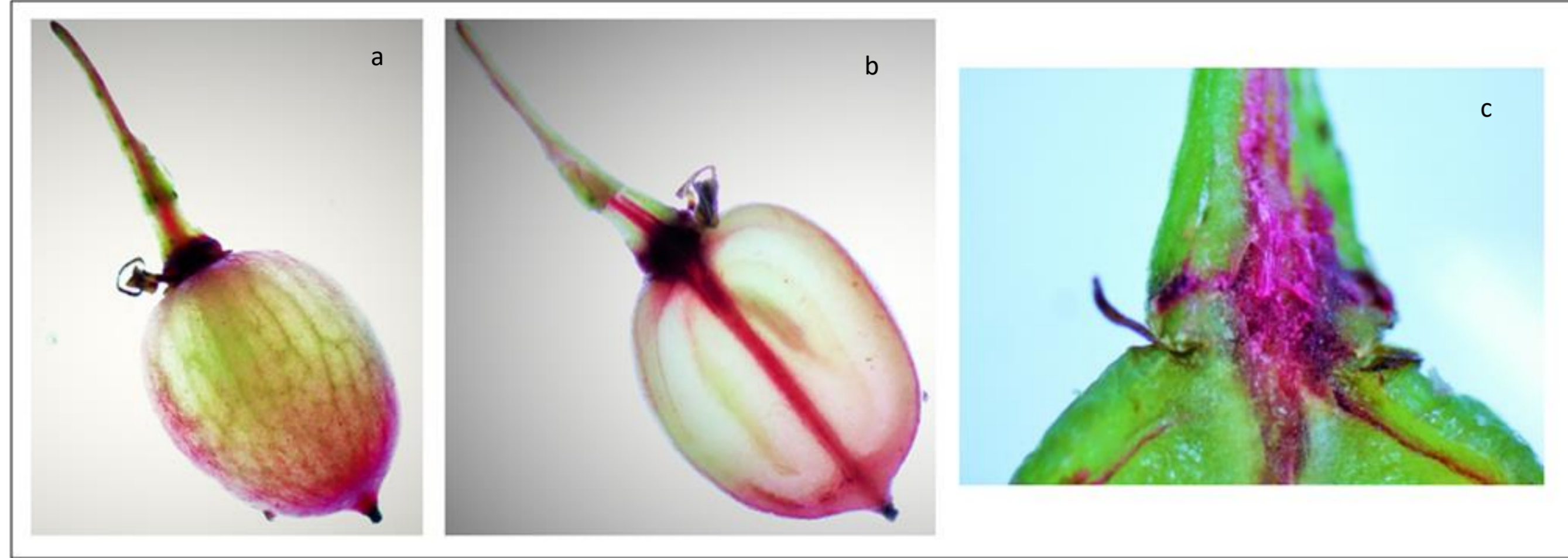


Objectives:

The berry shrinking in cv Shiraz (*Vitis vinifera* L.) is to date much debated, in order to understand: a) the role of the xylem during post-véraison; b) the existence and timing of xylematic back flow and c) the functionality of the phloem.

