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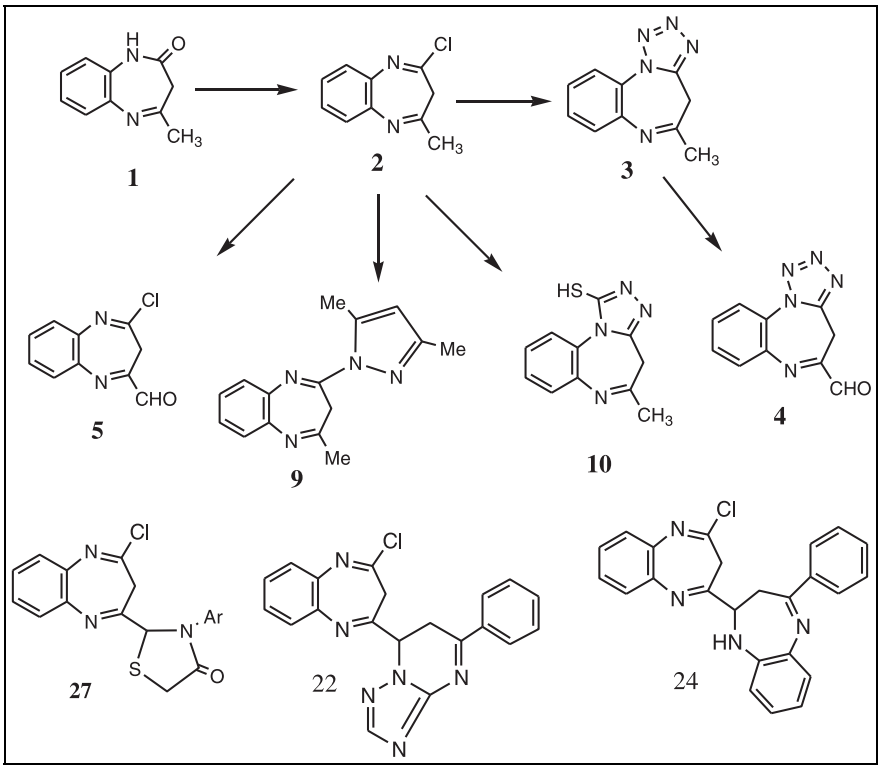
Received May 13, 2011
DOI 10.1002/jhet.1123
Published online 18 April 2013 in Wiley Online Library (wileyonlinelibrary.com).



Preparation of 4-chloro-3*H*-benzo[*b*][1,4]diazepine-2-carbaldehyde **5**, which is used as a key intermediate in the synthesis of chalcones derivatives, via its condensation with some aromatic acetophenone derivatives under ethanol piperidine condition was described. Also illustrated was the reaction of such chalcones with available nucleophilics and reagents of active methylene group to afford new series of fused and isolated pyrazoles, isoxazolines pyrimidines, pyridines, triazolo[1,5-*a*]pyrimidines, benzo[1,4]oxa(thia)zepines, and pyrido[1,2-*a*] benzimidazoles incorporating 4-chloro-3*H*-benzo[*b*][1,4]diazepine moiety, which have a potential pharmaceutical interest. Furthermore, condensation reaction of 4-chloro-3*H*-benzo[*b*][1,4]diazepine-2-carbaldehyde with aromatic amine derivatives to afford the Schiff's bases was described. The C═N double bond of the latter compounds has been reacted with chloroketene to give β-lactams and with sulfanylacetic acid to give the 2-(4-oxo-1,3-thiazolidinyl)-substituted derivative. The structures of the newly prepared compounds were established by elemental analysis, IR, MS, and ^{1}H NMR spectral analysis.

J. Heterocyclic Chem., **50**, E178 (2013).

INTRODUCTION

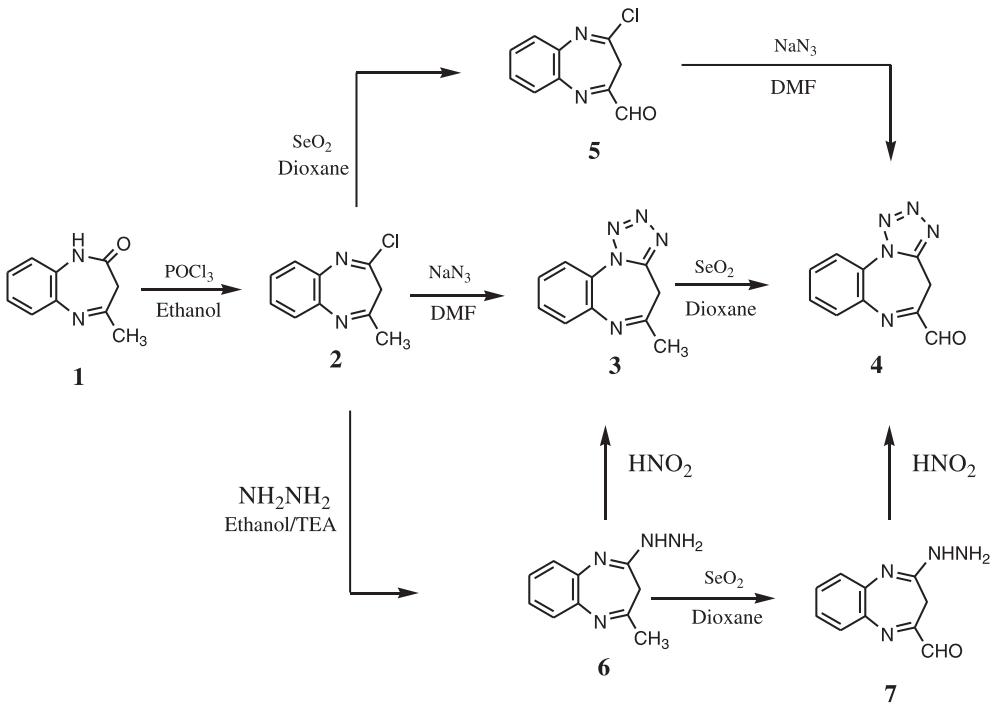
1,4-Benzodiazepines have been the object of intense studies since the early 1960s because of their value in psychotherapy and when one of them was introduced as a tranquilizer under the trade name Librium [1]. An impressive number of synthetic routes have thus been described. Recently, the attention has been concentrated on the synthesis of analogs having heterocycles in place of the benzene ring and on compounds having additional fused heterocyclic rings [2]. Some recently reported data on the naturally occurring antitumor pyrrolo[2,1-*c*][1,4] benzodiazepine (PBDs) antibiotics, and their heterocyclic analogs indicated that their cytotoxic and antitumor activity arises because of formation of covalent adducts between the azomethine group of the diazepine moiety and C(2)-amino group of a guanine residue within the minor groove of duplex DNA. Also, pyrimido[5,4-*f*][1,2,4]triazolo[3,4-*b*][1,3,4]thiadiazepine can be considered

to some extent as antibiotics [3]. Over the last decades, benzodiazepines have emerged as a particularly fascinating class of scaffolds in medicinal chemistry and have been viewed repeatedly as the prototype of a "privileged structure" as they hit various classes of pharmacologically relevant targets such as G-protein coupled receptors, ion channels, and enzymes [4]. 1,4-Benzodiazepine-3-ones are therefore of biological interest because they can act as fibrinogen receptor antagonists, angiotensin analogs, and protein kinase C activators [5]. Benzodiazepines form a well-known and widely applied class of biologically active compounds and are representatives of the family of privileged structures (PBDs) that can recognize and bind to specific sequences of DNA. They are potential regulators of gene expression with possible application as therapeutic agents in treatment of genetic disorders including cancer [6]. Heterocyclic scaffolds containing the diazepine moiety, which show additional bioactivities, oral fibrinogen antagonists are also interesting compounds [7,8].

RESULTS AND DISCUSSION

Reaction of compound 4-methyl-(1*H*,3(2*H*))-benzo[*b*][1,4]diazepin-2-one **1**[9] with $POCl_3$ gave 2-chloro-4-methyl-3*H*-benzo[*b*] [1,4]diazepine **2** [10–15] (Scheme 1). The structure of **2** was established by IR, ^{1}H NMR, and mass spectra spectroscopic analysis. Thus, the IR spectrum of compound **2** showed the disappearance of the absorption band of C═O group. The ^{1}H NMR spectrum ($CDCl_3$) displayed two singlet signals at δ 1.0 and 1.5 and multiplet signals at 7.2–7.6 because of methyl, methylene, and aromatic protons, respectively. The MS of **2** showed the molecular ion peak $[M]^+$ ion at $m/z = 192$ (55%). The chloro compound **2** is considered as the key intermediate compound that is used in the synthesis of all other new compounds. So compound **2** is used in the synthesis of new compound **4** through four indirect processes involving preparation of other new compounds **3**, **5**, **6**, and **7**.The first process involved treating of compound **2** with sodium azide using dimethylformamide as a solvent to afford the tetrazolo[1,5-*g*] [1,4]benzodiazepines **3**. The formation of compound **3** is suggested to proceed via intramolecular azide cycloaddition reaction [16–21] (Scheme 1). The structure of compound **3** was confirmed by elemental and spectroscopic analysis. Thus, the ^{1}H NMR spectrum (DMSO displayed two singlet signals at δ 1.0 and 2.5 and multiplet signals at 7.2–7.6 because of methyl, methylene, and aromatic protons, respectively. The MS of compound **3** exhibited the molecular ion peak $[M]^+$ ion at $m/z = 199$ (55%). Oxidation reaction of compound **3** takes place in a mixture of selenium dioxide and 1,4-dioxane to afford the corresponding tetrazolo[1,5-*g*]benzo[*b*][1,4]diazepine-5-carbaldehyde **4** [10]. The structure of the compound **4** is in an agreement with analytical and spectroscopic data (IR, ^{1}H NMR, and MS). Thus, the IR spectra of **4** showed the presence of absorption bands at 1699 cm^{-1} (C═O). Accordingly, the ^{1}H NMR spectrum (DMSO) of **4** showed two singlet signals at δ 2.5 and 9.8 ppm due to methylene and formyl protons, respectively, and a multiplet at 7.2–7.6

