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SYNTHESIS OF NEW BENZOCHROMONES COMPOUNDS WITH ANTICIPATED BIOLOGICALLY ACTIVITIES

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ABSTRACT

A range of some biologically interesting heterocyclic nuclei were synthesized *via* reaction of 4-allyl-2-cinnamoyl-1-hydroxynaphthalene with different reagents. Also, allyl benzoflavanones and flavones nuclei were constructed *via* different routes. All the newly synthesized compounds were established using elemental analyses as well as spectral techniques.

Keywords: Chromones, benzoflavones, allyl benzopyranone, pyrazoles, oxazoles.

INTRODUCTION

Chromones are one of the most widely distributed classes of natural compounds occurring in plant kingdom **(Ellis, et al., 1977 and Harborne, 1994)** Many naturally and synthetic derivatives perform a variety of biological activities including antinflammatory and immune-stimulatory activity **(Bors, et al., 1996; Ristano, et al., 2001 and Yahiaoui, et al., 2008)**. Flavonoids are a group of polyphenolic phytochemical compounds that occur unbiqutously in foods of plant origin. Several studies have addressed the ability of flavonoids to interfere with the catalytic activity or expression of aromatase which is a cytochrome p 450 enzyme **(Sanderson, et al., 2004; Santen, 2003 and Hackett, et al., 2005)** this enzyme being responsible for the final step of the estrogen biosynthesis. Benzopyranones possess potent clinical application in the treatment of renal colic, anginal syndrones, whopping cough peptic ulcer, lipid altering activity for example decreasing the atherogenic cholesterol fraction, elevating antiatherogenic HDL

cholesterol fraction and antiatherosclerotic activity **(Yamashita, et al., 1989; Gammil & Hyde, 1983 and Bourgery, et al., 1981)**.

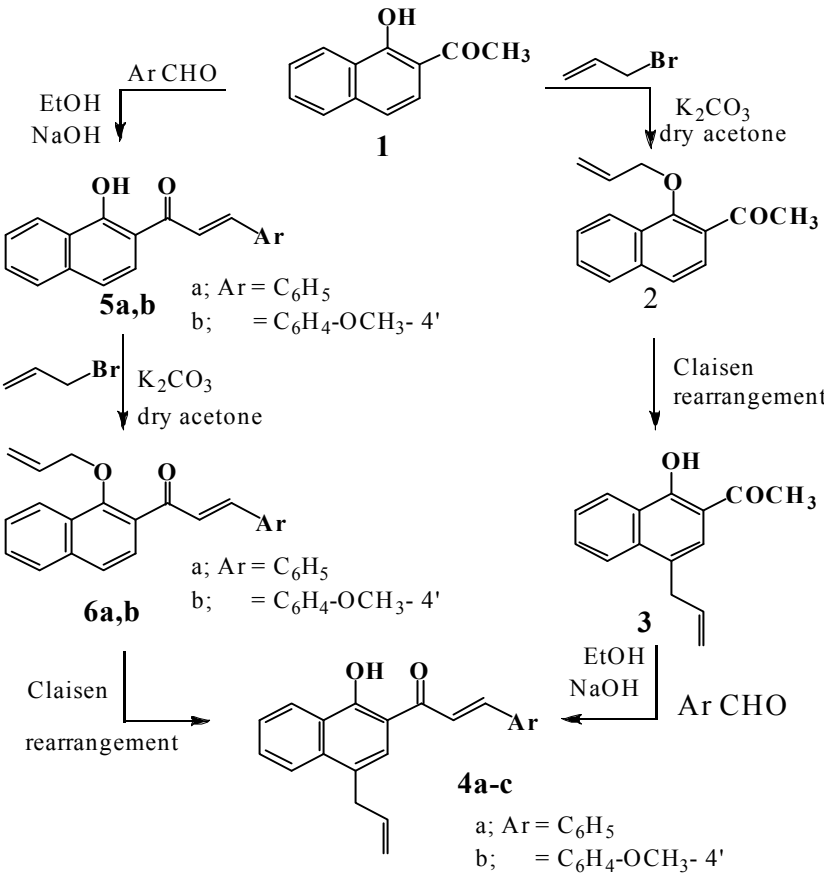
Moreover, the 7,8-benzoflavone or α-naphthoflavone (ANF) has been extensively studied with regard to its inhibition of chemical carcinogenesis and of certain cytochrome p-450 mixed-function oxidase **(Pouget, et al., 2002)**.

In view of these facts and in continuation of our research program in this field **(Abdel-Rahman, et al., 1999, 2000, 2002 and 2005; El-Desoky, et al., 1997, 2007, 2012; and El-Telbani, et al., 1998)**, we present here the synthesis of some *C*-allyl benzoflavones as well as *C*-allyl benzopyranone compounds that are considered as precursors to the synthesis of antitumor benzopyranone acetic acid analogue compounds **(Atiken, et al., 2000)**

RESULTS AND DISCUSSION

O-allylation of 2-acetyl-1-hydroxy naphthalene **(1)** afforded 2-acetyl-1-allyloxynaphthalene **(2)** which gave no coloration with alcoholic $FeCl_3$ solution **(Ammanamanchi & Balagopala, 1990).** Compound **2** was underwent Claisen rearrangement yielded in quantitative yield, 2-acetyl-4-allyl-1-hydroxynaphthalene **(3)** (Scheme 1). The assigned structures of **2** and **3** were established on the basis of the analytical and spectral data. The infrared spectrum of **3** showed the carbonyl stretching band due to intermolecular H-bonding at ν' 1623 cm^{-1} if compared by the carbonyl stretching of compound **2** at ν' 1674 cm^{-1}. Melting point and ^1H NMR spectrum of the latter product **3** were completely identical as reported in the literature **(Ammanamanchi & Balagopala, 1990).**

Claisen-Schmidt Condensation of 5-allyl-2-hydroxy-3,4-benzoacetophenone **(3)** with the appropriately different aromatic aldehydes namely benzaldehyde, 4-methoxybenzaldehyde and 3-hydroxy-4-methoxybenzaldehyde (vanillin) yielded in quantitative yield the corresponding 4-allyl-2-cinnamoyl-1-hydroxynaphthalene (3',4'-benzochalcones) derivatives **4a-c** (Scheme 1).



