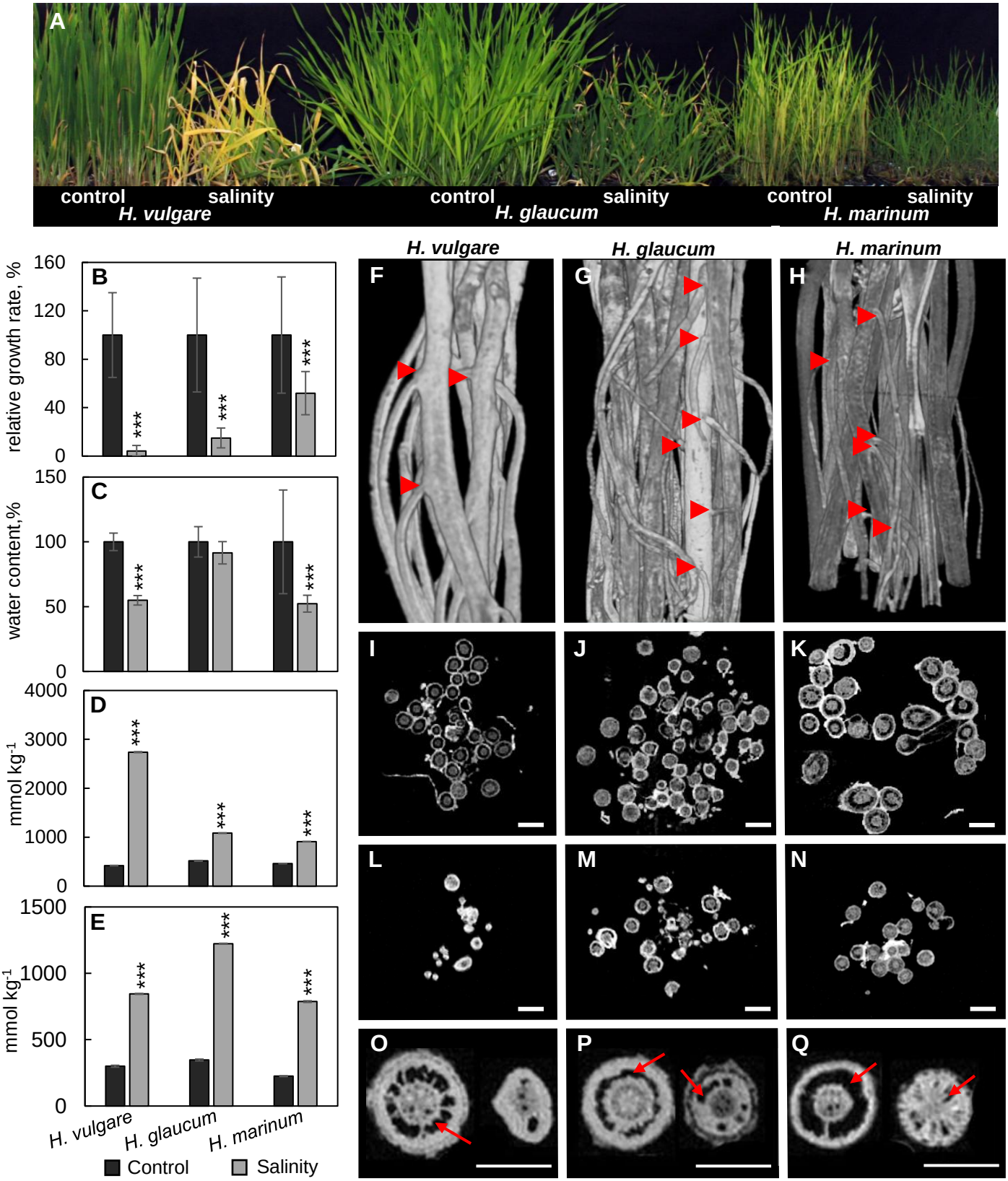

Fig. 1 Phenotypic appearance of *Hordeum vulgare*, *H. glaucum* and *H. marinum* plants grown under control hydroponic and salinity stress conditions. (a) Shoot phenotype; (b) Relative growth rate; (c) Plant water content; (d-e) Osmotic pressure of tissue sap from shoots (d) and roots (e). Data are mean ± SD; n = 5, *t* significant at: ***, $P < 0.001$. (f-q) Root phenotypes as analyzed by Magnetic Resonance Imaging. (f-g) 2D projections of 3D images of salt-stressed roots of *H. vulgare* (f), *H. glaucum* (g) and *H. marinum* (h). The 3D images are shown in the Supplemental Movies S1 and S2. Red triangles point to root branches. (i-n) Virtual cross sections of control (i-k) and salt-stressed roots (l-n) of *H. vulgare* (i, l), *H. glaucum* (j, m) and *H. marinum* (k, n). (o-q) Virtual cross sections of individual control (left) and salt-stressed roots (right) of *H. vulgare* (o), *H. glaucum* (p) and *H. marinum* (q). Bars, 1 mm in (i-n), 500 µm in (o-q).