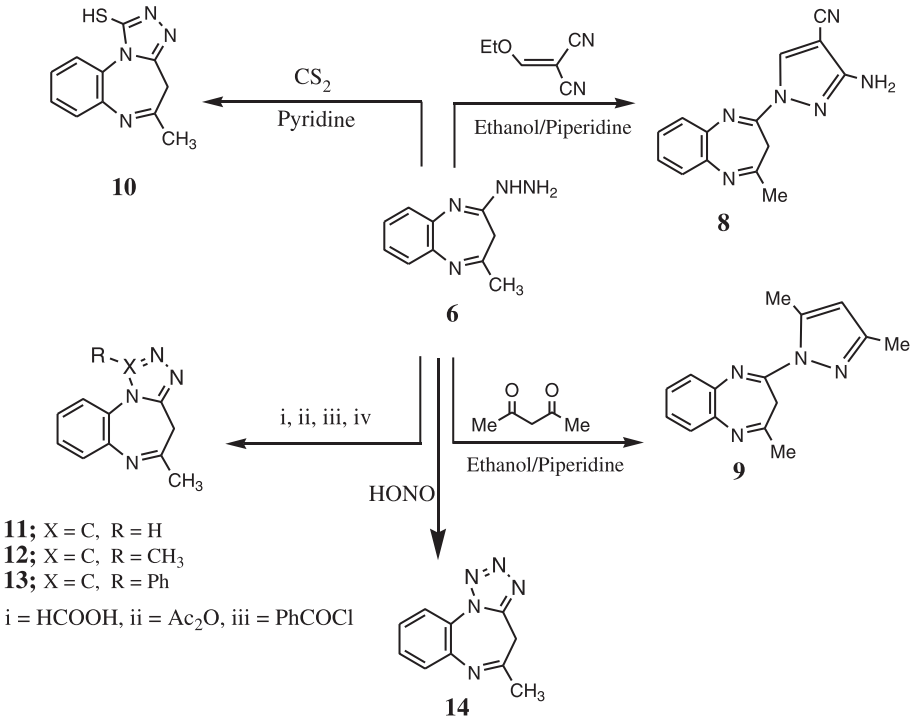
Scheme 1



due to aromatic protons. The MS of **4** displayed the molecular ion peak $[M]^+$ ion at $m/z = 213$ (65%). The second process involved the reaction of compound **2** with selenium dioxide to give the corresponding 4-chloro-3*H*-benzo[*b*][1,4]diazepine-2-carbaldehyde **5** [10]. The structure of **5** was established on the basis of its spectral data; the IR spectrum of **5** showed the presence of an absorption band at 1695 cm^{-1} (C=O). The ^1H NMR spectrum (DMSO) displayed two singlet signals at δ 1.6 for the cyclic methylene group, 9.8 for the formyl group, and multiplet signals at δ 7.2–7.6 for aromatic protons, respectively. The MS of **5** showed the $[M-1]^+$ ion at $m/z = 205$ (35%). Treating of compound **5** with sodium azide using dimethylformamide as a solvent gave the corresponding compound **4**.The third process involved the reaction of the chloro compound **2** with equimolar ratios of hydrazine hydrate in ethanol triethylamine mixture yielding 1-(2-methyl-3*H*-benzo[*b*][1,4]diazepin-4-yl)hydrazine **6** (Scheme 1). The structure of **6** was assigned on the basis of IR, ^1H NMR, and mass spectra. The IR spectrum of **6** showed the lack of any absorption of a C=O group; instead, new absorption bands between 3212 and 3323 cm^{-1} due to NH and NH_2 groups had appeared. The ^1H NMR spectrum (DMSO) displayed four singlet signals at δ 1.0 for methyl, 1.5 for methylene, 2.1 for NH, 2.2 for NH_2, and multiplet signals at 7.2–7.6 ppm due to aromatic protons, respectively. The MS showed the molecular ion peak $[M]^+$ ion at $m/z = 188$ (50%). Compound **6** underwent dehydration process involving ring closer on treatment with nitrous acid, giving the corresponding tetrazolo[1,4]benzodiazepines **3** (Scheme 1). The fourth process involved an oxidation reaction of compound **6** using SeO_2 as described previously, giving the corresponding formyl derivative **7**, which underwent cyclization process on treating with nitrous acid to give tetrazolo[1,5-*g*][1,4]benzodiazepine-5-carbaldehyde **4** (Scheme 1).

The hydrazinyl benzo[1,4]diazepine **6** underwent several cyclization reactions. Thus, reaction of equimolar ratios of compound **6** with equimolar ratios of ethoxymethylene malononitrile using ethanol as a solvent afforded the corresponding 3-amino-1-(2-methyl-3*H*-benzo[*b*][1,4]diazepin-4-yl)-1*H*-pyrazole-4-carbonitrile, **8**. The structure of compound **8** was established on the basis of its spectral data. The IR spectrum of **8** showed the presence of absorption bands at 2210 cm^{-1} (CN) and 3280 cm^{-1} (NH_2). The ^1H NMR spectrum ($CDCl_3$) displayed three singlet signals at δ 1.0, 1.5, and 4.5 due to the methyl, C-3 methylene, and NH_2 protons, respectively, and multiplet signals at 7.2–7.6 due to aromatic protons in addition to –CH= of pyrazole ring. The MS of **8** showed a peak corresponding to its molecular ion at $m/z = 264$ ($[M]^+$, 65%). Also, the reaction of equimolar ratios of compound **5** with equimolar ratios of pentan-2,4-dione using ethanol as solvent afforded the corresponding 2-methyl-4-(3,5-dimethyl-1*H*-pyrazol-1-yl)-3*H*-benzo[*b*][1,4]diazepine **9** (Scheme 2).

Scheme 2



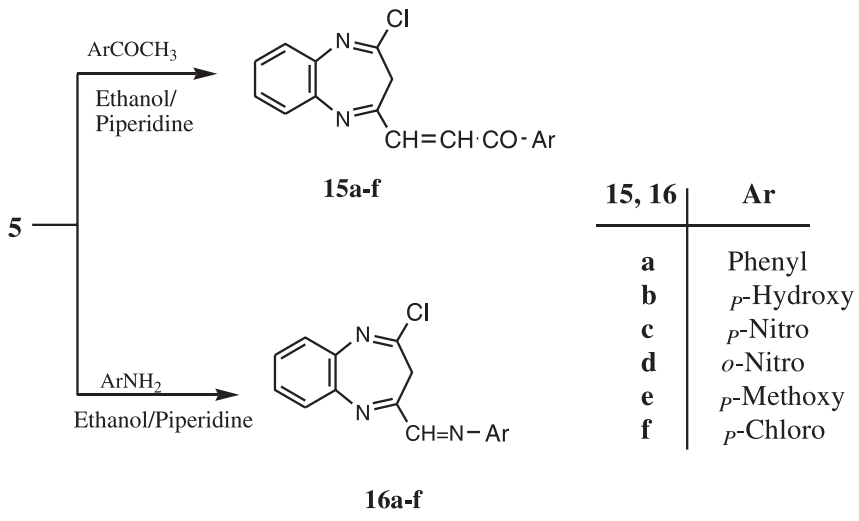
Likewise, compound **6** was utilized as a key intermediate for the synthesis of some new triazolo benzo[*b*][1,4]diazepine derivatives **10–14** via a mild and efficient reaction with carbon disulfide, formic acid, acetic anhydride, benzoyl chloride, and nitrous acid, giving the corresponding fused azolo[1,4]benzodiazepine derivatives **10–14** (Scheme 2). The structures of these compounds were in agreement with analytical and spectroscopic data. The IR spectra of **10–14** showed the lack of absorption band due to amino function, whereas the MS of compound **10** showed *m/z* at 230 ($[M]^+$, 30%), and the ^{1}H NMR spectrum of **10** (DMSO) showed three singlet signals at δ 2.03, 2.9, and 3.42 due to the CH_3, methylene, and SH protons, respectively, and a multiplet at δ 7.1–7.7 ppm for aromatic protons.

On the other hand, the carbaldehyde compound **5** reacted with acetophenone [and/or aromatic amine] derivatives in equimolar ratios using absolute ethanol as a solvent containing a catalytic amount of piperidine to give the corresponding 3-(2-chloro-3*H*-benzo[*b*][1,4]diazepin-4-yl)-1-phenyl-prop-2-en-1-ones **15a–f** [and/or 4-((phenylimino) methyl)-2(1*H*)-chloro-benzo[*b*][1,4] diazepines, **16a** and its derivatives **16b–f**] in good yields (Scheme 3). The structures of the synthesized compounds are in an agreement with analytical and spectroscopic data (IR, ^{1}H NMR, and MS). The IR spectra of compound **15** showed the presence of an absorption band of a carbonyl group centered between 1685 and 1705 cm^{-1}. Accordingly, the ^{1}H NMR spectrum ($CDCl_3$) of **15a** showed one singlet signal at δ 1.5 due to the C-3 methylene group and a multiplet signals at 6.1–7.6 due to aromatic and –CH═CH– protons, respectively. The MS of **15a** displayed the molecular ion peak $[M]^+$ ion at *m/z* = 308 (60%). The reactivity of exocyclic C═C conjugated with the carbonyl group in **15a–f** was investigated by reaction with hydrazine derivatives, hydroxylamine, urea, thiourea, and/or some laboratory-available active methylene compounds. The nature of the products obtained **17–25**, which was characterized by elemental and spectroscopic data, indicates that the reaction was suggested to proceed via condensation reaction followed by a nucleophilic attack through α,β-unsaturated ketonic group (Scheme 4).