Scheme 1

In order to provide additional evidence in favour of structure **4a-c**, it was synthesized unambiguously by an alternate procedure involving condensation of 2-acetyl-1-hydroxynaphthalene (**1)** with benzaldehyde or (4-methyoxybenzaldehyde) to yield the expected 2-hydroxy-3-cinnamoyl or (4-methoxycinnamoyl) naphthalene **(5a)** and (**5b)** as outlined in the literature **(Yahiaoui, et al., 2008)**. Reaction of **5a,b** with allyl bromide afforded 2-allyloxy-3-(4'-methoxycinnamoyl) naphthalene **(6a,b)** and finally, the latter adducts were underwent Claisen thermal rearrangement yielded the same products **4a,b**.

Also, the assigned structures of **4a-c** were established on the basis of the analytical and spectral analyses. the ^{1}H NMR spectra of **4a-c**

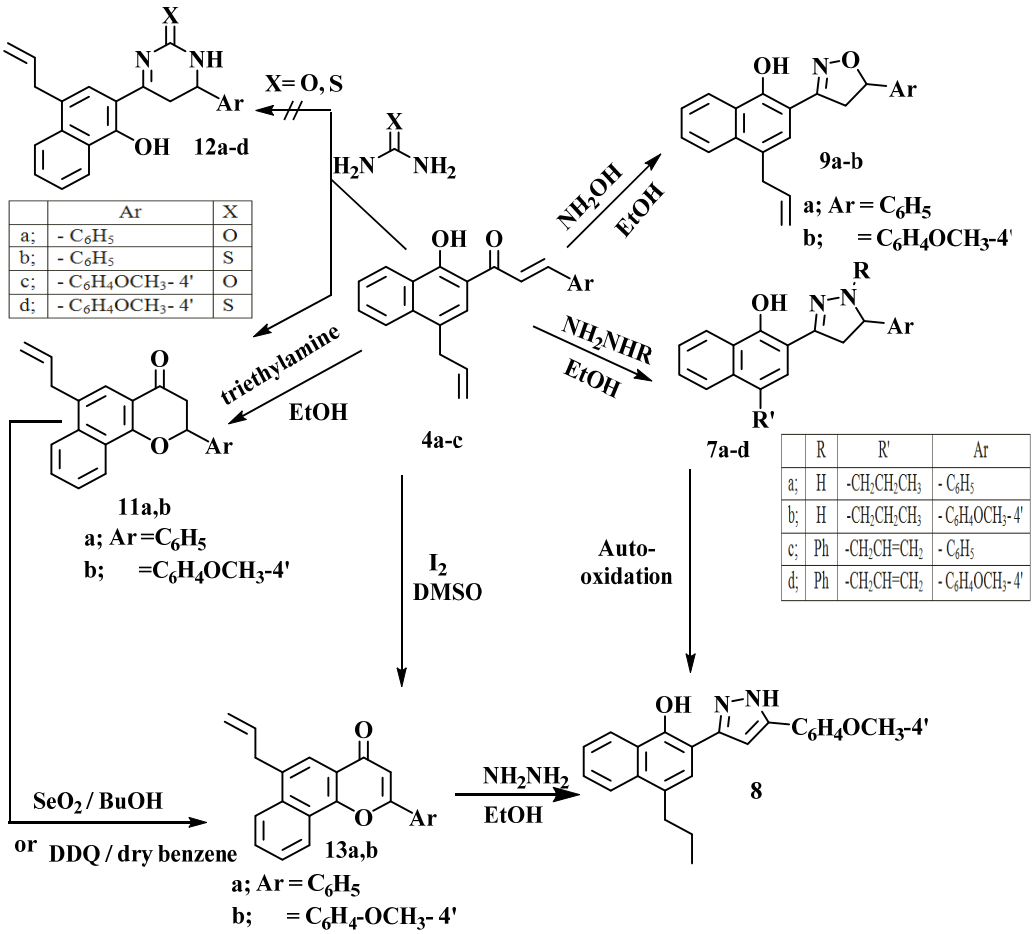
showed lack a signal at δ 2.78 ppm of acetyl protons, whereas the two olefinic protons of cinnamoyl group appeared as two doublets in the aromatic region δ 7.53-7.96 ppm in addition to the allyl protons (*c.f.* experimental part).

The electron impact mass spectra of the latter chalcones **4a,b** showed the assigned molecular weights M^+ at *m/z* 314 and 344 respectively and a base peak at *m/z* 210 *via* extrusion styrene moiety.

