR (KBr, cm⁻¹): 3403-3145 (NH), 3032 (Aromatic C-H), 2918-2813 (Aliphatic C-H), 2222 (C≡N), 1648 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 12.94 (s, 1H, NH), 6.96 (s, 1H, H-5), 7.37-8.08 (m, 8H, ArH); ¹³C NMR (DMSO-d₆, 100 MHz, ppm): δ = 161.92 (Carbonyl C-2), 116.13 (C=Q), 106.43 (C-5), 115.78-165.07 (aromatic); Mass (m/z): 359 (M+1).
3.5.3.6-(4-chlorophenyl)-2-oxo-4-(4-(trifluoromethyl)phenyl)-1,2-dihydropyridine-3-carbonitrile (148)

Yield: 86%; M.P.: >300°C; FT-IR (KBr, cm⁻¹): 3435 (NH), 3085-3035 (Aromatic C-H), 2924-2815 (Aliphatic C-H), 2221 (C=N), 1647 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 12.98 (s, 1H, NH), 7.02 (s, 1H, H₇), 7.60-7.80 (m, 8H, ArH); ¹³C NMR (DMSO-d₆, 100 MHz, ppm): δ = 161.97 (Carbonyl C-2), 116.06 (C=N), 107.01 (C-5), 125.03-157.96 (aromatic).

3.5.4. 6-(4-methoxyphenyl)-2-oxo-4-(4-(trifluoromethyl)phenyl)-1,2-dihydropyridine-3-carbonitrile (149)

Yield: 88%; M.P.: 274-276°C; FT-IR (KBr, cm⁻¹): 3142 (NH), 3088-3029 (Aromatic C-H), 2932-2838 (Aliphatic C-H), 2218 (C=N), 1625 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 12.76 (s, 1H, NH), 6.86 (s, 1H, H₇), 7.06-8.07 (m, 8H, ArH), 3.84 (s, 3H, OCH₃); ¹³C NMR (DMSO-d₆, 100 MHz, ppm): δ = 161.80 (Carbonyl C-2), 116.39 (C=N), 105.36 (C-5), 55.49(OCH₃), 114.34-158.17 (m, 8H, Ar-C); Mass (m/z): 371 (M+1).

3.5.5. 6-(4-nitrophenyl)-2-oxo-4-(4-(trifluoromethyl)phenyl)-1,2-dihydropyridine-3-carbonitrile (150)

Yield: 79%; M.P.: 230-232°C; FT-IR (KBr, cm⁻¹): 3349 (NH), 3085 (Aromatic C-H), 2947-2859 (Aliphatic C-H), 2221 (C=N), 1652 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 13.07 (s, 1H, NH), 7.23 (s, 1H, H₇), 7.80-8.35 (m, 8H, ArH); ¹³C NMR (DMSO-d₆, 100 MHz,
ppm): δ = 162.40 (Carbonyl C-2), 115.79 (C= N), 109.13 (C-5), 125.14-157.52 (Ar-C); Mass (m/z): 386 (M+1).

3.5.6.6-(4-bromophenyl)-2-oxo-4-(4-(trifluoromethyl)phenyl)-1,2-dihydropyridine-3-carbonitrile(151)

Yield: 89%; M.P.: 294-296°C; FT-IR (KBr, cm⁻¹): 3142 (NH), 3079-3025 (Aromatic C-H), 2925-2866 (Aliphatic C-H), 2223 (C= N), 1628 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 12.95 (s, 1H, NH), 6.96 (s, 1H, H-5), 7.74-8.09 (m, 8H, ArH); ¹³C NMR (DMSO-d₆, 100 MHz, ppm): δ = 162.07 (Carbonyl C-2), 116.06 (C= N), 106.86 (C-5), 124.99-158.06 (Ar-C); Mass (m/z): 419 (M+1).

3.5.7. 6-(3-nitrophenyl)-2-oxo-4-(4-(trifluoromethyl)phenyl)-1,2-dihydropyridine-3-carbonitrile(152)

Yield: 87%; M.P.: >300°C; FT-IR (KBr, cm⁻¹): 3104 (NH), 3075-3029 (Aromatic C-H), 2915-2872 (Aliphatic C-H), 2226 (C= N), 1645 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 13.15 (s, 1H, NH), 7.25 (s, 1H, H-5), 7.82-8.83 (m, 8H, ArH); Mass (m/z): 386 (M+1).