The IR spectra **17a** showed the presence of an absorption band centered between 3117–3293 cm^{-1} (NH) and 3309–3379 cm^{-1} (NH_2), with the absence of any characteristic absorption band of a C═O group. Accordingly, the ^{1}H NMR spectrum (DMSO) of **17a** showed four singlet signals at δ 1.5 due to the methylene, 4.2 for NH– of pyrazol ring, and 7.1 for NH– hydrazid, respectively, doublet at δ 1.7 due to the C-4 methylene protons of pyrazol ring, triplets at δ 2.6 due to the C-5 methine protons of pyrazol ring, and multiplet signals at δ 7.2–7.8 ppm for aromatic protons. The MS of **17a** displayed the molecular ion peak $[M]^+$ ion at *m/z* = 318 (55%).

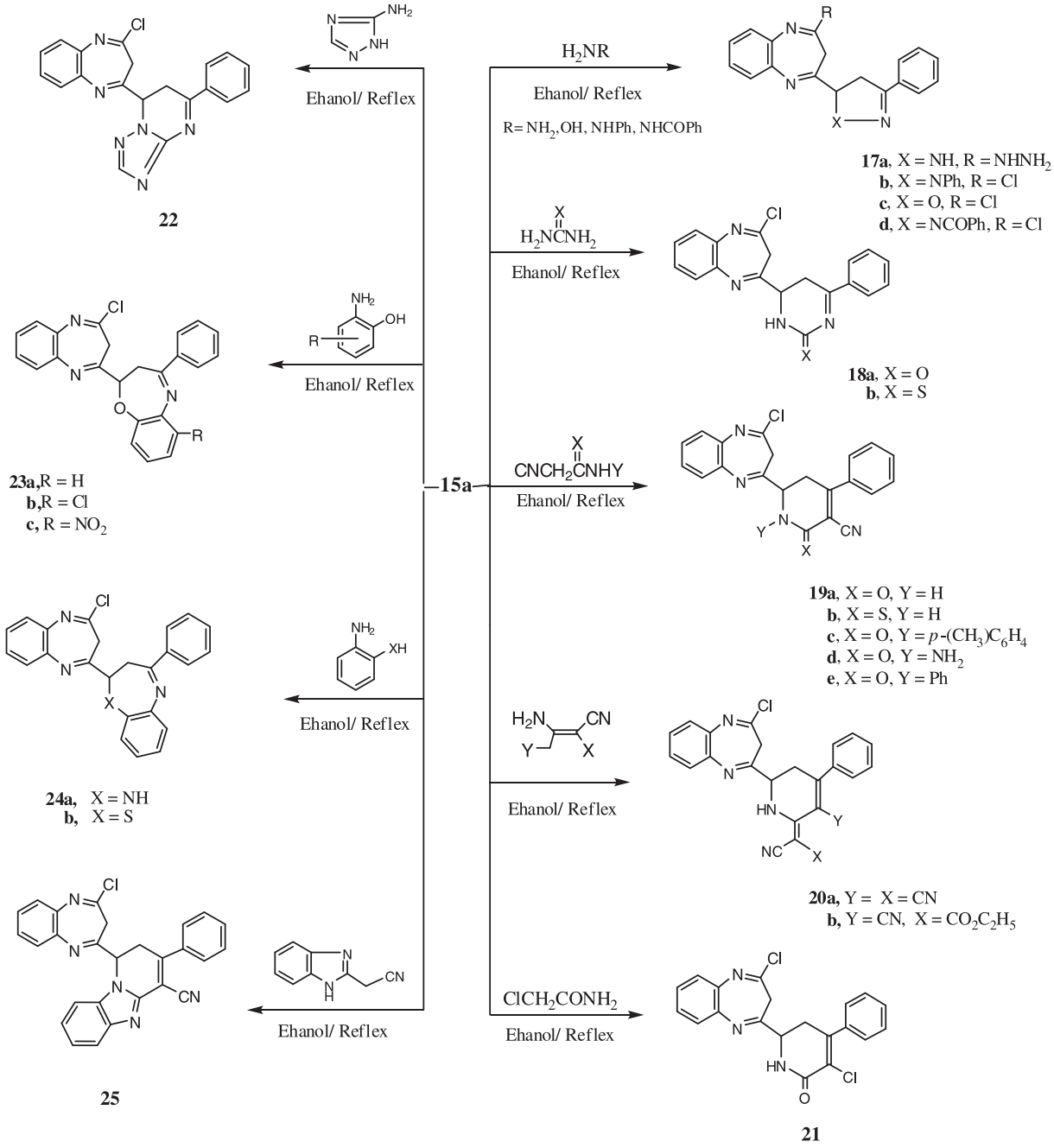
Reaction of equimolar ratios of compound **15a** with equimolar ratios of urea and/or thiourea afforded the corresponding 6-(−2-chloro-3*H*-benzo[*b*][1,4]diazepin-6-yl)-5,6-dihydro-4-phenylpyrimidin-2(1*H*)-ones **18a**,**b** (Scheme 4). This reaction was suggested to proceed via an initial condensation reaction of one amino group with the carbonyl group involving release of H_2O, followed by a nucleophilic addition reaction of the second amino group to the double bond. The structures of the synthesized compounds were confirmed by analytical and spectroscopic data (IR, ^{1}H NMR, and MS). Thus, the IR spectra of **18a** showed the presence of absorption bands centered between 1685–1705 cm^{-1} (C═O) and 3063–3288 cm^{-1} (NH). The ^{1}H NMR spectrum (DMSO) of **18a** showed two singlet signals at δ 1.5 due to the C-3 methylene group, 8.1 due to NH, doublet signals at δ 1.7 due to the

Scheme 3



15, 16	Ar
a	Phenyl
b	*p*-Hydroxy
c	*p*-Nitro
d	*o*-Nitro
e	*p*-Methoxy
f	*p*-Chloro

Scheme 4



methylene protons, and triplet signals at δ 3.7 due to methine proton of pyrimidine. The MS of **18a** showed a peak at *m/z* 350 ($[M-1]^+$, 25%).

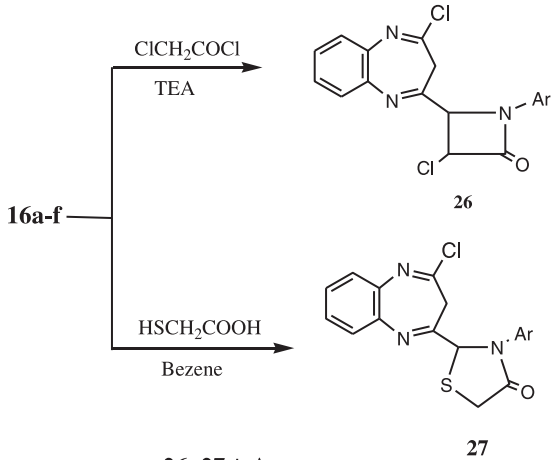
New pyridine derivatives have been prepared via reaction of equimolar ratios of **15a** with equimolar ratios of cyanoacetamide, cyanothioacetamide, 2-cyano-*N*-*p*-tolylacetamide, 2-cyanoacetohydrazide, 2-cyano-*N*-phenylacetamide, 2-aminoprop-1-ene-1,1,3-tricarbonitrile, ethyl 3-amino-2,4-dicyanobut-2-enoate, and/or 2-chloroacetamide, respectively, in ethanol, afforded the corresponding 2-chloro-4-(1,2,3,6-tetrahydro-4-phenylpyridin-2-yl)-3*H*-benzo[*b*][1,4]-diazepines **19a–e**, **20a**,**b**, and **21**, respectively (Scheme 4).The reaction was suggested to proceed through cyclocondensation reaction followed by a nucleophilic addition reaction of the amino/imino group to the double bond. The IR spectrum of **19a** showed the presence of absorption bands at 1699 cm^{-1} (C═O), 2210 cm^{-1} (CN), and 3180 cm^{-1} (NH). The ^1H NMR spectrum ($CDCl_3$) of **19a** displayed two singlet signals

at δ 1.5 (C-3) for protons of diazepine, 8.1 (NH), doublet signals at δ 2.3 of methylene protons, triplet signals at δ 3.6 due to the methine protons of pyridine, and multiplet signals at 7.2–7.6 ppm for aromatic protons, respectively. The MS of **19a** showed the molecular ion peak $[M]^+$ ion at $m/z = 374$ (55%).

Similarly, the chalcone function of **15a** was reacted with amino aromatic compounds in equimolar ratios in ethanolic solution containing a catalytic amount of piperidine to give 2-chloro-4-(6,7-dihydro-5-phenyl-[1,2,4]triazolo[5,1-*a*] pyrimidin-7-yl)-3*H*-benzo[*b*][1,4]diazepine **22**, 2-chloro-4-(2,3-dihydro-4-phenyl-benzo[*b*][1,4]oxazepin-2-yl)-3*H*-benzo [*b*][1,4]diazepines **23a–b** and **24a–b**, respectively (Scheme 4). The structures of these compounds were confirmed on the basis of elemental and spectroscopic analysis. Thus, the ^{1}H NMR spectrum (DMSO) of **23a** displayed singlet signals at δ 1.5 due to the C-3 methylene protons of diazepine, doublet at δ 1.8 due to the methylene protons, triplet at δ 3.9 due to the methine proton of oxazepine, and a multiplet at 6.7–7.3 ppm for aromatic protons. The MS of **23a** showed the molecular ion peak $[M]^+$ ion at $m/z = 399$ (45%). The IR spectrum of **24a** showed the presence of absorption bands at 3280 cm^{-1} (NH). The ^{1}H NMR spectrum (DMSO) **24a** displayed two singlet signals at δ 1.5 and 4.1 due to the C-3 methylene protons and NH, respectively, doublet at δ 1.7 due to the methylene protons, triplet at δ 2.7 due to the methine protons, and a multiplet at 6.8–7.6 ppm for aromatic protons. The MS of **24a** showed the molecular ion peak $[M]^+$ ion at $m/z = 398$ (50%). Also, compound **15a** was reacted with 2-cyanomethylbenzimidazole in equimolar ratios under ethanol/piperidine condition to give the corresponding pyrido[1,2-*a*]benzimidazole derivative **25**. The reaction was suggested to proceed via initial condensation reaction of the active methylene group with the carbonyl group involving dehydration process, followed by a nucleophilic addition reaction of the NH group at the double bond of compound **15a** to afford **25** (Scheme 4). The structure of **25** was assigned on the basis of IR, ^{1}H NMR, and mass spectra. Thus, the IR spectrum showed the presence of an absorption band at 2217 cm^{-1} (CN), whereas the absorption band that corresponded to C═O group completely disappeared. The ^{1}H NMR spectrum ($CDCl_3$) of 2**5** displayed one singlet signal at δ 1.5 due to the C-3 methylene protons, doublet at δ 2.5 due to the methylene, triplet at δ 3.7 due to the methine, and a multiplet at δ 7.0–7.6 ppm for aromatic protons. The MS showed the molecular ion peak $[M]^+$ ion at $m/z = 448$ (25%).

