2-methyl-2-imidazoline, also known as lysidine, is a non-planar heterocyclic molecule containing two $^{14}$N quadrupolar nuclei and one methyl group. The rotational spectra of this molecule were recorded in the frequency range from 7 to 20 GHz using a pulsed molecular jet Fourier transform microwave spectrometer\(^a\) and in selected frequency regions between 90 and 220 GHz using two different millimetre-wave spectrometers\(^{bc}\). Lysidine displays a very rich millimetre wave spectrum presumably attributable to the presence of two large amplitude motions in the molecule: an internal rotation of the methyl group and a ring-puckering motion. The decimetre-wave spectra are even more complex as the hyperfine structure arising from the nuclear quadrupole coupling interactions of two $^{14}$N nuclei is also resolved. The first analysis of this challenging spectrum guided by quantum chemical calculations is reported in the present contribution.