

### Behaviour of 1'-Hydroxy-3-(p-methoxyphenyl)-2'-acrylonaphthone Towards Some Nucleophilic and Electrophilic Reagents

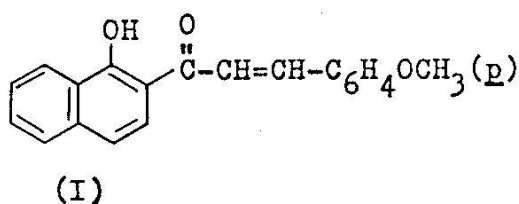
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**Summary:** Michael condensation of 1'-hydroxy-3-(p-methoxyphenyl)-2'-acrylonaphthone (I) with acetylacetone and ethyl acetoacetate gave the cyclohexenone derivatives (IIa and b). Compound (I) reacts with paraformaldehyde in amyl alcohol to give (III) which condensed with acetylacetone to give (IV). Condensation of (IIa) and (X) with p-chlorobenzaldehyde gave (V) and (XII). Reaction of (I) and (IIa) with ethyl chloroacetate and ethyl iodide gave (XIII) and (XVII). The action of hydrazines, hydroxylamine hydrochloride, urea, thiourea and amines on the above products has been described.

In continuation to our recent work on  $\alpha,\beta$ -unsaturated carbonyl systems [1-4], we report here the synthesis of some new cyclohexenones and their corresponding acetate and cinnamoyl derivatives in order to compare the reactivity of phenolic OH, 1,3-diketones and  $\alpha,\beta$ -unsaturated ketonic centers toward the action of some electrophilic and nucleophilic reagents and to prepare some hitherto unknown heterocyclic compounds.

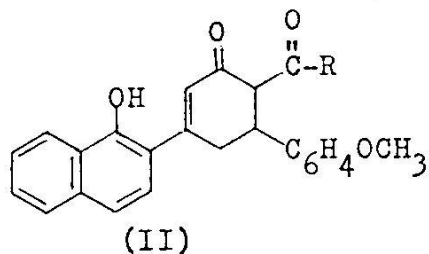
Michael condensation of acetylacetone and/or ethyl acetoacetate with 1'-hydroxy-3-(p-methoxyphenyl)-2'-acrylonaphthone (I) in the presence of sodium methoxide at 150-170°C leads to the formation of the corresponding cyclohexenone derivatives (IIa and b) respectively.



