Chemistry and Materials Research
ISSN 2224- 3224 (Print) ISSN 2225- 0956 (Online)
Vol.7 No.4, 2015

Synthesis new fused and non-fused chromene [I] derivatives derived from *2*-amino-*4-[4-*(dimethylamino)phenyl*]-5*-oxo-*4H,5H*-pyrano*[3,2-c]*chromene-*3*-carbonitrile

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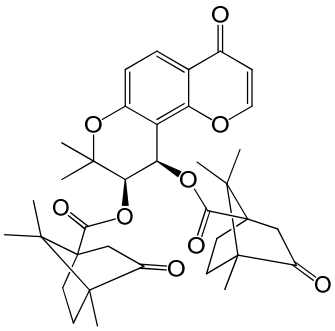
Abstract
A new series of pyrano-chromene and pyrimido pyrano-chromene derivatives were synthesized starting from 2-amino-4-[4-(dimethylamino)phenyl]-5-oxo-4*H*,5*H*-pyrano[3,2-*c*]chromene-3-carbonitrile (**5**). The structures of the synthesized compounds were elucidated by spectral data.
Key words: Chromenes, Pyrano-chromenes

Introduction

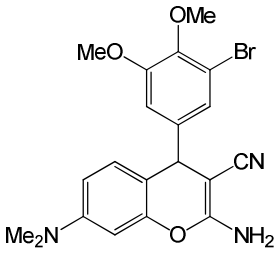
Chromenes and coumarins [1] have been the subject of the considerable chemical interest in the past decades. They occur widely in nature and exhibit important biological as well as pharmacological activities [2–5]. Among chromene derivatives are biologically interesting compounds showing antimicrobial [6–10], and antifungal activities [11, 12], inhibitors of influenza virus silidoses [13, 14], compounds with antihypertensive [15] and anti-allergic activity [16] and hair growth stimulant properties [17]. However, the chromenes are also well known for their biocidal [18, 19], wound healing [20], anti-inflammatory [21], and antiulcer [22] activities.

Some fused chromene derivatives were found useful as antiviral [23], antiproliferation agents [24], antioxidant [25, 26], antileishmanial [27], antitumor [28], and anti-HIV agents [29], central nervous system (CNS) activities and effects [30], as well as treatment of Alzheimer's disease [31], and Schizophrenia disorder [32]. Satyanarayana *et al.* [33] reported the synthesis and antifungal screening of new Schiff base of chromenes under conventional and microwave conditions. Furthermore, Lee *et al.* [34] have synthesized 3′*R*,4′*R*-di-(*O*)-(−)-camphanoyl-2′,2′-dimethyldihydropyrano[2,3-*f*]chromone (DCP) (**1**) as a potent *in vitro* inhibitor of HIV-1 replication in H9 lymphocyte cells with an EC_{50} of 6.78×10^{-4} μM. The family of 4-aryl-4*H*-chromenes has been recently reported to possess anti-cancer activity. These compounds, which are potent apoptosis inducers such as **2**, were found to be highly active in the growth inhibition MTT with the concentration causing 50 % cell growth inhibition (IC_{50}) values in the low nanomolar range [35]. Geiparvarin (**3**), a naturally occurring compound bearing a coumarin residue, has been shown to possess a significant inhibitory activity against a variety of cell lines including sarcoma 180, *Lewis* lung carcinoma, P-388 lymphocytic leukaemia, and *Walker* 256 carcinosarcoma [36].

In the present work, we report the synthesis of new chromenes derivatives .



1 DCP



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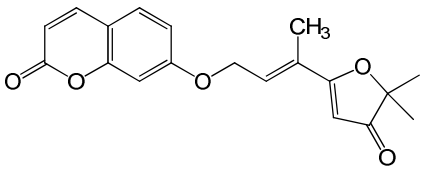


3 Geiparvarin

Experimental

General

All reactants and solvents used in this study were reagents grade and they are available from Sigma-Aldrich and Fluka companies Melting points are determined in open capillary tubes in a Germany, Stuarts, SMP30 Melting points apparatus and are un corrected. Infrared spectra were recorded as KBr discs using a SHIMADZU FT-

IR8400S spectrophotometer. ^{1}HNMR spectra (solvent DMSO-d6) were recorded on Bruker DMX-500 NMR spectrophotometer 300MHz spectrometer with TMS as internal standard which were made at chemistry department, Al-Bayt University, Jordan. Mass spectroscopic were recorded Shimadaza GC-Mass in the Al-Mustansiriyah University.

Synthesis of the Starting Compounds

Synthesis of 2-(4-Dimethylamino-benzylidene)-malononitrile [4]

To a mixture of *N,N* di-methyl amino benzaldehyde (0.15g, 1.0 mmol) and malono nitrile (0.07g, 1 mmol) in absolute ethanol (20 mL) was add the catalyst dipropylamine (few drops) and the reaction mixture was refluxed for 1 h., (TLC control hexane : ethyl acetate, 6:4). The reaction mixture was cooled and poured onto ice cold water, the product was filtered, dried and recrystallized from ethanol to give [4] as a yellow solid, (82% yield), m.p. 178., – GC-MS (EI, 70 eV): *m/z* (%) = 197 (100) $[M]^+$, 153 (4)., FT-IR (KBr, ν, cm^{-1}): 2210 cm^{-1} (CN), 2922 cm^{-1} (CH aliph.), 1512 cm^{-1} (C=C).

