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Original article

Synthesis of some new 4-styryltetrazolo[1,5-*a*]quinoxaline and 1-substituted-4-styryl[1,2,4]triazolo[4,3-*a*]quinoxaline derivatives as potent anticonvulsants

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Abstract

4-Methyltetrazolo[1,5-*a*]quinoxaline (**3**) was prepared by the azide cyclocondensation of 2-chloro-3-methylquinoxaline (**2**). The reaction of **3** with aromatic aldehydes furnished 4-styryltetrazolo[1,5-*a*]quinoxalines (**4a–f**). Compound **2**, on treatment with hydrazine hydrate gave 2-hydrazino-3-methylquinoxaline (**5**). The ring closure of **5** was achieved by the reaction of orthoesters and trifluoroacetic acid to yield 4-methyl-1-(substituted)[1,2,4]triazolo[4,3-*a*]quinoxalines (**7a–c**). Further, reaction of **7a–c** with different aromatic aldehydes furnished the title compounds, 4-styryl-1-(substituted)[1,2,4]triazolo[4,3-*a*]quinoxalines (**8a–i**) in good yield. In another scheme, the hydrazino compound **5** was treated with different aromatic aldehydes to yield corresponding *N*-arylidenehydrazino quinoxalines (**6a–d**). Further, the oxidative cyclization of hydrazones by nitrobenzene yielded 1-aryl-4-methyl[1,2,4]triazolo[4,3-*a*]quinoxalines (**7d–g**), which on condensation with aromatic aldehydes gave the title compounds, 1-aryl-4-styryl[1,2,4]triazolo[4,3-*a*]quinoxalines (**8j–u**). The newly synthesized compounds have been characterized by FTIR, ^{1}H NMR, ^{13}C NMR and mass spectral data, followed by elemental analysis. Some of the compounds were screened for in vivo anticonvulsant activity. Few of them exhibited promising results.

Keywords: Quinoxaline; 1,2,4-Triazolo; Styryl; Tetrazolo; Hydrazones; Anticonvulsant activity

1. Introduction

The tetrazole group which is considered analogous to carboxylic group [1] as a pharmacore possesses wide range of biological activities. Several substituted tetrazoles have been shown to possess anticonvulsant [2], anti-inflammatory [3], CNS depressant [4], antimicrobial [5], anti-aids [6] and antifertility [7,8] agents. Similarly tetrazolo quinoxalines have been reported for their antibacterial, antifungal or algicidal activities [9]. Earlier studies revealed [10] that most of the compounds derived from 1,2,4-triazoles have been shown to display a wide spectrum of biological activities. Moreover, a few fused triazoles to different heterocycles have been found to be significant anticonvulsant [11–15] and tranquillizing agents [16]. Also, 1,2,4-triazolo quinoxalines have been reported as antidepressant, cardiotonic and antifatigue agents [17]. Further, hydrazino quinoxalines and their cyclic analogues were reported as antimicrobial agents [18]. Keeping this in view, it was thought worthwhile to design the synthesis of title compounds wherein the biologically active triazole and tetrazole moieties are fused to potent quinoxaline ring at 1,2 positions. The present communication reports the multistep synthesis of hitherto unknown 4-styryltetrazolo[1,5-*a*]quinoxalines (**4a–f**), 4-styryl-1-(substituted)[1,2,4]triazolo[4,3-*a*]quinoxalines (**8a–i**) and 1-aryl-4-styryl[1,2,4]triazolo[4,3-*a*]quinoxalines (**8j–u**) starting from

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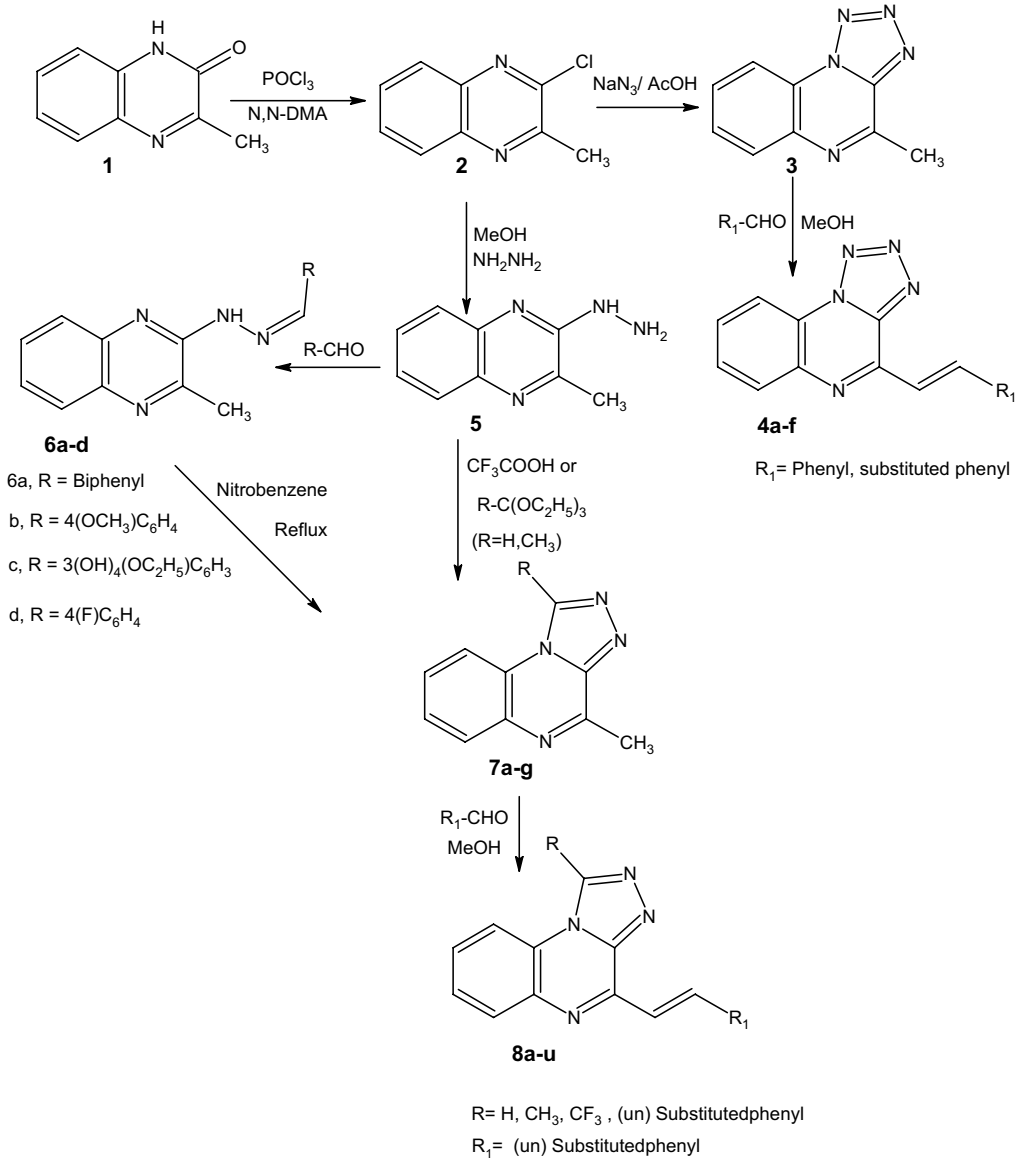

Scheme 1.