The cinnamoylnaphthalene **4a,b** were allowed to react with hydrazine hydrate or phenylhydrazine in ethanol to give only the corresponding pyrazoline derivatives **7a-d** . The formation of **7a-d** takes place as outlined in the literature **(Aziz, et al., 1976; Moustafa, et al., 1996 and Abdel Hafez, et al., 2001)** *via* 1,2-addition of hydrazine group to the carbonyl of chalcones derivatives **4a-c** followed by dehydration gave the corresponding pyrazolines **7a-d.**

The structural elucidation of the above pyrazoline derivatives **7a-d** was inferred from the correct elemental analysis as well as the spectral data. The infra-red spectra showed appearance a broad band of OH at ν' 3443-3550 cm^{-1} and one peak of NH at ν'3326 cm^{-1}. Also, ^{1}H NMR spectrum of compound **7a** for example revealed disappearance of the characteristic allyl protons and instead of it, a triplet methyl group at δ 1.04 with coupling constant 3 Hz, multiplet CH_2 at δ 1.79 ppm and triplet CH_2 at δ 2.99 ppm with coupling constant 3 Hz were observed. Reduction of the olefinic allyl group under the reaction conditions to provide the corresponding propyl adducts was previously reported in the literature **(Crockett, et al., 2011)**. Also, the pyrazoline C-H protons of the latter compounds were clearly observed as three doublet doublets in the regions δ 3.14, 3.68 and 4.86 ppm.

It is notable here , through strong heating the naphthylpyrazoline derivative **7b** , a new compound 5-(4-methoxyphenyl)-3-(4-allyl-1-hydroxynaphth-2-yl)-*1H*-pyrazole **(8)** was separated. The spectral analyses of **7b** proved autoxidation of the pyrazoline to pyrazole. ^{1}H NMR spectrum of **8** showed lack the pyrazoline doublet doublet protons and instead of it a singlet H-4 at δ 6.92 ppm.



Scheme 2

Also, compound **4a** was allowed to react with hydroxylamine hydrochloride to yield a quantitative yield of the corresponding 3-(4 allyl-1- hydroxynaphth-2-yl)-5- phenyl isoxazoline **(9).**

Yahiaoui, S. et al (2008) was observed that the introduction of a phenyl ring at position C-7 and C-8 on flavanone skeleton led to a new potent aromatase inhibitors more potent than amino gluthetimide (the first aromatase inhibitor used clinically). Therefore, in our research program, we planned to construct the allylbenzoflavone *via* cyclization of the above 2-hydroxybenzochalcones **4a,b** at refluxing in basic medium such as triethylamine, the expected 6-allyl-7,8-benzoflavanones **11a,b** were separated in quantitavely yields. The elemental and spectral

analyses were in agreement with the suggested structures.Oxidation of benzoflavanones **11a,b** using different oxidizing agents such as selenium dioxide in butanol or dichlorodicyanoquinone (DDQ) in dry benzene yielded the desired goal 6-allylbenzo[7,8]flavones **13a,b** (Scheme 2). The compounds **13a,b** were directly prepared in quantitative yields at treatment cinnamoylnaphthalene **4a,b** with iodine (I_2) in dimethyl sulfoxide . The elemental and spectral data of **13a,b** were completely in agreement with the assigned structure .^{1}H NMR spectra showed disappearance all doublet doublet signals of dihydropyran protons, meanwhile a new H-3 singlet was appeared at δ 8.06 ppm .

Also, when **4a,b** was allowed to react with urea or thiourea in presence a catalytic amount of triethylamine, as attempt to form the biologically interest pyrimidine or thiopyrimidine moieties **12a-d**, the latter compounds could not obtained but instead of it, the same previously prepared 7,8-benzoflavanone derivatives. **11a,b** were separated in good yields. All the spectral data, m.p and R_f (TLC) of them are the same.

EXPERIMENTAL

General

All melting points are uncorrected and were recorded using a Gallenkamp apparatus. Infrared spectra (IR) were recorded (KBr), (υ cm^{-1}) on a Mattson 5000 FTIR Spectrophotometer at faculty of science, Mansoura university. The ^{1}H NMR spectra were run on Bruker AC 300 MHz (Department of chemistry, Faculty of science, Cairo university) or Joel ECA 500 MHz spectrophotometer (National research center) using TMS as an internal reference and $CDCl_3$ or DMSO-d_6 as solvents and chemical shift (δ) values are recorded in ppm. Mass spectra (MS) were recorded on (Kratos, 70 eV) MS equipment and/or a Varian MAT 311 a spectrometer, at Microanalytical Center, Faculty of Science, and Cairo University. Elemental analyses (C, H and N) were carried out at the Microanalytical Center at Cairo University, Egypt.

Synthesis

2-Acetyl-1-allyloxynaphthalene (2): A mixture of (**1**) (1.86 g, 10 mmol), allyl bromide (1.17 ml, 12.5 mmol), and freshly ignited K_2CO_3 (5 g) was refluxed in dry acetone (20 ml) for 3hrs. The solvent was evaporated under reduced pressure and the resulting product was treated

with crushed ice and extracted with $CHCl_3$ (3×50 ml). The combined extracts were dried and evaporated to give a pale yellow oil **2** (1.82 g, 98%) this gave no colouration with alcoholic $FeCl_3$. The spectral data were completely in agreement with the published data **(Ammanamanchi & Balagopala, 1990).**

Synthesis of 2-acetyl-4-allyl-1-naphthol (3)

Procedure (a): Compound **(2**) (1.13 g, 5 mmol) was refluxed in freshly distilled *N, N-dimethylaniline* (b.p. 193^oC) (10 ml) for 7 hrs. the reaction mixture was poured into crushed ice. The reaction mixture was acidified by diluted HCl and the resulting pale green solid was filtered off, repeatedly washed with water and dried. The crude product was recrystallised from ethanol to yield greenish yellow needles of 2-acetyl-4-allyl-1-naphthol **(3)** (0.7 g, 62%). It gave a bright green colour with alcoholic $FeCl_3$.