***Synthesis of 2-amino-4-(4-(dimethylamino)phenyl)-5-oxo-4, 5- dihydropyran [3,2-c]chromene-3-carbonitrile* [5]**

To compound [4] , (0.19g, 1.0 mmol) dissolved in ethanol (25 mL) followed a few drops of dipropylamine, was added 4-hedroxy coumarine (0.16g, 1.0 mmol) , the reaction mixture was heated under reflux for 4h., (TLC control , heptane : ethyl acetate, 6 : 4). The reaction mixture was cooledand poured onto ice cold water, the product was filtered, dried and recrystallized from 1,4-dioxane to give [5] as an orange solid, (78% yield), m.p. 167., FT-IR (KBr, ν, cm^{-1}): 3323, 3406 cm^{-1} (NH_2), 2208 cm^{-1} (CN), 1707 cm^{-1} (C=O). ^{1}HNMR, δ = 2.85 ppm [s, 6H, $N(CH_3)_2$], δ = 4.0 ppm [s, 1H, CH],δ = 6.60-7.78 ppm [m, 10H, Ar-H and NH_2].

Synthesis of (E)-ethyl N-(3-cyano-4-(4-(dimethylamino) phenyl)-5-oxo-4,5-dihydropyrano[3,2-c]chromen-2-yl) formimidate [6]

A mixture of [5] (0.36g, 1.0 mmol), triethylorthoformate (0.15g, 1mmol) add (10 ml) acetic anhydride the mixture was heated under reflux for 9 h (TLC control, hexane : ethyl acetate, 6:4) . The reaction mixture was left to cool overnight and the solid formed was recrystallized from 1,4-dioxane to give [6] as an orange solid, (65% yield), m.p. 178., FTIR (KBr, ν, cm-1): 2210 cm^{-1} (CN), 1685 cm^{-1} (C=O), 1651 cm^{-1} (C=N)., ^{1}HNMR, δ = 1.27 ppm [t, 3H, CH_3], δ = 3.08 ppm [s, 6H, $N(CH_3)_2$], δ = 4.24 ppm [q, 2H, CH_2], δ = 6.82-8.11 ppm [m, 9H, Ar-H and N=CH].

Synthesis of 9-amino-7-(4-(dimethylamino)phenyl)-8-imino-8,9-dihydrochromeno[3',4':5,6]pyrano[2,3-d]pyrimidin-6(7H)-one [7]

A solution of [6], (0.4 g, 1.0 mmol) and hydrazine hydrate 80% (10 ml) in methanol (25 ml) was stirred for 7 h., (TLC control, heptane : ethyl acetate, 6:4). The mixture allowed to stand overnight. The precipitate formed was, filtered, dried and recrystallized from methanol to give [7] as a brown solid, (85% yield), m.p. 127., FT-IR (KBr, ν, cm^{-1}): 3294, 3311 cm^{-1} (NH_2), 3275 cm^{-1} (NH), 1683 cm^{-1} (C=O), 1651 cm^{-1} (C=N).,

Synthesis of compounds [8] , [9]

To solution of [6] (0.4g, 1.0 mmol) in methanol 25ml a solution of alkyl amine (1mmol , 5 ml) was added stirred for 1 hr. Then it is allowed to stand overnight. The precipitate formed was filtered, dried and recrystallized from methanol to give [8] or [9].

N'-(3-cyano-4-(4-(dimethylamino)phenyl)-5-oxo-4,5-dihydropyrano [3,2-c]chromen-2-yl)-N-methylformimid-amide [8]

From methylamine , orange solid, (78% yield), m.p. 144., FT-IR (KBr, ν, cm^{-1}): 3387 cm^{-1} (NH), 2208 cm^{-1} (CN), 1685 cm^{-1} (C=O), 1650 cm^{-1} (C=N).

N'-(3-cyano-4-(4-(dimethylamino)phenyl)-5-oxo-4,5-dihydropyrano[3,2-c]chromen-2-yl)-N-ethylformimid-amide [9]

From ethylamine, orange solid, (73% yield), m.p. 151., FT-IR (KBr, ν, cm^{-1}): 3336 cm^{-1} (NH), 2210 cm^{-1} (CN), 1732 cm^{-1} (C=O), 1645 cm^{-1} (C=N).

Synthesis of of compounds [10] , [11]

To solution of [5] , (0.36g, 1.0 mmol) in DMF (30 ml) , ethyl cyano- acetate or diethyl malonate (1mmole) was add. The mixture was heated under reflux for 9 h., (TLC control, hexane: ethyl acetate, 4:6). The solid product formed upon pouring on to ice / water mixture was collected by filteration and recrystallized from 1,4-dioxane to give [10] or [11].

2-cyano-N-(3-cyano-4-(4-(dimethylamino)phenyl)-5-oxo-4,5-dihydropyrano[3,2-c]chromen-2-yl)acetamide [10]

From ethyl cyano- acetate, brown solid, (89% yield), m.p. 138., FT-IR (KBr, ν, cm^{-1}): weak band 3367 cm^{-1} (NH), 2210 cm^{-1} (CN), 1685 cm^{-1} (C=O), 1650 cm^{-1} (C=N).

Ethyl 3-((3-cyano-4-(4-(dimethylamino) phenyl)-5-oxo-4,5-dihydropyrano [3,2-c]chromen-2-yl)amino)-3-oxopropanoate [11]

From diethyl malonate , green solid, (92% yield), m.p. 102., FT-IR (KBr, ν, cm^{-1}): weak band at 3171 cm^{-1} (NH), 2208 cm^{-1} (CN), 1718 cm^{-1} (C=O amid), 1672 cm^{-1} (C=O lactone),1649 cm^{-1} (C=N)., ^{1}HNMR, shows weak triplet signal at δ = 1.29 ppm for (CH_3), δ = 3.11 ppm (s, 6H, $N(CH_3)_2$), signal overlapped with signal of solvent (DMSO-d_6) at δ = 3.31 ppm for (-CH_2-), δ = 6.85-8.06 ppm [m, 9H, Ar-H and NH-CO]. Signals of (-CH_2O-) and (CH) of pyrone cycle not present.

