

NITROGEN BRIDGEHEAD COMPOUNDS. PART 54¹. NEW ROUTE FOR THE
PREPARATION OF 2,3a,6a-TRIAZAPHENALENE SKELETON

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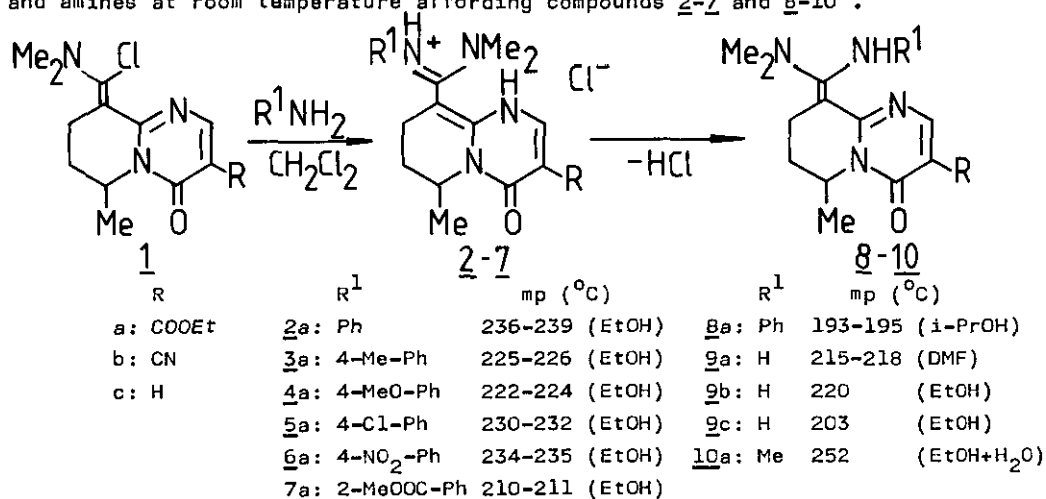
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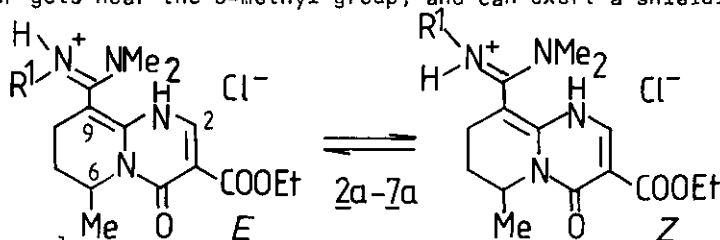
Abstract - A new approach for the synthesis of 2,3a,6a-triaza-
phenalene skeleton has been developed by the reaction of 9
with aldehydes.

In our previous papers^{1,2} we have reported the preparation of 2,3a,6a-triazaphe-
nalenium quaternary salts and some representatives of the neutral species. These
routes are not suitable for the syntheses of derivatives unsubstituted in posi-
tion 3. Therefore we have developed a new method which can be widely used in the
preparation of the title compounds. Compounds 1^{3,4} smoothly react with ammonia
and amines at room temperature affording compounds 2-7 and 8-10⁵.



As shown by the ¹H NMR spectra compounds 2-7 are present as Z-E equilibrium mix-
tures. Assignment was made on the basis of the 6-methyl signals, which in one of
the isomers exhibited an anomalous diamagnetic shift. Considering that the rota-
tion of the exocyclic amidine group is strongly hindered, the N-phenyl group of

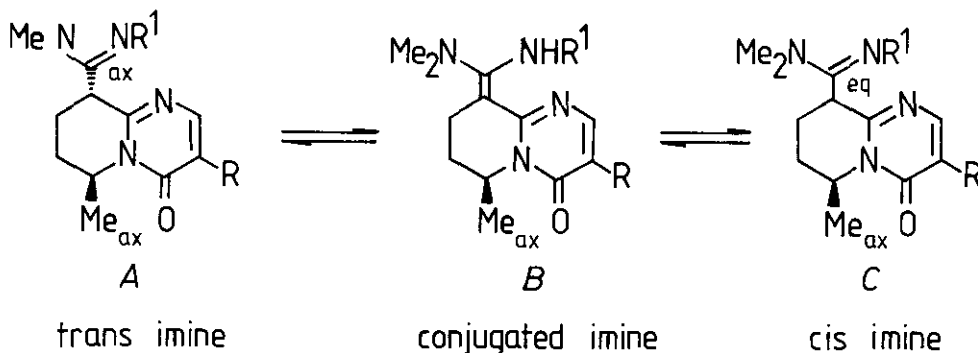
the E isomer gets near the 6-methyl group, and can exert a shielding effect.