Procedure (b): Compound **(2)** (1.13 g, 5 mmol) was heated at 185^oC for 3 hrs under nitrogen atmosphere, the resulting yellowish brown material was crystallized from ethanol to give fluorescent yellow needles, characterized as **3** (1.05 g, 93 %). Melting point and spectral data were in complete agreement with the published data **(Ammanamanchi & Balagopala, 1990).**

Condensation of 3 with aromatic aldehydes: Synthesis of chalcones 4a-c "General procedure": To a stirred solution of **3** (1.13 g, 5 mmol) and sodium hydroxide (1 g) in ethanol (50 ml) was added dropwise, at 0-5^0C during 30 min, a solution of the appropriate aldehyde (benzaldehyde, p-anisaldehyde and 3-hydroxy-4-methoxybenzaldehyde (vanillin)) (0.8 mmol) in ethanol (10 ml). The stirring was continued overnight at room temperature then diluted with cold water (100 ml) and neutralized with diluted hydrochloric acid. The precipitate was collected by filtration, washed with water, dried and crystallized from ethanol to give the corresponding chalcones:

N.B. Compounds **4a,b** were prepared also from *O*-allylation of the previously prepared chalcones (**5a,b**) **(Yahiaoui, et al., 2008)** by the same procedure outlined in the synthesis of compound **2** to give the compounds **6a,b** which directly underwent thermal Claisen rearrangement by the same procedures [a,b]. Melting points, R_f (TLC) and spectral analyses were completely identical.

Reaction of cinnamoylbenzofuran derivatives 4a-b with hydrazine hydrate or phenyl hydrazine (Synthesis pyrazolines derivatives 7a-d and 8) "General procedure": A mixture of the appropriate chalcones **4a**,**b** (5 mmol) and hydrazine hydrate (0.2 ml; 2 mmol) or phenylhydrazine (0.54 ml, 5 mmol) was refluxed in absolute ethanol (20 ml) for 1-3 hrs (controlled using TLC). The precipitate which was formed after cooling, filtered, washed with ethanol, dried and crystallized from ethanol to give the corresponding pyrazoline **7a-d** (Table 1).

5-(4-Methoxyphenyl)-3-(4-allyl-1-hydroxynaphth-2-yl)-1H-pyrazole (8)

N.B. Compound **8** was formed when the same procedure of synthesis **7b** is carried out under strong and long time refluxing (12 hrs).

General procedure for the synthesis of 5-(4-Phenyl) and (4-methoxyphenyl)-3-(4-allyl-1-hydroxynaphth-2-yl)-4,5-dihydroisoxazole (9a,b): A solution of hydroxylamine hydrochloride (0.198 g, 6 mmol) and sodium acetate (0.3 g) in least amount of water (2 ml) was added to suspension of **4a,b** (5 mmol) in ethanol (20 ml). The reaction mixture was refluxed for 3 hrs. On cooling and addition of cold water (30 ml), the solid that separated was filtered off, washed with water, dried and recrystallized from ethanol to give the corresponding isoxazoline **9a** and **9b** (*c.f.* Table 1).

General procedure for the synthesis of 6-allyl-2-phenyl and (4-methoxyphenyl)-7,8-benzo-2,3-dihydrobenzopyran-4-one (11a,b)

Procedure (a): Refluxing of chalcones **4a,b** (5 mmol) and triethylamine (0.5 ml) in absolute ethanol (20 ml) for 8 hrs (TLC controlling). After cooling, pour the reaction mixture in crushed ice (100 g) add few drops of diluted HCl until change the reaction mixture to just neutral. The precipitate was formed, filtered off, washed with water, dried and recrystallized from ethanol to give the corresponding flavanones **11a,b** (*c.f.* Table 1,2).

Procedure (b): The same products **11a,b** were formed at refluxing **4a,b** (0.5 mmol) and urea (or thiourea) (5 mmol) in ethanol (20 ml) for 5 hrs. The reaction mixture was worked up as previously mentioned in method A, give benzoflavanones **11a,b**. Melting point, R_f (TLC) and the spectral data are completly identical with the above authentic sample.

Synthesis of 6-allyl-2-phenyl and (4-methoxyphenyl)-7,8-benzobenzo-pyran-4-one "Benzoflavone" (13a,b).

Procedure (a): From chalcones "General procedure" A mixture of equimolar amounts of cinnamoylbenzofuran derivative **4a,b** (5 mmol) and iodine (1.26 g, 5 mmol) in dimethyl sulfoxide (15 ml) was heated at a temperature 100-110 ^{o}C for 45 min. After completion the reaction, the mixture was poured into crushed ice and the product was extracted by using ethyl acetate (3x25 ml) then the organic layer was washed with sodium thiosulphate solution, water and brine. The organic layer was dried over anhydrous magnesium sulphate and the solvent was evaporated under reduced pressure. The solid syrup was purified chromatographically (pet. ether/ ethyl acetate 7/3 as eluent) to afford the corresponding products **13a,b** (Table 1).

Procedure (b): From oxidation of the corresponding flavanones. Oxidation of **11a,b** by using a; selenium dioxide or b; 2,3-dichloro-5,6-dicyano-1,4-benzoquinone (DDQ) **(Chauncey, M. A. and Grundon, M. F. 1990)**.

N.B. All the products were completely identical with the authentic sample (procedure a) whatever in melting point, R_f (TLC) and the spectral analyses.

Table (1): Spectral data of the newly prepared compounds.

