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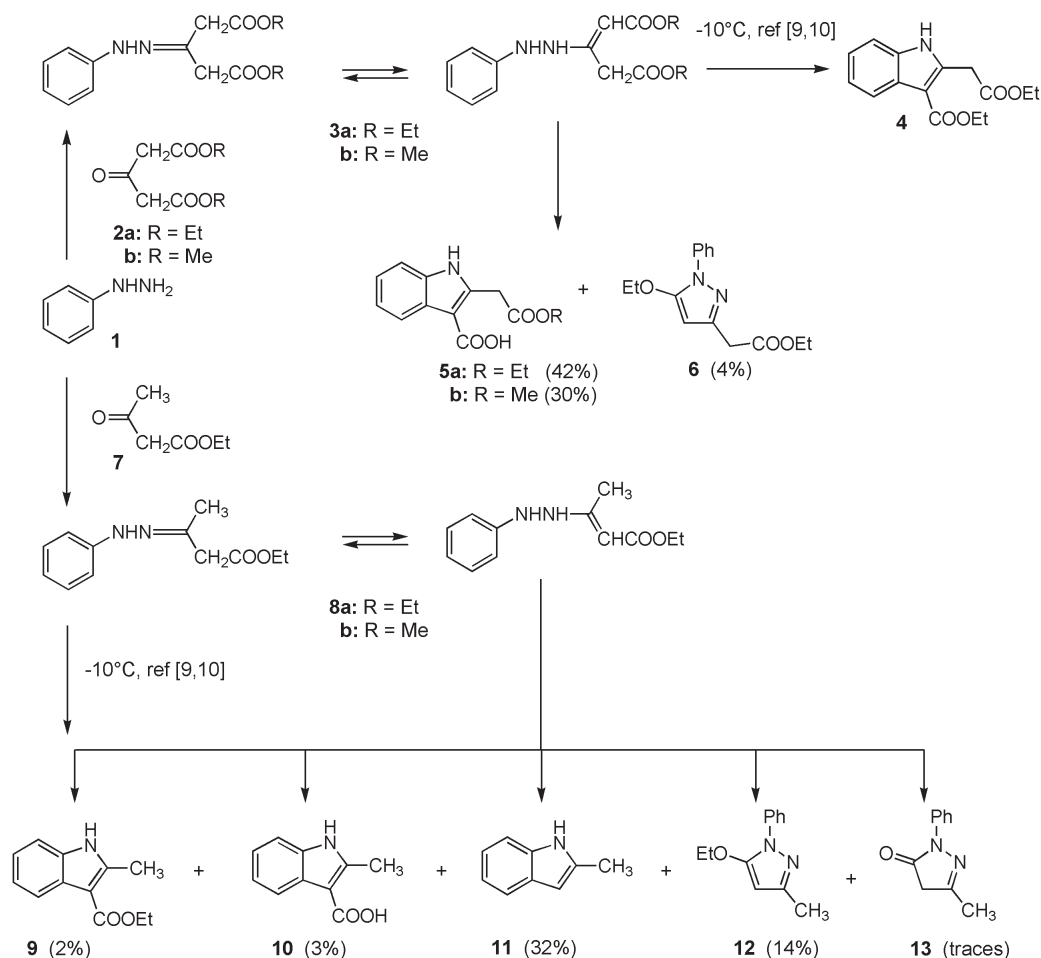
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The hydrazones **3a,b**, prepared from phenylhydrazine (**1**) and dialkyl 2-oxopropane-1,3-dicarboxylate (**2a,b**) were converted in concentrated sulfuric acid at  $-5\text{ }^{\circ}\text{C}$  into a mixture of alkyl (3-carboxyindol-2-yl)acetates (**5a,b**), and ethyl (5-ethoxy-1-phenyl-1*H*-pyrazol-3-yl)acetate **6**. The hydrazone **8**, prepared from **1** and ethyl acetoacetate (**7**) was transformed under the same conditions into a mixture of five compounds: ethyl 2-methylindol-3-carboxylate (**9**), 2-methylindol-3-carboxylic acid (**10**), 2-methylindol (**11**), 5-ethoxy-3-methyl-1-phenyl-1*H*-pyrazole (**12**), and 3-methyl-1-phenyl-1*H*-pyrazol-5-one (**13**).