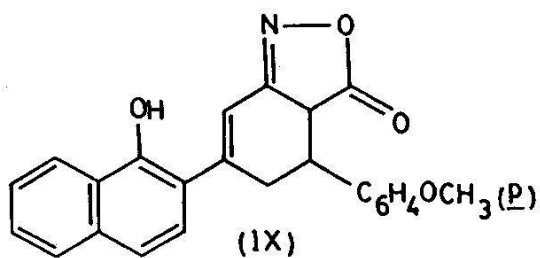
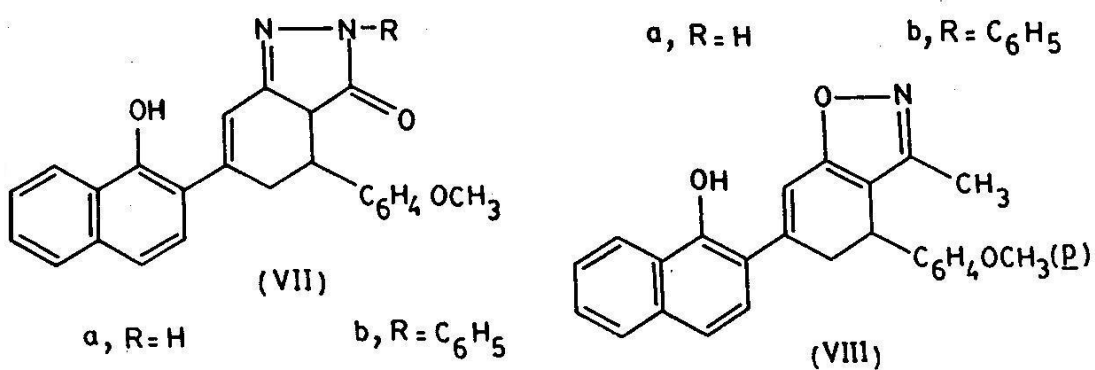
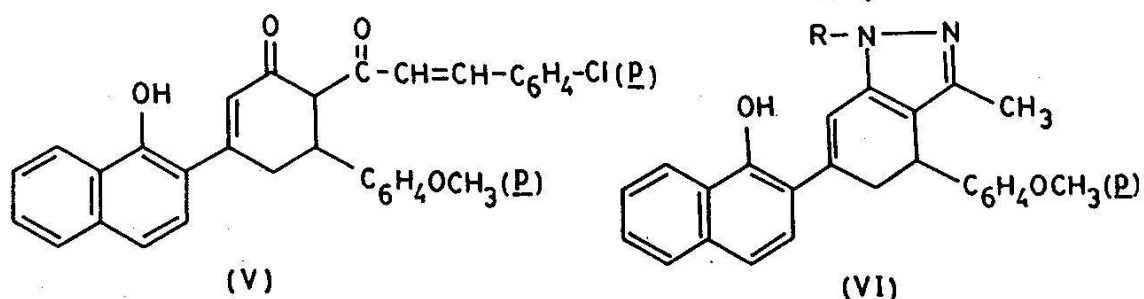
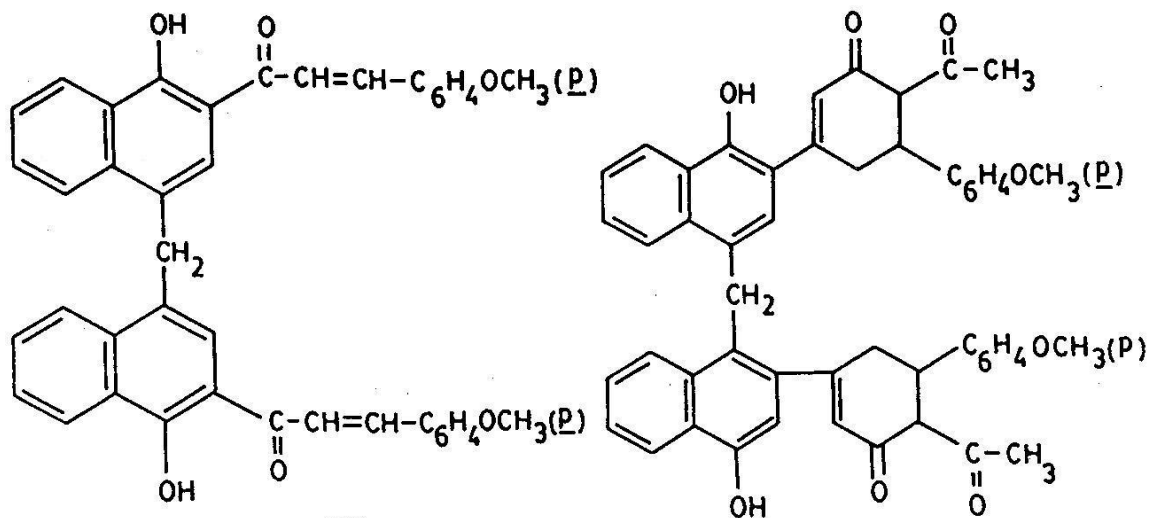
Condensation of (I) with paraformaldehyde in boiling amyl alcohol gave the bis product (III) [5,6] which reacts with two moles of acetylacetone in presence of sodium methoxide under Michael conditions to give (IV). Compound (IV) can be obtained alternatively via reaction of (IIa) with paraformaldehyde in boiling amyl alcohol.

Claisen-Schmidt condensation of (IIa) with p-chlorobenzaldehyde using piperidine as a base gave the corresponding cinnamoyl derivative (V).