1,2 diaminobenzene and pyruvic acid via quinoxaline ring build-up. Eighteen title compounds have been evaluated for their anticonvulsant activity following PTZ model.

2. Results and discussion

2.1. Chemistry

The target compounds were synthesized according to the representative scheme-1 (Scheme 1). The required starting material, 2-chloro-3-methylquinoxaline (**2**) was prepared in good yield from 3-methyl quinoxaline-2-one by the treatment of phosphorousoxychloride. The azide cyclocondensation of **2** with sodium azide, yielded 4-methyltetrazolo[1,5-*a*]quinoxaline (**3**), which on treatment with different aromatic aldehydes furnished 4-styryltetrazolo[1,5-*a*]quinoxaline (**4a**–**f**). The reaction of 2-chloro-3-methylquinoxaline (**2**) with hydrazine hydrate gave 2-hydrazino-3-methylquinoxaline (**5**). The cyclization of **5** was achieved by the reaction of orthoesters and trifluoroacetic acid to yield 4-methyl-1-(substituted)[1,2,4]triazolo[4,3-*a*]quinoxalines (**7a**–**c**). Further, compounds **7a**–**c** were condensed with different aromatic aldehydes to give the title compounds 4-styryl-1-(substituted)[1,2,4]triazolo[4,3-*a*]quinoxalines (**8a**–**i**) in good yield. Another series of title compounds, 1-aryl-4-styryl[1,2,4]triazolo[4,3-*a*]quinoxalines (**8j**–**u**) were prepared from the intermediate **5** in three steps. Compound **5** was treated with different aromatic aldehydes to yield corresponding *N*-arylidenehydrazino quinoxalines (**6a**–**d**) which on oxidative cyclization by nitrobenzene gave 1-aryl-4-methyl[1,2,4]triazolo [4,3-*a*]quinoxalines (**7d**–**g**). Finally, compounds **7d**–**g** were condensed with different aromatic aldehydes to obtain **8j**–**u**. The structural assignments to the new compounds were based on their elemental analysis and spectral (FTIR, ^{1}H NMR, ^{13}C NMR and mass) data.

The formation of 4-methyltetrazolo[1,5-*a*]quinoxaline (**3**) from **2** was confirmed by its mass spectrum. In its mass spectrum, molecular ion peak appeared at *m*/*z* 186 (100%), which matches with its molecular formula $C_9H_7N_5$. Further, condensation of aromatic aldehydes with compounds **3** was confirmed by the absence of three methyl protons and appearance of two vinylic protons as two doublets around aromatic region in ^{1}H NMR spectra of title compounds. Their structures were also confirmed by recording their FAB MASS spectra, which are consistent with their molecular formula. The synthesis of 2-hydrazino-3-methylquinoxaline (**5**) from **2** was confirmed by its NMR and FTIR spectra. Its FTIR spectrum showed strong peaks at 3188 and 2943 cm^{-1} indicating the presence of $-NHNH_2$ group, while ^{1}H NMR spectrum was in accordance with its structure. The mass spectrum of it showed a molecular ion peak at *m*/*z* 175 (50%), which tallies with its molecular formula $C_9H_{10}N_4$. The cyclization of compound **5** to triazoles (**7a–c**) was confirmed by recording its FTIR, NMR and mass spectra. In FTIR spectrum of **7a–c**, disappearance of strong peaks at 3188 and 2943 cm^{-1} indicates the absence of $-NHNH_2$ group. This confirms the cyclization. The mass spectrum of **7a** showed a molecular ion peak at *m*/*z* 253 (100%), which conforms to its molecular formula $C_{11}H_7F_3N_4$. In the ^{1}H NMR spectrum of **7b**, a singlet appeared at δ 9.3 integrating for one proton of triazolo ring. Appearance of molecular ion at *m*/*z* 185 (100%) in its mass spectrum confirms its molecular formula, $C_{10}H_8N_4$. Similarly the ^{1}H NMR spectrum of **7c** showed an additional singlet at δ 3.2 accounting for three protons of methyl group of triazole ring. The smooth cyclization of **5** was further confirmed by its mass spectrum, which showed a molecular ion peak at *m*/*z* 199(100%) corresponding to $C_{11}H_{10}N_4$.

The FTIR spectra of hydrazones **6a–d** displayed strong absorption bands between 1650 and 1420 cm^{-1} in the aromatic region. On cyclization of hydrazones to triazoles (**7d–g**), these bands shifted towards shorter wavelengths indicating complete aromatization of **6a–d**. In the FTIR spectrum, **5** exhibited a broad band at 3188 cm^{-1} due to NH stretching while compounds **6a–d** showed sharp band at 3320 cm^{-1}. The disappearance of these bands in the spectra of **7d–g** indicates cyclization. The mass spectrum of **7e** showed a molecular ion peak at *m*/*z* 321 (100%), which matches with its molecular formula $C_{18}H_{16}N_4O_2$. Finally, the formation of title compounds **8a–u** from **7a–g** was confirmed by the absence of three methyl protons and appearance of two vinylic protons as two doublets in aromatic region of their ^{1}H NMR spectra. Their structures were also confirmed by recording their FAB MASS spectra, which are in consistent with their molecular formulae. The results of physical and elemental analyses data are shown in Table 1.

3. Biological activity

3.1. Anticonvulsant activity

Anticonvulsant studies were carried out by PTZ animal model [19]. In the method, inbred male albino mice (Swiss strain) weighing between 20 and 30 g were used for the study. They were housed in groups of three mice per cage under standard laboratory conditions for 1 week before the experiments. The housing conditions were maintained at controlled temperature (23 °C) and humidity (50%). They received standard diet and water ad libitum. The animals were transferred to the laboratory 1 h before the start of the experiment. The institutional ethical committee approved the study. All the results were statistically analyzed and are expressed as the mean ± S.E.M.

