New Reaction of Schiff Base with Dimedone: New Method for the Acridine Derivatives Under Microwave Irradiation

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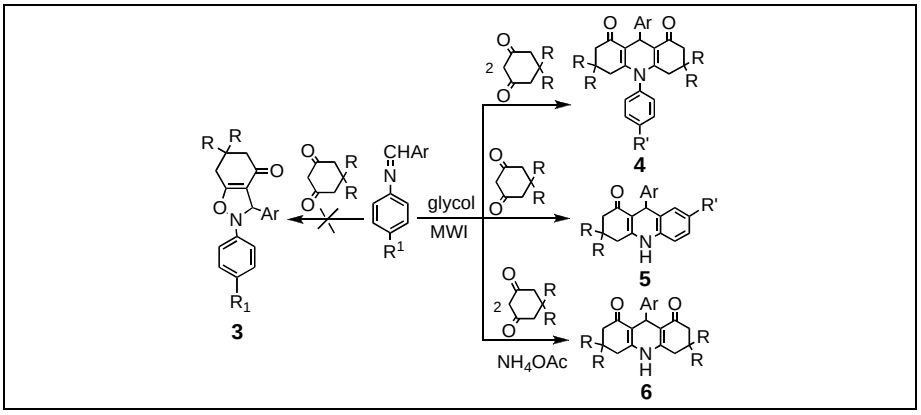

A novel cascade reaction of Schiff´s base was described. The products afforded in the reaction depended on the ratio of the two starting materials. A possible mechanism of the reactions is proposed, which underwent the breaking and new formation of the bond between carbon atom and nitrogen atom.

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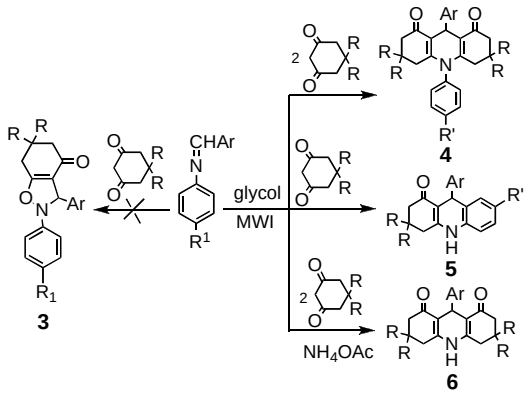
INTRODUCTION

Schiff´s base is a versatile intermediate in organic synthesis, which attracts more interests and great efforts of organic chemists, and is useful in reactions, such as cyclization [1], asymmetric catalytic hydrogenation [2], asymmetric chemical reduction [3] and oxidation [4], asymmetric alkylidation of α-carbon atom [5], cyclo additions of [4+2] [6], [3+2] [7] and [2+2] [8]. As a part of a research program directed towards the design and synthesis of lead compounds for potentially interesting drugs, Schiff´s base was taken into consideration as a possible starting point to obtain new substances of pharmacological activity. In our recent efforts aiming at synthesizing compound **3**, we treated **1** and **2** in glycol under microwave irradiation. The desired products **3** were not detected, however, a series of acridine derivative **5** [9] was obtained. This process is similar to that reported earlier [10]. In this paper we want to further investigate this interesting process.

When schiff´s base **1** and cyclic 1,3-dicarbonyl compounds **2** in the ratio of 1:2 or 1:1 were treated in glycol under microwave irradiation (MWI), a novel cascade reaction happened resulting in different kinds of acridine derivatives **4** [11] or **5** (Scheme 1), thus implying that the ratio of **1** and **2** plays a key role in the reaction process. Furthermore, when the reaction proceed in the presence of ammonium acetate and the ratio of **1** and **2** is 1:2, the product is another kind of acridine derivatives **6** [13] (Scheme 1), which indicates that ammonium acetate first participated in this reaction because of its strong nucleophilicity.

Scheme 1



The detailed results for the cascade reaction of Schiff base with dimedone or 1,3-cyclohexanediones in the ratio of 1:1 or 1:2 in the absence or presence of ammonium acetate are summarized in Table 1.

