Tetrahedron Letters No. 48, pp 4239 - 4240, 1975. Pergamon Press. Printed in Great Britain.

THE REACTION OF TRIALKYLBORANES AND ACYL HALIDES ON PHENYLMAGNESIUM BROMIDE. THE SYNTHESIS OF *ortho*-ALKYLACYLOPHENONE

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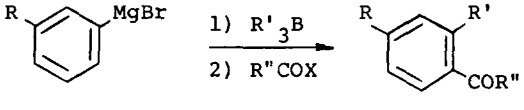
(Received in Japan 10 September 1975, received in UK for publication 13 October 1975)

Recently, boron ate complexes have found widespread use as versatile nucleophilic reagents for many novel reactions leading to the synthesis of olefins, acetylenes, ketones as well as alkylbenzenes.[1] This paper describes a new regioselective synthesis of *ortho*-alkylacylophenones by the reaction of acyl halide to an assumed trialkylphenylborate prepared from phenylmagnesium bromide and trialkylborane.

To an ether solution of phenylmagnesium bromide [I (R = H), 6.3 ml of 0.8 M solution, 5 mmol of PhMgBr] 490 mg (5 mmol) of triethylborane was added at room temperature.[2] The whole mixture was stirred at room temperature for 1 h, then cooled (-78°), 1.26 g (25 mmol) of acetyl chloride was added and the whole was allowed to warm gradually up to 0° (1 h). Water (15 ml) and 25 ml of 3 N sodium hydroxide were added and the ethereal solution was separated and condensed. Gas-chromatographic analyses showed that the main product was *ortho*-ethylacetophenone [II (R = H, R' = Et, R" = Me), 69% yield].[3] The *para*-isomer could not be detected. A pure sample was obtained by column chromatography (Silica gel, benzene).[4]



I

II

Following *ortho*-alkylacylophenones (II, R = H) are prepared analogously: R', R", yield %, X, (ref.); Et, Me, 71, Br, (3); Et, Pr, 35, Cl, (7); Pr, Me, 23, Cl, (8); Pr, Me, 25, Br, (8); Pr, Pr, 20, Cl; Bu, Me, 19, (9); Bu, Me, 23, (9); Bu, Pr, 22, Cl; i-Pr, Me, 2, Cl, (10).

When phenyllithium was used in place of phenylmagnesium bromide, mixtures of ethylacetophenones (yield 20%, *ortho para* = 94.6) and propylacetophenones (yield 24%, *ortho para* = 71:29) were obtained.[11]

The utility of the *ortho*-selective reaction was illustrated by another sample. When *meta*-tolylmagnesium bromide (I, R = Me) was treated with triethylborane and acetyl chloride, 2-ethyl-4-methylacetophenone (II, R = Me, R' = Et, R" = Me) was obtained as the only isolable ketone (yield 33%).[12,13]

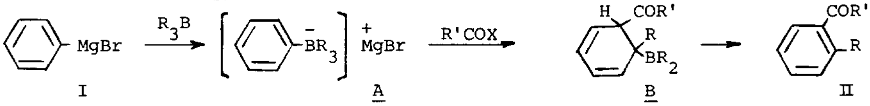
REFERENCES AND NOTES

1 For recent publications see following references as well as those cited therein Lithium trialkylalkynylborates (a) P Binger and R Koster, Synthesis, 350 (1974), (b) K Utimoto, T Furubayashi, and H Nozaki, Chem Lett , 397 (1975), (c) A Suzuki, N Miyaura, S Abiko, M Itoh, H C Brown, J A Sinclair, and M M Midland, J. Amer Chem Soc , 95, 3080 (1973), (d) A Pelter, C Subrahmanyam, R J Laub, K J Gould, and C R Harrison, Tetrahedron Letters, 2961 (1974) Lithium trialkylvinylborates (e) K Utimoto, K Uchida, and H Nozaki, Chem Lett , 1493 (1974). Lithium trialkylphenylborates (f) E Negishi and R E Merrill, Chem Commun , 860 (1974)

2 A heavy viscous oil separated out

3 W Winkler, Chem Ber , 81, 256 (1948)

4 The above described reaction could be explained by assuming (1) the formation of trialkylphenylborate (A) (ref 5), (2) electrophilic acylation occurring selectively on ortho-position, (3) concerted or successive alkyl migration from boron to carbon to form B and (4) dehydroboration of B to II or alternative oxidation (ref 6)



5 Complex formation in the reaction of PhMgBr and R_3B was evidenced by heavy oil separation Efforts for identifying the complex A were fruitless

6 Aromatization of similar dihydrobenzenes was discussed also by Negishi and co-workers[1f]

7 F Weygand, H Weber, and E Maekawa, Chem Ber , 90, 1879 (1957)

8 B B Elsner, H E Strauss, and E J Forbes, J Chem Soc , 578 (1957)

9 E. A Braude, E R H Jones, F Sondheimer, and J B Toogood, J Chem Soc , 607 (1949)

10 K S Dhami and J. B Stothers, Tetrahedron Letters, 631 (1964)

11 A mixture of *ortho*- and *para*-dialkylbenzenes was obtained from lithium trialkylphenylborate.[1f]

12 Ir (neat) 1680, 1605, 1580, 1550, 1460, 1350, 1265, 1230, 1140, 950, 805 cm^{-1}, uv (EtOH) λ_{max} 252 nm (ε = 9000), nmr (CCl_4) δ ppm, 1 17 (3H, t, J = 7 Hz), 2 36 (3H, s), 2 45 (3H, s), 2 85 (2H, q, J = 7 Hz), 7 00 (2H, m), 7 54 (1H, broad d, J = 9 Hz), ms m/e (rel %), 162 (M^+, 33), 147 (100), 119 (20), 105 (7), 91 (22), 77 (11)

13 The authors wish to thank the Ministry of Education, Japan, for a Grant-in-aid (911506)