3.5.8. 2-oxo-6-(p-tolyl)-4-(4-(trifluoromethyl)phenyl)-1,2-dihydropyridine-3-carbonitrile(153)

Yield: 88%; M.P.: 296-298°C; FT-IR (KBr, cm⁻¹): 3148 (NH), 3083-3041 (Aromatic C-H), 2925-2815 (Aliphatic C-H), 2220 (C= N), 1640 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 12.87 (s, 1H, NH), 6.91 (s, 1H, H-5), 7.33-8.08 (m, 8H, ArH, 2.37(CH₃); Mass (m/z): 355 (M+1).
3.5.9. 6-(4-hydroxyphenyl)-2-oxo-4-(4-(trifluoromethyl)phenyl)-1,2-dihydropyridine-3-carbonitrile(154)

Yield: 79%; M.P.: 296-298°C; FT-IR (KBr, cm⁻¹): 3146 (NH), 3041 (Aromatic C-H), 2222 (C≡N), 1658 (C=O); ¹H NMR (DMSO-d₆, 400 MHz, ppm): δ = 12.68 (s, 1H, NH), 10.25 (s, 1H, OH), 6.83 (s, 1H, H-5), 6.86-8.06 (m, 8H, ArH).

3.5.10. 6-(2',4'-difluoro-[1,1'-biphenyl]-4-yl)-2-oxo-4-(4-(trifluoromethyl)phenyl)-1,2-dihydropyridine-3-carbonitrile(155)

Yield: 75%; M.P.: 292-294°C; FT-IR (KBr, cm⁻¹): 3148 (NH), 3071-3037 (Aromatic C-H), 2921-2819 (Aliphatic C-H), 2220 (C≡N), 1652 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 12.96 (s, 1H, NH), 7.01 (s, 1H, H-5), 7.21-8.11 (m, 11H, ArH); Mass (m/z): 353 (M+1).

3.5.11. 6-(3-aminophenyl)-2-oxo-4-(4-(trifluoromethyl)phenyl)-1,2-dihydropyridine-3-carbonitrile(156)

Yield: 75%; M.P.: 296-298°C; FT-IR (KBr, cm⁻¹): 3436-3139 (NH), 3066-3020 (Aromatic C-H), 2918-2848 (Aliphatic C-H), 2221 (C≡N), 1637 (C=O); ¹H NMR(DMSO-d₆, 400 MHz, ppm): δ = 12.74 (s, 1H, NH), 7.18 (s, 1H, H-5), 5.34 (s, 2H, NH₂), 6.73-8.06 (m, 8H, ArH).

3.6. General procedure for preparing 1,2,3,5-tetraphenylpentan-1,5-diones

A mixture of benzyl phenyl ketone (10 mmol), acetophenones (10 mmol), bezaldehydes (10 mmol) and sodium hydroxide solution (10mL, 10%) in ethanol (50mL) was stirred for 60 minutes at room
temperature. The solid that separated was filtered and was recrystallized from ethanol.

### 3.6.1. 5-(4-fluorophenyl)-1,2,3-triphenylpentane-1,5-dione (157)

Yield: 97%; M.P.: 178-180°C; FT-IR(KBr, cm\(^{-1}\)): 1687,1671 (C=O), 3082-3026 (C-H), 2899-2857 (C-H), 1596 (C=C); \(^1\)H NMR(CDCl\(_3\), 400 MHz, ppm): \(\delta = 5.14 \text{ (d, 1H, H-2)}, 4.35 \text{ (m, 1H, H-3)}, 3.15 \text{ (dd, 1H, H-4a)}, 3.04 \text{ (dd, 1H, H-4b)}, 6.97-7.98 \text{ (m, Ar-H)}; ^{13}\text{C NMR (CDCl}_3, 100 MHz, ppm): \(\delta = 197.55 \text{ (C-1)}, 196.10 \text{ (C-5)}, 57.57 \text{ (C-2), 43.67 \text{ (C-3), 41.67 \text{ (C-4), 114.28-165.71\text{(Ar-C); Mass (m/z): 423 (M+1).}}}