Synthesis of 8-amino-7-(4-(dimethylamino)phenyl)-6,10-dioxo-6,7,10,11-tetrahydrochromeno[3',4':5,6]pyrano[2,3-b] pyridine-9-carbonitrile [12]

A solution of compound [10] (0.4g, 1.0 mmol) in 1,4-dioxane (25 mL) containing triethylamine (2 mL) was heated under reflux for 5 h., (TLC control, heptane : ethyl acetate, 7: 3). The solid product formed upon pouring onto ice / water mixture was collected by filtration and recrystallized from 1,4-dioxane to give [12] as an orange solid, (72% yield), m.p. 159., FT-IR (KBr, ν, cm^{-1}): weak band at 3360 cm^{-1} (OH), 3259, 3281 cm^{-1} (NH_2), , 2208 cm^{-1} (CN), 1699 cm^{-1} (C=O), 1676 cm^{-1} (C=N).

Synthesis of N-(3-cyano-4-(4-(dimethylamino)phenyl)-5-oxo-4,5,6a,10a-tetrahydropyrano[3,2-c]chromen-2-yl)-2-oxo-2H-chromene-3-carboxamide [13]

To a solution of [10], (0.4g,1.0 mmol) in 1,4-dioxane (25 mL) containing dipropylamine (0.5 mL), salicylicaldehyde (0.12g, 1.0mmol) was added. The reaction mixture was heated under reflux for 5h., (TLC control heptane : ethyl acetate, 6:4) . The solid products formed upon pouring onto ice/water mixture were containing few drops of hydrochloric acid was collected by filtration and recrystallized from 1,4-dioxane to give [13] as a yellow solid, (53% yield), m.p. 185., FT-IR (KBr, ν, cm^{-1}): 3269 cm^{-1} (NH), 2216 cm^{-1} (CN), 1735 cm^{-1} (C=O amid), 1683 cm^{-1} (C=O lactone), 1635 cm^{-1} (C=N).

Synthesis of compounds [14 -16]

A solution of compound [5] , (0.36 g, 1 mmol) in 1,4-dioxane (20 mL) and dipropylamine (0.5 mL) was treated with available aromatic aldehydes (1mmol) under reflux for 3-5 h., (TLC control, heptane : ethyl acetate, 4:6). The solid product formed upon pouring onto ice / water was collected by filtration and recrystallized from available solvent to give [14] or [15] or [16].

2-((4-bromobenzylidene)amino)-4-(4-(dimethylamino)phenyl)-5-oxo-4,5-dihydropyrano[3,2-c]chromene-3-carbonitrile [14]

From *p*-bromobenzaldehyde , orange solid, (77% yield), m.p. 179., FT-IR (KBr, ν, cm^{-1}): 2206 cm^{-1} (CN), 1678 cm^{-1} (C=O), 1654 cm^{-1} (C=N).

2-((4-chlorobenzylidene)amino)-4-(4-(dimethylamino)phenyl)-5-oxo-4,5-dihydropyrano[3,2-c]chromene-3-carbonitrile [15]

From *p*-chlorobenzaldehyde ,yellow solid, (71% yield), m.p. 181., FT-IR (KBr, ν, cm^{-1}): 2208 cm^{-1} (CN), 1681 cm^{-1} (C=O), 1653 cm^{-1} (C=N).

2-((4-(dimethylamino)benzylidene)amino)-4-(4-(dimethylamino) phenyl) -5-oxo-4,5-dihydropyrano[3,2-c]chromene-3-carbonitrile [16]

From *p-N,N-di* methylamino benzaldehyde, orange solid, (85% yield), m.p. 169., FT-IR (KBr, ν, cm^{-1}): 2206 cm^{-1} (CN), 1681 cm^{-1} (C=O), 1653 cm^{-1} (C=N)., ^{1}HNMR, δ = 3.11 ppm [s, 9H, $N(CH_3)_2$], δ = 3.57 ppm [s, 1H, CH], δ = 6.84-8.04 ppm [m, 13H, Ar-H and N=CH].

Synthesis of 7-(4-(dimethylamino)phenyl)-10-(pyridin-4-yl)chromeno [3',4':5,6]pyrano[2,3-d]pyrimidine-6,8(7H,9H)-dione [17]

A solution of compound [5], (0.36 g, 1 mmol) in 1, 4-dioxane (20 mL) and dipropylamine (0.5 mL) was treated with carboxy pyridine (1 mmol) under reflux for 3-5 h., (TLC control, heptane: ethyl acetate, 4:6). The solid product formed upon pouring onto ice / water was collected by filtration and recrystallized from ethanol to give [17] as an orange solid, (53% yield), m.p. 110., FT-IR (KBr, ν, cm^{-1}): 1724 cm^{-1} (C=O), 653 cm^{-1} (C=N).