Pentylenetetrazole (PTZ, Sigma Chemicals, USA) was used as convulsant and diazepam (Ranbaxy Laboratories, India) was used as standard drug. PTZ was dissolved in normal saline. Test compounds and standard drug were dissolved in 2% acacia suspension. The mice were divided into 20 groups of three each. Group-1 received diazepam at a dose of 4 mg/kg, group-2 received **4b**, group-3 received **4c**, group-4 received **4d**, group-5 received **4e**, group-6 received **4f**, group-7 received **8a**, group-8 received **8b**, group-9 received **8c**, group-10 received **8d**, group-11 received **8e**, group-12 received **8f**, group-13 received **8g**, group-14 received **8h**, group-15 received **8i**, group-16 received **8k**, group-17 received **8n**, group-18 received **8q** and group-19 received **8t**, at a dose of 10 mg/kg. Each dose was dissolved in 2% gum acacia and delivered orally in a volume of 0.1 ml/10 g body weight. The control group, i.e. group-20 received 0.1 ml/10 g of 2% gum acacia orally by gavage feeding. Convulsion was induced 1 h after the administration of the standard drug or the test compounds by i.p. injection of PTZ (80 mg/kg), dissolved in saline to a volume of 0.1 ml/10 g body weight. The time needed for the development of unequivocal sustained clonic seizure activity involving the limbs (isolated myoclonic jerks or other preconvulsive chewing behavior were not counted) was carefully noted. Duration of seizure was also noted. Seizure-free duration for a period of 1 h was taken as protection. The number of animals protected in each group was recorded and percent protection was calculated. The animals in the control group exhibited seizures at the dose of PTZ used in the study. The onset of seizure was found to be 119 ± 0.577 s and the mean seizure duration was 311 ± 0.577 s for the control group. Diazepam (4 mg/kg), **4c**, **4f**, **8b**, **8c**, **8f**, **8i** and **8t** protected the animals from developing convulsions at the dose of 10 mg/kg body weight in comparison with control group. For these compounds, all three mice in the group failed to have seizure and thus went for the maximal defined time of 3600 s. Animals were less active after receiving all of the test compounds than the control mice and enhanced effect was exhibited when compounds **4c**, **4f**, **8b**, **8c**, **8f**, **8i** and **8t** were administered. Amongst the tested compounds, **4c**, **4f**, **8b**, **8c**, **8f**, **8i** and **8t** exhibited promising anticonvulsant activity against PTZ induced seizure in mice at a dose of 10 mg/kg in comparison with diazepam at 4 mg/kg dose. The results are tabulated in Table 2.

A study of structure–activity relationship from the results tabulated in Table 2 reveals that compounds bearing CF_3, H or CH_3 group in position-1 and 4-fluorophenyl moiety (**4c**, **4f**, **8c**, **8f**, **8i** and **8t**) or 4-methoxyphenyl (**8b** and **8t**) substituents at C-4 of the title compounds have shown good anticonvulsant activity in comparison with standard drug diazepam. The increase in activity may be due to their easier transport

Table 1
Characterization data of compounds **4a–f** and **8a–u**

Compound	R	R_1	Molecular formula/Molecular weight	M.p. (°C)/ Crystallization solvent	Yield %	Analysis (%)		
						Found (Calc.)		
						C	H	N
4a	–	Biphenyl	$C_{22}H_{15}N_5$ 349.38	250–252 Chloroform	65	75.60 (75.64)	4.34(4.29)	20.11 (20.05)
4b	–	4(OCH_3)C_6H_4	$C_{17}H_{13}N_5O$ 303.33	196–198 Chloroform	67	67.29 (67.32)	4.25 (4.29)	23.13 (23.10)
4c	–	4-(F)C_6H_4	$C_{16}H_{10}FN_5$ 291.26	204–206 Chloroform	75	65.90 (65.97)	3.38 (3.43)	23.98 (24.05)
4d	–	3-(NO_2)C_6H_4	$C_{16}H_{10}N_6O_2$ 318.29	218–220 Chloroform	64	60.30 (60.32)	3.09 (3.14)	26.35 (26.41)
4e	–	6-Methoxy-2-naphthyl	$C_{21}H_{15}N_5O$ 353.37	210–212 Chloroform	78	71.35 (71.38)	4.20 (4.24)	19.80 (19.83)
4f	–	C_6H_5	$C_{16}H_{11}N_5$ 273.29	180–184 Chloroform	75	70.23 (70.25)	3.98 (4.02)	25.63 (25.61)
8a	CF_3	6-Methoxy-2-naphthyl	$C_{23}H_{15}F_3N_4O$ 420.38	250–252 Chloroform	62	62.55 (65.66)	3.59 (3.56)	13.27 (13.32)
8b	CF_3	4-(OCH_3)C_6H_4	$C_{19}H_{13}F_3N_4O$ 370.32	208–210 Chloroform	68	61.54 (61.56)	3.50 (3.51)	15.15 (15.12)
8c	CF_3	4-(F)C_6H_4	$C_{18}H_{10}F_4N_4$ 358.29	190–192 Chloroform	73	60.25 (60.28)	2.84 (2.79)	15.65 (15.62)
8d	CH_3	3-(NO_2)C_6H_4	$C_{18}H_{13}N_5O_2$ 331.32	198–200 Chloroform	73	65.23 (65.19)	3.95 (3.92)	21.15 (21.12)
8e	CH_3	4-(OCH_3)C_6H_4	$C_{19}H_{16}N_4O$ 316.35	210–212 Chloroform	78	72.10 (72.07)	5.00 (5.05)	17.68 (17.70)
8f	CH_3	4-(F)C_6H_4	$C_{18}H_{13}FN_4$ 304.32	240–242 Chloroform	61	70.94 (70.97)	4.25 (4.27)	18.43 (18.40)
8g	H	3-(NO_2)C_6H_4	$C_{17}H_{11}N_5O_2$ 317.30	260–262 Chloroform	70	64.25 (64.29)	3.50 (3.46)	22.04 (22.06)
8h	H	4-(OCH_3)C_6H_4	$C_{18}H_{14}N_4O$ 302.33	240–242 Chloroform	78	71.42 (71.44)	4.65 (4.63)	18.50 (18.52)
8i	H	4-(F)C_6H_4	$C_{17}H_{11}FN_4$ 290.29	206–208 Chloroform	65	70.24 (70.27)	3.80 (3.78)	19.26 (19.29)
8j	Biphenyl	Biphenyl	$C_{35}H_{24}N_4$ 500.59	218–220 Chloroform		83.85 (83.90)	4.75 (4.79)	11.15 (11.18)
8k	Biphenyl	4-(F)C_6H_4	$C_{29}H_{19}FN_4$ 442.48	260–262 Chloroform	71	78.61 (78.64)	4.25 (4.29)	12.68 (12.65)
8l	Biphenyl	3-(NO_2)C_6H_4	$C_{29}H_{19}N_5O_2$ 469.49	280–282 Chloroform	71	74.08 (74.12)	4.08 (4.04)	14.96 (14.90)
8m	4(OCH_3)C_6H_4	6-Methoxy-2-naphthyl	$C_{29}H_{22}N_4O_2$ 458.51	294–296 Chloroform	70	75.85 (75.89)	4.77 (4.79)	12.18 (12.21)
8n	4(OCH_3)C_6H_4	4-(Cl)C_6H_4	$C_{24}H_{17}ClN_4O$ 412.87	250–252 Chloroform	72	69.73 (69.75)	4.10 (4.11)	13.60 (13.56)
8o	4(OCH_3)C_6H_4	C_6H_5	$C_{24}H_{18}N_4O$ 378.42	230–233 Chloroform	82	76.07 (76.10)	4.73 (4.75)	14.82 (14.79)
8p	3-(OH)-4-(OC_2H_5)-C_6H_3	3-(NO_2)C_6H_4	$C_{25}H_{19}N_5O_4$ 453.45	158–160 Chloroform	68	66.10 (66.15)	4.20 (4.19)	15.40 (15.43)
8q	3-(OH)-4-(OC_2H_5)-C_6H_3	4-(Cl)C_6H_4	$C_{25}H_{19}ClN_4O_2$ 442.89	248–250 Chloroform	68	67.70 (67.73)	4.26 (4.29)	12.60 (12.64)
8r	3-(OH)-4-(OC_2H_5)-C_6H_3	C_6H_5	$C_{25}H_{20}N_4O_2$ 408.45	238–240 Chloroform	68	73.48 (73.44)	4.90 (4.89)	13.70 (13.71)
8s	4-(F)C_6H_4	3-(NO_2)C_6H_4	$C_{23}H_{14}FN_5O_2$ 411.38	274–276 Chloroform	74	67.12 (67.09)	3.44 (3.40)	16.99 (17.01)
8t	4-(F)C_6H_4	4-(OCH_3)C_6H_4	$C_{24}H_{17}FN_4O$ 396.41	220–222 Chloroform	74	72.62 (72.65)	4.30 (4.28)	14.151 (14.12)
8u	4-(F)C_6H_4	C_6H_5	$C_{23}H_{15}FN_4$ 366.39	244–246 Chloroform	74	75.30 (75.32)	4.11 (4.09)	15.23 (15.28)