RESULTS AND DISCUSSION

According to the results shown in Table 1, it can be seen that excellent yields of **4**, **5** or **6** have been

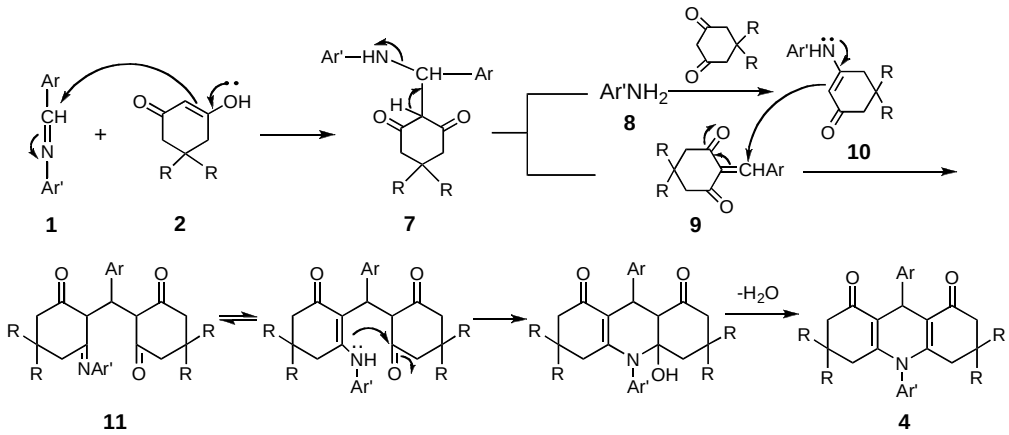
achieved under MWI. The different products resulting from different reaction conditions may be understood from the reaction mechanism. A tentative mechanism proposed for the reaction with the ratio 1:2 and without ammonium acetate may proceed *via* the pathway shown in Scheme 2. The addition of cyclic 1,3-dicarbony compound **2** to Schiff base **1** gives intermediate **7**, followed by the elimination of an arylamine **8** to form 2-arylidene-1,3-cyclohexanedione **9**, which then is attacked by intermediate **10** which afford the final product **4**. When ammonium acetate was added to this reaction system under the same conditions, another kind of N-unsubstituted acridine derivatives **6** were obtained. In this case, a similar mechanism is involved except that arylamine **8** is replaced by another stronger neucleophilic reagent, ammonia, formed from ammonium acetate to react with the second molecule of cyclic 1,3-dicarbony compound **2**, affording corresponding intermediate **10**, which ultimately led to the formation of **6**.

Table 1.

Synthesis of acridine derivatives **4**，**5**，**6**

Product	Ar	R	R^1	Time (min)	Yield (%)	m.p. (°C) (Lit.)
4a	4-$NO_2C_6H_4$	CH_3	CH_3	4	92	>300
4b	3-$NO_2C_6H_4$	CH_3	CH_3	5	90	291 (285~286)[12]
4c	4-FC_6H_4	CH_3	CH_3	4	90	262~264
4d	4-ClC_6H_4	CH_3	CH_3	4	95	274 (273~274)[12]
4e	3,4-$Cl_2C_6H_3$	CH_3	CH_3	5	92	253~255
4f	4-ClC_6H_4	CH_3	OH	4	93	>300
4g	4-BrC_6H_4	CH_3	OH	4	96	>300
4h	2-ClC_6H_4	H	CH_3	6	91	278~279
4i	4-BrC_6H_4	H	CH_3	4	90	>300
4j	3-$NO_2C_6H_4$	H	CH_3	5	92	248~249
4k	4-$NO_2C_6H_4$	H	CH_3	4	92	>300
4l	3-OH-4-$CH_3OC_6H_3$	H	CH_3	5	90	269~270
4m	4-$CH_3C_6H_4$	H	CH_3	6	89	216~218
4n	4-$CH_3OC_6H_4$	H	CH_3	5	90	256~257
4o	4-ClC_6H_4	H	OH	4	93	>300
5a	4-ClC_6H_4	CH_3	CH_3	4	93	255~256
5b	4-BrC_6H_4	CH_3	CH_3	4	94	240~241
5c	4-$(CH_3)_2NC_6H_4$	CH_3	CH_3	4	90	280~281
5d	4-ClC_6H_4	H	CH_3	4	95	291~293
5e	4-BrC_6H_4	H	CH_3	4	94	287~288
6a	2,4-$Cl_2C_6H_3$	H	–	4	90	>300
6b	4-BrC_6H_4	H	–	4	94	>300
6c	2-ClC_6H_4	H	–	4	93	>300