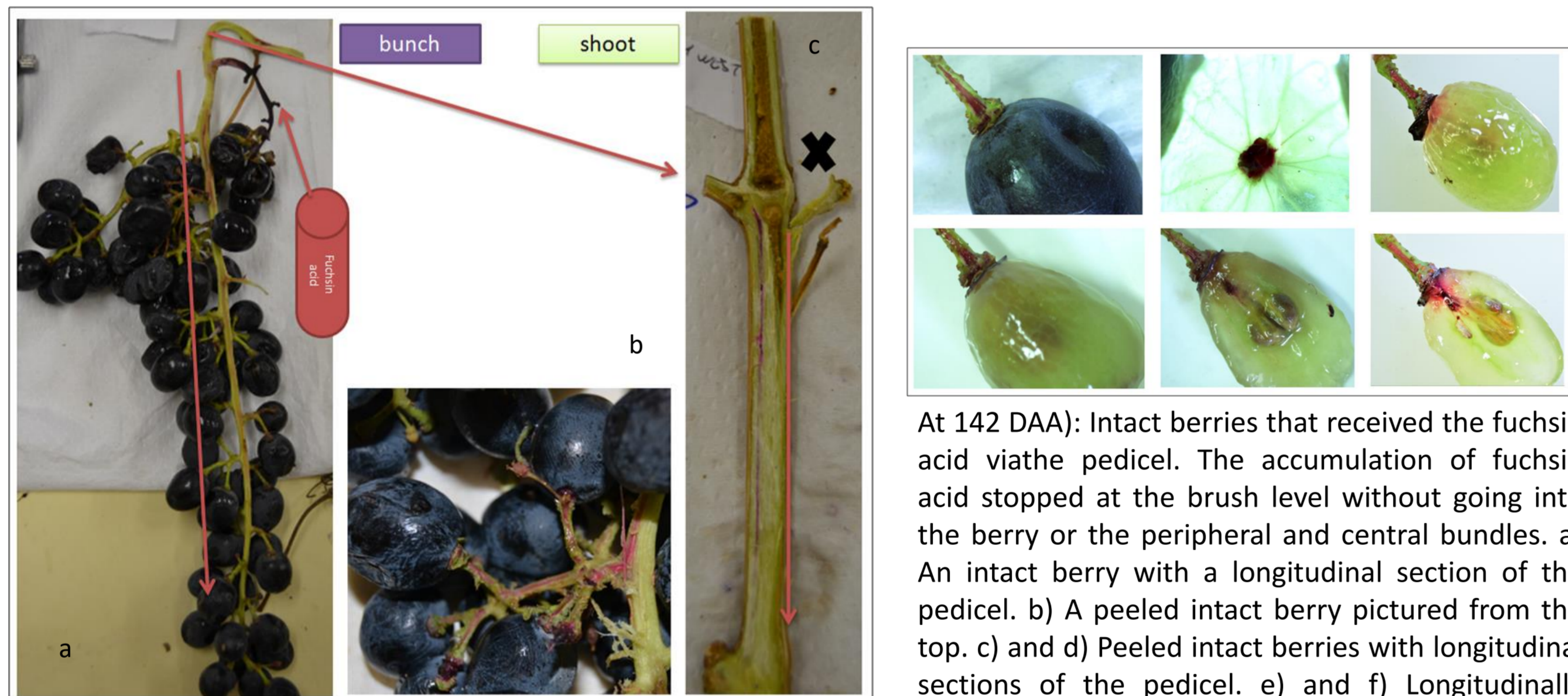
To solve these issues, we traced the xylematic flows from the vine to the berry and vice versa by using the fuchsin acid as a xylematic tracer. At berry maturity, in order to verify also the phloematic functionality, we used the fluorescent tracer 6(5)-carboxyfluorescein diacetate (CFDA).