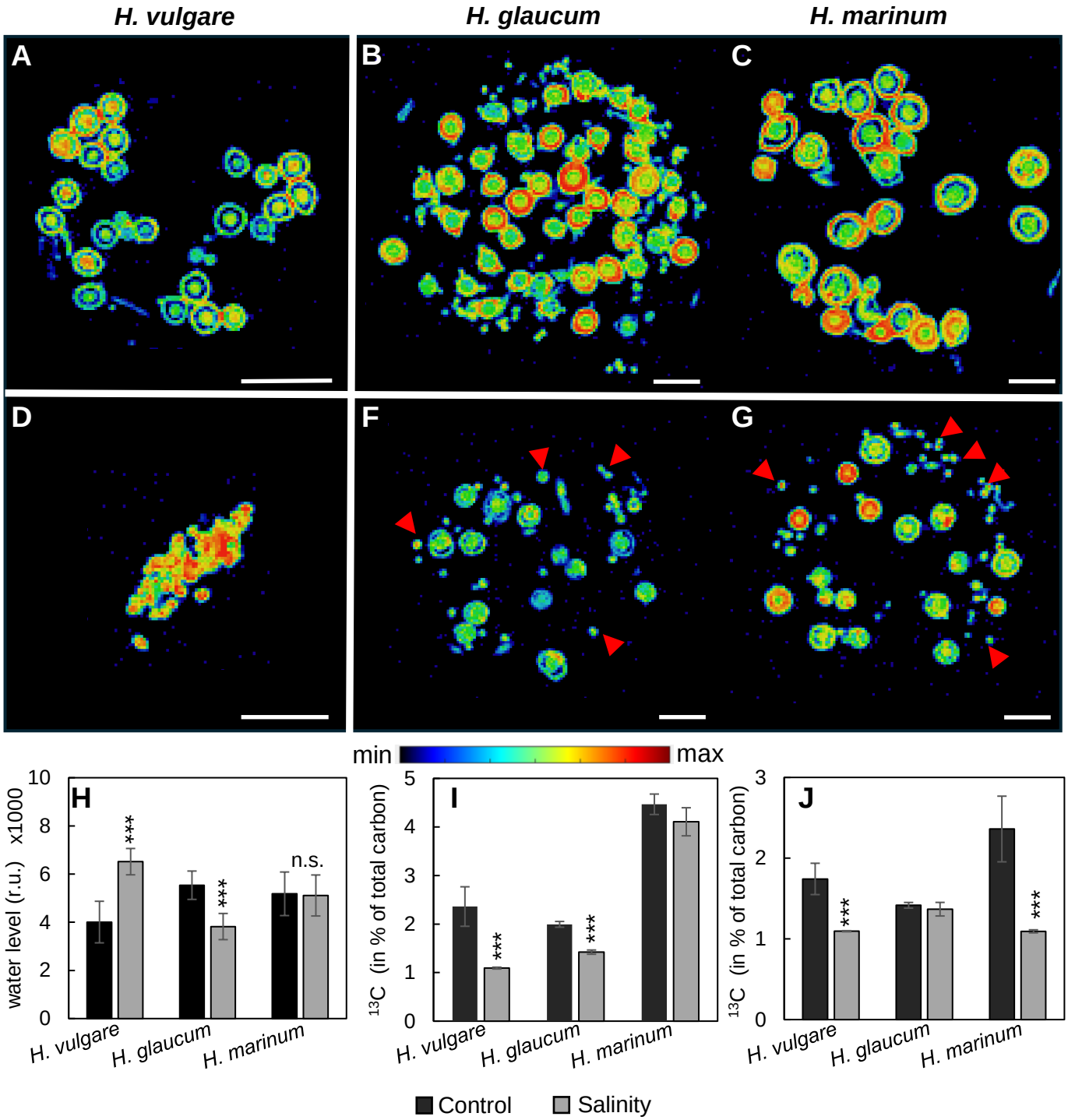

Fig. 2 Root water distribution, and ^{13}C-uptake and distribution in plants under hydroponic control and salt-stressed conditions. (a-g) Water distribution in virtual cross sections of control (a-c) and salt-stressed roots (d-g) of *H. vulgare* (a, d), *H. glaucum* (b, f) and *H. marinum* (c, g) as analyzed by Magnetic Resonance Imaging. Min/max values of the color bar represent the relative water concentrations. Red triangles indicate new formed roots under salinity stress. Bars, 1 mm in (a, d), 500 µm in (b, c, f, g). (h) Quantification of water content in roots of three barley