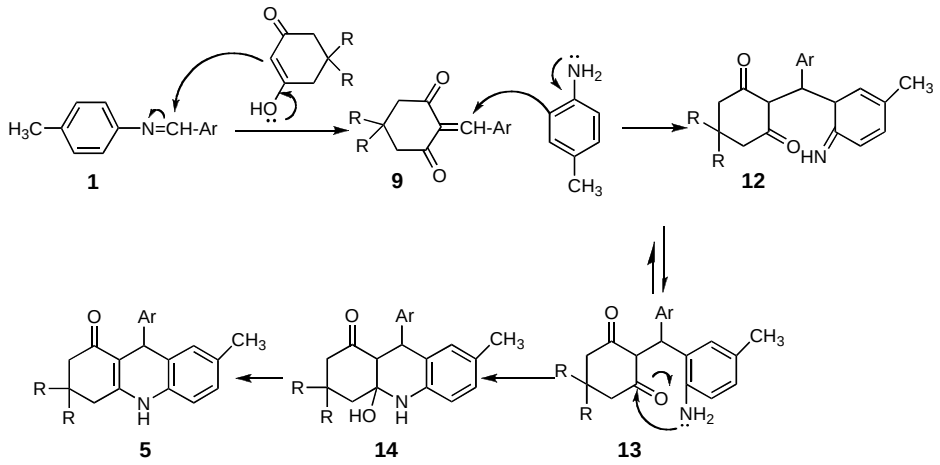
Scheme 2



originates from arylamine **8** with another molecule of cyclic 1,3-dicarbony compound **2** in the way of Michael addition to furnish imine **11**. Subsequent tautomerizationm intramolecular cyclodehydration

When the ratio of **1** and **2** is 1:1 in the absence of ammonium acetate, similar addition and elimination take place in the initial two steps (Sheme 3), then the Michael addition of arylamine **8** in place of intermediate **10** to 2-

Scheme 3



arylidene-1,3-cyclohexanedione **9**, subsequent tautomerization, cyclization and dehydrogenative aromatization gives the acridine derivatives **5**.

It is evident that this novel cascade reaction of Schiff base and can be reasonably anticipated as a new method to synthesize acridine derivatives.

All of the products were characterized by IR, ^{1}H NMR and elemental analysis. The structure of **4f** was further confirmed by an X-ray crystallographic analysis (Figure 1).

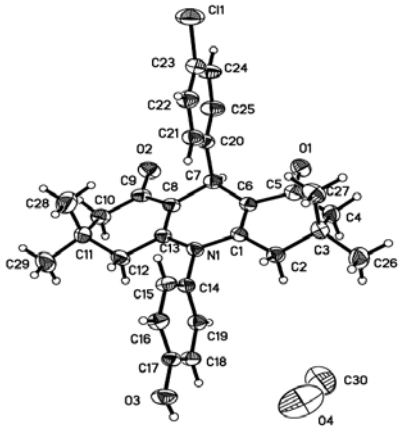


Figure 1 ORTEP diagram of **4f**

In summary, we have described by a novel cascade reaction of schiffs base with cyclic 1,3-dicarbonyl compounds accompanied by breaking C=N bond and formation of new C–N bond. And to our best knowledge, the microwave-assisted this class reaction is seldom reported.

EXPERIMENTAL

Microwave irradiation was carried out in a monomodal Emrys™ Creator microwave synthesizer. Melting points were determined in open capillaries and are uncorrected. The IR spectra were recorded on a TENSOR 27 spectrometer in KBr. ^{1}H NMR spectra were measured on a DPX 400 spectrometer operating at 400 MHz, using DMSO-d_6 as solvent and TMS as internal standard. Elemental analyses were determined by using a Perkin-Elmer 240c elemental analysis instrument.

General Procedure for 4. A mixture of schiff's base **1** (1 mmol), cyclic 1,3-dicarbonyl compounds **2** (2 mmol) and glycol (0.5 mL) were added to the reaction vessel of the monomodal Emrys™ Creator microwave synthesizer and allowed to react under microwave irradiation at 250 W power and 120℃ for several minutes. The automatic mode stirring helps in mixing and the uniform heating of the reactants. The reaction vessel was cooled to room temperature. The solid compound was collected by filtration, washed with water and recrystallized from DMF and ethanol mixture to give pure acridine derivatives **4**.