across biological membranes after the introduction of the styrylphenyl group at the position 4 of quinoxaline ring [20]. It can be inferred that presence of fluoro, trifluoromethyl, methoxy and methyl groups on the condensed heterocyclic system containing quinoxaline, fused with triazole or tetrazole at positions 1,2 in the backbone structure, influenced the activity to the greater extent, which may be attributed to the electronic factors exerted by the substituents and the hydrophobic nature of phenyl nucleus in the structure. This observation is in accordance with the structural requirements of

Table 2
Anticonvulsant activity of the tested compounds (PTZ animal mode)

Group	Drug/test compound	Dose (mg/kg)	Latency (s) (mean ± S.E.M)	Protection (%)	Duration of seizure (s) (mean ± S.E.M)
1	Diazepam	4	3600	100	0
2	**4b**	10	110 ± 2.866	0	11 ± 0.577
3	**4c**	10	3600	100	0
4	**4d**	10	110 ± 2.866	0	11 ± 0.577
5	**4e**	10	100 ± 2.866	0	8 ± 0.577
6	**4f**	10	3600	100	0
7	**8a**	10	110 ± 2.866	0	12 ± 0.842
8	**8b**	10	3600	100	0
9	**8c**	10	3600	100	0
10	**8d**	10	110 ± 2.866	0	11 ± 0.577
11	**8e**	10	100 ± 2.866	0	14 ± 0.842
12	**8f**	10	3600	100	0
13	**8g**	10	110 ± 2.866	0	12 ± 0.842
14	**8h**	10	123 ± 1.666	0	14 ± 0.842
15	**8i**	10	3600	100	0
16	**8k**	10	125 ± 0.577	0	8 ± 0.577
17	**8n**	10	110 ± 2.866	0	12 ± 0.842
18	**8q**	10	110 ± 2.866	0	12 ± 0.842
19	**8t**	10	3600	100	0
20	2% Gum acacia (control)	0.1 ml/10 g	119 ± 0.577	0	311 ± 0.577

$N = 3$ in each group.

CNS depressant drugs, as reported [21]. Since our preliminary studies were carried out only at one concentration, further studies using larger concentrations should be conducted for obtaining conclusive results. Therefore, the above seven compounds could be recommended for further studies including behavioral effect and concentration response studies to find out the advantages of these compounds over known anticonvulsants.

4. Experimental

4.1. General

Melting points were determined by open capillary and are uncorrected. The IR spectra (in KBr pellets) were recorded on a Shimadzu FT-IR 157 spectrophotometer. ^{1}H NMR spectra were recorded either on Perkin–Elmer EM-390 (300 MHz) or on Bruker WH-200 (400 MHz) spectrometer using TMS as an internal standard. ^{13}C NMR spectra were obtained on a Perkin–Elmer (Model RB-12, 100 MHz) spectrometer. All chemical shifts are reported in ppm downfield from tetramethylsilane. The mass spectra were recorded on a Jeol JMS-D 300 mass spectrometer (FAB) operating at 70 eV. Elemental analysis was performed on Flash EA 1112 Thermo Electron Corporation CHNS analyzer. The purity of the compounds was checked by thin layer chromatography (TLC) on Merck silica gel 60 F_{254} precoated sheets. Starting materials were purchased from Aldrich Chemical Company or Spectrochem Chemical Company and used without further purification. All solvents were of analytical grade and freshly distilled prior to use.

4.1.1. 2-Chloro-3-methylquinoxaline (*2*)

Compound **1** (25.0 g, 143.6 mmol) was added to cold phosphorousoxychloride (125 mL) in portions to get a slurry. To the resulting slurry *N*,*N*-dimethyl aniline (4.4 g, 36.3 mmol) was added dropwise below 15 °C. The brick red mixture was refluxed (at ≈105 °C) for 15 min and the resulting dark brown clear solution was then cooled to ambient temperature. It was added to ice cold water (1250 mL) and basified slowly under cooling with 40% aq. NaOH to pH 8. The brick red solid, thus separated was filtered, washed with water (2 × 250 mL) and dried to obtain crude **2**. The crude product was dissolved in hot hexane (400 ml), treated with activated charcoal and filtered. The filtrate on concentration to a small volume (25 mL) gave pure **2**, as brick red crystals, 20.0 g (72%), m.p. 82–84 °C (Lit. 84–86 °C). This is a more convenient and better method compared to the reported procedure [22]. IR (KBr) cm^{-1}: 1578.6, 1540, 1405, 1368, 1329, 978, 892, 736, 620 (Ar–H). MS (*m*/*z*, %): 179 (M + 1, 100), 178 (M^+, 30), 164 (40), 144 (15), 130 (40), 121 (20), 102 (40). ^{1}H NMR (DMSO-d_6) δ: 2.72 (s, 3H, CH_3), 7.59 (m, 2H, CH), 7.89 (m, 2H, CH). ^{13}C NMR (DMSO-d_6): 19.88 (–*C*H$_3$), 128.59, 129.02, 129.20, 129.98, 140.01, 140.56, 140.90 (aromatic carbons), 146.70 (N=*C*–CH$_3$). Anal. Calcd. for $C_9H_7ClN_2$: C, 60.47; H, 3.91; N, 15.67; Found: C, 60.40; H, 3.87; N, 15.69%.