species analyzed in (a-g). (i, j) ^{13}C-uptake and distribution in shoots (i) and roots (j) of three barley species under control and salinity stress conditions. Data are mean ± SD; n = 7-25 in (h), = 3-5 in (i, j), *t* significant at: ***, $P < 0.001$, n.s., not significant.

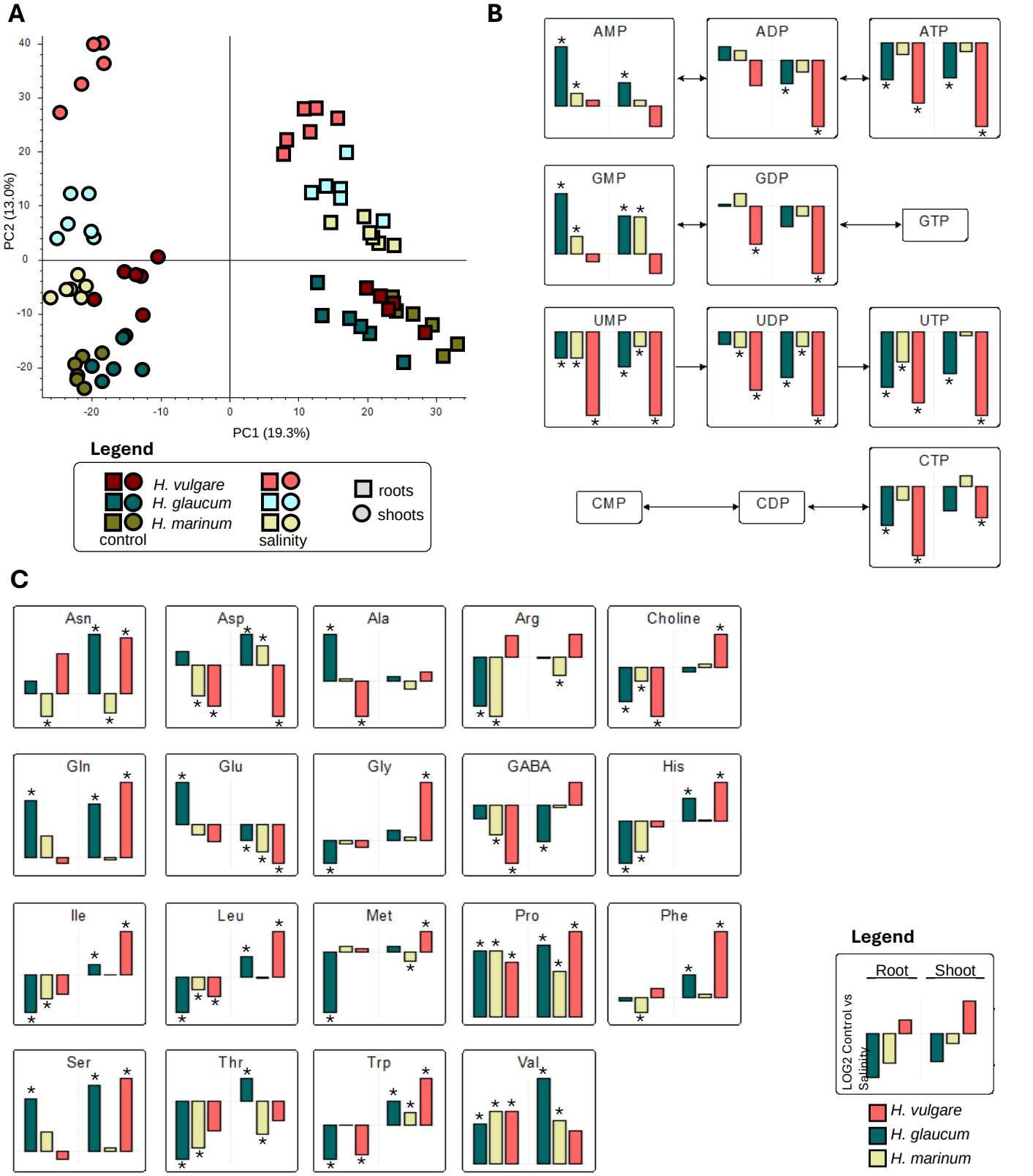

Fig. 3 The effect of salinity stress on metabolite content in three barley species. (a) Principal component analysis of metabolite distribution in roots and shoots of *H. vulgare*, *H. glaucum* and *H. marinum* plants grown under control and salinity stress conditions. (b, c) Changes in nucleotide (b) and amino