10-(4-Methyphenyl)-9-(4-nitrophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4a). This compound was obtained as yellow solid (95% ethanol), mp >300°; ir: 2956, 2867, 1638, 1576, 1511, 1470, 1367, 1339, 1220, 1175, 1141, 1017, 999, 917, 828, 742, 694, 663 cm^{-1}. ^{1}H nmr: δ, 8.16 (d, 2H, J=8.8 Hz, ArH), 7.58 (d, 2H, J=8.8 Hz, ArH), 7.35~7.43 (m, 4H, ArH), 5.13 (s, 1H, CH), 2.43 (s, 3H, CH3), 2.19~2.24 (m, 4H, 2×$COCH_2$), 1.79~2.01 (m, 4H, 2×CH_2), 0.88 (s, 6H, 2×CH_3), 0.70 (s, 6H, 2×CH_3). *Anal.* Calcd. for $C_{30}H_{32}N_2O_4$: C, 74.36; H, 6.66; N, 5.78. Found: C, 74.50; H, 6.51; N, 5.92.

10-(4-Methyphenyl)-9-(3-nitrophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4b). This compound was obtained as yellow solid (95% ethanol), mp 291°; ir: 2958, 2872, 1641, 1576, 1527, 1365, 1303, 1260, 1222, 1177, 1144 cm^{-1}. ^{1}H nmr: δ 7.30~8.14 (m, 8H, ArH), 5.15 (s, 1H, CH), 2.42 (s, 3H, CH3), 2.19~2.26 (m, 4H, 2×$COCH_2$), 1.82~2.06 (m, 4H, 2×CH_2), 0.89 (s, 6H, 2×CH_3), 0.70 (s, 6H, 2×CH_3). *Anal.* Calcd. for $C_{30}H_{32}N_2O_4$: C, 74.36; H, 6.66; N, 5.78. Found: C, 74.21; H, 6.69; N, 5.66.

9-(4-Fluorophenyl)-10-(4-methyphenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4c). This compound was obtained as yellow solid (95% ethanol), mp 262~264°; ir: 2962, 2866, 1641, 1575, 1507, 1470, 1361, 1221, 1143, 1025, 995, 887, 841, 738, 712, 659 cm^{-1}; ^{1}H nmr: δ 7.03~7.42 (m, 8H, ArH), 5.03 (s, 1H, CH), 2.42 (s, 3H, CH_3), 2.16~2.21 (m, 4H, 2×$COCH_2$), 1.78~1.99 (m, 4H, 2×CH_2),

0.88 (s, 6H, 2×CH_3), 0.71 (s, 6H, 2×CH_3). *Anal*. Calcd. for $C_{30}H_{32}FNO_2$: C, 78.75; H, 7.05; F, 4.15; N, 3.06; Found: C, 78.92; H, 6.94; N, 3.00.

9-(4-Chlorophenyl)-10-(4-methyphenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4d). This compound was obtained as yellow solid (95% ethanol), mp 274°; ir: 2958, 2891, 1640, 1574, 1512, 1487, 1361, 1298, 1257, 1221, 1144, 1122, 1098, 1015, 887, 841, 732, 712, 667 cm^{-1}. ^1H nmr: δ 7.27~7.42 (m, 8H, ArH), 5.02 (s, 1H, CH), 2.42 (s, 3H, CH_3), 2.17~2.22 (m, 4H, 2×$COCH_2$), 1.78~1.99 (m, 4H, 2×CH_2), 0.88 (s, 6H, 2×CH_3), 0.71 (s, 6H, 2×CH_3). *Anal*. Calcd. for $C_{30}H_{32}ClNO_2$: C, 76.01; H, 6.80; N, 2.95. Found: C, 76.23; H, 6.92; N, 3.01.

9-(3,4-Dichlorophenyl)-10-(4-methyphenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4e). This compound was obtained as yellow solid (95% ethanol), mp 253~255°; ir: 2958, 2870, 1639, 1574, 1511, 1470, 1360, 1263, 1219, 1177, 1142, 1024, 878, 839, 734, 706, 674, 629 cm^{-1}. ^1H nmr: δ 7.26~7.54 (m, 7H, ArH), 5.00 (s, 1H, CH), 2.42 (s, 3H, CH_3), 2.19 (m, 4H, 2×$COCH_2$), 1.81~1.99 (m, 4H, 2×CH_2), 0.88 (s, 6H, 2×CH_3), 0.72 (s, 6H, 2×CH_3). *Anal*. Calcd. for $C_{30}H_{31}Cl_2NO_2$: C, 70.86; H, 6.15; N, 2.75. Found: C, 70.89; H, 6.02; N, 2.88.