Cpd. No.	Spectral data
3	**IR (KBr): ν/cm^{-1}=** 3250-3600 (OH, broad), 1628 (C=O), 1573(C=C), 1506 **^{1}H NMR ($CDCl_3$) δ (ppm):** 2.78 (s, 3H, CO$\underline{CH_3}$), 3.73 (d, 2H, -$\underline{CH_2}$CH=CH_2, J = 6.1 Hz), 5.08 (dd, 1H, -CH_2-CH=$\underline{CH}_a$, J_{cis} = 9.9 Hz), 5.13 (dd, 1H, -CH_2-CH=$\underline{CH}_b$, J_{trans} = 15.3 Hz), 6.09 (m, 1H, -CH_2-$\underline{CH}$=CH_2), 7.46 (s, 1H, H-3), 7.54 (1H, dd, H-7, J = 7.65 Hz and J= 7.64 Hz), 7.66 (dd, 1H, H-6, J = 7.65 Hz and J = 7.64 Hz), 7.92 (d, 1H, H-5, J_{ortho}= 8.4 Hz), 8.5 (d, 1H, H-8, J_{ortho}= 8.4 Hz), 13.9 (s, 1H, OH).
4a	**IR (KBr): ν/cm^{-1}=** 3300-3550 (OH, broad), 1633 (C=O), 1621, 1573 (C=C), 1504 (Ar). **MS *m/z* (%) =** 314 [M+] (64.16), 210 (100.00; base peak), 226 (57.89), 102 (42.29), 181 (45.31), 165 (28.06), 152 (82.22), 139 (10.79), 127 (55.58), 115 (30.87), 76 (36.78).
4b	**IR (KBr): ν/cm^{-1}=** 3250-3650 (OH, broad), 1632 (C=O), 1629, 1605 (C=C), 1569 (Ar).

	MS *m/z* (%) =344 [M^+] (25.22), 134 (100.00; base peak), 273 (0.45), 210 (51.8), 181 (62.84), 165 (21.54), 152 (93.79), 127 (50.62), 118 (62.84), 115 (23.36), 102 (21.5), 90 (56.82), 76 (32.98). **^{1}H NMR ($CDCl_3$) δ (ppm):**3.78 (d, 2H, -$\underline{CH_2}$-CH=CH_2, *J* = 6 Hz), 3.89 (s, 3H,-O$\underline{CH_3}$), 5.13 (dd, 1H, -CH_2-CH=$\underline{CH_a}$, J_{cis} = 9.6 Hz), 5.17 (dd, 1H, -CH_2-CH=$\underline{CH_b}$, J_{trans} = 15.9 Hz), 6.15 (m, 1H, -CH_2-$\underline{CH}$=CH_2), 6.99 (d, 2H, H-3',5' AB system, *J* = 8.7 Hz), 7.56-7.67 (m, 4H, H-6,7,2), 8.003 (s ,1H ,H-3), 8.2 (d, 1H, H-5, J_{ortho}= 8.1 Hz), 8.56 (d, 1H, H-8, J_{ortho}= 8.1 Hz), 14.87 (s, broad, 1H, OH, exchangeable with D_2O).
4c	**IR (KBr): ν/cm^{-1}**=3350-3550 (OH, broad), 3063 (CH Aromatic), 1628 (C=O), 1573 (C=C), 1505 (Ar).
7a	**IR (KBr): ν/cm^{-1}**= 3370-3540 (OH, broad), 3045(CH), 1622 (C=N), 1576 (C=C), 1502 (Ar).
7b	**IR (KBr): ν/cm^{-1}**= 3320-3550 (OH, broad), 3326 (NH), 2959-2930 (CH Aliphatic), 1631 (C=N), 1608, 1586(C=C of naphthalene ring), 1509 (Ar). **MS *m/z* (%)** = 360 [M+] (92.07), 330 (75.37), 315 (29.34), 285 (33.72), 252 (38.95), 243 (25.72), 210 (31.80), 182 (38.10), 165 (71.06), 152 (46.48), 139 (35.06), 127 (34.40), 103 (48.97), 90 (69.14), 76 (100.00; base peak). **^{1}H NMR ($CDCl_3$) δ (ppm):** 0.96 (t, 3H, -CH_2-CH_2-$\underline{CH_3}$), 1.66 (m, 2H, -CH_2-$\underline{CH_2}$-CH_3), 2.93 (t, 2H, -$\underline{CH_2}$-CH_2-CH_3), 3.13 (dd, 1H, H-4'b), 3.73 (dd, 1H, H- 4'a), 3.74 (s, 3H , -O$\underline{CH_3}$), 4.86 (dd, 1H, H-5'), 6.93 (d, 2H , H-2",6", *J* = 9 Hz), 7.24 (s, 1H, H-3), 7.35 (d, 2H, H-3",5", *J* = 8.7 Hz), 7.74 (S, Broad, 1H, NH, exchangeable with D_2O), 7.97 (d, 1H, H-5, *J* = 7.8 Hz), 8.24 (d, 1H, H-8, *J* = 7.8 Hz), 12.07 (S, Broad, 1H, OH, exchangeable with D_2O).
7c	**IR (KBr):** ν/cm^{-1}= 3300-3550 (OH, broad), 3060 (CH), 1629 (C=N) , 1595 (C=C), 1499(Ar). **MS *m/z* (%)** = 404 [M^+] (100.00; base peak), 388 (3.56), 376 (5.54), 363 (4.37), 327 (24.36), 310 (4.75), 286 (17.34), 258 (6.20), 221 (2.08), 208 (8.20), 192 (13.80), 181 (33.7), 165 (6.97), 152 (12.61), 103 (13.43), 90 (12.93), 77 (21.38). **^{1}H NMR ($CDCl_3$) δ (ppm):** 3.37 (dd, 1H, N-CH(Ph)-$\underline{CH_a}$, J_{cis} = 7.5 Hz and $J_{geminal}$= 17.4 Hz), 3.73 (d, 2H, , -$\underline{CH_2}$CH=CH_2, *J* = 6 Hz), 4.19 (dd,1H, N-CH(Ph)-$\underline{CH_b}$, J_{trans} = 12.3 Hz and $J_{geminal}$= 17.4 Hz), 5.05 (dd, 1H, -CH_2-CH=$\underline{CH_a}$), 5.1 (dd, 1H, -CH_2-CH=$\underline{CH_b}$), 5.27 (dd, 1H, N-$\underline{CH}$(Ph)-CH_2, J_{cis} = 7.5 Hz and J_{trans}= 12.3 Hz), 6.08 (m, 1H, -CH_2-$\underline{CH}$=CH_2), 11.65 (s, broad, 1H, OH, exchangeable with D_2O).
7d	**IR (KBr): ν/cm^{-1}**=3200-3650 (OH, broad), 1630 (C=N), 1597(C=C), 1500 (Ar).
8	**IR (KBr): ν/cm^{-1}**=3250-3600 (OH, broad), 3410 (NH), 1615 (C=N), 1518 (C=C), 1507 (Ar). **MS *m/z* (%) =** 359 [M^++1] (59.58), 345 (16.25), 329 (100.00; base peak), 315 (14.88), 301 (16.08), 286 (17.14), 218 (25.6), 202 (41.67), 164 (44.36), 152 (35.58), 90 (40.62), 76 (67.72). **^{1}H NMR ($CDCl_3$) δ (ppm):** 1.07 (t, 3H, -CH_2-CH_2-$\underline{CH_3}$), 1.6 (s, broad, 1H,