acid content (c). Metabolomic data in (b, c) are shown as $\log_2$(fold-change) values of the relation salinity to control, negative values mean decreased metabolite content, positive values – increased metabolite content. Adjusted *p*-values were calculated using Benjamini-Hochberg correction method and significantly different values are indicated by *, $P < 0.05$ (n = 6).

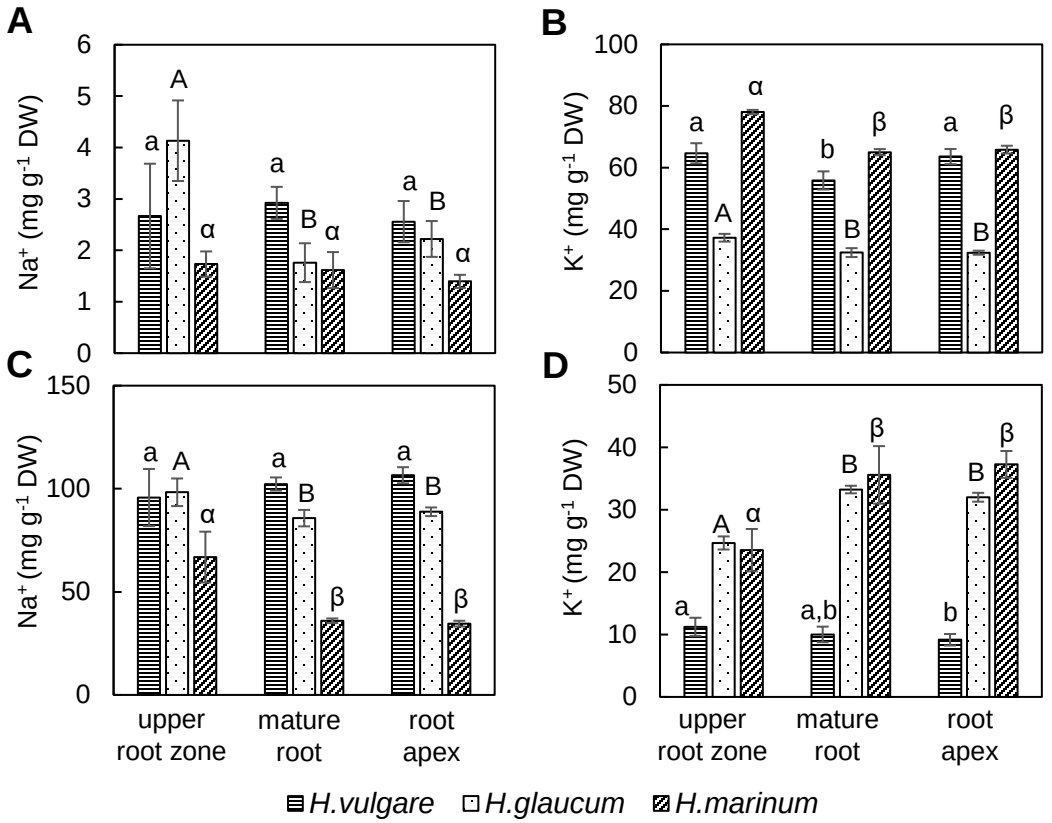

Fig. 4 Na^+ (a, c) and K^+ (b, d) accumulation in different root zones of *H. vulgare*, *H. glaucum* and *H. marinum* plants grown under control hydroponic (a, b) and salinity stress conditions (c, d). Data are