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REACTION OF 10-CYANOTETRAHYDRO-BENZO[*b*][1,6]NAPHTHYRIDINES WITH ACETYLENEDICARBOXYLIC ESTER

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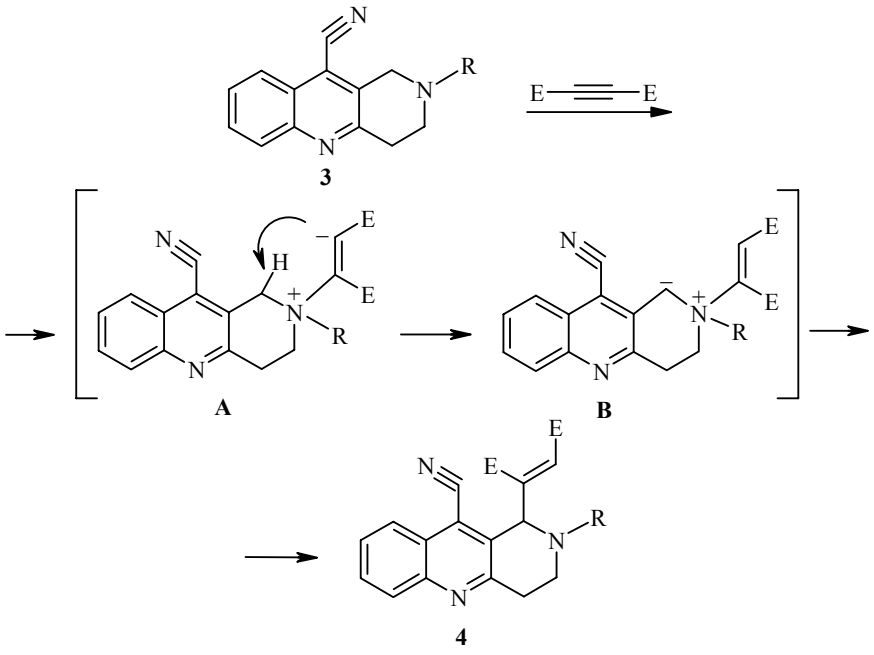
We recently showed that the tetrahydropyridine moiety in tetrahydropyrrolo[3,2-*c*]pyridines and tetrahydro-γ-carbolines, when treated with activated alkynes, depending on the solvent used is either cleaved to form alkoxy derivatives **1** [1] or expands to an eight-membered ring to form condensed azocines **2** [2].

While studying the reaction of tetrahydrobenzo[*b*][1,6]naphthyridine (**3**) [3] (where the π-deficient 4-cyanoquinoline moiety is condensed with the tetrahydropyridine moiety) with acetylenedicarboxylic ester (ADCE) in methanol, instead of the expected azocinoquinoline we obtained the product of a Stevens rearrangement: dimethyl ester of 2-(2-methyl-10-cyano-1,2,3,4-tetrahydrobenzo[*b*][1,6]naphthyridin-1-yl)but-2-enedioic acid (**4**).



E = COOMe; R = *i*-Pr

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The reaction probably occurs *via* formation of a zwitterion **A**, and due to the electron-acceptor effect of the quinoline moiety, the protons of the 1-CH_2 group can be eliminated by the anionic center of the zwitterion **A**, as a result of which the ylide **B** is formed. Rearrangement of the latter leads to benzonaphthyridine **4**. The structure of compound **4** was established using X-ray diffraction analysis and confirmed by the set of spectral data.

Dimethyl Ester of (*Z*)-2-(2-Isopropyl-1,2,3,4-tetrahydro-10-cyanobenzo[*b*][1,6]-naphthyridin-1-yl)butene-2-dioic Acid (4). A mixture of benzonaphthyridine **3** (0.5 g, 2.0 mmol) and ADCE (0.31 ml, 2.5 mmol) in absolute methanol (5 ml) was stirred for 4 h at ~20°C (monitored by TLC, Silufol, ethanol). The methanol was distilled off under vacuum, the residue was recrystallized from an ethyl acetate–hexane mixture. We obtained 0.30 g (38%) of compound **4**: light yellow crystals; mp 135-137°C. Mass spectrum, *m*/*z* (I_{rel}, %) 393 $[M]^+$ (16), 378 (30), 350 (21), 334 (23), 251 (20), 250 (100), 234 (18), 208 (40), 206 (20), 193 (15). ^{1}H NMR spectrum (400 MHz, $CDCl_3$), δ, ppm (*J*, Hz): 8.13 (2H, m, H-6, H-9); 7.80 (1H, m, H-7); 7.68 (1H, m, H-8); 5.84 (1H, s, =C<u>H</u>–CO_2Me); 5.32 (1H, s, H-1); 3.79 (3H, s, O–CH_3); 3.70 (3H, s, O–CH_3); 3.39 (1H, m, CH-*i*-Pr); 3.22-2.9 (4H, m, 3-, 4-CH_2); 1.14 (3H, d, *J* = 6.0, CH_3); 1.11 (3H, d, *J* = 6.0, CH_3). ^{13}C NMR spectrum (100 MHz, $CDCl_3$), δ, ppm: 166.8, 164.5, 157.9, 150.2, 146.5, 131.5, 130.9, 129.2, 128.4, 124.7, 124.6, 122.8, 117.4, 113.9, 61.2, 52.1, 51.8, 50.4, 39.9, 31.2, 20.9, 18.4. Found, %: C 67.32; H 5.92; N 10.91. $C_{22}H_{23}N_3O_4$. Calculated, %: C 67.16; H 5.89; N 10.68.

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REFERENCES

1. T. N. Borisova, L. G. Voskressensky, L. N. Kulikova, T. A. Soklakova, and A. V. Varlamov, *Molecular Diversity*, **6**, 207 (2003).
2. A. V. Varlamov, T. N. Borisova, L. G. Voskressensky, T. A. Soklakova, L. N. Kulikova, A. I. Chernyshev, and G. G. Alexandrov, *Tetrahedron Lett.*, **43**, 6767 (2002).
3. F. Gatto, M. Rosaria del Giudice, and C. Mustazza, *J. Heterocycl. Chem.*, **33**, 1807 (1996).
4. J. H. Brewster and M. M. Kline, *J. Am. Chem. Soc.*, **74**, 5179 (1953).