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In connection with our research in the field of indole alkaloids, such as aplysinopsins, and their analogues [1–4] and meridianins and their analogues [5] on the basis of 3-dimethylaminopropenoates and related enaminones [6–8] we became interested in ethyl 3-ethoxycarbonylindol-2-acetate (**4**) and ethyl 2-methylindole-2-carboxylate (**9**). The preparations of both compounds have been described in the literature [9].

According to the literature [9] compound **4** has been prepared from phenylhydrazine (**1**) and diethyl 2-oxopropane-1,3-dicarboxylate (**2a**) to give the corresponding hydrazone or ne-hydrazone intermediate **3a** which has been then converted in concentrated sulfuric acid at  $-10\text{ }^{\circ}\text{C}$  [10] into the indole derivative **4**. In an analogous manner, compound **9** has been obtained from hydrazone **8**, prepared from phenylhydrazine (**1**) and ethyl acetoacetate (**7**) in sulfuric acid [9,10].



When we carried out the transformation of phenylhydrazone **3a** in sulfuric acid at  $-5^{\circ}\text{C}$  two compounds were isolated ethyl 3-carboxyindol-2-yl acetate (**5a**) and ethyl (5-ethoxy-1-phenyl-1*H*-pyrazol-3-yl)acetate (**6**) in 42% and 4% yield, respectively, while from phenylhydrazone **3b** only methyl 3-carboxyindol-2-ylacetate **5b** was isolated in 30% yield. On the other hand, when hydrazone (**8**), prepared from phenylhydrazone (**1**) and ethyl acetoacetate (**7**), was added to concentrated sulfuric acid at  $-5^{\circ}\text{C}$ , four compounds were isolated: ethyl 2-methylindol-3-carboxylate (**9**), 2-methylindol-3-carboxylic acid (**10**), 2-methylindole (**11**), 5-ethoxy-3-methyl-1-phenyl-1*H*-pyrazole (**12**) in 2%, 3%, 32% and 14% yield, while 3-methyl-1-phenyl-1*H*-pyrazol-5-one (**13**) was detected only in traces, on thin layer chromatography (Scheme 1).

The structures of new compounds were determined by ir,  $^1\text{H}$  nmr, mass spectra, and elemental analyses for C, H, and N. The known compounds were identified by comparison with authentic samples, prepared according to procedures described in the literature.

## EXPERIMENTAL

Melting points were taken on a Kofler micro hot stage. The  $^1\text{H}$  NMR and 2D NMR HMBC, NOESY spectra were obtained on a Bruker Avance DPX 300 (300 MHz) spectrometer with DMSO- $d_6$  or  $\text{CDCl}_3$  as solvent and TMS as internal standard ( $\delta$  in ppm,  $J$  in Hz). IR spectra were recorded with Perkin–Elmer Spectrum BX FTIR and BIO RAD Excalibur Series FTS 3000 MX FTIR spectrophotometers (KBr discs,  $\nu$  in  $\text{cm}^{-1}$ ). MS spectra were obtained on an Autospeck Q spectrometer. The microanalyses for C, H, and N were obtained on a Perkin Elmer Series II CHN Analyser 2400. Medium pressure chromatography (MPLC) was performed with a Büchi isocratic system with detection on silica gel (Merck, silica gel 40, 0.015–0.035 mm); column dimensions (wet filled) 15x460 mm; backpressure 25–30 bar; detection: UV 254 nm; sample amount 200 mg of mixture.

Reaction of Phenylhydrazone of Dialkyl 2-Oxopropane-1,3-dicarboxylates in Sulfuric Acid. Preparation of **5a,b** and **6**.

Phenylhydrazine (**1**) (18 g) and diethyl 2-oxopropane-1,3-dicarboxylate (**2a**) (21 g) in ether (100 ml) with two drops of acetic acid at  $0^{\circ}\text{C}$  for 1 h, followed by evaporation of solvent at room temperature, was added dropwise to concentrated sulfuric acid (70 ml) at  $-5^{\circ}\text{C}$  with vigorous stirring during 5 min. After 0.5 h at that temperature the mixture was poured into ice, and extracted with ether. Organic phase was dried with anhydrous sodium sulfate, and evaporated *in vacuo*. Oily mixture of products was separated by chromatography. Fractions containing products were evaporated *in vacuo* to give **5a** and **6** in 42 and 4% yield, respectively.