Characteristic ^1H NMR shifts of compounds 2a-7a; JEOL-FX-100; in CDCl_3 (TMS)

Com- pound	<u>E</u> Isomer			<u>Z</u> Isomer			<u>E</u> : <u>Z</u> Ratio
	6-Me	H-2	NH	6-Me	H-2	NH	
<u>2a</u>	0.67d	8.08d $\Delta=4\text{Hz}$	11.50d 10.58s	1.13d	8.12d $\Delta=4\text{Hz}$	11.45 d 10.60 s	50:50
<u>3a</u>	0.64d	8.08d $\Delta=6\text{Hz}$	11.56d 10.49s	1.09d	8.14d $\Delta=6\text{Hz}$	11.50 d 10.60 s	45:55
<u>4a</u>	0.65d	8.09d $\Delta=5.5\text{Hz}$	11.56d 10.54s	1.09d	8.15d $\Delta=5.5\text{Hz}$	11.50 d 10.60 s	45:55
<u>5a</u>	0.74d	8.07d $\Delta=5.5\text{Hz}$	11.56d 10.60s	1.12d	8.14d $\Delta=5.5\text{Hz}$	11.50 d 10.68 s	45:55
<u>6a</u>	-	-	-	1.08d	8.05s	12.20br 11.00br	0:100
<u>7a</u>	0.82d	8.21d $\Delta=6\text{Hz}$	12.55d 10.32s	1.17d	8.28d $\Delta=6\text{Hz}$	13.00 d 10.57 s	40:60

Compounds 8a-10a may exhibit tautomerism between forms A, B, and C. According to their ^1H NMR and ^{13}C NMR spectra, compounds 9b and 9c really shows this equilibria but in 9b, B isomer (86%) predominates to such a great extent that we have failed in the correct assignment of isomers A (5%) and C (9%).

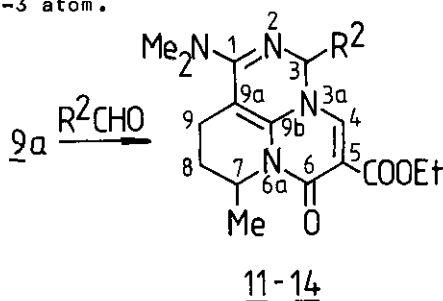


^1H NMR shifts of compound <u>9c</u> JEOL-FX-100 in CDCl_3 (TMS)									
Isomer	6-Me	H-2	H-3	H-6	H_2 -7, H_2 -8	H-9	NMe_2	NH	Ratio
<u>A</u>	1.40d	7.81d $^3\text{J}=7\text{Hz}$	6.35dd $^6\text{J}_{3,9}=1\text{Hz}$	5.02m	1.70-2.65m	4.13m	3.00s	8.60br	18%
<u>B</u>	1.28d	7.61d	5.78d	5.02m	1.70-2.65m	-	2.85s	8.60br	60%
<u>C</u>	1.46d	7.83d	6.38dd $^6\text{J}_{3,9}=0.5\text{Hz}$	5.02m	1.70-2.65m	4.10m	3.02s	8.60br	22%

^{13}C NMR shifts of compound <u>9c</u> JEOL-FX-100 in CDCl_3 (TMS)											
Isomer	C-2	C-3	C-4	C-6	C-7	C-8	C-9	C-9a	6-Me	NCN	$(\text{CH}_3)_2\text{N}$
<u>A</u>	152.2*	113.1	162.6	47.8*	24.1	20.0	43.9	158.8	19.3	164.3	38.5*
<u>B</u>	151.0	103.0	162.6	45.3	26.7	20.3	79.0	158.9	17.7	165.0	40.5
<u>C</u>	152.4*	112.9	162.6	47.9*	27.4	21.9	46.3	158.8	19.0	164.3	38.7*