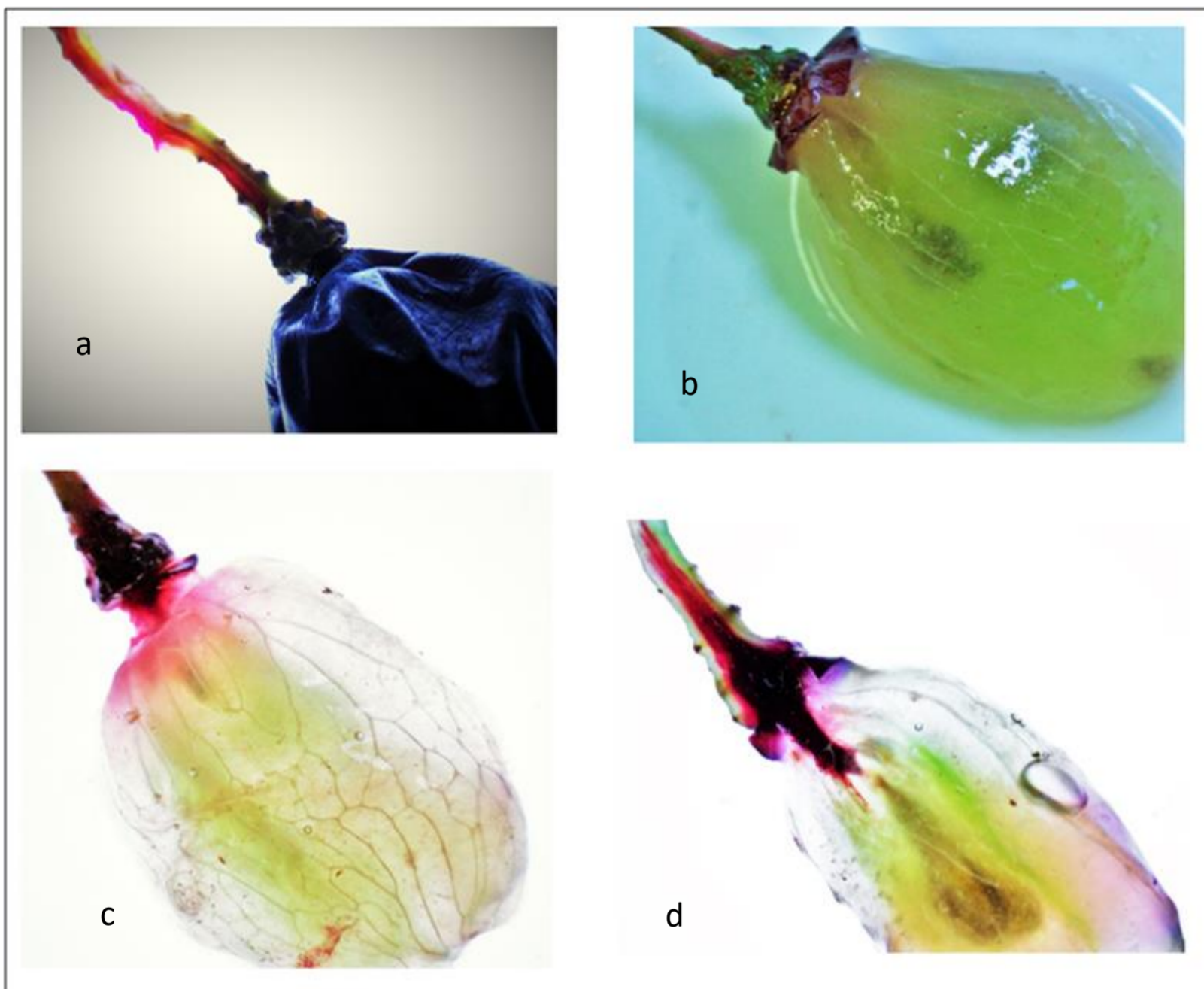
At 38 days after anthesis (DAA): Fuchsin acid absorption by a wing of the bunch. a) A whole berry in which water passage from the rachis to the pedicel is shown. The epidermal staining highlights the berry transpiration. b) A longitudinal section of the berry to show water movement into the central vasculature. c) Longitudinal section of the berry pedicel interface.



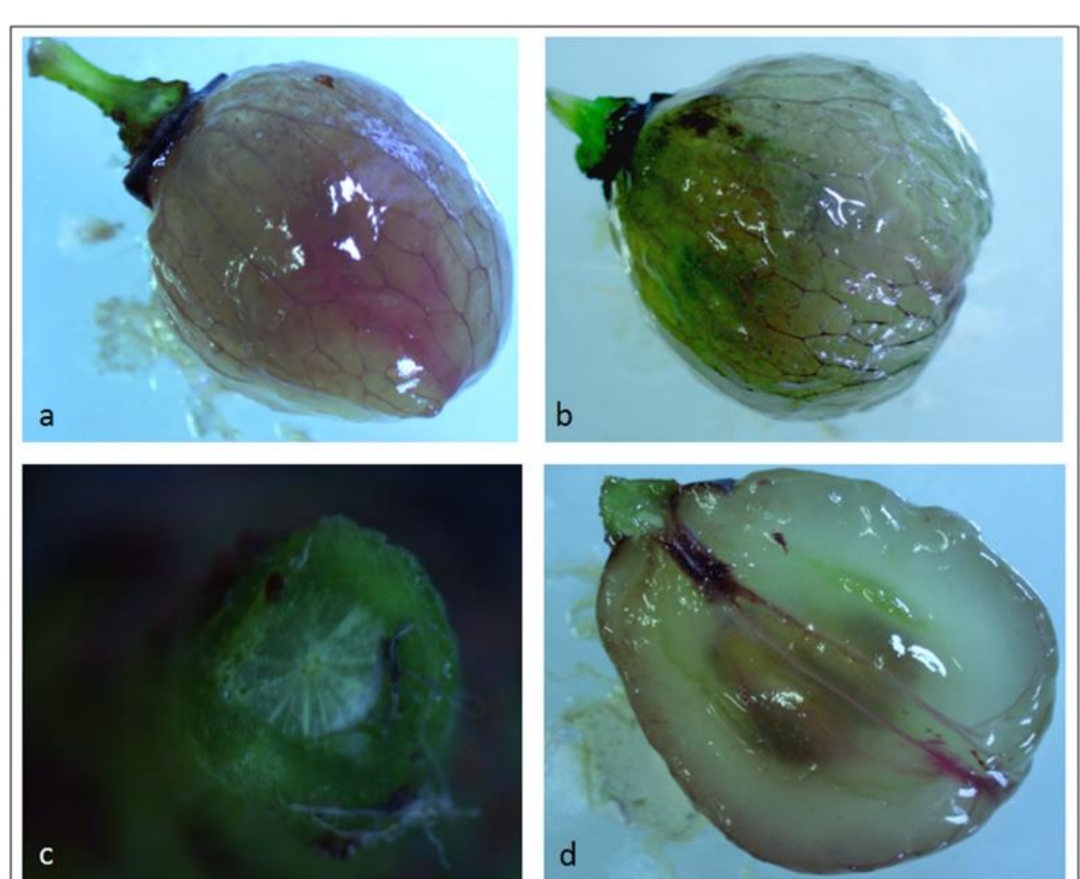
At 45 DAA: Absorption of the dye solution by the shoot basal part without shoot disconnection. a) Technique used to absorb the fuchsin acid via the shoot. b) Hydric flow stained with fuchsin acid and the water clearly flowing from the bottom part of the shoot towards the bunch. c) Staining of the leaf veins.