	OH, exchangeable with D_2O), 1.80 (m, 2H, -CH_2-$\underline{CH_2}$-CH_3), 3.03 (t, 2H, -$\underline{CH_2}$-CH_2-CH_3), 3.89 (s, 3H , -OCH_3), 6.92 (s, 1H, CH pyrazole), 7.03 (d, 2H, H-3",5", J = 8.7 Hz), 7.96 (s, 1H, H-3), 7.99 (d, 1H, H-5, J = 8.3 Hz), 8.47 (d, 1H, H-8, J = 8.4 Hz).
9a	**IR (KBr): ν/cm^{-1}=** 3600-3200 (OH, broad), 1572 (C=C), 1637 (C=N), 1509 (Ar). **MS *m/z* (%) =** 329 [M^+] (86.58), 313 (21.24), 311 (100.00; base peak), 294 (17.29), 285 (49.11), 270 (15.10), 223 (41.33), 209 (37.74), 193 (13.15), 182 (24.06), 152 (54.75), 127 (34.78), 114 (17.27), 102 (49.86), 89 (21.85), 76 (52.61).
9b	**IR (KBr): ν/cm^{-1}=** 3520-3230 (OH, broad), 1615 (C=N), 1575(C=C), 1516(Ar). **^{1}H NMR ($CDCl_3$) δ (ppm):** 2.88 (dd, 1H, $\underline{CH_a}$-C=O, J_{cis}= 11.4 Hz and $J_{geminal}$= 16.5 Hz), 3.40 (dd, $\underline{CH_b}$-C=O, 1H, J_{trans}= 3.5 Hz and $J_{geminal}$= 16.8 Hz), 3.74 (d, 2H, -$\underline{CH_2}$CH=CH_2, J = 6.6 Hz), 3.78 (s, 3H , -OCH_3), 5.09 (dd, 1H, -CH_2-CH=$\underline{CH_b}$), 5.13 (dd, 1H, -CH_2-CH=$\underline{CH_a}$), 5.7 (dd, 1H, H-2 isoxazoline, J_{trans}= 3.3 Hz and J_{cis}= 11.1 Hz), 6.06 (m, 1H, -CH_2-$\underline{CH}$=CH_2), 6.99 (d, 2H, H-3',5' AB system, J_{ortho}= 8.7 Hz), 7.73 (s, 1H, H-3), 7.99 (d, 1H, H-5, J_{ortho}= 8.1 Hz), 8.14 (d, 1H, H-8, J_{ortho}= 8.4 Hz), 11.28 (s, 1H, OH, exchangeable with D_2O).
11a	**IR (KBr): ν/cm^{-1}=**1680 (C=O), 1620 (C=C), 1510 (Ar). **MS *m/z* (%) =** 314 [M+] (80.33), 238 (3.25), 210 (100.00; base peak), 181 (33.53), 153 (63.8), 139 (3.65), 127 (24.61), 103 (25.17), 77 (14.12), 57 (17.92). **^{1}H NMR ($CDCl_3$) δ (ppm):** 3.01(dd, 1H, $\underline{CH_a}$-C=O, J_{trans}= 3.3 Hz and $J_{geminal}$= 16.8 Hz), 3.19 (dd, 1H, $\underline{CH_b}$-C=O, J_{cis}= 13.5 Hz and $J_{geminal}$= 16.8 Hz), 3.78 (d, 2H, -$\underline{CH_2}$CH=CH_2, J = 6.3 Hz), 5.11 (dd, 1H, -CH_2-CH=$\underline{CH_b}$, J_{trans} = 17.8 Hz), 5.13 (dd, 1H, -CH_2-CH=$\underline{CH_a}$, J_{cis} = 9.6 Hz), 5.70 (dd, 1H, H-2, J_{trans}= 3 Hz and J_{cis}= 13.5 Hz), 6.11 (m, 1H, -CH_2-$\underline{CH}$=CH_2), 7.4 -7.7 (m, 7H, Ar-H), 7.78 (s, 1H, H-5), 8.01 (d, 1H, H-7, J_{ortho}= 8.4 Hz), 8.41 (d, 1H, H-10, J_{ortho}= 8.4 Hz).
11b	**IR (KBr): ν/cm^{-1}=** 1670 (C=O), 1619 (C=C), 1514 (Ar). **^{1}H NMR ($CDCl_3$) δ (ppm):** 2.93 (dd, 1H, $\underline{CH_a}$ pyranone, $J_{geminal}$ =16.8 Hzand J_{trans} = 3.3 Hz), 3.12 (dd, 1H, $\underline{CH_b}$ pyranone, $J_{geminal}$ =16.2 Hz and J_{cis} = 13.2 Hz), 3.77 (d, 2H, -$\underline{CH_2}$CH=CH_2, J = 6.6 Hz), 3.87 (s, 3H, OCH_3), 5.09 (dd, 1H, -CH_2-CH=$\underline{CH_a}$, J_{cis} = 9.6 Hz), 5.12 (dd, 1H, -CH_2-CH=$\underline{CH_b}$, J_{trans} = 16.5 Hz), 5.63 (dd, 1H, CH pyranone, J_{cis} = 13.5 Hz and J_{trans} = 3 Hz), 6.07 (m, 1H, -CH_2-$\underline{CH}$=CH_2), 7.01 (d, 2H, H-2' and H-6' (AB system), J = 7.8 Hz), 7.51 (d, 2H, H-3' and H-5' (AB system), J = 8.1 Hz), 7.55- 7.66 (m, 2H, H-6,7, J = 7.2 Hz and J = 7.8 Hz), 7.78 (s, 1H, H-3), 7.99 (d, 1H, H-5, J_{ortho} = 8.4 Hz), 8.38 (d, 1H, H-8, J_{ortho} = 8.4 Hz).
13a	**IR (KBr): ν/cm^{-1}=** 1645 (C=O), 1607, 1571 (C=C), 1511 (Ar).
13b	**IR (KBr): ν/cm^{-1}=**1636 (C=O), 1599 (C=C), 1510 (Ar).