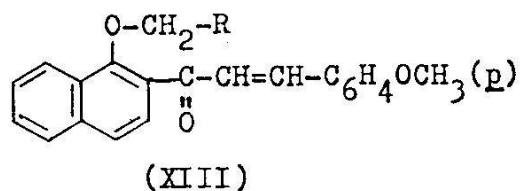
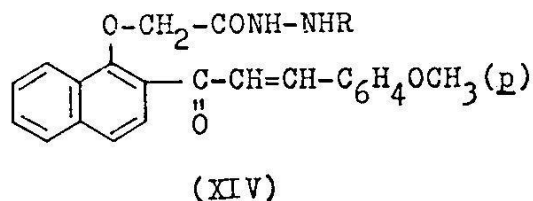
Condensation of (IIa and b) with hydrazine hydrate and/or phenylhydrazine in boiling ethanol gives the corresponding indazole derivatives (VI) and (VII) respectively.



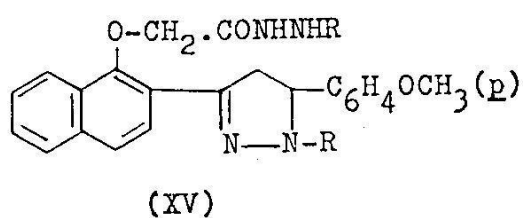
a, R = CH<sub>3</sub>      b, R = OC<sub>2</sub>H<sub>5</sub>



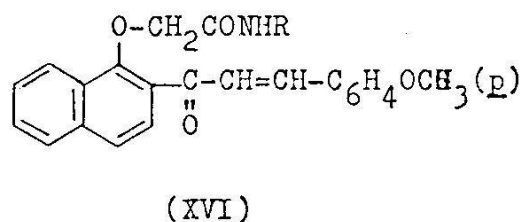
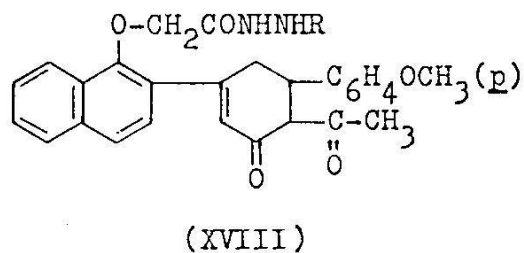
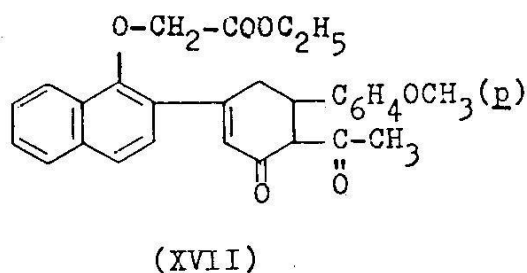


a, R = COOC<sub>2</sub>H<sub>5</sub>b, R = CH<sub>3</sub>

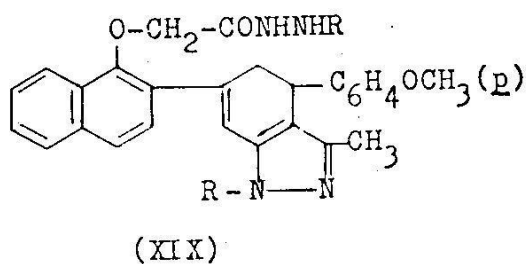
a, R = H

b, R = C<sub>6</sub>H<sub>5</sub>

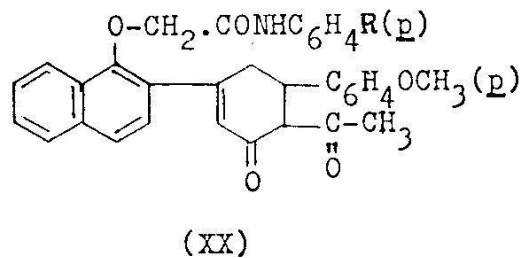
a, R = H

b, R = C<sub>6</sub>H<sub>5</sub>a, R = C<sub>2</sub>H<sub>5</sub>b, R = CH<sub>2</sub>-C<sub>6</sub>H<sub>5</sub>

a, R = H

b, R = C<sub>6</sub>H<sub>5</sub>

a, R = H

b, R = C<sub>6</sub>H<sub>5</sub>a, R = CH<sub>3</sub>b, R = OCH<sub>3</sub>

Reaction of (XIIIa) with primary amines, namely, ethylamine and/or benzylamine in boiling ethanol afforded the aminolysis of the ester group giving (XVIa and b) respectively.