Synthesis of 10-amino-12-(4-(dimethylamino)phenyl)-2-oxo-3,12-dihydro-2H-pyrano[3,2-c][1,2,4]triazolo[1,5-a]quinoline-11-carbonitrile [18]

To a solution of [5] , (0.36 g, 1.0 mmol) in pyridine (20 ml), semicarbazaide hydrochloride (0.11 g , 1 mmol , 1.0 mmol) was added and the reaction was heated under reflux for 18 h., (TLC control, hexane : ethyl acetate, 5:5). After cooling, the mixture was poured into cold water. The solid crude product was filtered, dried, and recrystallized from DMSO to give [18] as a yellow solid, (83% yield), m.p. 184., FTIR (KBr, ν, cm^{-1}): 3304, 3398 cm^{-1} (NH_2), 3203 cm^{-1} (NH), 2210 cm^{-1} (CN), 1683 cm^{-1} (C=O), 1660 cm^{-1} (C=N).

Synthesis of N-(3-cyano-4-(4-(dimethylamino)phenyl)-5-oxo-4,5-dihydropyrano[3,2-c]chromen-2-yl)benzamide [19]

A mixture of [5], (0.36 g, 1.0 mmol), and benzoyl chloride (1mmol , 0.14g) in pyridine (20 ml) was refluxed for 10 h., (TLC control, hexane : ethyl acetate, 4:6). The solid product formed upon pouring onto ice / water was collected by filtration and recrystallized from 1,4-dioxane to give [19] as a green solid, (92% yield), m.p. 191., FT-IR (KBr, ν, cm^{-1}): 3371 cm^{-1} (NH), 2210 cm^{-1} (CN), 1724 cm^{-1} (C=O amid), 1688 cm^{-1} (C=O lactone), 1614 cm^{-1} (C=N).

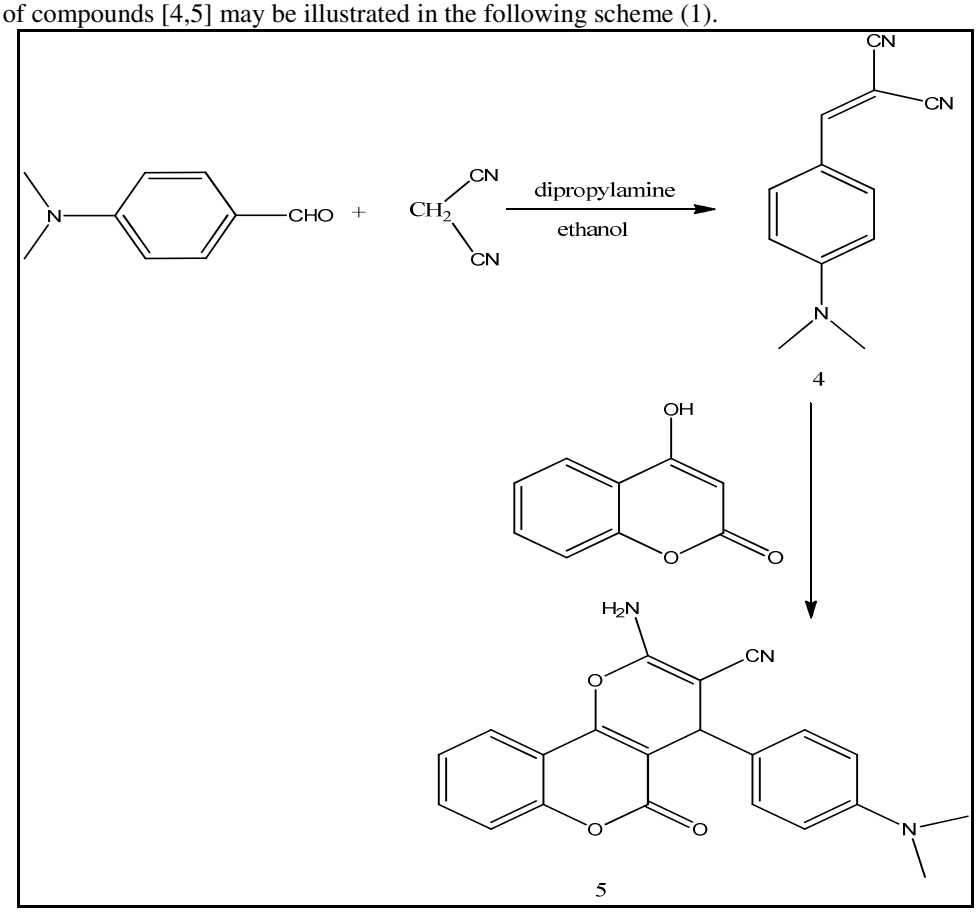
Synthesis of 7-(4-(dimethylamino)phenyl)-10-(4-methoxyphenyl) chromeno[3',4':5,6]pyrano[2,3-d]pyrimidine-6,8(7H,9H)-dione [20]

A mixture of [5], (0.36 g, 1.0 mmol), and *p*-methoxy benzoyl chloride (1 mmol ,0.17g) in pyridine (20 ml) was refluxed for 18 h., (TLC control, hexane : ethyl acetate, 4:6). The solid product formed upon pouring onto ice / water was collected by filtration and recrystallized from 1,4-dioxane to give [20] as a green solid, (89% yield), m.p. 134., FT-IR (KBr, ν, cm^{-1}): weak band at 3330 cm^{-1} (NH), 1681 cm^{-1} (C=O), 1650 cm^{-1} (C=N)., ^{1}HNMR, δ = 3.09 ppm, [s, 6H, $N(CH_3)_2$], δ = 3.58 ppm, [s, 3H, OCH_3], δ = 6.76-7.67 ppm, [m, 12H, Ar-H], δ = 12.30 ppm, [s, 1H, NH], signal of CH of pyrone cycle not present.