	MS *m/z* (%) =342 (68.65), 327 (10.32), 313 (6.00), 302 (2.22), 294 (6.62), 228 (28.65), 210 (100.00; base peak), 181 (39.9), 164 (10.85), 152 (78.26), 127 (27.91), 76 (24.86). **^{1}H NMR ($CDCl_3$) δ(ppm):** 3.89 (d, 2H, -$\underline{CH_2}$CH=CH_2, J = 6.3 Hz), 3.91 (s, 3H, OCH_3), 5.14 (dd, 1H, -CH_2-CH=$\underline{CH_a}$, J_{cis} = 8.4 Hz), 5.19 (dd, 1H, -CH_2-CH=$\underline{CH_b}$, J_{trans}= 16.2 Hz), 6.14 (m, 1H, -CH_2-$\underline{CH}$=CH_2), 7.10 (d, 2H, H-2',6'), 7.80 (m, 3H, H-3 and H-8,9), 8.13 (m, 3H, H-3',5' and H-7), 8.15 (d, 1H, H-5, J_{ortho}= 6.3 Hz), 8.67 (d, 1H, H-8, J_{ortho}= 6.9 Hz).

Table (2): Elemental Analysis of the Newly Prepared Compounds.

Cpd. No.	m.p. (C)	Yield (%), (Colour)	Mol. Formula (Mol. Wt.)	Expremental analysis Calc. (Found)		
				C %	H %	N %
3	92-94	62, Yellow	$C_{15}H_{14}O_2$ (226.27)	79.62 (79.58)	6.24 (6.41)	——
4a	84 - 85	78 , Red	$C_{22}H_{18}O_2$ (314.38)	84.05 (84.29)	5.77 (5.64)	——
4b	90 -92	86 , Orange	$C_{23}H_{20}O_3$ (344.40)	80.21 (80.39)	5.85 (5.68)	——
4c	102-104	97 , Yellow	$C_{23}H_{20}O_4$ (360.40)	76.65 (76.62)	5.59 (5.61)	——
7a	85-86	83 , Green	$C_{22}H_{22}N_2O$ (330.42)	79.97 (79.79)	6.71 (6.85)	8.48 (8.42)
7b	108 - 110	78, Green	$C_{23}H_{24}N_2O_2$ (360.45)	76.64 (76.86)	6.71 (6.92)	7.77 (7.54)
7c	146-148	84 , Yellow	$C_{28}H_{24}N_2O$ (404.50)	83.14 (83.37)	5.98 (5.75)	6.93 (6.77)
7d	150 - 152	86 , Buff	$C_{29}H_{26}N_2O_2$ (434.53)	80.16 (80.11)	6.03 (6.12)	6.45 (6.39)
8	180 - 182	92 , Brown	$C_{23}H_{22}N_2O_2$ (358.43)	77.07 (77.15)	6.19 (6.05)	7.82 (7.78)
9a	184 - 185	85 , colourless	$C_{22}H_{19}NO_2$ (3298.39)	80.22 (80.02)	5.81 (5.69)	4.25 (4.09)
9b	124-126	87 , colourless	$C_{23}H_{18}N_3O$ (356.39)	77.51 (77.42)	5.09 (5.15)	3.93 (3.85)
11a	107 - 109	85 , colourless	$C_{22}H_{18}O_2$ (314.38)	84.05 (84.21)	5.77 (5.58)	——
11b	120-122	85 , Yellow	$C_{23}H_{20}O_3$ (344.4)	80.21 (80.35)	5.85 (5.75)	——
13a	136-137	73 , Brown	$C_{22}H_{16}O_2$ (312.12)	84.59 (84.31)	5.16 (5.40)	——
13b	90 - 92	78 , Buff	$C_{23}H_{18}O_3$ (342.39)	80.68 (80.74)	5.30 (5.15)	——

REFERENCES

Abdel Hafez, O. M. ; Ahmed, Kh. M. ; Haggag, E. E. , *Molecules* 6 **(2001)** 396.