Similarly, reaction of (IIa) with ethyl chloroacetate in boiling dry acetone and presence of anhydrous  $K_2CO_3$  gave the corresponding acetate derivative (XVII).

Reaction of (XVII) with hydrazine hydrate and/or phenyl hydrazine in boiling ethanol (molar ratio 1:1) gave the corresponding hydrazide derivative (XVIII) which emphasizes that the hydrazinolysis of ester group takes place more easily than the condensation with 1,3-diketone systems to give the indazole derivatives.

On the other hand, reaction of hydrazines with (XVII) (molar ratio 1:2) affected the hydrazinolysis of ester group and condensation with 1,3-diketone system giving (XIXa and b) respectively.

This work investigates also, the reaction of (XVII) with primary amines. Thus, reaction of (XVII) with p-toluidine and/or p-anisidine gave the corresponding acetamide derivatives (XXa and b) respectively.

### Experimental

The infrared spectra were taken on a Unicam SP 1200 Spectrophotometer using KBr wafer technique and given in Table 2. The PMR spectra were determined with Model 390 spectrophotometer and given in Table 3.

All melting points were uncorrected.

*Base catalyzed cycloaddition of acetylacetone and ethyl acetoacetate to (I) and (III): Formation of (IIa, b) and (IV):*

A mixture of (I) (0.01 mole), acetyl acetone and/or ethyl acetoacetate (0.01 mole). (0.02 mole in case

of (III)) and sodium methoxide solution [prepared from 0.35g of metallic sodium in 15 ml of absolute methyl alcohol (0.015 mole)], was fused in an oil bath at 150-170°C for 4 hrs. The reaction mixture was poured into water then extracted with ether. The aqueous layer was acidified with ice cold dilute hydrochloric acid. The solid products obtained were crystallized from proper solvent to give (IIa, b) and (III) respectively (cf. Table 1).

*Condensation of (I) and (IIa) with paraformaldehyde: Formation of (III) and (IV):*

To a solution of (I) and (IIa) (0.01 mole) in 15 ml of amyl alcohol, 1 ml of conc. HCl was added, and the mixture was heated under reflux for 3 hrs. The condensation product that separated on cooling was filtered and purified by crystallization, to give (III) and (IV) respectively (cf. Table 1).

*Condensation of (IIa) and (Xa and b) with p-chlorobenzaldehyde: Formation of (V) and (XIIa and b):*

A mixture of (IIa) or (Xa or b) (0.01 mole), p-chlorobenzaldehyde (0.01 mole) and ethanol (20 ml) was treated with few drops of piperidine and refluxed for 4 hrs. The solid products that separated after evaporation of most of the solvent and cooling were crystallized from proper solvent to give the cinnamoyl derivatives (V) and (XIIa and b) respectively (cf. Table 1).

*Reaction of (IIa, b), (XIa), (XVII) with hydrazines: Formation of (VIa, b), (VIIa, b), (XIVa, b), (XVa, b), (XVIIIa, b) and (XIXa, b):*

A mixture of (IIa and b), (XIa) or (XVII) (0.01 mole), hydrazine hydrate and/or phenylhydrazine (0.01 or 0.02 mole) and ethanol (15 ml), was refluxed for 6 hours. The solid