mean ± SD; n = 4, values followed by the same letter (Latin lowercase for *H. vulgare*, Latin uppercase for *H. glaucum* and Greek lowercase for *H. marinum*) do not differ significantly by ANOVA test at $p < 0.05$.

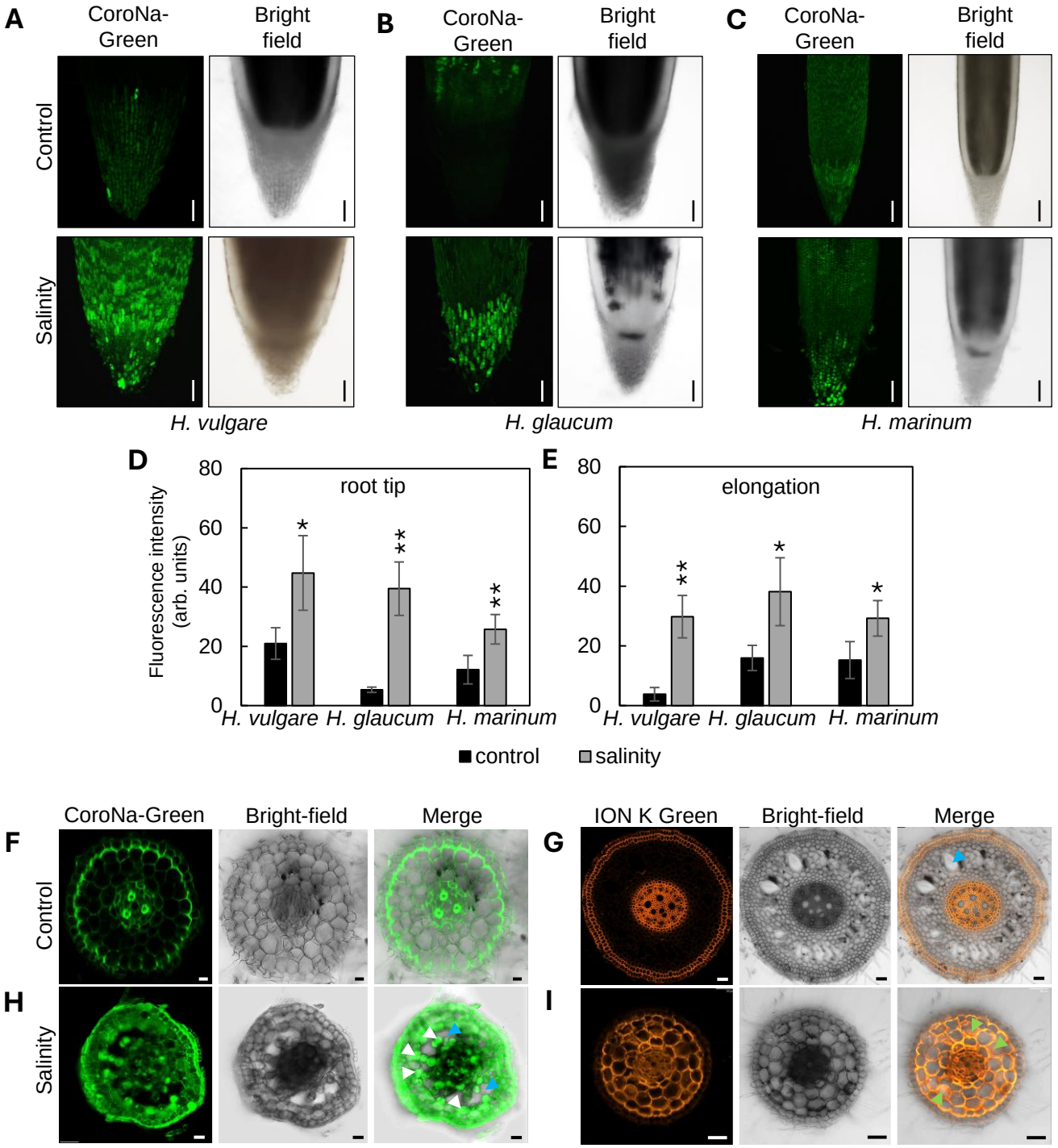

Fig. 5 Accumulation and patterning profiles of Na^+ and K^+ in roots of barley species grown under control and salinity stress conditions. (a-c) The representative images of Na^+ distribution within control (above left) and stressed roots (below left) of *H. vulgare* (a), *H. glaucum* (b) and *H. marinum* as visualized by CoroNa Green (c). Panels next to fluorescence images represent respective bright field images. Bars, 100 µm. (d, e) Quantification of intensity of CoroNa Green fluorescence in root tips (d) and elongation zone (e). Data are mean ± SD; n = 3-4, *t* significant at: *, $P < 0.05$; **, $P < 0.01$. (f-i) Na^+ (f, h) and K^+ distribution (g, i) in the upper parts of *H. marinum* roots grown under control (f, g) and salinity stress conditions (h, i) as analyzed by CoroNa Green and ION Potassium Green-2 AM staining, correspondingly. Vacuoles filled by Na^+ are indicated by white arrowheads, cytosolic K^+ - by green arrowheads and aerenchyma zone - by blue arrowheads. Bars, 50 µm.

