Resistance to Spectinomycin Determined by R Factors of Various Compatibility Groups

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R factor mediated resistance to spectinomycin (an antibiotic aminoglycoside) was reported by Smith in 1967. He observed that several R factors (all of which conferred streptomycin resistance on their hosts) also conferred spectinomycin resistance. He found that several of the spectinomycin-resistant bacteria carried *fi*⁺ R factors but that in at least one strain the resistance was determined by an *fi*⁻ R factor (Smith, 1967). Benveniste, Yamada & Davies (1970) showed that R factor mediated resistance to both streptomycin and spectinomycin was conferred by streptomycin/spectinomycin adenylate synthetase. R factor mediated resistance to streptomycin (without spectinomycin resistance) was shown to be due to production of streptomycin phosphotransferase (Ozanne, Benveniste, Tipper & Davies, 1969).

In a recent review, Davies, Brzezinska & Benveniste (1971) conclude that these two enzymes were responsible for all R-mediated resistance to streptomycin or spectinomycin investigated in their laboratory or in other laboratories studying inactivation of aminoglycosides by the Enterobacteriaceae. If this conclusion is generally valid we can identify the enzyme responsible for inactivation of streptomycin by testing for coincident spectinomycin resistance.

The resistance patterns to streptomycin and spectinomycin determined by R factors of various compatibility groups are reported here.

METHODS

Bacteria. *Escherichia coli* K12, J53 *met pro* (Clowes & Hayes, 1968).

R factors. Listed in Table 1.

Resistance determination. Resistances to streptomycin and spectinomycin were detected by streaking over nutrient agar dishes containing streptomycin (15 µg/ml) or spectinomycin (50 µg/ml).

RESULTS AND DISCUSSION

Resistance to streptomycin and spectinomycin of J53 carrying R factors of various compatibility groups are listed in Table 1.

The *fi*⁺ R factors tested all gave resistance to both streptomycin and spectinomycin (or to neither). Thus, presumably all inactivate these aminoglycosides by adenylation. Smith (1967) reported some bacteria carrying *fi*⁺ R factors resistant to streptomycin but not to spectinomycin. Possibly, the streptomycin resistance of these strains was determined by covert *fi*⁻ R factors also present in the bacteria (see Romero & Meynell, 1969).

All but one of the I-like R factors tested failed to confer spectinomycin resistance. We, therefore, believe that the plasmids of this group that confer streptomycin resistance do so by phosphorylation. R62 is an unusual R factor since it is a member of the I-like compatibility group, being incompatible with R144 (Hedges & Datta, unpublished) produces I-like

Table 1. Resistance to spectinomycin conferred by R factors which determine streptomycin resistance

Compatibility group	<i>fi</i> character	Phenotype of J53 carrying the plasmid		Reference
		Resistant to streptomycin and spectinomycin	Resistant to streptomycin but sensitive to spectinomycin	
F _{II}	<i>fi</i> ⁺	R1, R2, R28, R52, R73, R77, R82, R114, R192, R196, R312	None	Lawn <i>et al.</i> (1967)
I		R222		Watanabe <i>et al.</i> (1964)
	<i>fi</i> ⁺	R62		Lawn <i>et al.</i> (1967)
	<i>fi</i> ⁻		R64, R92, R163, R302, R306, R307, R308, R313 _r	Lawn <i>et al.</i> (1967)
N	<i>fi</i> ⁻	N3, R15, R46		Datta & Hedges (1971)
		RM98		Khatoun & Iyer (1971)
		R132, R48	R348N, R269N	Hedges (1972)
		R390, R395, R396, R398, R400		Coetzee, Datta & Hedges (1972)
W	<i>fi</i> ⁻	S-a, RA3, RA4	None	Hedges & Datta (1971)
T	<i>fi</i> ⁻	R402	R401	Coetzee <i>et al.</i> (1972)
Unclassified	<i>fi</i> ⁻		R300, R305, R310	Lawn <i>et al.</i> (1967)

pili and yet is *fi*⁺. Unlike other I-like R factors it confers resistance to ampicillin (Lawn, Meynell, Meynell & Datta, 1967). This plasmid probably contains genetic information derived from an F-like plasmid and the streptomycin/spectinomycin resistance determinant may be part of this heritage.

Most N plasmids which confer resistance to streptomycin also confer spectinomycin resistance. There are, however, two exceptions (see Table 1).

Three R factors, R300, R305 and 310, confer resistance to streptomycin but not to spectinomycin. These three *fi*⁻ plasmids, all carrying streptomycin and sulphonamide resistances, are compatible with N and with I-like R factors (unpublished data). They may all be members of a single compatibility group but the identity of their resistances makes it impossible to test this point. All plasmids of the W group which conferred streptomycin resistance also conferred spectinomycin resistance.

Like the N group, the T group includes plasmids showing both types of streptomycin resistance.

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