Table-1: Physical data of new compounds

Compound	M.p. °C (Colour)	Solvent (yield)	Formula	Found			Required		
				C	H	N	C	H	N
(IIa)	160-1 (b)	B (70)	C <sub>25</sub> H <sub>22</sub> O <sub>4</sub>	77.53	5.43	--	77.72	5.69	--
(IIb)	154-5 (b)	B (85)	C <sub>26</sub> H <sub>24</sub> O <sub>5</sub>	74.80	5.44	--	75.00	5.76	--
(III)	260-1 (b)	B (60)	C <sub>41</sub> H <sub>32</sub> O <sub>6</sub>	78.73	5.02	--	79.35	5.16	--
(IV)	208-9 (b)	E (55)	C <sub>51</sub> H <sub>44</sub> O <sub>8</sub>	77.75	5.24	--	78.06	5.61	--
(V)	210 (c)	E (65)	C <sub>32</sub> H <sub>25</sub> O <sub>4</sub> Cl	75.17	4.38	--	75.51	4.91	--
(VIa)	225 (a)	E (70)	C <sub>25</sub> H <sub>22</sub> N <sub>2</sub> O <sub>2</sub>	78.20	5.56	7.12	78.53	5.75	7.32
(VIb)	180 (b)	E (70)	C <sub>31</sub> H <sub>26</sub> N <sub>2</sub> O <sub>3</sub>	80.97	5.46	5.81	81.22	5.67	6.11
(VIIa)	158 (b)	E (70)	C <sub>24</sub> H <sub>20</sub> N <sub>2</sub> O <sub>3</sub>	74.62	4.73	7.16	75.00	5.20	7.29
(VIIb)	184-5 (b)	B/E(60)	C <sub>30</sub> H <sub>24</sub> N <sub>2</sub> O <sub>3</sub>	77.73	4.86	5.76	78.26	5.21	6.08
(VIII)	136-7 (c)	E (40)	C <sub>25</sub> H <sub>21</sub> NO <sub>3</sub>	77.80	5.32	3.48	78.32	5.48	3.65
(IX)	205-6 (c)	E (55)	C <sub>24</sub> H <sub>19</sub> NO <sub>4</sub>	74.72	4.80	3.33	74.80	4.93	3.63
(Xa)	192 (c)	E (70)	C <sub>26</sub> H <sub>22</sub> N <sub>2</sub> O <sub>3</sub>	75.62	5.12	6.46	67.09	5.36	6.82
(Xb)	182-3 (b)	B (50)	C <sub>26</sub> H <sub>22</sub> N <sub>2</sub> O <sub>2</sub> S	72.82	4.75	6.39	73.23	5.16	6.57
(XIa)	165 (b)	B/E(45)	C <sub>25</sub> H <sub>20</sub> N <sub>2</sub> O <sub>4</sub>	72.44	4.60	6.62	72.81	4.85	6.79
(XIb)	187 (e)	E (65)	C <sub>25</sub> H <sub>20</sub> N <sub>2</sub> O <sub>3</sub> S	69.48	4.37	6.13	70.09	4.67	6.54
(XIIa)	235 (b)	E (65)	C <sub>33</sub> H <sub>25</sub> N <sub>2</sub> O <sub>3</sub> Cl	74.12	4.52	4.73	74.36	4.69	
(XIIb)	212-3 (b)	E (60)	C <sub>33</sub> H <sub>25</sub> N <sub>2</sub> O <sub>2</sub> CIS	71.80	4.13	5.11	72.19	4.55	
(XIIIa)	152-4 (b)	E (70)	C <sub>24</sub> H <sub>22</sub> O <sub>5</sub>	73.22	5.38	--	73.84	5.64	
(XIIIb)	177-8 (b)	P/B (55)	C <sub>22</sub> H <sub>20</sub> O <sub>3</sub>	79.23	5.66	--	79.51	6.02	
(XIVa)	162 (a)	E (55)	C <sub>22</sub> H <sub>20</sub> N <sub>2</sub> O <sub>4</sub>	69.86	5.24	7.28	70.21	5.31	
(XIVb)	121 (a)	B/E(65)	C <sub>28</sub> H <sub>24</sub> N <sub>2</sub> O <sub>4</sub>	73.73	5.00	5.87	74.33	5.30	
(XVa)	187-8 (b)	E (70)	C <sub>22</sub> H <sub>22</sub> N <sub>2</sub> O <sub>3</sub>	72.56	5.66	7.53	72.92	6.07	
(XVb)	215-6 (b)	B/E(65)	C <sub>34</sub> H <sub>30</sub> N <sub>2</sub> O <sub>3</sub>	79.13	5.46	5.13	79.37	5.83	
(XVIa)	172 (a)	E (70)	C <sub>24</sub> H <sub>23</sub> NO <sub>4</sub>	73.64	5.48	3.37	74.03	5.91	
(XVIb)	154-5 (a)	E (60)	C <sub>29</sub> H <sub>25</sub> NO <sub>4</sub>	76.58	5.37	2.89	77.16	5.54	
(XVII)	168-9 (b)	E (55)	C <sub>29</sub> H <sub>28</sub> O <sub>6</sub>	73.46	5.62	--	73.72	5.93	
(XVIIIa)	150-1 (b)	E (80)	C <sub>27</sub> H <sub>26</sub> N <sub>2</sub> O <sub>5</sub>	70.55	5.41	6.16	70.74	5.67	
(XVIIIb)	133-5 (b)	B (60)	C <sub>33</sub> H <sub>30</sub> N <sub>2</sub> O <sub>5</sub>	73.71	5.31	5.03	74.15	5.52	
(XIXa)	166-7 (b)	E (60)	C <sub>27</sub> H <sub>26</sub> N <sub>4</sub> O <sub>3</sub>	71.22	5.41	11.80	71.36	5.72	
(XIXb)	191-2 (b)	B (65)	C <sub>33</sub> H <sub>30</sub> N <sub>4</sub> O <sub>3</sub>	74.50	5.42	10.23	74.71	5.66	
(XXa)	190 (b)	B/E(65)	C <sub>34</sub> H <sub>31</sub> NO <sub>5</sub>	76.10	5.44	2.27	76.54	5.81	
(XXb)	206-8 (b)	E (80)	C <sub>34</sub> H <sub>31</sub> NO <sub>6</sub>	73.95	5.38	2.41	74.31	5.64	