4.1.2. Preparation of 4-methyltetrazolo[1,5-a] quinoxaline (*3*)

A mixture of 2-chloro-3-methylquinoxaline **2** (10 g 0.056 mol), sodium azide (4.4 g, 0.067 mol) in water (15 mL), acetic acid (10 mL) and dimethylsulphoxide (200 mL) was stirred at 40 °C for 3 h. Completion of the reaction was monitored by TLC (hexane:ethyl acetate, 4:1 v/v). It was then cooled to room temperature and added to cold water (500 mL). A crystalline solid separated was filtered off, washed with water, dried and recrystallized from chloroform as light yellow crystals, 9.5 g (92%), m.p. 134–136 °C. IR (KBr) cm^{-1}: 1570.6, 1546, 1400, 1362, 1329, 898, 734, 620

(Ar–H). MS (*m/z*, %): 186 (M + 1, 100), 185 (M^+, 80), 164 (20), 131 (15), 107 (40), 121 (20), 102 (15). ^{1}H NMR ($CDCl_3$) δ: 3.16 (s, 3H, CH_3), 7.78 (m, 2H), 8.23 (d, 1H), 8.62 (d, 1H). ^{13}C NMR (DMSO-d_6): 21.71 (–*C*H_3), 116.29, 124.52, 129.71, 129.85, 130.36, 136.80, 142.89, 151.09. Anal. Calcd. for $C_9H_7N_5$: C, 58.34; H, 3.78; N, 37.81; Found: C, 58.30; H, 3.73; N, 37.88%.

4.1.3. 3-[(*E*)-2-Arylvinyl]tetrazolo[1,5-a]quinoxaline (**4a–f**)

General procedure: A mixture of compound **3** (1.5 g, 0.008 mol), an appropriate aldehyde (0.0097 mol), acetic acid (10 mL) and catalytic amount (0.2 mL) of conc. sulfuric acid was refluxed (118 °C) for 1 h. The reaction mass was cooled to room temperature; the separated solid was filtered, washed with water (2 × 20 mL) and finally with cold methanol to obtain compounds **4a–f**. They were recrystallized from appropriate solvents.

Compound **4a**: IR (KBr) cm^{-1}: 3054, 2929, 1625, 1540, 1475, 1392, 1360, 1315, 1255. ^{1}H NMR ($CDCl_3$) δ: 7.50 (complex m, 12H), 8.58 (d, 1H, $J = 8.6$ Hz). ^{13}C NMR (DMSO-d_6): 116.62, 123.36, 124.41, 125.10, 125.56, 126.55, 127.99, 128.15, 128.20, 129.60, 130.91, 136.54, 136.65, 136.93, 137.91, 139.99, 141.58, 143.57.

Compound **4b**: IR (KBr) cm^{-1}: 3050, 2925, 1625, 1537, 1475, 1390, 1356, 1312, 1254. MS (*m/z*, %): 304 (M + 1, 50), 303 (M^+, 20), 245 (20), 244 (15), 107 (40), 102 (15), 75 (10). ^{1}H NMR ($CDCl_3$) δ: 3.80 (s, 3H, OCH_3), 7.18 (m, 2H), 7.23 (d, 1H, vinylic proton, $J = 16.6$ Hz), 7.39 (m, 2H), 7.56 (t, 1H, $J = 8.38$ Hz), 7.60 (d, 1H, $J = 8.38$ Hz), 7.92 (d, 1H, vinylic proton, $J = 16.6$ Hz), 7.95 (t, 1H, $J = 8.5$ Hz), 8.65 (d, 1H, $J = 8.5$ Hz). ^{13}C NMR (DMSO-d_6): 57.60 (–O*C*H_3), 115.74, 116.40, 123.36, 124.41, 125.08, 125.55, 126.55, 127.89, 128.06, 133.65, 136.54, 137.91, 141.58, 160.32.

Compound **4c**: IR (KBr) cm^{-1}: 3075, 1625, 1600, 1525, 1510, 1410, 1305, 1225, 736, 620 (Ar–H). MS (*m/z*, %): 292 (M + 1, 40), 291 (M^+, 20), 125 (20), 120 (15), 75(10). ^{1}H NMR ($CDCl_3$) δ: 7.20 (m, 2H), 7.23 (d, 1H, vinylic proton, $J = 16.5$ Hz), 7.39 (m, 2H), 7.59 (t, 1H, $J = 8.38$ Hz), 7.63 (d, 1H, $J = 8.38$ Hz), 7.92 (d, 1H, vinylic proton, $J = 16.5$ Hz), 7.96 (t, 1H, $J = 8.5$ Hz), 8.63 (d, 1H, $J = 8.5$ Hz). ^{13}C NMR (DMSO-d_6): 116.40, 117.79, 118.49, 123.36, 124.41, 125.55, 126.55, 129.70, 129.87, 131.79, 133.65, 136.54, 137.91, 141.58, 159.28, 165.78.

Compound **4d**: IR (KBr) cm^{-1}: 3050, 2925, 1625, 1537, 1475, 1450, 1390, 1362, 1329, 890 (Ar–H). MS (*m/z*, %): 319 (M + 1, 50), 289(20), 273 (10), 245 (10), 244 (10), 165 (10), 120 (15), 107 (20), 89 (20), 75 (10). ^{1}H NMR ($CDCl_3$) δ: 7.70 (d, 1H, vinylic proton, $J = 16.4$ Hz), 7.79 (t, 1H, $J = 8.50$ Hz), 7.88 (t, 1H, $J = 6.86$ Hz), 7.94 (d, 1H, $J = 8.30$ Hz), 7.99 (d, 1H, $J = 7.70$ Hz), 8.12 (d, 1H, vinylic proton, $J = 16.4$ Hz), 8.24 (d, 1H, $J = 6.86$ Hz), 8.29 (d, 1H, $J = 8.50$ Hz), 8.60 (s, 1H), 8.63 (d, 1H, $J = 8.50$ Hz). ^{13}C NMR (DMSO-d_6): 116.60, 124.73, 125.22, 128.72, 129.20, 130.28, 130.39, 130.49, 131.22, 131.73, 134.35, 136.23, 137.15, 142.62, 147.07 and 149.06.

Compound **4e**: IR (KBr) cm^{-1}: 3058, 2930, 1620, 1528, 1471, 1452, 1388, 1360, 1324, 893 (Ar–H). MS (*m/z*, %): 354 (M + 1, 40), 353 (M^+, 20), 289 (20), 242 (15), 120 (10), 105 (10), 73 (15).

4.1.4. Preparation of 2-hydrazino-3-methylquinoxaline (**5**)

A mixture of 20 g (0.112 mol) of 2-chloro-3-methylquinoxaline (**2**) and 9.0 g (0.28 mol) of hydrazine hydrate in 150 mL of methanol was stirred for 16 h at room temperature. The reaction mixture was filtered, and the solids were washed with methanol and air dried to give 17 g (87.6%) of product, m.p. 180–182 °C. MS (*m/z*, %): 175 (M + 1, 100), 174 (M^+, 80), 149 (50), 107(20), 95(10). ^{1}H NMR (DMSO-d_6) δ: 2.43 (s, 3H, CH_3), 7.28 (t, 1H), 7.48 (t, 1H), 7.56 (d, 1H, $J = 8.50$ Hz), 7.69 (d, 1H, $J = 8.20$ Hz). ^{13}C NMR (DMSO-d_6): 21.27 (–*C*H_3), 123.64, 124.68, 128.03, 128.94, 136.21, 140.48, 146.74, 146.95. Anal. Calcd. for $C_9H_{10}N_4$: C, 61.99; H, 5.74; N, 32.14; Found: C, 62.06; H, 5.70; N, 32.18%.

