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SELECTIVE REACTIONS OF ALKYLATED 1-ACYL-2,2-DIBROMOCYCLOPROPANES

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The preparation of several 1-acyl-2,2-dibromocyclopropanes has been reported recently by Barlet[1)] using phase transfer conditions. We are interested in certain reactions of this class of compounds and a preliminary report on our work is presented here. The compounds used in this study are recorded in Table 1. A substituent in α-position appears to be a prerequisite for cyclopropane formation[1)] since reactions of phorone or mesityl oxide gave none of the desired products. It is also worth noting that the addition to carvone was quite regioselective, no compound arising from addition to the exocyclic double bond was detected.

Selective reduction of the dibromocyclopropyl ketones <u>1</u>-<u>5</u> to the monobromides was achieved in good yields with tributyltin hydride (BTH) (Table 2), in each case a mixture of stereoisomers was obtained. On the other hand exclusive reduction of the carbonyl group was obtained using lithium aluminium hydride (LAH) or sodium borohydride (SBH). With LAH as reducing agent the alcohols were isolated in good yields, however, with SBH satisfactory yields were only obtained with ketones <u>1</u> and <u>5</u> (Table 2).

Reaction between ketone <u>1</u> and methyllithium gave as the only isolable product 1-acetyl-2-bromo-1-methylcyclopropane (<u>6</u>) with the bromine and acetyl group in an E configuration. The yield did vary with the order of admixture being 5% when the base was added to <u>1</u> and 43% with the inverse addition. In both cases the main product was a high-boiling residue.

Clearly methyllithium undergoes metal-halogen exchange considerably faster than addition to the carbonyl group. The organolithium derivative formed is usually unstable and eliminates lithium bromide to give a carbene or carbenoid$^{2)}$. The products detected will then be derived from this intermediate. However, relatively stable organolithium derivatives have been observed in cases where the oxygen atom of an ether function coordinates with lithium$^{3)}$. We believe this explains the formation of 6E and the necessity for adding the ketone to methyllithium, the high-boiling residue probably results from reaction of the organolithium intermediate with the carbonyl group of another molecule of 1.

Table 1

Reaction between bromoform and α,β-unsaturated ketones under phase transfer conditions$^{1)}$

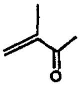
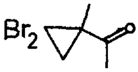
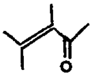
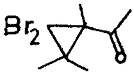
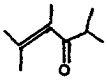
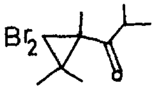
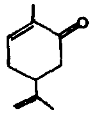
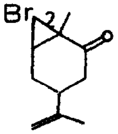
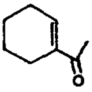
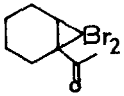
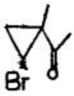
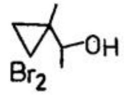
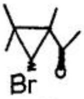
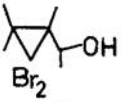
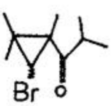
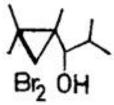
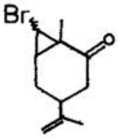
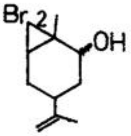
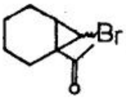
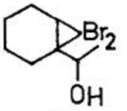
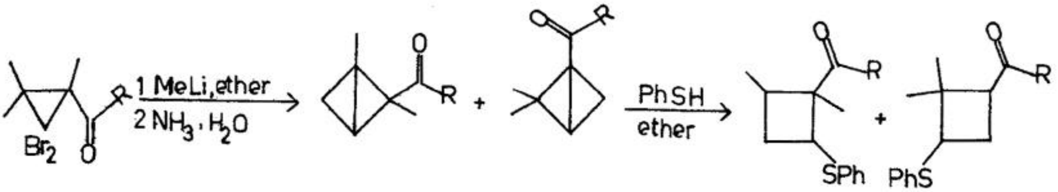
Ketone	gem-Dibromocyclopropane		Yield (%)
		(1)	79
		(2)	21
		(3)	30
		(4)	87
		(5)	20

Table 2

Reduction of 1-acyl-2,2-dibromocyclopropanes

Ketone	Reducing agent				
	TBH	(yield %)	LAH (yield %)		SBH (yield %)
1	 6	(88)	(95)	 7	(82)
2	 8	(75)	(85)	 9	(30)
3	 10	(90)	(60)	 11	(0)
4	 12	(90)	(90)	 13	(20)
5	 14	(90)		 15	(90)



R = Me	2	16a	17a	18a	19a
R = i-Pr	3	16b	17b	18b	19b

Scheme 1

Reaction of 3 with methyllithium gave a mixture of substituted bicyclo-1,1,0 butanes 16b and 17b[4)] in 90% yield (Scheme 1). Addition of thiophenol[4b)] to an ether solution of this product gave a mixture of isomeric phenylthio-cyclobutanes in 90% yield (Scheme 1). In the same way an isomeric mixture of sulfides 18a and 19a was prepared in 50% yield from dibromoketone 2. Treatment of the dibromides 4 and 5 with methyllithium resulted in at least ten products which have not yet been identified.

Reaction of alcohol 7 with two equivalents of methyllithium gave 3-methyl--1,2-pentadien-4-ol (20) as the exclusive product in 83% yield, thus, the allenyl alcohol 20 is available through three simple steps from commercially available starting material in better than 60% overall yield.

References

1) R. Barlet, C.R. Akad. Sc. Paris (C), 278, 621 (1974).

2) W. Kirmse, Carbene Chemistry, Academic Press, 1971, ch. 12.

3) K.G. Taylor, W.E. Hobbs, M.S. Clark, and J. Chaney, J. Org. Chem., 37, 2436 (1972) and references therein.

4) a) W.R. Moore, S.S. Hall, and C. Largman, Tetrahedron Lett., 4353 (1969)
   b) L. Skattebøl, ibid., 2361 (1970).