9-(4-Chlorophenyl)-10-(4-hydrophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4f). This compound was obtained as yellow solid (95% ethanol), mp >300°; ir: 3262, 2960, 2875, 1642, 1640, 1566, 1515, 1451, 1364, 1316, 1264, 1225, 1177, 1145, 1090, 1013, 886, 852, 782 cm^{-1}. ^1H nmr: δ 10.00 (s, 1H, OH), 6.92~7.30 (m, 8H, ArH), 5.01 (s, 1H, CH), 2.17~2.22 (m, 4H, 2×$COCH_2$), 1.83~2.00 (m, 4H, 2×CH_2), 0.90 (s, 6H, 2×CH_3), 0.72 (s, 6H, 2×CH_3). *Anal*. Calcd. for $C_{29}H_{30}ClNO_3$: C, 73.17; H, 6.35; N, 2.94. Found: C, 73.24; H, 6.26; N, 3.03.

9-(4-Bromophenyl)-10-(4-hydrophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4g). This compound was obtained as yellow solid (95% ethanol), mp >300°; ir: 3162, 2958, 1638, 1564, 1513, 1463, 1365, 1316, 1264, 1178, 1146, 1070, 1009, 887, 850, 734, 779cm^{-1}. ^1H nmr: δ 10.00 (s, 1H, OH), 7.42 (d, 2H, J=8.0 Hz, ArH), 7.24 (d, 2H, J=8.0 Hz, ArH), 6.90-7.22 (m, 4H, ArH), 5.01 (s, 1H, CH), 2.16~2.23 (m, 4H, 2×$COCH_2$), 1.83~2.00 (m, 4H, 2×CH_2), 0.90 (s, 6H, 2×CH_3), 0.72 (s, 6H, 2×CH_3). *Anal*. Calcd. for $C_{29}H_{30}BrNO_3$: C, 66.92; H, 5.81; N, 2.69. Found: C, 70.01; H, 5.94; N, 2.54.

9-(2-Chlorophenyl)-10-(4-methyphenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4h). This compound was obtained as yellow solid (95% ethanol), mp 278~279°; ir: 2938, 2915, 1642, 1571, 1512, 1467, 1445, 1429, 1356, 1288, 1231, 1183, 1137, 1030, 960, 859, 777, 750, 701, 663, 609, 549 cm^{-1}. ^1H nmr: δ 7.30~7.40 (m, 8H, ArH), 5.12 (s, 1H, CH), 2.40 (s, 3H, CH_3), 1.92~1.99 (m, 4H, 2×$COCH_2$), 1.76~1.84 (m, 4H, 2×CH_2), 1.55~1.65 (m, 4H, 2×CH_2). *Anal*. Calcd. for $C_{26}H_{24}ClNO_2$: C, 74.72; H, 5.79; N, 3.35. Found: C, 74.79; H, 5.64; N, 3.44.

10-(4-Methyphenyl)-9-(4-bromophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4i). This compound was obtained as yellow solid (95% ethanol), mp >300°; ir 2944, 2925, 1635, 1572, 1509, 1458, 1423, 1360, 1284, 1230, 1135, 1020, 957, 910, 840, 755 cm^{-1}. ^1H nmr: δ 7.01~7.38 (m, 8H, ArH), 5.12 (s, 1H, CH), 2.40 (s, 3H, CH_3), 1.92~2.28 (m, 8H, 4×CH_2), 1.59~1.65 (m, 2H, CH_2). *Anal*. Calcd. for $C_{26}H_{24}BrNO_2$: C, 67.54; H, 5.23; N, 3.03. Found: C, 67.63; H, 5.06; N, 3.00.

10-(4-Methyphenyl)-9-(3-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4j). This compound was obtained as yellow solid (95% ethanol), mp 248~249°; ir: 2947, 1644, 1574, 1521, 1452, 1433, 1287, 1232, 1186, 1138, 954, 913 cm^{-1}. ^1H nmr: δ 7.26~8.12 (m, 8H, ArH), 5.23 (s, 1H, CH), 2.40 (s, 3H, CH_3), 1.95~2.30 (m, 8H, 4×CH_2), 1.79~1.86 (m, 2H, CH_2), 1.58~1.68 (m, 2H, CH_2). *Anal*. Calcd. for $C_{26}H_{24}N_2O_4$: C, 72.88; H, 5.65; N, 6.54. Found: C, 72.98; H, 5.52; N, 6.62.