Finally, the Schiff's compound **16a–f** were reacted with each of chloroacetyl chloride and thioglycolic acid via cycloaddition concept to afford the new derivatives of β-lactam **26** and thiazolidinone **27** (Scheme 5). The IR spectrum of **26a** showed the presence of absorption bands at 1705 cm^{-1} (C═O). The ^{1}H NMR spectrum (DMSO) of **26a** showed one singlet signal at δ 1.5 due to the methylene protons and two doublets at 3.9 and 5.2 for the protons at C4 and C3 of the β-lactam units, respectively. The MS of **26a** showed the molecular ion peak $[M]^+$ ion at $m/z = 358$ (30%). Also, the Schiff's bases **16a–f** were reacted with thioglycolic acid in equimolar ratio in boiling benzene using a water separator system; the SH group of thioglycolic acid could be added to the CH═N group of Schiff's bases **16a–f** followed by ring closer involving dehydration processes to afford 2-(2-chloro-3*H*-benzo[*b*][1,4]diazepin-4-yl)-3-phenylthiazolidin-4-ones **27a–f** (Scheme 5). The MS of **27a** showed the molecular ion peak $[M]^+$ ion at $m/z = 355$ (31%).

Scheme 5



26, 27	Ar
a	Phenyl
b	*P*-Hydroxy
c	*P*-Nitro
d	*o*-Nitro
e	*P*-Methoxy
f	*P*-Chloro

CONCLUSION

A straightforward synthesis of variously substituted newly isolated heterocyclic system, starting with 2-chloro-4-methyl-3*H*-benzo[*b*][1,4]diazepine **2** and several commercially available reactants under very simple reaction conditions, was described. The results obtained in this report when combined with the previous investigations on the same subject clearly indicate that the oxidation with SeO2 in dioxane occurs more likely at the side chain methyl rather than the cyclic methylene group. Finally, this work opened a new avenue for the synthesis of a variety of new 4-chloro-3*H*-benzo[*b*][1,4]diazepine-2-carbaldehyde derivatives, and it can be used to prepare new compounds under facile synthesis conditions.

EXPERIMENTAL

All melting points are measured using Gallenkamp melting point apparatus and are uncorrected. Elemental analyses were carried out at the Micro Analytical Center of Cairo University. IR (KBr pellets $\upsilon = cm^{-1}$) spectra were determined in Shimadzu FT IR 8101 PC infrared spectrophotometers (Cairo University), ^1H NMR spectra (δ = ppm) were accomplished using Varian Mercury VX-300 MHz NMR Spectrometer, and mass spectroscopy was recorded on Shimadzu GCMS-QP-1000 EX spectrometer (Cairo University).

Preparation of 4-chloro-2-methyl-3*H*-benzo[*b*][1,4]diazepine (2). To a stirred mixture of **1** (1.74 g, 0.01 mol) and anhydrous ethanol (30 mL) was added drop-wise $POCl_3$ (5 mL) at −10 to −5°C. The reaction mixture was then stirred for an additional 1 h at room temperature and then heated for 2 h at 60°C. After the reaction was completed, the mixture was poured onto crushed ice (200 g) under vigorous stirring. The mixture was kept overnight at 0°C; the pale yellow solid was collected by filtration and washed successively with water and then was air-dried to provide **2** (0.92 g, 49%) and recrystallized from ethanol; mp 265–67°C. ^1H NMR ($CDCl_3$): δ 1.0 (s, 3H, CH_3), 1.5 (s, 2H, CH_2) and 7.2–7.6 (m, 4H, Ar–H). Ms: *m/z* 192 ([M]$^+$, 55%). Calcd. for $C_{10}H_9N_2Cl$ (192.64). Calcd.: C, 62.35; H, 4.71; N, 14.54; Cl, 18.40%. Found: C, 61.17; H, 4.31; N, 14.15; Cl, 17.41%.

Preparation of 5-methyl-4*H*-tetrazolo [1, 5-*g*]benzo[*b*][1,4] diazepine (3). ***Method A.*** A mixture of **2** (1.92 g, 0.01 mol) and sodium azide (3.25 g, 0.05 mol) in 20 mL of dimethylformamide] was stirred at 80°C for 24 h. Then the reaction mixture was poured into 150 mL of crushed ice, and after 12 h the resultant solid was collected by filtration to provide **3** (1.5 g, 79%) as a brownish yellow solid; mp 285–87°C. ^1H NMR (DMSO): δ 1.0 (s, 3H, CH_3), 2.5 (s, 2H, CH_2), and 7.2–7.6 (m, 4H, Ar–H). Ms: *m/z* 199 ([M]$^+$, 55%). Calcd. for $C_{10}H_9N_5$ (199.21). Calcd.: C, 60.29; H, 4.55; N, 35.16%. Found: C, 59.17; H, 4.31; N, 34.11%.

Method B. To a stirred cold solution of **6** (1.88 g, 0.01 mol) in 30 mL of glacial acetic acid, a cold solution of sodium nitrite (0.7 g, 0.01 mol) in 10 mL of H_2O was added drop-wise with stirring at 5°C. The mixture was stirred for further 4 h at room temperature. The solid that precipitated was collected by filtration, washed with water, air dried, and recrystallized from ethanol to afford 65% yield of **3**.

Preparation of 4*H*-tetrazolo [1, 5-*d*]benzo[*b*][1,4]diazepine-5-carbaldehyde (4). ***Method A.*** A pure crystallized sample of **3** (1.99 g, 0.01 mol) and equimolar ratio of selenium dioxide (1.10 g, 0.01 mol) was heated under reflux in dioxane (30 mL) for 16 h. The reaction mixture was filtered while hot to remove selenium metal, and the filtrate was cooled and then poured into ice water mixture. The precipitated product was filtered, dried, collected, and recrystallized from ethanol. Yield 75%, mp 280–82°C. IR: 1699 (CO). ^1H NMR (DMSO): 2.5 (s, 2H, CH_2), 7.2–7.6 (m, 4H, Ar–H) and 10.1 (s, 1H, CHO). Ms: *m/z* 213 ([M$^+$], 65%). Calcd. for $C_{10}H_7N_5O$ (213.2). C, 56.34; H, 3.31; N, 32.85%. Found: C, 56.01; H, 3.10; N, 32.66%.

Method B. This compound was obtained from **5** and/or **7**, according to the same experimental procedure described for **3**; methods A and B, respectively.

Preparation of 4-chloro-3*H*-benzo[*b*][1,4]diazepine-2-carbaldehyde (5). This compound was prepared according to the same experimental procedure described for the synthesis of **4** (method A) and recrystallized from ethanol (0.86 g, 59%); mp 285–87°C. ^1H NMR ($CDCl_3$): δ 1.6 (s, 2H, CH_2) and 7.2–7.6 (m, 4H, Ar–H) and 10.1 (s, 1H, CHO). Ms: *m/z* 206 ([M]$^+$, 40%). Calcd. for $C_{10}H_7N_2OCl$ (206.63). Calcd.: C, 58.13; H, 3.41; N, 13.56; O, 7.74%. Found: C, 57.33; H, 2.91; N, 12.76; O, 6.94%.

Preparation of 1-(2-methyl-3*H*-benzo[*b*][1,4]diazepin-4-yl) hydrazine (6). A mixture of **2** (1.92 g, 0.01 mol) and hydrazine hydrate (0.5 mL, 0.01 mol) in 30 mL ethanol containing 0.1 mL triethylamine was refluxed at 80°C for 4 h. The reaction mixture was concentrated under reduced pressure, and the residue washed with acidified cold water and then triturated with methanol. The formed pale green product was filtered, washed well with methanol, and recrystallized from methanol. Yield 66%, mp 250–52°C. IR: 3212–3323 (NH) and (NH_2). ^1H NMR (DMSO): 1.0 (s, 3H, CH_3), 1.5 (s, 2H, CH_2), 4.1 (s, 2H, NH_2), 4.7 (s, 1H, NH), 7.2–7.6 (m, 4H, Ar–H). Ms: *m/z* 188 ([M$^+$], 50%). Calcd. for $C_{10}H_{12}N_4$ (188.23): C, 63.81; H, 6.43; N, 29.77%. Found: C, 63.01; H, 6.20; N, 29.66%.

Preparation of 4-hydrazinyl-3*H*-benzo[*b*][1,4]diazepine-2-carbaldehyde (7). This compound was obtained from **6**, according to the same experimental procedure described for **4** (method A). The formed green product was filtered, washed well with methanol, and recrystallized from methanol. Yield 55%, mp 290–92°C. IR: 3212–3323 (NH) and (NH_2). ^1H NMR (DMSO): 1.5 (s, 2H, CH_2), 4.1 (s, 2H, NH_2), 4.7 (s, 1H, NH), 7.2–7.6 (m, 4H, Ar–H) and 10.1 (s, 1H, CHO). Ms: *m/z* 202.21 ([M$^+$], 55%). Calcd. for $C_{10}H_{10}N_4O$ (202.21): C, 56.40; H, 4.98; N, 27.71%. Found: C, 56.01; H, 4.22; N, 27.06%.