Results and discussion

Preparation and characterization of 2-amino-4-[4-(dimethylamino) phenyl]-5-oxo-4*H*,5*H*-pyrano[3,2-*c*]chromene-3-carbonitrile [5]

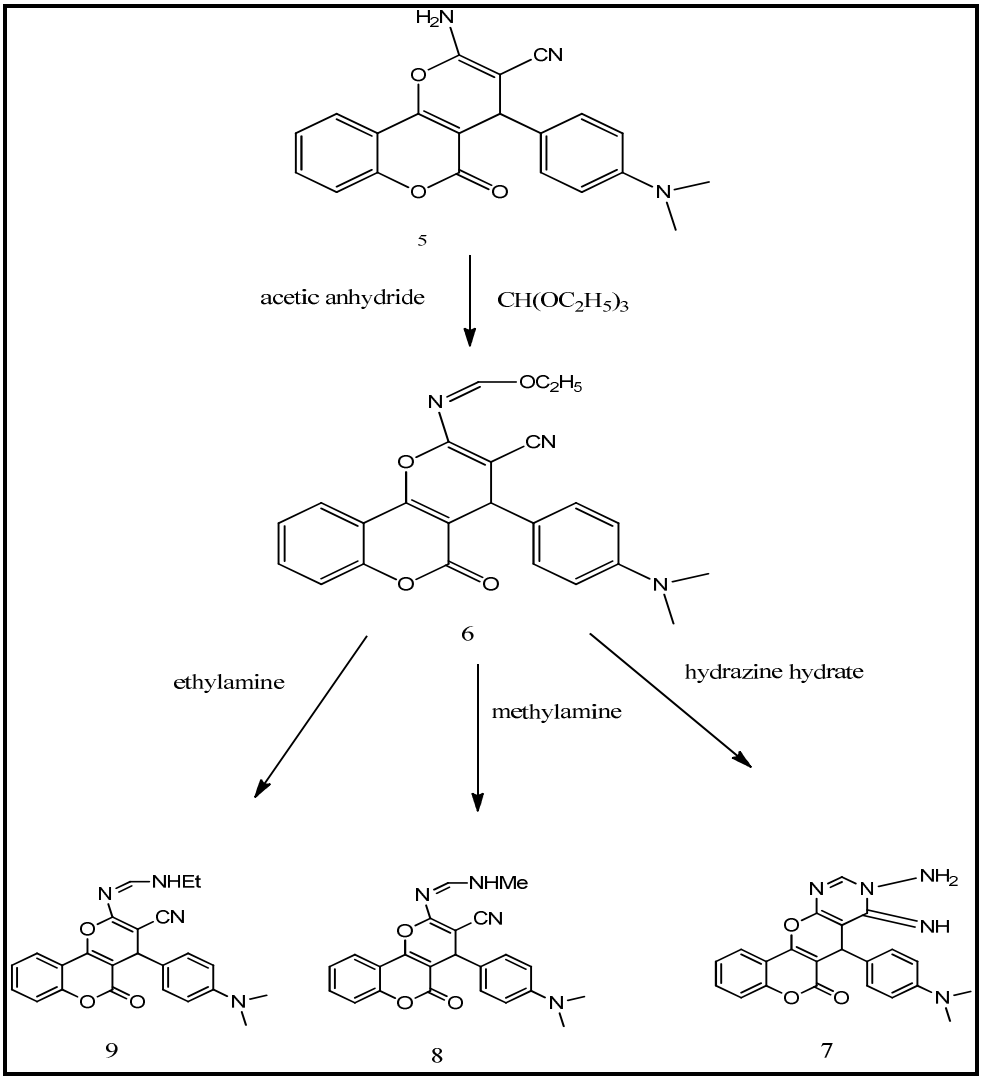
In the present study, we report on the synthesis of 2-amino-4-[4 - (dimethylamino) phenyl]-5-oxo-4*H*,5*H*-pyrano [3,2-*c*] chromene-3-carbonitrile *via* reaction of molononitrile with 4-(dimethyl- amino) benzaldehyde to produced [4-(dimethylamino) benzylidene] propanedinitrile [4], which upon condensation with 4-hydroxycoumarin in presence of dipropylamine gave 2-amino-4-[4-(dimethylamino) phenyl]-5-oxo-4*H*,5*H*-pyrano[3,2-*c*]chromene-3-carbonitrile[5]. These results are similar to the results obtained in literatures[37,38]. The formation of compounds [4,5] may be illustrated in the following scheme (1).



Scheme (1)

Compound [4] was characterized by FT-IR and mass spectra, the FT-IR spectrum of compound [4] shows (CN) stretching band at 2210 cm^{-1}, (C=C) stretching band at 1612 cm^{-1} and (C-H)aliphatic stretching band at 2922 cm^{-1}. The mass spectrum shows the molecular ion peak at m/z = 197 which is in agreement with the molecular formula of this compound $C_{12}H_{11}N_3$. Compound [5] was characterized by FT-IR and ^{1}HNMR, the FT-IR spectrum of compound [5] shows the (NH_2) stretching bands at 3406 and 3323 cm^{-1} and (CN) stretching band at 2208 cm^{-1} and (C=O) stretching band of lactone at 1707 cm^{-1}. The ^{1}HNMR spectrum shows singlet signal at δ = 2.85 ppm for $N(CH_3)_2$, singlet signal at δ = 4.0 ppm for CH of pyrone cycle, and multi- signal at δ = 6.60-7.78 ppm for Ar-H and NH_2.

