

Abstract

The influence of two DNA gyrase inhibitors, nalidixic acid and novobiocin, on DNA synthesis in isolated pea chloroplasts was examined. Novobiocin at $1\text{--}5\text{ mol m}^{-3}$ markedly lowered [^3H]thymidine incorporation into DNA (30–95% inhibition); while less effective, nalidixic acid at similar concentrations also diminished incorporation (25–35% inhibition). The inhibition of chloroplast DNA (ctDNA) biosynthesis by nalidixic acid and novobiocin was confirmed by autoradiography and densitometry. These data are consistent with the view that chloroplasts contain a DNA gyrase-like enzyme which is necessary for DNA replication. Despite this, interpretation of the results is not straightforward, as both nalidixic acid and novobiocin also inhibited photosynthetic activity. Each substance (at millimolar levels) reduced ferricyanide-dependent O_2 evolution in isolated chloroplasts. However, at lower concentrations ($0.05\text{--}0.3\text{ mol m}^{-3}$) they slightly enhanced photosynthetic electron flow; thus, these compounds may act as uncouplers of photophosphorylation as well as inhibitors of electron transport. Nalidixic acid and novobiocin at relatively low (0.1 mol m^{-3}) concentrations also strongly reduced CO_2 -dependent O_2 evolution (an index of CO_2 photo-assimilation) in isolated plastids. Thus, caution must be exercised in assessing results from studies in which nalidixic acid and novobiocin are used with whole plants, cells, protoplasts or isolated chloroplasts.