Preparation of 3-amino-1-(2-methyl-3*H*-benzo[*b*][1,4] diazepin-4-yl)-1*H*-pyrazole-4-carbonitrile (8). A solution of hydrazide **6** (1.88 g, 0.01 mol) and ethoxymethylene malononitrile (1.22 g, 0.01 mol) in 30 mL ethanol containing 0.1 mL piperidine was refluxed for 4 h then allowed to cool. The formed solid was filtered off, washed with ethanol to afford the pyrazole derivative **8**, and recrystallized from ethanol. Yield 70%, mp 150–52°C. IR: 2210 (CN), 3280 (NH_2). ^1H NMR ($CDCl_3$): 1.0 (s, 3H, CH_3), 1.5 (s, 2H, CH_2), 4.5 (s, 2H, NH_2), 7.2–7.6 (m, 5H, Ar–H and CH pyrazole ring). Ms: *m/z* 264 ([M$^+$], 65%). Calcd. for $C_{14}H_{12}N_6$ (264.29): C, 63.62; H, 4.58; N, 31.80%. Found: C, 63.01; H, 4.20; N, 31.66%.

Preparation of 2-methyl-4-(3,5-dimethyl-1*H*-pyrazol-1-yl)-3*H*-benzo[*b*][1,4]diazepine (9). To a solution of hydrazide **6** (1.88 g, 0.01 mol) and acetylacetone (1.00 mL, 0.01 mol) in 30 mL ethanol containing 0.1 mL piperidine was refluxed for 4 h then allowed to cool. The formed solid was filtered off, washed with ethanol to afford the pyrazole derivative **9**, and recrystallized from ethanol. Yield 65%, mp 255–57°C. IR: 3212–3323 (NH_2). ^1H NMR ($CDCl_3$): 1.0 (s, 3H, CH_3), 1.5 (s, 2H, CH_2), 2.8 (s, 3H, CH_3), 2.9 (s, 3H, CH_3), 5.6 (s, 1H, CH pyrazole), 7.2–7.6 (m, 5H, Ar–H and CH pyrazole). Ms: *m/z* 252 ([M$^+$], 50%). Calcd. for $C_{15}H_{16}N_4$ (252.14): C, 71.40; H, 6.39; N, 22.21%. Found: C, 71.01; H, 6.20; N, 22.01%.

Preparation of 5-methyl-4*H*-benzo[1,2,4]triazolo[4,3-*d*][1,4]diazepine-1-thiol (10). A mixture of **6** (0.18 g, 1 mmol) and carbon disulphide (2 mL) in 20 mL pyridine was heated on water bath for 8 h. The solid product so formed was filtered off while hot, washed several times with ethanol forming brown crystals, and recrystallized from ethanol. Yield: 57%. mp 250–52°C. ^1H NMR (DMSO): δ 2.03 (s, 3H, CH_3), 2.9 (s, 2H, methylene protons) and 3.42 (s, 1H, SH) and 7.1–7.7 (m, 4H, Ar–H). MS: *m/z* 320 (M$^+$, 30%). Calcd. for $C_{11}H_{10}N_4S$ (230.29): C, 57.37; H,

4.38; N, 24.33; S, 13.92%. Found: C, 57.33; H, 4.01; N, 24.15; S, 13.15%.

General procedure for preparation of compounds (11–13). A mixture of **6** (0.36 g, 2 mmol) and formic acid (10 mL) R=H, or acetic anhydride (25 mL) R=CH_3, or benzoyl chloride (15 mL) R=Ph was heated at reflux for 4 h, and then it was allowed to cool. The solid product was collected by filtration and recrystallized from proper solvent.

***5*-Methyl-4*H*-benzo[*b*][1,2,4]triazolo[4,3-*d*][1,4]diazepine (11).** Pale yellow crystals (MeOH). Yield: 50%. mp 235–237°C. ^{1}H NMR (DMSO): δ 2.03 (s, 1H, CH_3), 2.9 (s, 2H, methylene protons), 7.1–7.7 (m, 4H, Ar–H) and 8.70 (s, 1H, C-1 of triazole). MS: *m/z* 198 (M^+, 40%). Calcd. for $C_{11}H_{10}N_4$ (198.22): C, 66.65; H, 5.08; N, 28.26%. Found: C, 66.13; H, 5.01; N, 28.22%.

***1,5*-Dimethyl-4*H*-benzo[*b*][1,2,4]triazolo[4,3-*d*][1,4] diazepine (12).** Yellow crystals (MeOH). Yield: 60%. mp 286–88°C. ^{1}H NMR (DMSO): δ 2.03 (s, 1H, CH_3), 2.5 (s, 3H, C-1 methyl), 2.9 (s, 2H, methylene protons) and 7.1–7.7 (m, 4H, Ar–H). MS: *m/z* 212 (M^+, 60%). Calcd. for $C_{12}H_{12}N_4$ (230.29): C, 67.90; H, 5.70; N, 26.40%. Found: C, 67.30; H, 5.00; N, 26.15%.

***5*-Methyl-1-phenyl-4*H*-benzo[*b*][1,2,4]triazolo[4,3-*d*][1,4] diazepine (13).** Pale yellow crystals (DMF: H_2O/3:1). Yield: 62%. mp 170–72°C. ^{1}H NMR ($CDCl_3$): δ 2.03 (s, 1H, CH_3), 2.9 (s, 2H, methylene protons) and 7.1–7.7 (m, 9H, Ar–H). MS: *m/z* 275 (M + 1, 30%). Calcd. for $C_{17}H_{14}N_4$ (274.32): C, 74.43; H, 5.14; N, 20.42%. Found: C, 74.30; H, 5.10; N, 20.25%.

Preparation of 5-methyl-4*H*-benzo[*b*]tetrazolo[1,5-*d*][1,4] diazepine (14). To an ice-cooled solution of **6** (0.18 g, 1 mmol) in 30 mL (HCl/AcOH: v/v), a solution of sodium nitrite (0.01 mol) in water (10 mL) was added drop-wise. The solution was stirred at room temperature for an additional 2 h; the crude product obtained was filtered off and recrystallized from ethanol as yellow crystals. Yield: 70%. mp 215–17°C. ^{1}H NMR ($CDCl_3$): δ 2.03 (s, 1H, CH_3), 2.9 (s, 2H, methylene protons) and 7.1–7.7 (m, 4H, Ar–H). MS: *m/z* 200 (M + 1, 40%). Calcd. for $C_{10}H_9N_5$ (199.21): C, 60.29; H, 4.55; N, 35.16%. Found: C, 60.13; H, 4.10; N, 35.33%.

Preparation of 3-(2-chloro-3*H*-benzo[*b*][1,4]diazepin-4-yl)-1-phenyl-prop-2-en-1-one (15a) and its derivatives (15b–f). ***General procedure.*** A mixture of the formyl **5** (2.06 g, 0.01 mol) and acetophenone (1.2 mL, 0.01 mol), *p*-hydroxyacetophenone (1.36 g, 0.01 mol), *p*-nitroacetophenone (1.65 g, 0.01 mol), *o*-nitroacetophenone (1.65 g, 0.01 mol), *p*-methoxyacetophenone (1.34 g0.01 mol), and *p*-chloroacetophenone (1.54 g0.01 mol) in 30 mL ethanol containing 0.1 mL of piperidine was refluxed for 5 h. The reaction mixture was concentrated, cooled, then poured into ice/H_2O mixture, and the solid product thus so formed was filtered and washed for several times with water to afford **15a–f** derivatives.

Compound 15a. Yellow crystals (MeOH), yield 66%. mp 180–2°C. IR: υ (cm^{-1}) 1685–1705 (C=O), ^{1}H NMR ($CDCl_3$): δ 1.5 (s, 2H, CH_2), 6.1–7.9 (m, 11H, Ar–H). Ms: *m/z* 308 ($[M]^+$, 60%). Calcd. for $C_{18}H_{13}N_2OCl$ (308.76). Calcd.: C, 70.02; H, 4.24; N, 9.07; Cl, 11.48%. Found: C, 70.17; H, 4.31; N, 9.15; Cl, 11.18%.

Compound 15b. Pale green crystals (MeOH), yield 54%, mp 220–22°C, IR: υ (cm^{-1}) 1685–1705 (C=O), 3345 (OH), ^{1}H NMR ($CDCl_3$): δ 1.5 (s, 2H, CH_2), 6.1–7.9 (m, 10H, Ar–H) and 9.9 (s, 1H, phenolic OH). Ms: *m/z* 324 ($[M]^+$, 65%). Calcd. for $C_{18}H_{13}N_2O_2Cl$ (324.76). Calcd.: C, 66.57; H, 4.03; N, 8.63; Cl, 10.92%. Found: C, 66.17; H, 3.91; N, 8.15; Cl, 10.18%.

Compound 15c. Brown crystals (ethanol), yield 71%, mp 200–02°C. IR: υ (cm^{-1}) 1685–1705 (C=O), ^{1}H NMR ($CDCl_3$): δ 1.5 (s, 2H, CH_2), 6.1–7.9 (m, 10H, Ar–H). Ms: *m/z* 353 ($[M]^+$, 62%). Calcd. for $C_{18}H_{12}N_3O_3Cl$ (353.76). Calcd.: C, 61.11; H, 3.42; N, 11.88; Cl, 10.02%. Found: C, 61.17; H, 3.31; N, 11.15; Cl, 10.18%.

Compound 15d. Pale green crystals (ethanol), yield 59%, mp 170–72°C. IR: υ (cm^{-1}) 1685–1705 (C=O), ^{1}H NMR ($CDCl_3$): δ 1.5 (s, 2H, CH_2), 6.1–7.9 (m, 10H, Ar–H). Ms: *m/z* 352 ($[M-1]^+$, 66%). Calcd. for $C_{18}H_{12}N_3O_3Cl$ (353.76). Calcd.: C, 61.11; H, 3.42; N, 11.88; Cl, 10.02%. Found: C, 61.17; H, 3.31; N, 11.15; Cl, 10.18%.