4.1.5. Preparation of 2-(N-arylidenehydrazino)-3-methylquinoxalines (**6a–d**)

General procedure: A mixture of 5.0 g (0.028 mol) of 2-hydrazino-3-methylquinoxaline (**5**) and, an aromatic aldehyde (0.029 mol), methanol (10 mL) and glacial acetic acid (2 mL) was refluxed for 3–4 h. The reaction mass was then cooled to room temperature, and kept overnight. The separated solid was filtered, washed with methanol (5 mL), dried and crystallized from a mixture of ethanol and acetic acid to obtain compounds **6a–d**.

Compound **6a**: Yield 7.5 g (78.9%), m.p. 238–240 °C. IR (KBr) cm^{-1}: 3320, 2930, 1650, 1528, 1471, 1420, 1380, 1362, 1326, 893 (Ar–H). ^{1}H NMR ($CDCl_3$) δ: 2.41 (s, 3H, $-CH_3$), 6.90 (m, 2H), 7.21 (m, 3H), 7.57 (m, 5H), 7.85 (m, 2H), 7.96 (d, 1H, $J = 8.50$), 8.19 (s, 1H). ^{13}C NMR (DMSO-d_6): 19.32 (*C*H_3), 114.55, 127.27, 127.40, 127.81, 127.97, 128.42, 128.79, 131.75, 132.79, 133.50, 136.33, 137.24, 138.21, 142.45, 142.92. Anal. Calcd. for $C_{22}H_{18}N_4$: C, 78.01; H, 5.31; N, 16.54; Found: C, 78.12; H, 5.38; N, 16.50%.

Compound **6b**: Yield 5.0 g (61.7%), m.p. 208–210 °C. IR (KBr) cm^{-1}: 3318, 2931, 1628, 1521, 1476, 1450, 1379, 1355, 1324, 890 (Ar–H). Anal. Calcd. for $C_{17}H_{16}N_4O$: C, 69.78; H, 5.47; N, 19.15; Found: C, 69.75; H, 5.52; N, 19.08%.

Compound **6c**: Yield 6.5 g (72.2%), m.p. 230–232 °C. IR (KBr) cm^{-1}: 3324, 2930, 1616, 1532, 1475, 1448, 1369, 1355, 1317, 896 (Ar–H). Anal. Calcd. for $C_{18}H_{18}N_4O_2$: C, 67.00; H, 5.58; N, 17.37; Found: C, 67.11; H, 5.62; N, 17.41%.

Compound **6d**: Yield 6.2 g (79.5%), m.p. 194–496 °C. IR (KBr) cm^{-1}: 3323, 2924, 1620, 1524, 1473, 1450, 1380, 1361, 1318, 879 (Ar–H). ^{1}H NMR ($CDCl_3$) δ: 2.60 (s, 3H, $-CH_3$), 7.32 (m, 2H), 7.57 (t, 1H, $J = 6.86$), 7.67 (m, 4H), 7.96 (d, 1H, $J = 8.52$), 8.19 (s, 1H). ^{13}C NMR (DMSO-d_6): 20.2 (*C*H_3), 114.25, 115.75, 116.41, 127.27, 127.81, 127.97, 129.13, 131.79, 132.75, 133.56, 137.24, 142.45, 145.52,

151.96. Anal. Calcd. for $C_{16}H_{13}FN_4$: C, 68.49; H, 4.63; N, 19.97; Found: C, 68.46; H, 4.60; N, 19.94%.

4.1.6. Preparation of 4-methyl-1-(trifluoromethyl)[1,2,4]triazolo[4,3-a]quinoxaline (7a)

2-Hydrazino-3-methylquinoxaline (**5**, 5.0 g, 0.028 mol) was added to 32.72 g (0.28 mol) of trifluoroacetic acid taken in a dry flask, at 5–10 °C with stirring under nitrogen atmosphere. The mixture was then heated to 100 °C for 3 h and poured over ice/H_2O. The separated solid was filtered, washed well with water and dried at 60 °C under vacuum. It was recrystallized from chloroform to give 5.0 g (70%) of product, m.p. 130–132 °C. IR (KBr) cm^{-1}: 3026, 1517, 1493, 1457, 1420, 1376, 1353, 1285, 1214, 1179, 1141, 1070, 988. MS (*m/z*, %): 253 (M + 1, 100), 252 (70), 234 (20), 137 (80), 107 (30). ^1H NMR ($CDCl_3$) δ: 3.10 (s, 3H, CH_3), 7.73 (d, 2H, $J = 8.50$ Hz), 8.17 (t, 2H, $J = 8.70$ Hz). ^{13}C NMR (DMSO-d_6): 21.18, 116.73, 117.78, 120.46, 121.48, 124.25, 129.02, 129.78, 130.75, 136.72, 145.98, 149.10, 152.48, 160.19. Anal. Calcd. for $C_{11}H_7F_3N_4$: C, 52.34; H, 2.77; N, 22.20; Found: C, 52.30; H, 2.82; N, 22.26%.

4.1.7. Preparation of 4-methyl[1,2,4]triazolo[4,3-a]quinoxaline (7b)

A mixture of 5.0 g (0.028 mol) of 2-hydrazino-3-methylquinoxaline (**5**) and 50 mL of triethyl orthoformate was stirred at 100 °C for 1 h. The reaction mass was then cooled to room temperature and the solid separated was filtered, washed with hexane, dried and finally recrystallized from chloroform to give 4.5 g (85.2%), m.p. 168–170 °C. IR (KBr) cm^{-1}: 3026, 1517, 1493, 1457, 1420, 1376, 1353, 1285, 1214, 1179, 1141, 1070, 988. MS (*m/z*, %): 185 (M + 1, 100), 184 (M+, 80), 131 (20), 107 (15). ^1H NMR ($CDCl_3$) δ: 3.05 (s, 3H, $-CH_3$), 7.60 (m, 2H), 7.90 (d, 1H, $J = 8.60$ Hz), 8.05 (d, 1H, $J = 8.60$ Hz), 9.3 (s, 1H, proton on triazole ring). ^{13}C NMR (DMSO-d_6): 21.17, 116.11, 123.50, 129.19, 130.90, 131.94, 137.47, 138.33, 140.29, 147.40. Anal. Calcd. for $C_{10}H_8N_4$: C, 65.15; H, 4.34; N, 30.40; Found: C, 65.20; H, 4.38; N, 30.38%.