Table-2: The infrared of some new compounds (KBr,  $\text{cm}^{-1}$ )

Compound	Group frequencies
(IIa)	$\nu$ OH(3440), $\nu$ CH <sub>2</sub> (2980), $\nu$ C=O (1675,1700), $\nu$ C=C (1600)
(IIb)	$\nu$ OH (3180-3240), $\nu$ CH <sub>2</sub> (2820,2895), $\nu$ C=O (1680,1735)
(III)	$\nu$ OH (3460), $\nu$ C=O (1680,1690), $\nu$ CH <sub>2</sub> (2870)
(IV)	$\nu$ OH (3360,3410), $\nu$ C=O (1670,1685,1690), $\nu$ CH <sub>2</sub> (2840,2920)
(V)	$\nu$ OH (3445), $\nu$ C=O (1680,1705)
(VIa)	$\nu$ OH or $\nu$ NH(3440), $\nu$ CH <sub>2</sub> (2920), $\nu$ C=N (1670), $\nu$ C=C (1600)
(VIIa)	$\nu$ C=N or $\nu$ C=O (1665), $\nu$ NH or $\nu$ OH (3450), $\nu$ C=C (1610)
(VIII)	$\nu$ OH (3300), $\nu$ CH <sub>2</sub> (3040), $\nu$ C=N (1675), $\nu$ C=C (1600)
(IX)	$\nu$ C=N or C=O (1680), CH <sub>2</sub> (2920), OH (4420), C=C (1590)
(Xb)	$\nu$ OH or $\nu$ NH (3160-3480), $\nu$ C=N (1625), $\nu$ C=S (1575)
(XIb)	$\nu$ C=N or $\nu$ C=O (1670), $\nu$ NH or $\nu$ OH (3440), $\nu$ C=S (1545), $\nu$ C=C (16
(XIIb)	$\nu$ OH or $\nu$ NH (3380), $\nu$ C=S (1550), $\nu$ C=N (1660)
(XIIIa)	$\nu$ CH <sub>2</sub> (3030), $\nu$ C=O (1700), $\nu$ C=C (1590)
(XIVb)	$\nu$ C=O (1680,1725), $\nu$ CH <sub>2</sub> (2920), $\nu$ NH (3410), $\nu$ C=C (1610)
(XVb)	$\nu$ CH <sub>2</sub> (2885,2910), $\nu$ NH (3380), $\nu$ C=O (1685), $\nu$ C=C (1600)
(XVII)	$\nu$ C=O (1680,1700,1720) $\nu$ CH <sub>2</sub> (2980), $\nu$ C=C (1600)
(XVIIa)	$\nu$ C=O (1660,1680,1690), $\nu$ CH <sub>2</sub> (3050), $\nu$ NH (3460,3440)
(XIXa)	$\nu$ C=O (1660,1680,1690), $\nu$ CH <sub>2</sub> (2920), $\nu$ NH (3390)
(XXa)	$\nu$ C=O (1680,1695,1705), $\nu$ NH (3360), $\nu$ CH <sub>2</sub> (2930)