10-(4-Methyphenyl)-9-(4-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4k). This compound was obtained as yellow solid (95% ethanol), mp >300°; ir: 2953, 2915, 1631, 1600, 1574, 1511, 1342, 1284, 1230, 1179, 1132 cm^{-1}. ^1H nmr: δ 7.31~8.13 (m, 8H, ArH), 5.23 (s, 1H, CH), 2.40 (s, 3H, CH_3), 1.94~2.89 (m, 8H, 4×CH_2), 1.79~1.85 (m, 2H, CH_2), 1.62~1.65 (m, 2H, CH_2). *Anal*. Calcd. for $C_{26}H_{24}N_2O_4$: C, 72.88; H, 5.65; N, 6.54. Found: C, 72.99; H, 5.39; N, 6.58.

10-(4-Methyphenyl)-9-(3-methoxyl-4-hydroxylphenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4l). This compound was obtained as yellow solid (95% ethanol), mp 269~270°; ir: 3045, 2948, 2931, 2862, 1650, 1623, 1573, 1512, 1468, 1452, 1379,1358, 1287, 1230, 1183, 1132, 1031, 955, 920, 819, 752, 720, 672 cm^{-1}. ^1H nmr: δ 8.60 (s, 1H, OH), 6.64~7.38 (m, 7H, ArH), 5.06 (s, 1H, CH), 3.71 (s, 3H, OCH_3), 2.39 (s, 3H, CH_3), 2.19~2.28 (m, 6H, 3×CH_2), 1.91~1.98 (m, 2H, CH_2),1.80~1.85 (m, 2H, CH_2), 1.60~1.65 (m, 2H, CH_2). *Anal*. Calcd. for $C_{27}H_{27}NO_4$: C, 75.50; H, 6.34; N, 3.26. Found: C, 75.74; H, 6.20; N, 3.12.

10-(4-Methyphenyl)-9-(4-methyphenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4m). This compound was obtained as yellow solid (95% ethanol), mp 216~218°; ir: 2915, 2855, 1642, 1575, 1521, 1452, 1433, 1287, 1286, 1230, 1179, 1132, 1046, 1021, 954, 913, 856, 815, 756, 723 cm^{-1}. ^1H nmr: δ 7.37 (d, 4H, ArH), 7.15 (d, 2H, J=8.0 Hz, ArH), 7.03 (d, 2H, J=8.0 Hz, ArH), 5.10 (s, 1H, CH), 2.40 (s, 3H, CH_3), 2.18~2.24 (m, 9H, 3×CH_2 and CH_3), 1.81~1.99 (m, 4H, 2CH_2), 1.57~1.64 (m, 2H, CH_2). *Anal* Calcd. for $C_{27}H_{27}NO_2$: C, 81.58; H, 6.85; N, 3.52. Found: C, 81.71; H, 6.90; N, 3.43.

10-(4-Methyphenyl)-9-(4-methoxyphenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4n). This compound was obtained as yellow solid (95% ethanol), mp 256~257°; ir: 2938, 1637, 1569, 1509, 1360, 1287, 1232, 1181, 1130, 954, 913, 825, 758 cm^{-1}. ^1H nmr: δ 7.37 (d, 4H, ArH), 7.18 (d, 2H, J=8.8 Hz, ArH), 6.80 (d, 2H, J=8.8 Hz, ArH), 5.07 (s, 1H, CH), 3.70 (s, 3H, OCH_3), 2.40 (s, 3H, CH_3), 2.18~2.25 (m, 6H, 3×CH_2), 1.80~1.83 (m, 4H, 2×CH_2), 1.59~1.61 (m, 2H, CH_2). *Anal*. Calcd. for $C_{27}H_{27}NO_3$: C, 78.42; H, 6.58; N, 3.39. Found: C, 78.63; H, 6.65; N, 3.21.

9-(4-Chlorophenyl)-10-(4-hydrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4o). This compound was obtained as yellow solid (95% ethanol), mp >300°; ir: 3161, 1636, 1561, 1489, 1453, 1385, 1362, 1269, 1234, 1140, 1088, 959 cm^{-1}. ^1H nmr: δ 9.94 (s, 1H, OH), 6.89~7.28 (m, 8H, ArH), 5.11 (s, 1H, CH), 2.17~2.28 (m, 6H, 3×CH_2), 1.96~2.04 (m, 2H, CH_2), 2.18~2.25 (m, 6H, 3×CH_2), 1.80~1.86 (m, 2H, CH_2), 1.59~1.67 (m, 2H, CH_2). *Anal* Calcd. for $C_{25}H_{22}ClNO_3$: C, 71.51; H, 5.28; N, 3.34. Found: C, 71.74; H, 5.13; N, 3.24.