Abdel-Rahman, A. H. ;Hammouda, M. A. A. ; El-Desoky, S. I. *Heteroat. Chem.* 16 **(2005)** 20 – 27. doi: 10.1002/hc.20048

Abdel-Rahman, A. H. ; Keshk, E. M. ; El-Telbani, E. M. , *Z. Naturforsch.* 57b **(2002)** 557-562.

Abdel-Rahman, A. H. ; Khalil, A. M. ; El-Desoky, S. I. ; Keshk, E. M. , *Chem. Papers* 53 **(1999)** 323-327.

Abdel-Rahman, A. H. ; Khalil, A. M. ; Keshk, E. M. , *Chem. Papers* 54 **(2000)** 324-331.

Ammanamanchi, A. S. R. ;Balagopala, M. I. , *J. Chem. Soc. Perkin Trans.* 1 **(1990)** 993 – 998.

Atiken, R. A. ; Bibby, M. C. ; Copper, P. A. ; Double, J. A. ; Laws, A. L. ; Kithie, R. B. ; Wilson, D. A. C. , *Arch. Pharm. Med. Chem.* 333 **(2000)** 181.

Aziz, G. ; Nosseir, M. H. ; Doss, N. L. ; Rizk, A. S. , *Indian J. Chem.* 14b (4) **(1976)** 286.

Bors, W. ; Heller, W. ; Michel, C. ; Stettmaier, K. *"Antioxidants"* (Eds, : E. cadenas, L. parker) Marcel Dekker, New York **(1996)**.

Bourgery, G. ; Dostent, P. ; Lacour, A. ; Langlois, M. ; Pourrias, B. ; Versailles , *J. T. J. Med. Chem.* 24 **(1981)** 159 -165.

Chauncey, M. A.; Grundon, M. F. *Synthesis*11 **(1990**) 1005-1007.

Crockett, S. L. ;Poller, B.; Tabanca, N.; Pferschy-Wenzig, E.-M.; Kunert, O. ; Wedge, D. E. ; Bucar, F. , *J. Sci. Food Agric.* 91 **(2011)** 428 – 434.

El-Desoky, S. I.; Badria, F. A. ; Abozeid, M. A. ; Kandeel, E. A. ; Abdel-Rahman, A. H. , J. Med. Chem. Res. **(2012)**. doi: 10.1007/s00044-012-0201-0.

El-Desoky, S. I. ; Hammad, M. A. ; Grant, N. ; El-Telbany, E. M. ; Abdel-Rahman, A. H. , *Tetrahedron*. 53 **(1997)** 15799 – 15806. doi: 10.1016/S0040-4020(97)10032-1.

El-Desoky, S. I. ; J. Heterocyclic Chem. 44 **(2007)**1309 – 1315.

Ellis, G. P. *"Chromenes, Chromanones and Chromones"* John Willy & Sons, New York **(1977).**

El-Telbani, E. M. ; El-Desoky, S. I. ; Hammad, M. A. ; Abdel-Rahman, A. H. ; Schmidt, R. R. *Eur. J. Org. Chem.* 11 **(1998)** 2317.

Gammil, R. B. ; Hyde, B. R. , *J. Org. Chem.* 48 **(1983)** 3863 -3867.

Hackett, J. C. ; Kim, Y. W. ;Su, B. ; Brueggemeier, R. W. ,*Bioorg. Med. Chem.* 13 **(2005)** 4063 – 4070.

Harborne, J. B. *"The Flavonoid- Advances in Research since 1986"* Chapman and Hall, London **(1994).**

Moustafa, A. ; Hishmat, O. H. ; Wassef, M. E. ; El-Ebrashi, N. M. A. ; Nawar, A. A. , *Liebig's Ann.* 692 **(1996)** 166.

Pouget, C. ; Fagnere, C. ; Basly, J. P. ; Besson, A. E. ,Champavier, Y. ;Habrioux, G. ; Chulia, A. , *J. Pharm. Res.* 19 **(2002)** 286 – 291.

Ristano, G. ;Grassi, G. ; Foti, F. J. Heterocycl. Chem. ,38 **(2001)** 1083.

Sanderson, J. T. ; Hordijk, J. ; Denison, M. S.; Springsteel, M. F. ; Nantz, M. H. ; Vander Berg, M. , *Toxicol. Sci.* 82 **(2004)** 70 -79.

Santen, R. ,*J. Steroids* 68 **(2003)** 559 -567.

Yahiaoui, S. ;Fagnere, C. ; Pouget, C. ;Buxeraud, J. ; Chulia, A. J. *Bioorganic & medicinal chemistry* 16 **(2008)** 1474 – 1480. doi: 10.1016/j.bmc.

Yamashita, A.; Toy, A. ; Scahil, T. A. , *J. Org. Chem.* 54 **(1989)** 3625.

تشييد بعض مركبات البينزو كرومون ذات نشاطات بيولوجية متوقعة

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تم تشييد في هذا البحث العديد من الأنوية الحلقية غير المتجانسة ذات الاهتمامات البيولوجية المتميزة من خلال تفاعل ٤– أليل–٢– سينامويل–١–هيدروكسى نفثالين مع بعض الكواشف المختلفة. أيضا تم تحضير مشتقات الأليل بنزوفلافانون وكذلك الأليل بنزوفلافون بطرق مختلفة. جميع المركبات الجديدة تم إثبات التركيب البنائي لها من خلال التحليل العنصري الدقيق بالإضافة للتقنيات الطيفية المختلفة.