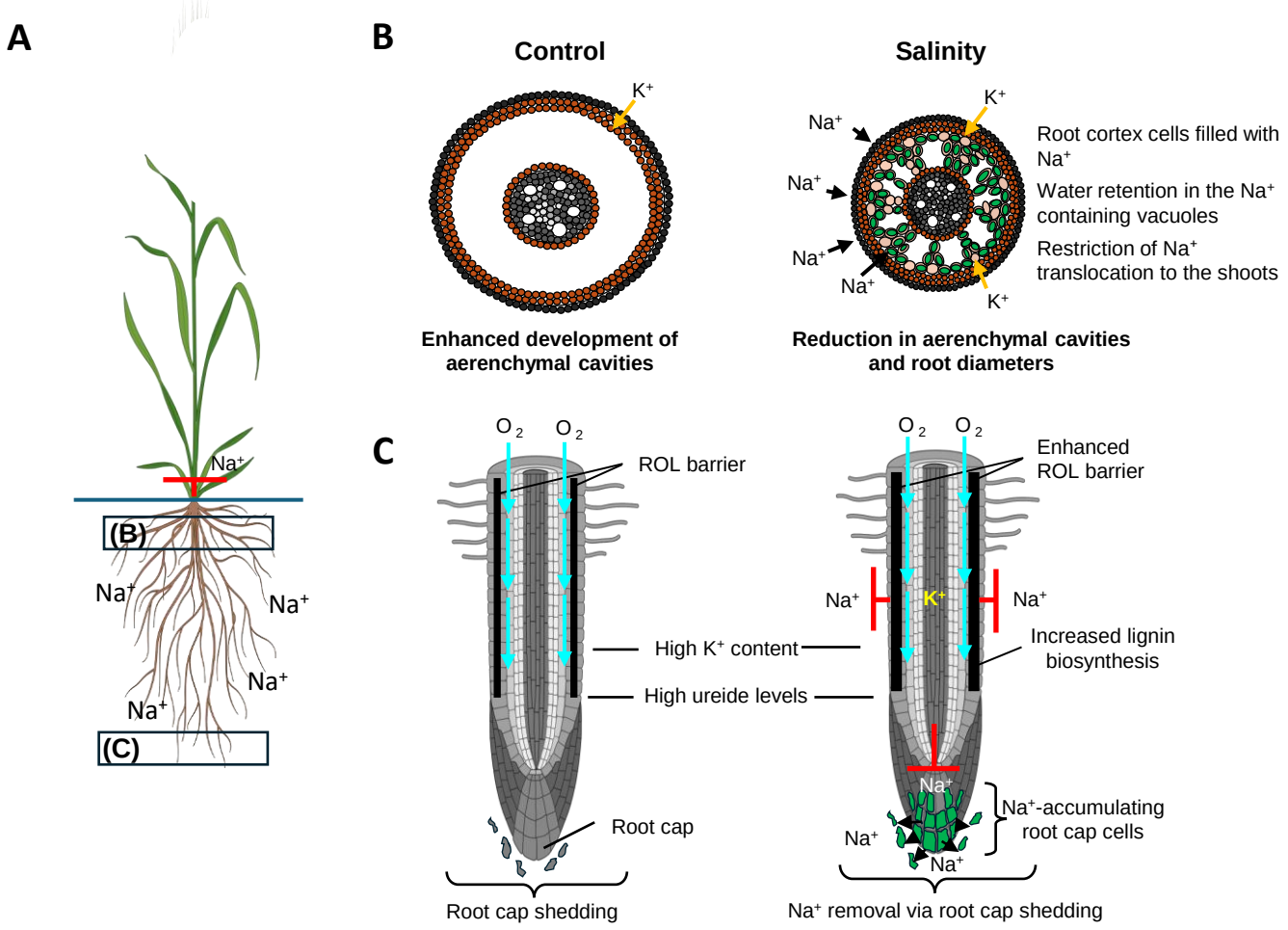

Fig. 6. A schematic overview of the main processes occurring during waterlogging and salinity stress in different root zones of *H. marinum*. (a) An experimental scheme. Positions of roots, shown in detail in (b) and (c), are labelled by black boxes. (b, c) Adaptation processes occurred in the upper parts of newly developed adventitious and lateral roots (b), and root tips and elongation zones (c) of *H. marinum* roots in response to waterlogging (left) and combined salinity and waterlogging stresses (right). Black arrows indicate the directions of Na^+ transport, blue arrows indicate movement of O_2, and red T-lines indicate restriction of Na^+ transport. Vacuoles accumulating Na^+ are shown in green, cytosol with K^+ in orange, and green patches indicate Na^+ in the cells. Abbreviation: ROL, radial oxygen loss. The images were created with partial help of BioRender (https://biorender.com).