### 3.6.2. 3-(4-chlorophenyl)-5-(4-fluorophenyl)-1,2-diphenylpentane-1,5-dione (158)

Yield: 98%; M.P.: 189-191°C; FT-IR(KBr, cm\(^{-1}\)): 1670 (C=O), 3086-3023(C-H), 2960-2855 (C-H), 1596 (C=C); \(^1\)H NMR(CDCl\(_3\), 400 MHz, ppm): \(\delta = 5.08 \text{ (d, 1H, H-2)}, 4.33 \text{ (m, 1H, H-3), 3.12 \text{ (dd, 1H, H-4a), 3.04 \text{ (dd, 1H, H-4b), 6.99-8.07 \text{ (m, Ar-H)}; ^{13}\text{C NMR (CDCl}_3, 100 MHz, ppm): \(\delta = 198.27 \text{ (C-1), 198.81 \text{ (C-5), 58.51 \text{ (C-2), 43.96 \text{ (C-3), 42.49 \text{ (C-4), 115.46-166.87 \text{(Ar-C); Mass (m/z): 457 (M+1).}}}}

### 3.6.3. 5-(4-fluorophenyl)-3-(4-methoxyphenyl)-1,2-diphenylpentane-1,5-dione (159)

Yield: 96%; M.P.: 183-185°C; FT-IR(KBr, cm\(^{-1}\)): 1686 (C=O), 3086-3033 (C-H), 2938-2897 (C-H), 1596 (C=C); \(^1\)H NMR(CDCl\(_3\), 400 MHz, ppm): \(\delta = 5.09 \text{ (d, 1H, H-2)}, 4.31 \text{ (m, 1H, H-3), 3.13 \text{ (dd, 1H, H-}
4a), 3.04 (dd, 1H, H-4b), 6.68-7.81 (m, Ar-H); $^{13}$C NMR (CDCl$_3$, 100 MHz, ppm): $\delta = 198.74$ (C-1), 197.38 (C-5), 58.86 (C-2), 43.99 (C-3), 42.85 (C-4), 55.08 (OCH$_3$), 113.77-166.76 (Ar-C).

**3.6.4. 5-(4-fluorophenyl)-1,2-diphenyl-3-(p-tolyl)pentane-1,5-dione(160)**

Yield: 97%; M.P.: 177-179°C; FT-IR(KBr, cm$^{-1}$): 1671 (C=O), 3086-3029 (C-H), 2958-2857 (C-H), 1596 (C=C); $^1$H NMR(CDCl$_3$, 400 MHz, ppm): $\delta = 5.12$ (d, 1H, H-2), 4.35 (m, 1H, H-3), 3.11 (dd, 1H, H-4a), 3.03 (dd, 1H, H-4b), 6.95-8.07 (m, Ar-H); $^{13}$C NMR (CDCl$_3$, 100 MHz, ppm): $\delta = 198.61$ (C-1), 197.30 (C-5), 58.65 (C-2), 44.29 (C-3), 42.88 (C-4), 21.00 (CH$_3$), 127.7-139.4 (Ar-C); Mass (m/z): 437 (M+1).

**3.6.5. 3-(4-bromophenyl)-5-(4-fluorophenyl)-1,2-diphenylpentane-1,5-dione(161)**

Yield: 97%; M.P.: 191-193°C; FT-IR(KBr, cm$^{-1}$): 1670 (C=O), 3081-3031 (C-H), 2964 (C-H), 1596 (C=C); $^1$H NMR(CDCl$_3$, 400 MHz, ppm): $\delta = 5.09$ (d, 1H, H-2), 4.32 (m, 1H, H-3), 3.12 (dd, 1H, H-4a), 3.04 (dd, 1H, H-4b), 6.98-7.81 (m, Ar-H); $^{13}$C NMR (CDCl$_3$, 100 MHz, ppm): $\delta = 198.24$ (C-1), 196.77 (C-5), 58.44 (C-2), 44.00 (C-3), 42.45 (C-4), 115.47-168.88 (Ar-C); Mass (m/z): 501 (M+1).

**3.7. Antibacterial activity materials and Methods**

The synthesized derivatives were screened for the antibacterial activity against two Gram-positive bacteria *viz.*, *Bacillus subtilis* and *Staphylococcus aureus* and two Gram-negative bacteria *viz.*,
*Escherichia coli* and *Pseudomonas aeruginosa* by using the disc diffusion method\(^{146-148}\). Ciprofloxacin was used as reference standard for comparing the results.