*, +, and x interchangeable

Compound 9a readily cyclizes with aldehydes affording the triazaphenalene derivatives 11-14. Compound 9a (3 mmole) was reacted with 38% aqueous CH_2O (0.5 ml) in CH_2Cl_2 (15 ml) at ambient temperature for 12 h to give compound 11 in yield 70%. Compound 9a (5 mmole) was reacted with aldehyde (25 mmole) in ethanol (20 ml) at reflux temperature for 5-10 h to give tricyclic compounds 12-14 in yield 65-75%. The cyclization proceeds highly stereoselectively, as ^1H and ^{13}C NMR spectra show in all cases the formation of single stereoisomer. We have recently described that in the thermodynamically more stable form the 2,3a,6a-triazaphenalenium salts contain the R^2 group in pseudo-axial position trans to the 7-Me group.² Compounds 12-14 are very likely to be the same structure but NMR data do not offer enough evidence for the determination of the geometry of the C-3 atom.



	R^2	mp ($^{\circ}\text{C}$)	
<u>11</u>	H	160	(EtOH)
<u>12</u> *	i-Pr	186	(EtOH)
<u>13</u>	Pr	96-98	(Et ₂ O)
<u>14</u> **	Ph	146	(EtOH)

*: picrate salt, **: perchlorate salt

Characteristic ^1H NMR shifts of compounds 11-14; JEOL-FX-100 in CDCl_3 (TMS)

Compound	$(\text{CH}_3)_2\text{N}$	H-3	H-4	H-7	7- CH_3	$(\text{C}(8)\text{H}_2-\text{C}(9)\text{H}_2)$
<u>11</u>	2.77s	4.90d ⁺ 5.05d ⁺	7.79s	5.06m	1.22d	1.6-2.6m
<u>12</u> [*]	3.24s	5.18d	8.03s	5.02m	1.28d	1.2-3.0m
<u>13</u>	2.76s	5.16t	7.81s	4.88m	1.21d	1.0-2.8m
<u>14</u> ^{**}	3.24s	6.82d	8.80s	4.90m	1.28d	1.7-3.0m

+ $^2\text{J} = 13\text{Hz}$, * picrate salt, ** perchlorate salt

Characteristic ^{13}C NMR shifts of compounds 11-14; JEOL-FX-100 in CDCl_3 (TMS)

Compound	C-1	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-9a	C-9b	$(\text{CH}_3)_2\text{N}$	CH_3
<u>11</u>	141.8	68.2	147.7	101.0	163.7	45.3	25.8	18.8	86.8	156.3	40.4	15.2
<u>12</u> [*]	146.7	74.6	148.0	104.5	157.4	46.9	25.8	19.3	82.1	154.9	41.6	15.5
<u>13</u>	138.5	68.7	148.0	100.0	160.4	45.2	25.6	18.7	85.4	156.3	40.0	15.7
<u>14</u> ^{**}	146.0	67.7	148.6	104.4	156.8	46.8	25.3	18.8	83.3	154.4	41.7	15.3

* picrate salt, ** perchlorate salt

These new 2,3a,6a-triazaphenalene derivatives can be quaternized on the N-2 atom furnishing the same triazaphenelenium salts prepared by direct cyclization. Therefore this route is regarded as a structure proving synthesis of the 2,3a,6a-triazaphenelenium derivatives we have recently described.²

REFERENCES AND NOTES

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5. A solution of compound 1 (10 mmol) and aromatic amine (20 mmol) in CH_2Cl_2 (20 ml) was refluxed for 3 h. The precipitated amine hydrochloride was filtered off and the filtrate was evaporated to dryness in vacuo. The residue was recrystallized from ethanol. Yield 80-90%. The bases can be liberated with aqueous Na_2CO_3 solution. Compounds 9-10 can be prepared with excess of gaseous ammonia or methylamine in similar manner. Yield 80-85%.

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