General Procedure for 5. A mixture of schiff's base **1** (1 mmol), cyclic 1,3-dicarbonyl compounds **2** (1 mmol) and glycol (0.5 mL) were added to the reaction vessel of the

monomodal Emrys™ Creator microwave synthesizer and allowed to react under microwave irradiation at 250 W power and 120 ℃ for several minutes. The automatic mode stirring helps in mixing and the uniform heating of the reactants. The reaction vessel was cooled to room temperature. The reaction mixture was poured into water (50 mL), the solid compound was collected by filtration, washed with water and recrystallized from DMF and ethanol mixture to give pure acridine derivatives **5**.

9-(4-Chlorophenyl)-3,3,7-trimethyl-3,4,9,10-tetrahydroacridin-1(2*H*)-one (5a). This compound was obtained as yellow solid (95% ethanol), mp 255~256°; ir: 3270, 1618, 1594, 1488, 1383, 1289, 1262, 1215, 1146, 1089, 1015 cm^{-1}. ^1H nmr: δ 9.41 (s, 1H, NH), 7.23 (d, 2H, J=8.4 Hz, ArH), 7.16 (d, 2H, J=8.4 Hz, ArH), 6.82~6.92 (m, 3H, 5,6,8-H), 5.04 (s, 1H, CH), 1.99-2.51 (m, 7H, 2×CH_2 and CH_3), 1.03 (s, 3H, CH_3), 0.93 (s, 3H, CH_3). *Anal.* Calcd. for $C_{22}H_{22}ClNO$: C, 75.09; H, 6.30; N, 3.98. Found: C, 75.18; H, 6.19; N, 3.77.

9-(4-Bromophenyl)-3,3,7-trimethyl-3,4,9,10-tetrahydroacridin-1(2*H*)-one (5b). This compound was obtained as yellow solid (95% ethanol), mp 240~241°; ir: 3270, 3195, 1696, 1618, 1552, 1486, 1383, 1288, 1260, 1214, 1145 cm^{-1}. ^1H nmr: δ 9.42 (s, 1H, NH), 7.37 (d, 2H, J=8.4 Hz, ArH), 7.11 (d, 2H, J=8.4 Hz, ArH), 6.83~6.92 (m, 3H, 5,6,8-H), 5.02 (s, 1H, CH), 1.95~2.55 (m, 7H, 2×CH_2 and CH_3), 1.03 (s, 3H, CH_3), 0.93 (s, 3H, CH_3). *Anal.* Calcd. for $C_{22}H_{22}BrNO$: C, 66.67; H, 5.60; N, 3.53; Found: C, 66.50; H, 5.49; N, 3.45.

9-(4-Dimethylaminophenyl)-3,3,7-trimethyl-3,4,9,10-tetrahydroacridin-1(2*H*)-one (5c). This compound was obtained as yellow solid (95% ethanol), mp 280~281°; ir: 3256, 3175, 3083, 1614, 1584, 1517, 1389, 1265, 1214, 1038, 1011 cm^{-1}. ^1H nmr: δ 9.28 (s, 1H, NH), 6.95 (d, 2H, J=8.8 Hz, ArH), 6.80~6.86 (m, 3H, 5,6,8-H), 6.53 (d, 2H, J=8.4 Hz, ArH), 4.87 (s, 1H, CH), 1.94-2.46 (m, 7H, 2×CH_2 and CH_3), 1.03 (s, 3H, CH_3), 0.93 (s, 3H, CH_3). *Anal.* Calcd. for $C_{24}H_{28}N_2O$: C, 79.96; H, 7.83; N, 7.77. Found: C, 80.12; H, 7.75; N, 7.64.

9-(4-Chlorophenyl)-7-methyl-3,4,9,10-tetrahydroacridin-1(2*H*)-one (5d). This compound was obtained as yellow solid (95% ethanol), mp 291~293° ; ir: 3268, 3191, 1594, 1489, 1386, 1388, 1306, 1291, 1250, 1189, 1070 cm^{-1}. ^1H nmr: δ 9.48 (s, 1H, NH), 7.36 (d, 2H, J=8.4 Hz, ArH), 7.11 (d, 2H, J=8.4 Hz, ArH), 6.84~6.91 (m, 3H, 5,6,8-H), 5.05 (s, 1H, CH), 2.55~2.62 (m, 2H, CH_2), 2.22~2.27 (m, 2H, CH_2), 2.15 (s, 3H, CH_3), 1.82~1.95 (m, 2H, CH_2). *Anal.* Calcd. for $C_{20}H_{18}NO$: C, 83.30; H, 6.29; N, 4.86. Found: C, 83.48; H, 6.11; N, 4.79.