Preparation and characterization of compound [6-9]



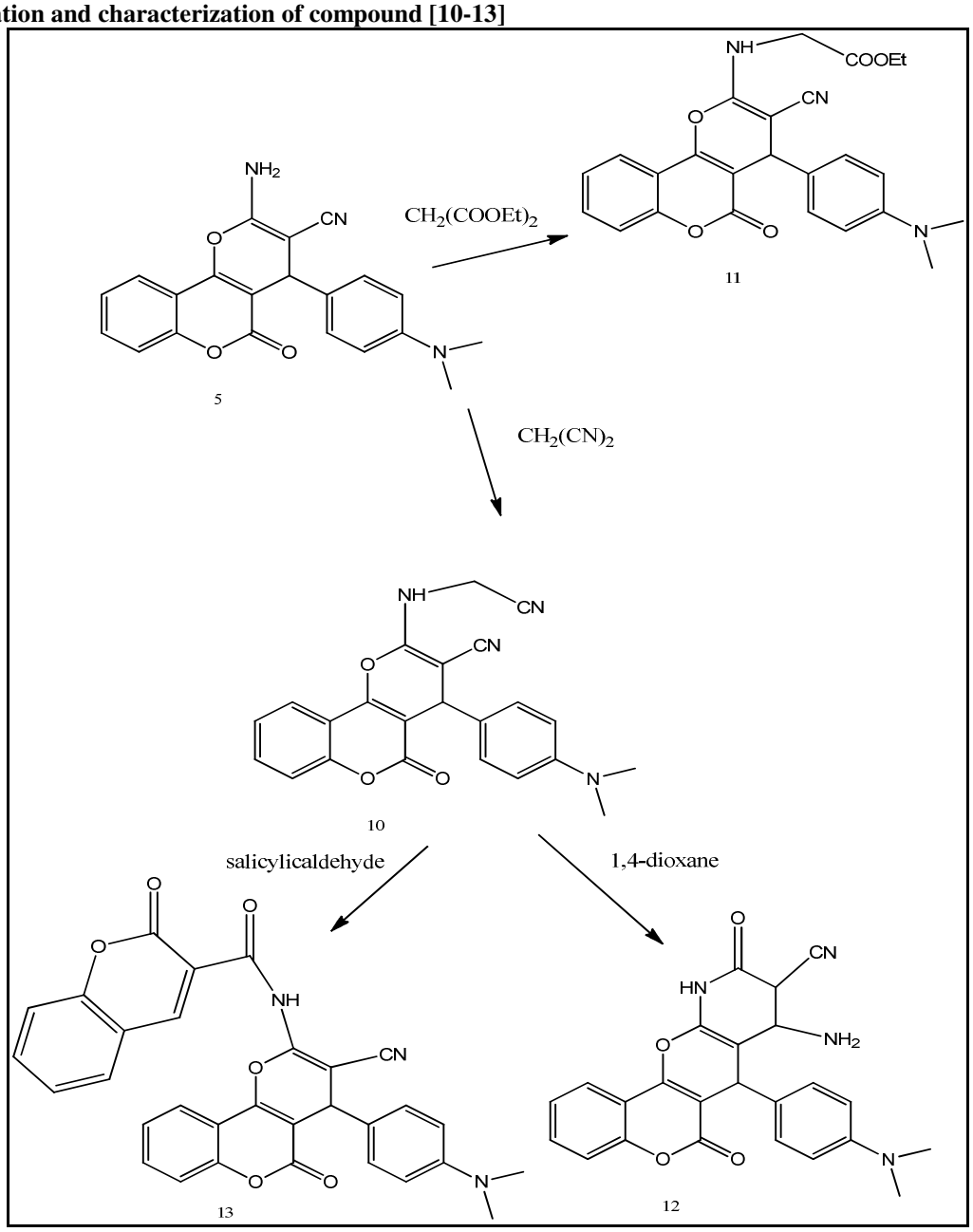
Scheme (2)

Compound [5] was selected as a key intermediate for the synthesis of new fused and non fused chromene derivatives, treatment of **[5]** with triethyl orthoformate in acetic anhydride gave the corresponding imidoformate derivative **[6]** in 65 % yield. This compound was characterized by FT-IR and ^{1}HNMR, the FT-IR spectrum of compound [6] shows disappearance of the amino group stretching bands at 3406 and 3323 cm^{-1} . The ^{1}HNMR spectrum shows triplet signal at δ = 1.27 ppm for CH_3, singlet signal at δ = 3.08 ppm for $N(CH_3)_2$, quartet signal at δ = 4.24 ppm for CH_2, and multi-signal at δ = 6.82-8.11 ppm for Ar-H and N=CH.

To synthesize derivatives [7-9], the compound [6] was reacted for one hours at room temperature with hydrazine hydrate to give fused chromene derivative [7], while when reacted with methyl amine or ethyl amine to gave non fused chromene derivatives [8] or [9]. These results are similar to the results obtained in literatures[39,40]. The synthetic reactions are summarized in scheme (2).

The structures of compounds [7-9] were confirmed by FT-IR spectra, The FT-IR spectrum of compound [7] shows disappearance the (CN) stretching band at 2206 cm^{-1} and appearance (NH) stretching band at 3203 cm^{-1} and (NH_2) stretching bands at 3315 and 3250 cm^{-1}, while the FT-IR spectra of compounds [8] and [9] shows appearance the cyano group (CN) stretching band 2202 or 2208 cm^{-1} and also (NH) stretching band at 3387 or 3304 cm^{-1}.

Preparation and characterization of compound [10-13]



Scheme (3)

The synthesized systems of these compounds are based on two synthetic key precursors, namely, [5] and [10] . The synthetic strategies adopted to obtain the newly synthesized [12] and [13] depended on the regioselective attack on the ethyl cyano acetate moiety of the key precursors [10] by different reagents, which, in one or two steps added a highly funtionalized substituent or heterocyclic ring to the molecule. These results are similar to the results obtained in literatures[41].

