Laser ablation molecular beam Fourier transform microwave spectroscopy LA-MB-FTMW has provided the first observation of the rotational spectra of the glycine-H$_2$O complex.\textsuperscript{a} As a continuation of this work we present the study of monohydrated complexes of alanine, uracil and thymine and the first observations of the dihydrated clusters glycine-(H$_2$O)$_2$ and alanine-(H$_2$O)$_2$. For the microsolvated amino acids only the conformer with cis-COOH configuration and bifurcated NH$_2$····O=C H-bond has been observed. Both alanine-H$_2$O and glycine-H$_2$O have similar shapes: the water molecule being bonded through two O-H···O hydrogen bonds to the carboxylic group of the amino acid. The dihydrated clusters have also comparable structures where the two water molecules form a cycle with the COOH group through sequential H-bonds. The rotational spectra of uracyl-H$_2$O and thymine-H$_2$O show the same complexity than those of the bare molecules\textsuperscript{b,c} due to the hyperfine structure of two quadrupolar $^{14}$N atoms. The detected conformers show comparable structures with the water molecule bonded through two N-H···O and O-H···O=C hydrogen bonds to the N bases. The structure of hydrogen bond has been investigated by isotopic substitution.