9-(4-Bromophenyl)-7-methyl-3,4,9,10-tetrahydroacridin-1(2*H*)-one (5e). This compound was obtained as yellow solid (95% ethanol), mp 287~288°; ir: 3267, 1642, 1572, 1510, 1405, 1361, 1284, 1230, 1136, 1069, 1009 cm^{-1}. ^1H nmr: δ 9.47 (s, 1H, NH), 7.44 (d, 2H, J=8.4 Hz, ArH), 7.11 (d, 2H, J=8.4 Hz, ArH), 6.83~6.92 (m, 3H, 5,6,8-H), 5.07 (s, 1H, CH), 2.50~2.60 (m, 2H, CH_2), 2.20~2.25 (m, 2H, CH_2), 2.14 (s, 3H, CH_3), 1.80~1.90 (m, 2H, CH_2). *Anal.* Calcd. for $C_{20}H_{18}BrNO$: C, 65.23; H, 4.93; N, 3.80. Found: C, 65.46; H, 4.86; N, 3.65.

General Procedure for 6. A mixture of schiff's base **1** (1 mmol), cyclic 1,3-dicarbonyl compounds **2** (2 mmol), ammonium acetate (1.5 mmol) and glycol (0.5 mL) were added to the reaction vessel of the monomodal EmrysTM Creator microwave synthesizer and allowed to react under microwave irradiation at 250 W power and 120℃ for several minutes. The automatic mode stirring helps in mixing and the uniform heating of the reactants. The reaction vessel was cooled to room temperature. The reaction mixture was poured into water (50 mL), the solid compound was collected by filtration, washed with ethanol and recrystallized from ethanol to give pure acridine derivatives **6**.

9-(2,4-Dichlorophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (6a). This compound was obtained as yellow solid (95% ethanol), mp >300°; ir: 3279, 3193, 3070, 2943, 2873, 1643, 1604, 1489, 1464, 1395, 1362 cm^{-1}. ^1H nmr: δ 9.51 (s, 1H, NH), 7.11~7.76 (m, 3H, ArH), 5.05 (s, 1H, CH), 2.48~2.52 (m, 4H, 2×$COCH_2$), 2.11~2.22 (m, 4H, 2×CH_2), 1.86~1.93 (m, 2H, CH_2), 1.73~1.80 (m, 2H, CH_2). *Anal.* Calcd. for $C_{19}H_{17}Cl_2NO_2$: C, 63.00; H, 4.73; N, 3.87. Found: C, 63.12; H, 4.61; N, 3.69.

9-(4-Bromophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (6b). This compound was obtained as yellow solid (95% ethanol), mp >300°; ir: 3273, 3203, 2931, 2882, 1644, 1597, 1472, 833, 753 cm^{-1}. ^1H nmr: δ 9.48 (s, 1H, NH) 7.35 (d, 2H, J=8.4 Hz, ArH), 7.10 (d, 2H, J=8.4 Hz, ArH), 4.87 (s, 1H, CH), 2.49~2.56 (m, 4H, 2×$COCH_2$), 2.16~2.26 (m, 4H, 2×CH_2), 1.89~1.95 (m, 2H, CH_2),1.71~1.84 (m, 2H, CH_2). *Anal.* Calcd. for $C_{19}H_{18}BrNO_2$: C, 61.30; H, 4.87; N, 3.76; Found: C, 61.21; H, 4.71; N, 3.83.

9-(2-Chlorophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (6c). This compound was obtained as yellow solid (95% ethanol), mp >300°; ir: 3288, 2946, 2880, 2762, 1970, 1930, 1645, 1609, 1489 cm^{-1}. ^1H nmr: δ 9.48 (s, 1H, NH), 7.25~7.28(m, 1H, ArH), 7.14~7.18(m, 2H, ArH), 7.03~7.06(m, 1H, ArH), 5.11 (s, 1H, CH), 3.66 (s, 3H, OCH_3), 2.47~2.50 (m, 4H, 2×$COCH_2$), 2.11~2.18 (m, 4H, 2×CH_2), 1.82~1.93 (m, 2H, CH_2), 1.68~1.78 (m, 2H, CH_2). *Anal* Calcd. for $C_{19}H_{18}ClNO_2$: C, 69.62; H, 5.53; N, 4.27. Found: C, 69.69; H, 5.49; N, 4.25.

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