The key precursors [10] and [11] were obtained via the reaction of [5] with respective active methylene reagents (XCH_2CO_2Et; X=CN; X=CO_2Et).

The structures of the synthesized compounds have been characterized by FT-IR and some of them by ^{1}HNMR. The FT-IR spectrum of compounds [10] and [11] shows disappearance of the amino group stretching bands at 3406 and 3323 cm^{-1} and appearance (NH) stretching band at 3367 - 3396 cm^{-1}. The ^{1}HNMR spectrum of [11] shows weak triplet signal at δ = 1.29 pmm for (CH_3), singlet signal at δ = 3.11 pmm for $N(CH_3)_2$), signal overlapped with signal of solvent (DMSO-d_6) at δ = 3.31 pmm for (-CH_2-), and multi – signal at δ = 6.85-8.06 ppm for Ar-H and NH-CO]. Signals of (-CH_2O-) and (CH) of pyrone cycle not present.

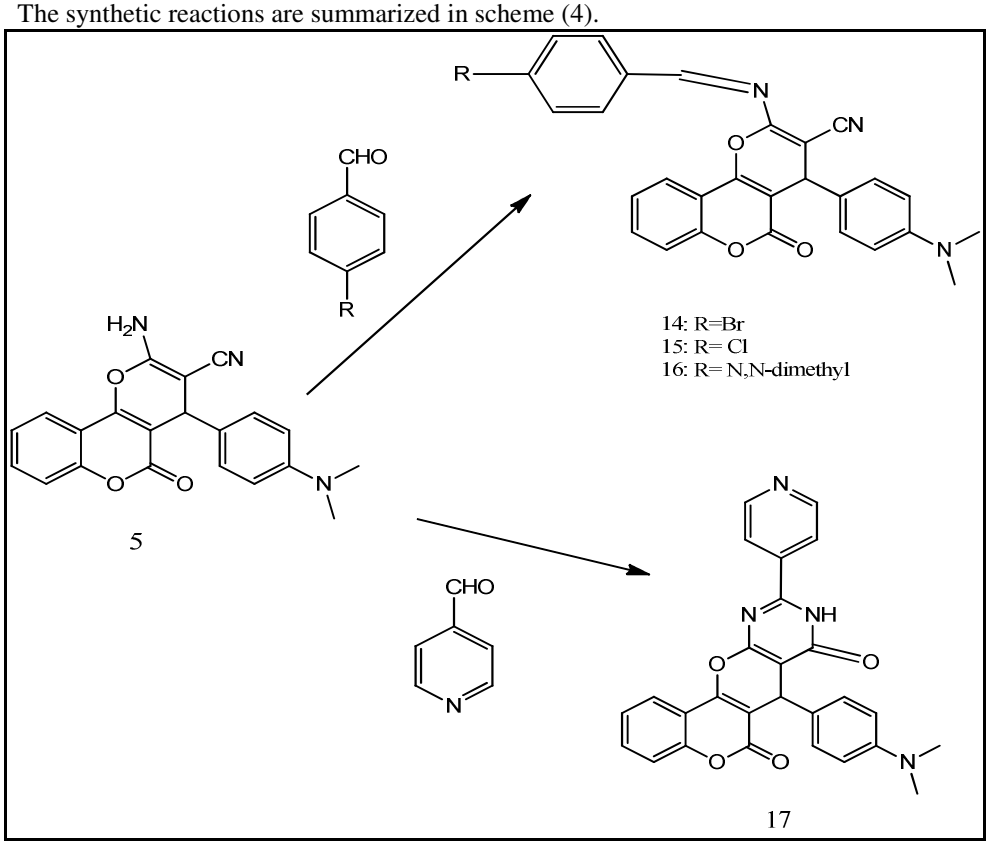
Compound [10] underwent ready cyclization when heated in 1,4-dioxane containing triethylamine to give chromene pyridine derivative [12]. The FT-IR spectrum of compound [12] shows weak (NH) stretching band at 3360 cm^{-1} in the keto form and (NH_2) stretching bands at 3281 and 3259 cm^{-1}.

Thus, the reaction of [10] with salicylaldehyde gave the coumarine derivative [13]. The FT-IR spectrum shows disappearance (NH_2) stretching bands at 3323 and 3406 cm^{-1}.

Preparation and characterization of compound [14-17]

The Schiff bases compounds [14-17] were synthesized by reaction compound [5] with substituted aromatic aldehydes in 1,4-dioxane. The reaction with carboxy pyridine gave fused chromene derivative (17) while the reaction other substituted aromatic aldehydes gave non-fused chromene derivatives (14-16), this due to the high activity of carboxy pyridine. These results are similar to the results obtained in literatures[42,43]

The synthetic reactions are summarized in scheme (4).