4.1.8. Preparation of 1,4-dimethyl[1,2,4]triazolo[4,3-a]quinoxaline (7c)

A mixture of 5.0 g (0.028 mol) of 2-hydrazino-3-methylquinoxaline (**5**) and 50 mL of triethyl orthoacetate was stirred at 100 °C for 3 h. The reaction mass was then cooled to room temperature and quenched into 250 mL of ice cold water. The resulting product was filtered, washed with hexane, dried and finally recrystallized from chloroform to give 5.0 g (88%), m.p. 82–84 °C. IR (KBr) cm^{-1}: 3026, 1517, 1493, 1457, 1420, 1376, 1353, 1285, 1214, 1179, 1141, 1070, 988. MS (*m/z*, %): 199 (M + 1, 100), 196 (10), 179 (10), 169 (20), 148 (20), 147 (10), 131 (10), 117 (5), 113 (10), 106 (5), 97 (10). ^1H NMR ($CDCl_3$) δ: 3.0 (s, 3H, $-CH_3$), 3.20 (s, 3H, $-CH_3$), 7.6 (m, 2H), 8.00 (d, 1H, $J = 8.70$ Hz), 8.15 (d, 1H, $J = 8.70$ Hz). ^{13}C NMR (DMSO-d_6): 12.45 ($-CH_3$), 18.24 ($-CH_3$), 116.17, 123.55, 130.56, 131.78, 132.47, 137.51, 138.05, 148.29, 148.68. Anal. Calcd. for $C_{11}H_{10}N_4$: C, 66.59; H, 5.04; N, 28.25; Found: C, 66.63; H, 5.14; N, 28.22%.

4.1.9. Preparation of 1-aryl-4-methyl[1,2,4]triazolo[4,3-a]quinoxalines (7d–g)

General procedure: Compound **6** (0.009 mol) was added to nitrobenzene (10–15 mL) and the mixture was refluxed for 3–4 h in an oil bath. When the reaction was over, nitrobenzene was removed by applying high vacuum. The resulting residue was triturated with water and filtered. The dry product was then recrystallized from chloroform to give **7d–g**.

Compound **7d**: Yield 6.0 g (81.0%), m.p. 245–247 °C. 3024, 1520, 1488, 1450, 1374, 1351, 1281, 1210, 1179, 1141, 1070, 981. ^1H NMR ($CDCl_3$) δ: 2.72 (s, 3H, $-CH_3$), 7.21 (m, 5H), 7.43 (m, 3H), 7.62–7.71 (m, 2H), 7.96 (d, 1H, $J = 8.50$), 8.19 (s, 1H), 8.26 (d, 2H, $J = 8.35$). ^{13}C NMR (DMSO-d_6): 18.24 (CH_3), 116.74, 123.31, 127.40, 127.59, 128.22, 128.79, 129.17, 131.03, 131.22, 131.61, 132.94, 137.46, 138.08, 140.34, 145.59, 146.12, 147.86. Anal. Calcd. for $C_{22}H_{16}N_4$: C, 78.48; H, 4.75; N, 16.64; Found: C, 78.53; H, 4.78; N, 16.60%.

Compound **7e**: Yield 4.0 g (81.6%), m.p. 215–217 °C. 3026, 1520, 1497, 1452, 1371, 1348, 1280, 1209, 1074, 990. Anal. Calcd. for $C_{17}H_{14}N_4O$: C, 70.26; H, 4.82; N, 19.28; Found: C, 70.20; H, 4.80; N, 19.23%.

Compound **7f**: Yield 5.8 g (90%), m.p. 238–240 °C. MS (*m/z*, %): 321 (M + 1, 100), 320 (M+, 20), 307 (20), 273 (10), 180 (5), 120 (10), 107 (25). ^1H NMR ($CDCl_3$) δ: 1.45 (t, 3H, CH_3), 3.05 (s, 3H, CH_3), 4.1 (q, 2H, $-OCH_2$), 7.1 (m, 4H), 7.32 (t, 1H, $J = 8.50$), 7.50 (t, 1H, $J = 8.20$), 7.65 (d, 1H, $J = 8.50$), 8.41 (d, 1H, $J = 8.48$). ^{13}C NMR (DMSO-d_6): 14.76 (CH_3), 20.60 (CH_3), 65.02 (OCH_2), 113.27, 115.29, 116.08, 118.81, 123.51, 125.82, 128.03, 128.69, 129.43, 135.38, 144.57, 146.47, 148.60, 150.44, 153.13. Anal. Calcd. for $C_{18}H_{16}N_4O_2$: C, 67.42; H, 4.99; N, 17.48; Found: C, 67.40; H, 4.94; 17.43%.

Compound **7g**: Yield 5.75 g (94%), m.p. 212–214 °C. 3025, 1522, 1493, 1450, 1373, 1359, 1285, 1218, 1179, 1141, 1070, 975, 830. Anal. Calcd. for $C_{16}H_{11}FN_4$: C, 68.99; H, 3.95; N, 20.12; Found: C, 68.96; H, 3.98; N, 20.08%.

4.1.10. Preparation of 1-substituted-4-[(E)-2-arylvinyl][1,2,4]triazolo[4,3-a]quinoxaline (8a–u)

General procedure: A mixture of compounds **7a–g** (0.10 mol), an appropriate aldehyde (0.11 mol), methanol (10 mL) and catalytic amount (0.2 mL) of conc. sulfuric acid was refluxed (65 °C) for 8 h. The reaction mass was cooled to room temperature, and kept in deep-freezer for 8 h. The separated solid was filtered, washed with cold methanol (5 mL) to obtain compounds **8a–u**. They were crystallized from appropriate solvents.

Compound **8a**: IR (KBr) cm^{-1}: 3020, 1519, 1490, 1457, 1380, 1353, 1285, 1214, 1179, 1070, 988. MS (*m/z*, %): 421 (M + 1, 40), 420 (10), 365 (20), 245 (10), 179 (10), 148 (20), 131 (10), 113 (10), 106 (5), 97 (10), 77 (10). ^1H NMR ($CDCl_3$) δ: 3.90 (s, 3H, $-OCH_3$), 7.2 (m, 3H), 7.8

(complex m, 6H), 8.2 (d, 1H), 8.30 (s, 1H), 8.67 (d, 1H, $J = 8.50$ Hz). ^{13}C NMR (DMSO-d_6): 55.43, 106.17, 108.40, 115.53, 116.39, 119.53, 121.84, 122.66, 123.02, 124.06, 125.00, 125.36, 129.70, 130.41, 131.13, 131.53, 131.83, 131.85, 132.73, 132.84, 133.73, 134.38, 135.87, 136.91, 137.44, 139.08, 141.08, 141.15, 141.22, 159.00.

Compound **8b**: IR (KBr) cm^{-1}: 3023, 1512, 1496, 1451, 1387, 1350, 1284, 1214, 1179, 1073. ^{1}H NMR ($CDCl_3$) δ: 3.80 (s, 3H, $-OCH_3$), 6.89 (d, 2H), 7.19 (d, 2H, vinylic protons), 7.45 (d, 2H, vinylic protons, $J = 16.40$ Hz), 7.53 (complex m, 2H), 7.72 (t, 1H, $J = 8.20$ Hz), 7.91 (t, 1H, $J = 6.86$ Hz), 8.66 (d, 1H, $J = 8.50$ Hz).