**Culture medium:**

Nutrient broth was used for the preparation of inoculum of the bacteria and nutrient agar was used for the screening method.

**Composition of Nutrient agar medium:**

- **Peptone**: 5.0 gm
- **Sodium chloride**: 5.0 gm
- **Beef extract**: 1.5 gm
- **Yeast extracts**: 1.5 gm
- **Agar**: 15.0 gm
- **Distilled water**: 1000 ml
- **pH**: 7.4 ± 0.2

**Procedure**

Determination of antibacterial activity by disc-diffusion method\(^{251,252}\)

The test organisms were subculture using nutrient agar medium. The tubes containing sterilized medium were inoculated with the respective bacterial strain. After incubation at 37°C ±1°C for 18 hours, they were stored in a refrigerator. The nutrient agar medium was sterilized by autoclaving at 121°C for 15 min. The petriplates, tubes and flasks plugged with cotton were sterilized in hot-air oven at
160 °C, for an hour. Into each sterilized petriplate (20 cm diameter), was poured about 125 mL of molten nutrient agar medium which was already inoculated with the respective strain of bacteria (5 mL of inoculum to 250 mL of nutrient agar medium) aseptically. The plates were left at room temperature aseptically to allow the solidification. After solidification, the paper discs containing the derivatives were placed at different areas on the surface of each plate and labeled accordingly.

Each test compound (5 mg) was dissolved in dimethyl sulfoxide (5 mL Analar grade) to give a concentration of 1000 µg/mL. Ciprofloxacin solution was also prepared to give a concentration of 1000 µg/mL in sterilized distilled water. The pH of all the test solutions and control was maintained in between 2 to 3 by using con.HCl. All the compounds were tested at dose levels of 1000 µg and DMSO used as a control. The solutions of each test compound, control and reference standard were added separately in the cups and the plates were kept undisturbed for at least 2 hours in a refrigerator to allow diffusion of the solution properly into nutrient agar medium. Petri dishes were subsequently incubated at 37±1 °C for 24 hours. After incubation, the diameter of zone of inhibition surrounding each of the cups was measured with the help of an antibiotic zone reader. The results are presented in Table.

3.8. Microwave Oven

A conventional (unmodified) domestic microwave oven quipped with a turnable (LG; MG-395 WA, 230v~50Hz, 760W) operating at 2450Hz was used for irradiation.
3.9. FT-IR measurement

FT-IR spectra were reported in NICOLET-AVATAR-330 FT-IR spectrometer. The sample was mixed with KBr and pellet technique was adopted to record the spectra.

3.10. Mass measurement

Mass spectra were recorded on SCIEX-API 2000 LC-MS spectrometer using electron spray soft ionization technique in positive and negative mode.

3.11. 1D-NMR and 2D-NMR measurements

$^1$H NMR spectra were recorded at 400 MHz on BRUKER AV-III or Varian 400 MHz spectrometer using CDCl$_3$ or DMSO-$d_6$ as solvent and TMS as internal standard. $^{13}$C NMR spectra were recorded at 100 MHz on BRUKER AV-III spectrometer in CDCl$_3$ or DMSO-$d_6$. HSQC and HMBC spectra were recorded on a BRUKER AV-III 400 NMR spectrometer, using standard parameters. For recording $^1$H NMR spectra, solution were prepared by dissolving about 10 mg of the compound in 0.5 mL of CDCl$_3$ or DMSO-$d_6$. While for recording $^{13}$C NMR spectra, about 50 mg of the compound was dissolved in the same volume of the solvent. TMS (Tetramethylsilane) was used as an internal standard.

3.12. Theoretical calculations

Geometry optimizations were carried out according to DFT using B3LYP/6-31G (d,p) basis set available in Gussian -03 Package.
3.13. X-ray data collection, structure solution and refinement

Crystal was grown by slow evaporation technique using ethanol as solvent. Determination of the unit cell and data collection were performed on a (Bruker, 2008) APEX2 diffractometer using graphite-monochromated Mo-Kα radiation (λ = 0.71073 Å) at 293K with crystal size of 0.25x0.20x0.20 mm. Multi-scan absorption correction were applied using the SADABAS program. The structure was solved by direct methods and successive Fourier difference syntheses (SHELXS-97) and refined by full matrix least square procedure on F² with anisotropic thermal parameters. All non hydrogen atoms were refined (SHELXL-97) and placed at chemically acceptable position.