Compound 15e. Yellow crystals (ethanol), yield 62%, mp 255–57°C. IR: υ (cm^{-1}) 1685–1705 (C=O), ^{1}H NMR ($CDCl_3$): δ 1.5 (s, 2H, CH_2), 3.8 (s, 3H, –OCH_3), 6.1–7.9 (m, 10H, Ar–H). Ms: *m/z* 338 ($[M]^+$, 60%). Calcd. for $C_{19}H_{15}N_2O_2Cl$ (338.79). Calcd.: C, 67.36; H, 4.46; N, 8.27; Cl, 10.46%. Found: C, 67.17; H, 4.31; N, 8.15; Cl, 10.18%.

Compound 15f. Yellow crystals (ethanol), yield 62%, mp 255–57°C. IR: υ (cm^{-1}) 1685–1705 (C=O), ^{1}H NMR ($CDCl_3$): δ 1.5 (s, 2H, CH_2), 6.1–7.9 (m, 10H, Ar–H). Ms: *m/z* 342 ($[M]^+$, 70%). Calcd. for $C_{18}H_{12}N_2OCl_2$ (342.21). Calcd.: C, 62.99; H, 3.52; N, 8.16; Cl, 20.66%. Found: C, 62.17; H, 3.31; N, 8.15; Cl, 20.18%.

Preparation of 4-((phenylimino) methyl)-2(1*H*)-chloro-benzo [*b*][1,4]diazepines (16a) and its derivatives (16b–f). ***General procedure.*** A mixture of equimolar amount of **5** (2.06 g, 0.01 mol) and aniline (0.93 mL, 0.01 mol), *p*-hydroxyaniline (1.09 g, 0.01 mol), *p*-nitroaniline (1.38 g, 0.01 mol), *o*-nitroaniline (1.38 g, 0.01 mol), *p*-methoxyaniline (1.23 g, 0.01 mol), and *p*-chloroaniline (1.27 g, 0.01 mol) in 30 mL ethanol containing 0.1 mL of piperidine was refluxed for 5 h. The reaction mixture was concentrated, poured into ice/H_2O mixture, and the solid product thus formed, filtered, washed for several times with water and crystallized from methanol.

Compound 16a. Brown crystals (methanol), yield 58%, mp 235–37°C. ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 7.1–7.8 (m, 10H, Ar–H and CH=N). Ms: *m/z* 281 (M^+, 60%). Calcd. for $C_{16}H_{12}N_3Cl$ (281.74). C, 68.21; H, 4.29; N, 14.91; Cl, 12.58%. Found: C, 67.45; H, 4.52; N, 14.12; Cl, 12.48%.

Compound 16b. Yellow crystals (methanol), yield 60%, mp 210–12°C. IR: υ (cm^{-1}) 3345 (OH), ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 7.1–7.8 (m, 9H, Ar–H and CH=N). Ms: *m/z* 297 (M^+, 55%). Calcd. for $C_{16}H_{12}N_3OCl$ (297.74). C, 64.54; H, 4.06; N, 14.11; Cl, 11.91%. Found: C, 62.45; H, 4.52; N, 14.12; Cl, 11.48%.

Compound 16c. Pale yellow crystals (methanol), yield 74%, mp 280–82°C. ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 7.1–7.8 (m, 9H, Ar–H and CH=N). Ms: *m/z* 326 (M^+, 70%). Calcd. for $C_{16}H_{11}N_4O_2Cl$ (326.74). C, 58.82; H, 3.39; N, 17.15; Cl, 10.85%. Found: C, 58.45; H, 3.52; N, 17.12; Cl, 10.48%.

Compound 16d. Brown crystals (methanol), yield 65%, mp 215–17°C. ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 7.1–7.8 (m, 9H, Ar–H and CH=N). Ms: *m/z* 326 (M^+, 55%). Calcd. for $C_{16}H_{11}N_4O_2Cl$ (326.74). C, 58.82; H, 3.39; N, 17.15; Cl, 10.85%. Found: C, 58.45; H, 3.52; N, 17.12; Cl, 10.48%.

Compound 16e. Pale green crystals (ethanol), yield 55%, mp 230–32°C. ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 3.8 (s, 3H, –OCH_3), 7.1–7.8 (m, 9H, Ar–H and CH=N). Ms: *m/z* 331 (M^+, 80%). Calcd. for $C_{17}H_{14}N_3OCl$ (311.77). C, 65.49; H, 4.53; N,

13.48; Cl, 11.37%. Found: C, 65.45; H, 4.52; N, 13.12; Cl, 11.48%.

Compound 16f. Pale green crystals (ethanol), yield 55%, mp 230–32°C. ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 7.1–7.8 (m, 9H, Ar–H and CH=N). Ms: *m/z* 316 (M^+, 55%). Calcd. for $C_{16}H_{11}N_3Cl_2$ (316.18). C, 60.78; H, 3.51; N, 13.29; Cl, 22.43%. Found: C, 60.45; H, 3.52; N, 13.12; Cl, 22.48%.

Preparation of 2-hydrazino-4-(4,5-dihydro-3-phenyl-1*H*-pyrazol-5-yl)-3*H*-benzo[*b*][1,4]diazepine (17a) and its derivatives (17b–d). ***General procedure.*** A mixture of **15a** (3.08 g, 0.01 mol) and hydrazine hydrate (0.05 mL, 0.01 mol), phenyl hydrazine (1.08 mL, 0.01 mol), hydroxylamine (0.33 g, 0.01 mol), and benzohydrazide (1.36 g, 0.01 mol) in 30 mL ethanol containing 0.1 mL of piperidine was refluxed for 5 h. The reaction mixture was concentrated under reduced pressure and the residue washed with acidified cold water and then triturated with methanol.

Compound 17a. Pale green crystals (methanol), yield 66%, mp 255–57°C. IR: 3117–3293 (NH) and (NH_2). ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 1.7 (d, 2H, CH_2), 2.6 (t, 1H, CH), 4.1 (s, 2H, NH_2), 4.2 (s, H, NH), 7.1 (s, H, NH hydrazide), 7.2–7.8 (m, 9H, Ar–H). Ms: *m/z* 318 ([M^+], 55%). Calcd. for $C_{18}H_{18}N_6$ (318.38): C, 67.90; H, 5.70; N, 26.40%. Found: C, 67.01; H, 5.20; N, 26.66%.

Compound 17b. Brown crystals (methanol), yield 50%, mp 295–97°C. ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 1.7 (d, 2H, CH_2), 3.6 (t, 1H, CH), 7.2–8.01 (m, 14H, Ar–H). Ms: *m/z* 398 ([M^+], 75%). Calcd. for $C_{24}H_{19}N_4Cl$ (398.89): C, 72.27; H, 4.08; N, 14.05%. Found: C, 72.01; H, 4.20; N, 13.66%.

Compound 17c. Yellow crystals (methanol), yield 60%, mp 180–82°C. ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 1.7 (d, 2H, CH_2), 3.6 (t, 1H, CH), 7.2–7.8 (m, 9H, Ar–H). Ms: *m/z* 323 ([M^+], 55%). Calcd. for $C_{18}H_{14}N_3OCl$ (323.78): C, 66.77; H, 4.36; N, 12.98%. Found: C, 65.01; H, 4.20; N, 11.66%.

Compound 17d. Yellowish brown crystals (ethanol), yield 40%, mp 230–32°C. ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 1.7 (d, 2H, CH_2), 3.6 (t, 1H, CH), 7.2–8.01 (m, 14H, Ar–H). Ms: *m/z* 426 ([M^+], 75%). Calcd. for $C_{25}H_{19}N_4OCl$ (426.9): C, 70.34; H, 4.49; N, 13.12%. Found: C, 69.01; H, 3.20; N, 12.66%.

Preparation of 6-(2-chloro-3*H*-benzo[*b*][1,4]diazepin-4-yl)-5,6-dihydro-4-phenylpyrimidin-2(1*H*)-one (18a) and its derivative (18b). ***General procedure.*** A mixture of equimolar amounts of **15a** (3.08 g, 0.01 mol) and urea (0.60 g, 0.01 mol) or thiourea (0.76 g, 0.01 mol) and 0.1 mL piperidine was refluxed for 8 h in 30 mL of ethanol. The solvent was evaporated under vacuum, and the residue was poured to 30 mL acidified cold water and then triturated with methanol. The product was filtered and crystallized from ethanol.

Compound 18a. Brown crystals (ethanol), yield 70%, mp 196–98°C. IR: 1685–1705 (C=O), 3063–3288 (NH). ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 1.7 (d, 2H, CH_2), 3.7 (t, 1H, CH), 7.2–7.8 (m, 9H, Ar–H) and 8.1 (s, H, NH), Ms: *m/z* 350 ([M-1]$^+$, 25%). Calcd. for $C_{19}H_{15}N_4OCl$ (350.9): C, 65.05; H, 4.31; N, 15.97; Cl, 10.11%. Found: C, 65.01; H, 4.20; N, 15.66; Cl, 10.01%.

Compound 18b. Brown crystals (methanol), yield 59%, mp 210–12°C. IR: 1230 (C=S), 3063–3288 (NH). ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 1.7 (d, 2H, CH_2), 3.7 (t, 1H, CH), 7.2–7.8 (m, 9H, Ar–H) and 8.1 (s, H, NH), Ms: *m/z* 365 ([M-1]$^+$, 35%). Calcd. for $C_{19}H_{25}N_4SCl$ (366.8): C, 62.20; H, 4.12; N, 15.27; Cl, 9.66%. Found: C, 62.01; H, 4.20; N, 15.66; Cl, 9.01%.