Compound **8d**: IR (KBr) cm^{-1}: 3018, 1519, 1490, 1449, 1376, 1350, 1282, 1218, 1180, 1068, 980. MS (*m/z*, %): 332 (M + 1, 60), 331 (50), 245 (10), 113 (10), 97 (10). ^{1}H NMR ($CDCl_3$) δ: 2.79 (s, 3H, CH_3), 7.33 (d, 1H, vinylic protons, $J = 16.50$), 7.45 (t, 1H, $J = 8.20$), 7.46 (d, 1H, vinylic protons, $J = 16.50$), 7.50 (t, 1H, $J = 7.70$), 7.59 (d, 1H, $J = 8.20$), 7.82 (t, 1H, $J = 6.86$), 7.90 (d, 1H, $J = 7.70$), 8.05 (d, 1H), 8.39 (d, 1H, $J = 8.48$), 8.54 (s, 1H). ^{13}C NMR (DMSO-d_6): 12.45 (CH_3), 116.42, 122.59, 123.86, 124.48, 130.56, 131.78, 131.80, 132.50, 132.69, 133.18, 136.97, 137.53, 138.80, 139.08, 139.96, 146.40, 151.54.

Compound **8f**: IR (KBr) cm^{-1}: 3028, 1520, 1487, 1451, 1379, 1280, 1220, 1176, 1070, 975. ^{1}H NMR ($CDCl_3$) δ: 2.84 (s, 3H, CH_3), 7.20 (d, 2H, $J = 8.80$), 7.39 (m, 2H), 7.44 (t, 1H, $J = 6.80$), 7.46 (d, 1H, $J = 8.20$), 7.49 (d, 1H, vinylic proton, $J = 16.20$), 7.59 (d, 1H, $J = 8.20$), 7.82 (t, 1H, $J = 6.80$), 8.40 (d, 1H, $J = 8.40$). ^{13}C NMR (DMSO-d_6): 12.52 (CH_3), 116.40, 117.81, 118.51, 123.06, 123.80, 128.99, 129.17, 130.56, 131.63, 131.82, 132.50, 135.87, 139.10, 139.97, 146.44, 159.33, 165.80.

Compound **8h**: IR (KBr) cm^{-1}: 3020, 1519, 1490, 1457, 1380, 1353, 1285, 1214, 1179, 1070, 988. ^{1}H NMR ($CDCl_3$) δ: 3.82 (s, 3H, $-OCH_3$), 6.89 (d, 2H, $J = 8.40$), 7.19 (d, 1H, vinylic proton, $J = 16.00$), 7.45 (d, 1H, vinylic proton $J = 16.00$), 7.50 (m, 5H), 8.43 (d, 1H, $J = 8.58$), 10.19 (s, 1H, triazolo proton). ^{13}C NMR (DMSO-d_6): 57.60 (OCH_3), 115.74, 116.40, 123.08, 123.84, 127.35, 127.80, 129.20, 130.92, 131.92, 135.87, 136.93, 138.06, 138.28, 140.26, 160.38.

Compound **8j**: IR (KBr) cm^{-1}: 3022, 1514, 1478, 1439, 1383, 1342, 1279, 1210, 1170, 1067, 960. MS (*m/z*, %): 501 (M + 1, 50), 500 (M+, 20), 486 (10), 379 (10), 376 (10), 361 (25), 307 (30), 253 (50), 242 (10), 226 (10), 165 (20), 120 (20), 107 (30), 105 (20).

Compound **8n**: IR (KBr) cm^{-1}: 3020, 1525, 1489, 1453, 1382, 1350, 1287, 1213, 1179, 981. MS (*m/z*, %): 413 (M + 1, 60), 412 (M+, 50), 379 (20), 242 (30), 120 (10), 107 (25). ^{1}H NMR ($CDCl_3$) δ: 3.05 (s, 3H, OCH_3), 7.18 (d, 2H, $J = 8.47$), 7.20 (d, 1H, vinylic proton, $J = 16.70$), 7.37 (m, 2H), 7.45 (d, 1H, vinylic proton, $J = 16.70$), 7.50 (m, 2H), 7.70 (m, 2H), 7.80 (m, 1H), 8.17 (d, 2H, $J = 8.40$), 8.48 (d, 1H, $J = 8.50$). ^{13}C NMR (DMSO-d_6): 55.10 (OCH_3), 117.03, 117.75, 121.66, 123.02, 123.60, 127.57, 128.44, 129.10, 131.05, 131.63, 132.95, 133.54, 135.15, 135.87, 137.54, 138.66, 139.35, 143.85, 161.32.

Compound **8p**: IR (KBr) cm^{-1}: 3020, 1519, 1490, 1380, 1353, 1285, 1214, 1179, 1070, 978, 875. MS (*m/z*, %): 454 (M + 1, 90), 453 (M$^+$, 10), 438 (10), 307 (20), 281 (10), 221 (10), 167 (20), 107 (30), 91 (20), 89 (20), 73 (10). ^{1}H NMR ($CDCl_3$) δ: 1.28 (t, 3H, CH_3), 4.00 (q, 2H, OCH_2), 7.50 (complex m, 12H), 8.94 (d, 1H, $J = 7.80$), 9.71 (s, 1H, OH).

Compound **8u**: IR (KBr) cm^{-1}: 3018, 1512, 1494, 1449, 1383, 1350, 1280, 1210, 1175, 1076, 975. ^{1}H NMR ($CDCl_3$) δ: 6.99 (t, 1H, $J = 7.30$), 7.19 (d, 1H, vinylic proton, $J = 16.40$ Hz), 7.36 (m, 8H), 7.68 (d, 2H, $J = 7.58$), 7.82 (t, 1H, $J = 6.86$), 8.32 (d, 1H, $J = 8.66$), 8.49 (d, 1H, $J = 8.50$). ^{13}C NMR (DMSO-d_6): 117.03, 117.93, 118.63, 123.02, 123.06, 123.78, 123.84, 127.30, 128.70, 129.10, 129.28, 129.73, 131.05, 131.63, 132.95, 135.87, 136.84, 137.54, 138.66, 139.35, 143.85, 161.08, 167.58.

5. Conclusion

In the present investigation, 27 new 4-styryltetrazolo[1,5-*a*]quinoxaline and 1-substituted-4-styryl[1,2,4]triazolo[4,3-*a*]quinoxaline derivatives were synthesized and characterized by spectral analysis. They were screened for preliminary anticonvulsant activity by PTZ animal model. Compounds **4c**, **4f**, **8b**, **8c**, **8f**, **8i** and **8t** exhibited promising activity, which is comparable to the standard. The activity was attributed to the presence of fluoro, trifluoromethyl, methoxy and methyl groups on the condensed heterocyclic system containing quinoxaline, fused to triazole or tetrazole at 1,2 positions in the backbone structure of title compounds. The electronic factors exerted by the substituents and the hydrophobic nature of phenyl nucleus in the title compounds influenced the activity.

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