products obtained after evaporation of most of ethanol and cooling were crystallized from the proper solvent to give (VIa,b), (VIIa,b), (XIVa,b), (XVa,b), (XVIIIa,b), and (XIXa,b) respectively (cf. Table 1).

*Reaction of (IIa and b) with hydroxylamine hydrochloride: Formation of (VIII) and (IX):*

A mixture of (IIa and b) (0.01 mole), hydroxylamine hydrochloride (0.01 mole), sodium acetate (2 g), ethanol (15 ml) and few drops of water was refluxed for 6 hours. The solid products obtained after cooling were

crystallized from proper solvent to give (VIII) and (IX) respectively. (cf. Table 1).

*Reaction of (IIa,b) and (V) with urea and/or thiourea: Formation of (Xa,b), (XIa,b) and (XIIa,b):*

A mixture of (IIa,b) or (V) (0.01 mole), urea and/or thiourea (0.01 mole) and ethanol (20 ml) was treated with 10 drops of glacial acetic acid and refluxed for 6 hours. The solid products obtained after evaporation of most of the solvent were crystallized from proper solvent to give (Xa,b), (XIa,b) and (XIIa,b) respectively (cf. Table 1).

Table-3: The P.M.R. spectra of some new compounds in DMSO

Compound	$\delta$ -value	Group
(IIb)	7.10 - 8.05(m)	10 H (aromatic protons)
	6.40, 6.60, 6.80	3 H (cyclohexenone ring)
	3.70	2 H (cyclic $-\text{CH}_2-$ )
	2.45	2 H ( $-\text{CH}_2-\text{CH}_3$ )
	3.30	3 H ( $-\text{CH}_2-\text{CH}_3$ )
(VIII)	6.70 - 8.20(m)	10 H (aromatic protons)
	6.35 (s)	1 H ( $-\text{CH}-$ in cyclohexenone ring)
	3.15	2 H $-\text{CH}-$ in cyclohexenone)
	3.60, 3.70	6 H (two $-\text{CH}_3$ groups)
(Xb)	7.00 - 8.10(m)	10 H (aromatic protons)
	6.45 (s)	1 H ( $\text{CH}$ in cyclohexenone)
	3.40	2 H ( $\text{CH}_2$ in cyclohexenone)
	3.10, 2.70	6 H (two $\text{CH}_3$ groups)

Reaction of (I) and (IIa) with ethyl chloroacetate or ethyl iodide: Formation of (XIIIa,b) and (XVII):

A mixture of (I) or (IIa) (0.01 mole), anhydrous  $\text{K}_2\text{CO}_3$  (0.03 mole), ethyl chloroacetate and/or ethyl iodide (0.03 mole) and dry acetone (50 ml) was refluxed for 30 hours on a steam bath, the solvent evaporated and water added. Then extracted with ether and the solid products obtained after evaporation of ether were crystallized from proper solvent to give (XIIIa,b) and (XVII) respectively (cf. Table 1).

Reaction of (XIIIa) and (XVIII) with primary amines: Formation of (XVIa,b) and (XXa,b):

A mixture of (XIIIa) or (XVII) (0.01 mole), primary amines, namely, ethylamine, benzylamine, p-toluidine and/or p-anisidine (0.01 mole) and ethanol (20 ml), was refluxed for 6 hours. The solid products that obtained after evaporation of most of ethanol were crystallized from proper

solvent to give (XVIa,b) and (XXa,b) respectively (cf. Table 1).

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