Preparation of 6-(2-chloro-3*H*-benzo[*b*][1,4]diazepin-4-yl)-1,2,5,6-tetrahydro-2-oxo-4-phenylpyridine-3-carbonitrile (19a) and its derivatives (19b–e) (20a,b) and (21). ***General procedure.*** A mixture of **15a** (3.08 g, 0.01 mol) and cyanoacetamide (0.84 g, 0.01 mol) in 30 mL of ethanol in the presence of 0.1 mL of piperidine was refluxed for 8 h. The reaction mixture was concentrated under vacuum and the residue washed with acidified cold water and then triturated with methanol. The solid product formed was filtered and crystallized from ethanol to afford **19a** in 72% yield. In analogously, the chalcone **15a** was reacted with cyanothioacetamide (1.0 g, 0.01 mol), 2-cyano-*N*-*p*-tolylacetamide (1.74 g, 0.01 mol), 2-cyanoacetohydrazide (0.99 g, 0.01 mol), 2-cyano-*N*-phenylacetamide (1.6 g, 0.01 mol), 2-aminoprop-1-ene-1,1,3-tricarbonitrile (1.32 g, 0.01 mol), ethyl 3-amino-2,4-dicyano-but-2-enoate (1.79 g, 0.01 mol), and 2-chloroacetamide (0.93 g, 0.01 mol) to yield the pyridine derivatives **19b–e**, **20a**,**b**, and **21**, respectively.

Compound 19a. Yellow crystals (methanol), yield 72%, mp 284–86°C. IR: 1699 (C=O), 2210 (CN), 3180 (NH). ^{1}H NMR ($CDCl_3$): 1.5 (s, 2H, CH_2), 2.3 (d, 2H, CH_2), 3.6 (t, 1H, CH), 7.2–7.6 (m, 9H, Ar–H) and 8.1 (s, H, NH), Ms: *m/z* 374 ([M^+], 55%). Calcd. for $C_{21}H_{15}N_4OCl$ (374.82): C, 67.29; H, 4.03; N, 14.95; Cl, 9.46%. Found: C, 67.01; H, 4.20; N, 14.66; Cl, 9.01%.

Compound 19b. Yellow crystals (methanol), yield 55%, mp 248–50°C. IR: 1251 (C=S), 2218 (CN), 3311 (NH). Ms: *m/z* 390 ([M^+], 65%). Calcd. for $C_{21}H_{15}N_4SCl$ (390.89): C, 64.53; H, 3.87; N, 14.33; Cl, 9.07%. Found: C, 63.11; H, 4.21; N, 21.12; Cl, 9.01%.

Compound 19c. Red crystals (methanol), yield 65%, mp 231–33°C. IR: 1698 (C=O), 2210 (CN). ^{1}H NMR ($CDCl_3$): 1.5 (s, 2H, CH_2), 2.3 (s, 3H, CH_3), 2.4 (d, 2H, CH_2), 3.6 (t, 1H, CH), 7.2–7.6 (m, 13H, Ar–H), Ms: *m/z* 464 ([M^+], 70%). Calcd. for $C_{28}H_{21}N_4OCl$ (464.95): C, 72.33; H, 4.55; N, 12.05; Cl, 7.63%. Found: C, 72.01; H, 4.20; N, 12.66; Cl, 7.01%.

Compound 19d. Pale red crystals (methanol), yield 75%, mp 217–19°C. IR: 1699 (C=O), 2210 (CN), 3280 (NH_2). Ms: *m/z* 374 ([M^+], 80%). Calcd. for $C_{21}H_{16}N_5OCl$ (389.84): C, 64.70; H, 4.14; N, 17.96; Cl, 9.09%. Found: C, 64.01; H, 4.20; N, 17.66; Cl, 9.01%.

Compound 19e. Yellow crystals (methanol), yield 35%, mp 285–87°C. IR: 1688 (C=O), 2210 (CN). Ms: *m/z* 450 ([M^+], 55%). Calcd. for $C_{27}H_{19}N_4OCl$ (450.92): C, 71.92; H, 4.25; N, 12.43; Cl, 7.86%. Found: C, 71.41; H, 4.10; N, 12.06; Cl, 9.21%.

6-(2-Chloro-3*H*-benzo[*b*][1,4]diazepin-4-yl)-2-(dicyanomethylene)-1,2,5,6-tetrahydro-4-phenyl pyridine-3-carbonitrile (20a). Brown crystals (methanol), yield 50%, mp 220–22°C. IR: 2217 (CN). ^{1}H NMR ($CDCl_3$): 1.5 (s, 2H, CH_2), 2.3 (d, 2H, CH_2), 2.9 (t, 1H, CH) and 7.2–7.6 (m, 9H, Ar–H). Ms: *m/z* 422 ([M^+], 55%). Calcd. for $C_{24}H_{15}N_6OCl$ (422.87): C, 68.17; H, 3.58; N, 19.87; Cl, 8.38%. Found: C, 67.01; H, 2.20; N, 18.66; Cl, 7.01%.

Compound 20b. Brown crystals (methanol), yield 63%, mp 220–22°C. IR: 1699 (C=O), 2210 (CN), 3180 (NH). ^{1}H NMR ($CDCl_3$): 1.4 (t, 3H, CH_3), 1.5 (s, 2H, CH_2), 2.4 (d, 2H, CH_2), 2.8 (t, 1H, CH), 4.2 (q, 2H, CH_2), 7.2–7.6 (m, 9H, Ar–H) and 8.1 (s, H, NH). Ms: *m/z* 469 ([M^+], 60%). Calcd. for $C_{26}H_{20}N_5O_2Cl$ (469.92): C, 66.45; H, 4.29; N, 14.90; Cl, 7.54%. Found: C, 66.11; H, 4.20; N, 14.26; Cl, 7.01%.

3-Chloro-6-(2-chloro-3*H*-benzo[*b*][1,4]diazepin-4-yl)-5,6-dihydro-4-phenylpyridin-2(1*H*)-one (21). Yellow crystals (methanol), yield 40%, mp 155.57°C. IR: 1688 (C=O), 3233 (NH). Ms: *m/z* 383 ([M-1]$^+$, 25%). Calcd. for $C_{20}H_{15}N_3OCl_2$ (384.26): C, 62.51; H, 3.93; N, 10.94; Cl, 18.45%. Found: C, 62.01; H, 3.10; N, 10.06; Cl, 18.21%.

Preparation of 2-chloro-4-(6,7-dihydro-5-phenyl-[1,2,4] triazolo[5,1-*a*]pyrimidin-7-yl)-3*H*-benzo[*b*][1,4]diazepine (22). A mixture of **15a** (3.08 g, 0.01 mol) and 5-amino-1*H*-1,2, 4-triazole (0.84 g, 0.01 mol) in 30 mL ethanol in the presence of 0.1 mL of piperidine was refluxed for 8 h. The reaction mixture was concentrated and poured into ice/water mixture, and the solid product thus formed was filtered, washed for several times with water, and crystallized from methanol. Yield 55%, mp 241–43°C; ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 1.9 (d, 2H, CH_2), 3.8 (t, 1H, CH), 7.2–7.6 (m, 9H, Ar–H) and 8.2 (s, H, CH triazole ring), Ms: *m/z* 374 ([M]$^+$, 60%). Calcd. for $C_{20}H_{15}N_6Cl$ (374.82): C, 64.09; H, 4.03; N, 22.42; Cl, 9.46%. Found: C, 64.01; H, 3.80; N, 22.06; Cl, 9.01%.

Preparation of 2-chloro-4-(2,3-dihydro-4-phenyl-benzo[*b*] [1,4]oxazepin-2-yl)-3*H*-benzo[*b*][1,4] diazepine (23a) and its derivatives (23b–c) and (24a,b). ***General procedure.*** A mixture of equimolar amounts **15a** (3.08 g, 0.01 mol) and *o*-aminophenol (1.09 g, 0.01 mol), 2-amino-3-chlorophenol (1.43 g, 0.01 mol), 2-amino-3-nitrophenol (1.54 g, 0.01 mol), *o*-phenylenediamine (1.08 g, 0.01 mol), and *o*-aminothiophenol (1.25 g, 0.01 mol) in 30 mL ethanol containing 0.1 mL of piperidine was refluxed for 8 h. The reaction mixture was concentrated, cooled, and then poured into ice/H_2O mixture. The solid product thus so formed was filtered, washed for several times with water, and crystallized from ethanol.

Compound 23a. Brown crystals (ethanol), yield 70%, mp 180–182°C. ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 1.8 (d, 2H, CH_2), 3.9 (t, 1H, CH) and 6.7–7.3 (m, 13H, Ar–H), Ms: *m/z* 399 ([M]$^+$, 45%). Calcd. for $C_{24}H_{18}N_3OCl$ (399.87): C, 72.07; H, 4.54; N, 10.51; Cl, 8.87%. Found: C, 71.55; H, 3.72; N, 10.06; Cl, 8.01%.

Compound 23b. Yellow crystals (ethanol), yield 60%, mp 270–72°C. Ms: *m/z* 434 ([M]$^+$, 50%). Calcd. for $C_{24}H_{17}N_3OCl_2$ (434.32): C, 66.37; H, 3.95; N, 9.67; Cl, 16.33%. Found: C, 66.02; H, 3.27; N, 9.12; Cl, 16.19%.

Compound 23c. Yellow crystals (ethanol), yield 72%, mp 205–07°C. Ms: *m/z* 586 ([M + 2]$^+$, 35%). Calcd. for $C_{24}H_{17}N_4O_3Cl$ (444.8): C, 64.83; H, 3.85; N, 12.59; Cl, 7.97%. Found: C, 64.21; H, 3.22; N, 12.14; Cl, 7.12%.

Compound 24a. Brown crystals (ethanol), yield 52%, mp 275–77°C. IR: 3280 (NH). ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 1.7 (d, 2H, CH_2), 2.7 (t, 1H, CH), 4.1 (s, 1H, NH), 6.8–7.6 (m, 13H, Ar–H), Ms: *m/z* 398 ([M]$^+$, 50%). Calcd. for $C_{24}H_{19}N_4Cl$ (398.89): C, 72.27; H, 4.80; N, 14.05; Cl, 8.89%. Found: C, 72.01; H, 3.22; N, 14.06; Cl, 8.01%.