2-(2-Ethoxy-2-oxoethyl)-1*H*-indole-3-carboxylic Acid (**5a**).

This compound was obtained as white solid (42%, 12 g) mp =  $194\text{--}198^{\circ}\text{C}$  (ethanol/water)  $^1\text{H}$  nmr ( $\text{CDCl}_3$ ):  $\delta$  1.33 (t, 3H,  $J$  = 7.16,  $\text{OCH}_2\text{CH}_3$ ); 4.27 (q, 2H,  $J$  = 7.16,  $\text{OCH}_2\text{CH}_3$ ); 4.41 (s, 2H,  $\text{CH}_2$ ); 7.21–7.26 (m, 2H, indole); 7.38–7.42 (m, 1H, indole); 8.18–8.21 (m, 1H, indole); 10.06 (broad s, 1H, NH). (DMSO):  $\delta$

1.19 (t, 3H,  $J$  = 6.97,  $\text{OCH}_2\text{CH}_3$ ); 4.11 (q, 2H,  $J$  = 7.16,  $\text{OCH}_2\text{CH}_3$ ); 4.18 (s, 2H,  $\text{CH}_2$ ); 7.09–7.18 (m, 2H, indole); 7.40–7.43 (m, 1H, indole); 7.94–7.98 (m, 1H, indole); 11.82 (broad s, 1H, NH); 12.02 (broad s, 1H, COOH). ir: 3310, 1720, 1670, 1560, 1460, 1210, 740. ms:  $m/z$  (EI) 247 ( $\text{M}^+$ ); hrms:  $m/z$  (EI) calcd. for  $\text{C}_{13}\text{H}_{13}\text{NO}_4$ : 247.084458. found: 247.084950.

Anal. Calcd. for  $\text{C}_{13}\text{H}_{13}\text{NO}_4$ : C, 63.15; H, 5.30; N, 5.67. Found: C, 62.96; H, 5.51; N 5.42.

Ethyl (5-Ethoxy-1-phenyl-1*H*-pyrazol-3-yl)acetate (**6**).

This compound was obtained as colorless oil, (4 %, 1060 mg)  $^1\text{H}$  nmr ( $\text{CDCl}_3$ ):  $\delta$  1.27 (t, 3H,  $J$  = 7.17,  $\text{OCH}_2\text{CH}_3$ ); 1.42 (t, 3H,  $J$  = 6.96,  $\text{OCH}_2\text{CH}_3$ ); 3.65 (s, 2H,  $\text{CH}_2$ ); 4.11–4.22 (m, 4H,  $2\times\text{OCH}_2\text{CH}_3$ ); 7.19–7.25 (m, 1H, phenyl); 7.35–7.42 (m, 2H, phenyl); 7.68–7.72 (m, 2H, phenyl) (The compound is identical with the compound reported in the literature [11]).

2-(2-Methoxy-2-oxoethyl)-1*H*-indole-3-carboxylic Acid (**5b**).

Phenylhydrazine (**1**) (18 g) and dimethyl 2-oxopropane-1,3-dicarboxylate (**2b**) (20 g) in ether (100 ml) with two drops of acetic acid at  $0^{\circ}\text{C}$  for 1 h, followed by evaporation of solvent at room temperature, was added dropwise to concentrated sulfuric acid (70 ml) at  $-5^{\circ}\text{C}$  with vigorous stirring during 5 min. After 0.5 h at that temperature the mixture was poured into ice, and extracted with ether to give white solid 12.7 g (30%), mp =  $176\text{--}180^{\circ}\text{C}$  (toluene)  $^1\text{H}$  nmr ( $\text{CDCl}_3$ ):  $\delta$  3.83 (s, 3H,  $\text{OCH}_3$ ); 4.44 (s, 2H,  $\text{CH}_2$ ); 7.25–7.29 (m, 2H, Ph); 7.39–7.43 (m, 1H, indole); 8.18–8.21 (m, 1H, indole); 9.92 (broad s, 1H, NH). (DMSO):  $\delta$  3.64 (s, 3H,  $\text{OCH}_3$ ); 4.20 (s, 2H,  $\text{CH}_2$ ); 7.10–7.19 (m, 2H, indole); 7.39–7.42 (m, 1H, indole); 7.94–7.97 (m, 1H, indole); 11.83 (broad s, 1H, NH); 12.05 (broad s, 1H, COOH). ir: 3380, 3120, 1730, 1650, 1460, 1210, 740.