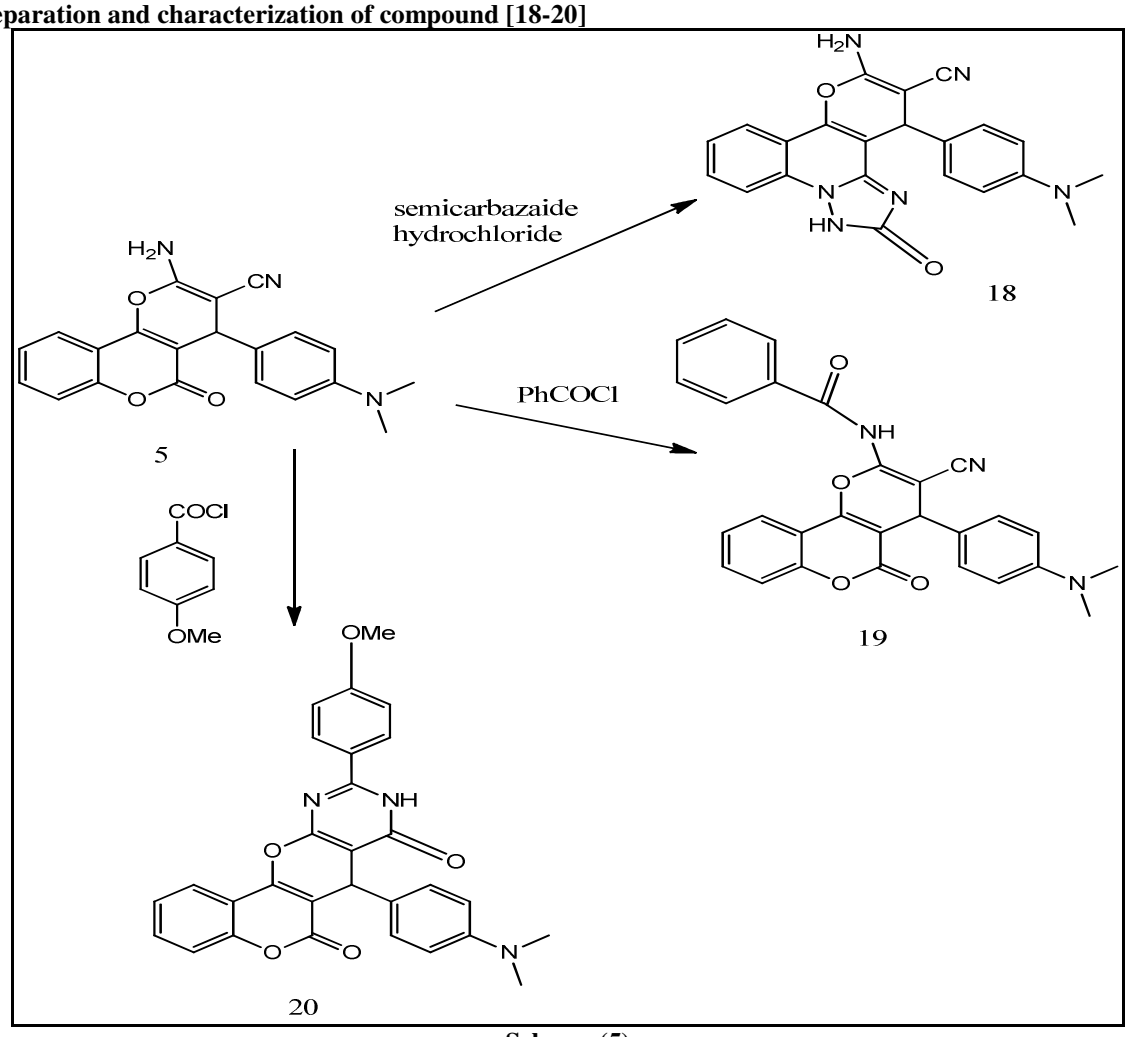


Scheme (4)

The structures of the synthesized compounds have been characterized by FT-IR and some of them by ^{1}HNMR. The FT-IR spectra of these compounds shows disappearance (NH_2) stretching bands at 3323 and 3406 cm^{-1}, while compound [17] shows disappearance the (CN) stretching band at 2208 cm^{-1} and disappearance (NH_2) stretching bands at 3323 and 3406 cm^{-1}.

Compound [16] was characterized by ^{1}HNMR, the ^{1}HNMR spectrum shows singlet signal at δ = 3.11 ppm for $N(CH_3)_2$], singlet signal at δ = 3.57 ppm for CH of pyrone cycle , and muli-signal at δ = 6.84-8.04 ppm for Ar-H and N=CH].

Preparation and characterization of compound [18-20]



Scheme (5)

To synthesize these derivatives, an attempt to construct a third heterocyclic ring condensed with coumarin was successful *via* reaction of [5] with semicarbazide hydrochloride in refluxing dry pyridine to give triazolo[1,5-*a*]quinolone **[**18**]** in 83 % yield.

The FT-IR spectrum of compound [18] shows appearance of (NH) stretching band at 3203 cm^{-1} and (C=O) of lactam at 1693 cm^{-1} and disappearance of (C=O) of lactone at 1707 cm^{-1}.

Thus, Benzoylation of **[5]** with benzoylchloride or *p*-methoxy Benzoyl chloride afforded the non fused chromene derivative [19**]** and fused chromene - pyrimido derivative [20] respectively. These results are similar to the results obtained in literatures[(42,44)].

The FT-IR spectrum of compound [19] shows appearance of (NH) stretching band at 3416 cm^{-1} and disappearance (NH_2) stretching bands at 3323 and 3406 cm^{-1}, while the FT-IR spectrum for compound [20] shows disappearance stretching bands of the (CN) at 2208 cm^{-1} and (NH_2) at 3323 and 3406 cm^{-1}. The ^{1}HNMR spectrum of [20] shows singlet signal at δ = 3.09 ppm for $N(CH_3)_2$, singlet signal at δ = 3.58 ppm for OCH_3,and muli-signal at δ = 6.76-7.67 ppm, for Ar-H], δ = 12.30 ppm, [s, 1H, NH], signal of CH of pyrone cycle not present.

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