Compound 24b. Yellow crystals (ethanol), yield 70%, mp 230–32°C. Ms: *m/z* 414 ([M-2]$^+$, 30%). Calcd. for $C_{24}H_{18}N_3SCl$ (415.94): C, 69.30; H, 4.36; N, 10.10; Cl, 8.52%. Found: C, 69.01; H, 4.81; N, 10.06; Cl, 8.11%.

Preparation of 2-chloro-4-(6, 7-dihydro-8-phenyl-pyrido [1, 2-*a*] benzimidazolo-6-yl)-3*H*-benzo[*b*][1,4]diazepine (25). A mixture of **15a** (3.08 g, 0.01 mol), 2-cyanomethylbenzimidazole (1.57 g, 0.01 mol) and 0.1 mL of piperidine in 30 mL of ethanol was refluxed for 8 h. The solvent was evaporated under vacuum, and the residue was washed by acidified cold water and then triturated with methanol. The solid product was filtered and crystallized from ethanol as yellow crystals, yield 60%, mp 248–50°C. IR: 2217 (CN). ^{1}H NMR ($CDCl_3$): 1.5 (s, 2H, CH_2), 2.5 (d, 2H, CH_2), 3.7 (t, 1H, CH), 7.0–7.6 (m, 13H, Ar–H), Ms: *m/z* 448 ([M]$^+$, 25%). Calcd. for $C_{27}H_{18}N_5Cl$ (447.92): C, 72.40; H, 4.05; N, 15.64; Cl, 7.92%. Found: C, 72.01; H, 4.22; N, 15.06.

Preparation of 3-chloro-4-(2-chloro-3*H*-benzo[*b*][1,4] diazepin-4-yl)-1-phenylazetidin-2-one (26a) and its derivatives (26b–f). ***General procedure.*** To a well-stirred solution of **16a** (0.5 g, 0.002 mol) and triethylamine (0.404 mL, 0.004 mol) in dry dioxane (20 mL), chloroacetyl chloride (0.22 mL, 0.002 mol) was added drop-wise at room temperature, then the reaction mixture was refluxed for 8 h. The precipitate of triethylamine hydrochloride was filtered and washed thoroughly with dioxane. The filtrate was evaporated to one-third of its original volume, cooled, and poured into acidified ice and the precipitate formed washed with water thoroughly, dried, and crystallized from methanol. Similarly, β-lactam derivatives **26b–f** were synthesized according to the same procedure.

Compound 26a. Brown crystals (methanol), yield 60%, mp 280–82°C. IR: 1705 (C═O). ^{1}H NMR (DMSO): 1.5 (s, 2H, CH_2), 3.9 (d, 1H, CH, C-4 of β-lactam ring), 5.2 (d, 1H, CH, C-3 of β-lactam ring), 7.1–7.6 (m, 9H, Ar–H). Ms: *m/z* 358 ([M]$^+$, 30%), Calcd. for $C_{18}H_{13}N_3OCl_2$ (358.22): C, 60.35; H, 3.66; N, 11.73; Cl, 19.79%. Found: C, 60.09; H, 3.22; N, 11.18; Cl, 9.12%.

Compound 26b. Yellow crystals (methanol), yield 63%, mp 270–72°C. IR: 1705 (C═O), 3327 (OH). 1.5 (s, 2H, CH_2), 3.9 (d, 1H, CH, C-4 of β-lactam ring), 5.2 (d, 1H, CH, C-3 of β-lactam ring), 7.1–7.6 (m, 8H, Ar–H) and 10.1 (s, 1H, phenolic OH). Ms: *m/z* 374 ([M]$^+$, 25%), Calcd. for $C_{18}H_{13}N_3O_2Cl_2$ (374.22): C, 57.77; H, 3.50; N, 11.23; Cl, 18.95%. Found: C, 57.09; H, 3.22; N, 11.08; Cl, 18.12%.

Compound 26c. Pale green crystals (methanol), yield 68%, mp 193–95°C. IR: 1688–1715 (C═O). ^{1}H NMR ($CDCl_3$): 1.5 s, 2H, CH_2), 3.9 (d, 1H, CH, C-4 of β-lactam ring), 5.2 (d, 1H, CH, C-3 of β-lactam ring), 7.1–7.6 (m, 8H, Ar–H). Ms: *m/z* 403 ([M]$^+$, 45%), Calcd. for $C_{18}H_{12}N_4O_3Cl_2$ (403.22): C, 53.62; H, 3.00; N, 12.89; Cl, 17.58%. Found: C, 53.07; H, 2.22; N, 12.18; Cl, 17.11%.

Compound 26d. Brown crystals (ethanol), yield 62%, mp 175–77°C. IR: 1705 (C═O), Ms: *m/z* 403 ([M]$^+$, 30%), Calcd. for $C_{18}H_{12}N_4O_3Cl_2$ (403.22): C, 53.62; H, 3.00; N, 12.89; Cl, 17.58%. Found: C, 53.17; H, 2.12; N, 12.11; Cl, 17.01%.

Compound 26e. Yellow crystals (ethanol), yield 70%, mp 230–32°C. IR: 1705 (C═O), Ms: *m/z* 388 ([M]$^+$, 55%), Calcd. for $C_{19}H_{15}N_3O_2Cl_2$ (388.25): C, 58.78; H, 3.89; N, 10.82; Cl, 18.26%. Found: C, 58.17; H, 3.09; N, 10.11; Cl, 18.01%.

Compound 26f. Brown crystals (ethanol), yield 67%, mp 210–12°C. IR: 1688–1715 (C═O). ^{1}H NMR ($CDCl_3$): 1.5 (s, 2H, CH_2), 3.9 (d, 1H, CH, C-4 of β-lactam ring), 5.2 (d, 1H, CH, C-3 of β-lactam ring), 7.1–7.6 (m, 8H, Ar–H). Ms: *m/z* 392 ([M]$^+$, 60%), Calcd. for $C_{18}H_{12}N_3OCl_3$ (392.67): C, 55.06; H, 3.08; N, 10.70; Cl, 27.09%. Found: C, 55.07; H, 3.22; N, 10.22; Cl, 27.02%.

Preparation of 2-(2-chloro-3*H*-benzo[*b*][1,4]diazepin-4-yl)-3-phenylthiazolidin-4-one (27a) and its derivatives (27b–f). ***General procedure.*** An equimolar mixture of **16a** (0.84 g, 0.003 mol) and thioglycolic acid (0.276 mL, 0.003 mol) in dry benzene (20 mL) was refluxed for 10 h. The reaction mixture was evaporated to dryness under reduced pressure. The thiazolidinone was separated off, washed with ether, and crystallized from ethanol. Analogously, **16b–f** reacted with thioglycolic acid to yield **27b–f**.

Compound 27a. Brown crystals (methanol), yield 55%, mp 230–32°C. IR: 1669 (C═O), ^{1}H NMR ($CDCl_3$): 1.5 (s, 2H, CH_2), 3.5 (s, 2H, CH_2), 4.5 (s, 1H, CH), 7.1–7.6 (m, 9H, Ar–H). Ms: *m/z* 355 ($[M]^+$, 31%). Calcd. for $C_{18}H_{14}N_3OSCl$ (355.84): C, 60.76; H, 3.97; N, 11.81; Cl, 9.96%. Found: C, 60.46; H, 3.13; N, 11.46; Cl, 9.11%.

Compound 27b. Yellow crystals (methanol), yield 70%, mp 215–17°C. IR: 1705 (C═O), 3329 (OH). Ms: *m/z* 371 ($[M]^+$, 22%). Calcd. for $C_{18}H_{14}N_3O_2SCl$ (371.05): C, 58.14; H, 3.79; N, 11.30; Cl, 9.53%. Found: C, 58.14; H, 3.13; N, 11.16; Cl, 9.03%.

Compound 27c. Pale green crystals (ethanol), yield 80%, mp 180–82°C. IR: 1705 (C═O). Ms: *m/z* 400 ($[M]^+$, 31%). Calcd. for $C_{18}H_{13}N_4O_3SCl$ (400.84): C, 53.94; H, 3.27; N, 13.98; Cl, 8.84%. Found: C, 53.46; H, 3.13; N, 13.46; Cl, 8.11%.

Compound 27d. Yellow crystals (ethanol), yield 65%, mp 290–92°C. IR: 1710 (C═O). ^{1}H NMR ($CDCl_3$): 1.5 (s, 2H, CH_2), 3.5 (s, 2H, CH_2), 4.5 (s, 1H, CH), 7.1–7.6 (m, 8H, Ar–H). Ms: *m/z* 399 ($[M\text{-}1]^+$, 54%). Calcd. for $C_{18}H_{13}N_4O_3SCl$ (400.84): C, 53.94; H, 3.27; N, 13.97; Cl, 8.84%. Found: C, 53.16; H, 3.11; N, 13.06; Cl, 8.11%.

Compound 27e. Brown crystals (methanol), yield 65%, mp 225–27°C. IR: 1705 (C═O). Ms: *m/z* 385 ($[M]^+$, 42%). Calcd. for $C_{19}H_{16}N_3O_2SCl$ (385.87): C, 59.14; H, 4.18; N, 10.89; Cl, 9.19%. Found: C, 59.46; H, 4.10; N, 10.46; Cl, 9.01%.

Compound 27f. Brown crystals (ethanol), yield 65%, mp 187–89°C. IR: 1692 (C═O). ^{1}H NMR ($CDCl_3$): 1.5 (s, 2H, CH_2), 3.5 (s, 2H, CH_2), 4.5 (s, 1H, CH), 7.1–7.6 (m, 8H, Ar–H). Ms: *m/z* 390 ($[M]^+$, 65%). Calcd. for $C_{18}H_{13}N_3OSCl_2$ (390.29): C, 55.39; H, 3.36; N, 10.77; Cl, 18.17%. Found: C, 55.26; H, 3.11; N, 10.16; Cl, 18.01%.

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