Anal. Calcd. for  $\text{C}_{12}\text{H}_{11}\text{NO}_4$ : C, 61.80; H, 4.75; N, 6.01. Found: C, 61.86; H, 4.73; N 6.31.

Reaction of Phenylhydrazone of Ethyl Acetoacetate in Sulfuric Acid. Preparation of compounds **9–13**.

Phenylhydrazine (**1**) (18 g) and ethyl acetoacetate (**7**) (15 g) in ether (100 ml) with two drops of acetic acid at  $0^{\circ}\text{C}$  for 1 h, followed by evaporation of solvent at room temperature, was added dropwise to concentrated sulfuric acid (70 ml) at  $-5^{\circ}\text{C}$  with vigorous stirring during 5 min. After 0.5 h at that temperature the mixture was poured into ice, and extracted with ether. Organic phase was dried with anhydrous sodium sulfate, and evaporated *in vacuo*. Oily mixture of products was separated by chromatography. Fractions containing product were evaporated *in vacuo* to give **9**, **10**, **11**, and **12** in 2, 3, 32, and 14% yields, respectively. 3-Methyl-1-phenyl-1*H*-pyrazole-5-one (**13**) was present in traces, identified only by thin layer chromatography by comparison with an authentic sample.

Ethyl (2-Methylindol-3-yl)carboxylate (**9**).

This compound was obtained in 2 %, 480 mg;  $^1\text{H}$  nmr ( $\text{CDCl}_3$ ):  $\delta$  1.40 (t, 3H,  $J$  = 7.1,  $\text{OCH}_2\text{CH}_3$ ); 2.28 (s, 3H,  $\text{CH}_3$ ); 4.24 (q, 2H,  $J$  = 7.1,  $\text{OCH}_2\text{CH}_3$ ); 7.25–7.32 (m, 2H, indole); 7.41–7.43 (m, 2H, indole); 7.84 (broad s, 1H, NH) (The compound is identical with the compound reported in the literature [9]).

2-Methyl-1*H*-indole-3-carboxylic acid (**10**).

This compound was obtained in 3 %, 640 mg;  $^1\text{H}$  nmr ( $\text{CDCl}_3$ ):  $\delta$  2.79 (s, 3H,  $\text{CH}_3$ ); 7.21–7.26 (m, 2H, indole);

7.31–7.34 (m, 1H, indole); 8.16–8.19 (m, 1H, indole), 8.33 (broad s, 1H, NH) (The compound is identical with the compound reported in the literature [12]).

#### 2-Methylindole (**11**).

This compound was obtained as white solid, which gradually darkened, (32 %, 4920 mg)  $^1\text{H}$  nmr ( $\text{CDCl}_3$ ):  $\delta$  2.33 (s, 3H,  $\text{CH}_3$ ); 6.18 (s, 1H, 3-H); 7.02–7.12 (m, 2H, indole); 7.16–7.19 (m, 1H, indole); 7.48–7.51 (m, 1H, indole); 7.56 (broad s, 1H, NH) (The compound is identical with the compound reported in the literature [13]).

#### 5-Ethoxy-3-methyl-1-phenyl-1H-pyrazole (**12**).

This compound was obtained as colorless oil, (14 %, 3190 mg)  $^1\text{H}$  nmr ( $\text{CDCl}_3$ ):  $\delta$  1.42 (t, 3H,  $J = 7.1$ ,  $\text{OCH}_2\text{CH}_3$ ); 2.27 (s, 3H,  $\text{CH}_3$ ); 4.11 (q, 2H,  $J = 7.1$ ,  $\text{OCH}_2\text{CH}_3$ ); 5.46 (s, 1H, 4-H); 7.18–7.23 (m, 1H, phenyl); 7.36–7.41 (m, 2H, phenyl); 7.69–7.72 (m, 2H, phenyl) (The compound is identical with the compound reported in the literature [14]).

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