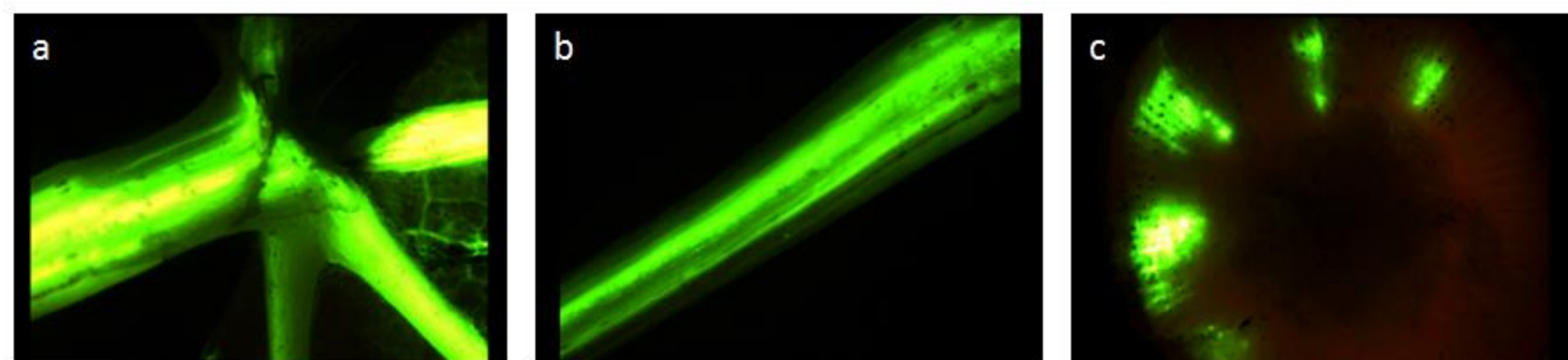
At 142 DAA: After absorption by the bunch, the fuchsin acid goes into the rachis (a), towards the pedicels (b), from the bunch to the shoot (c), and then towards the basal part.



At 142 DAA: Shrivelled berries that received the fuchsin acid via the pedicel showing an accumulation of fuchsin acid at the brush level without entering the berry or the peripheral and central bundles. a) A whole shrivelled berry with a longitudinal section of the pedicel. b) and c) A whole peeled shrivelled berry with a longitudinal section of the pedicel. d) Longitudinally dissected peeled shrivelled berries.



At 116 DAA: Fuchsin acid absorption by the berry. a) and b) Whole peeled berries with fuchsin acid distribution inside peripheral bundles, but without movement towards the pedicel: no xylematic back-flow. c) Pedicel cross section: no trace of fuchsin acid. d) Pedicel longitudinal section of the shrivelled berry.



At 112 DAA: CFDA absorption by the leaf. Observations were made by means of a fluorescence microscope. a) CFDA distribution inside the leaf veins observed with a longitudinal section. b) CFDA distribution inside the petiole observed with a longitudinal section. c) CFDA distribution inside the shoot observed with a cross section.

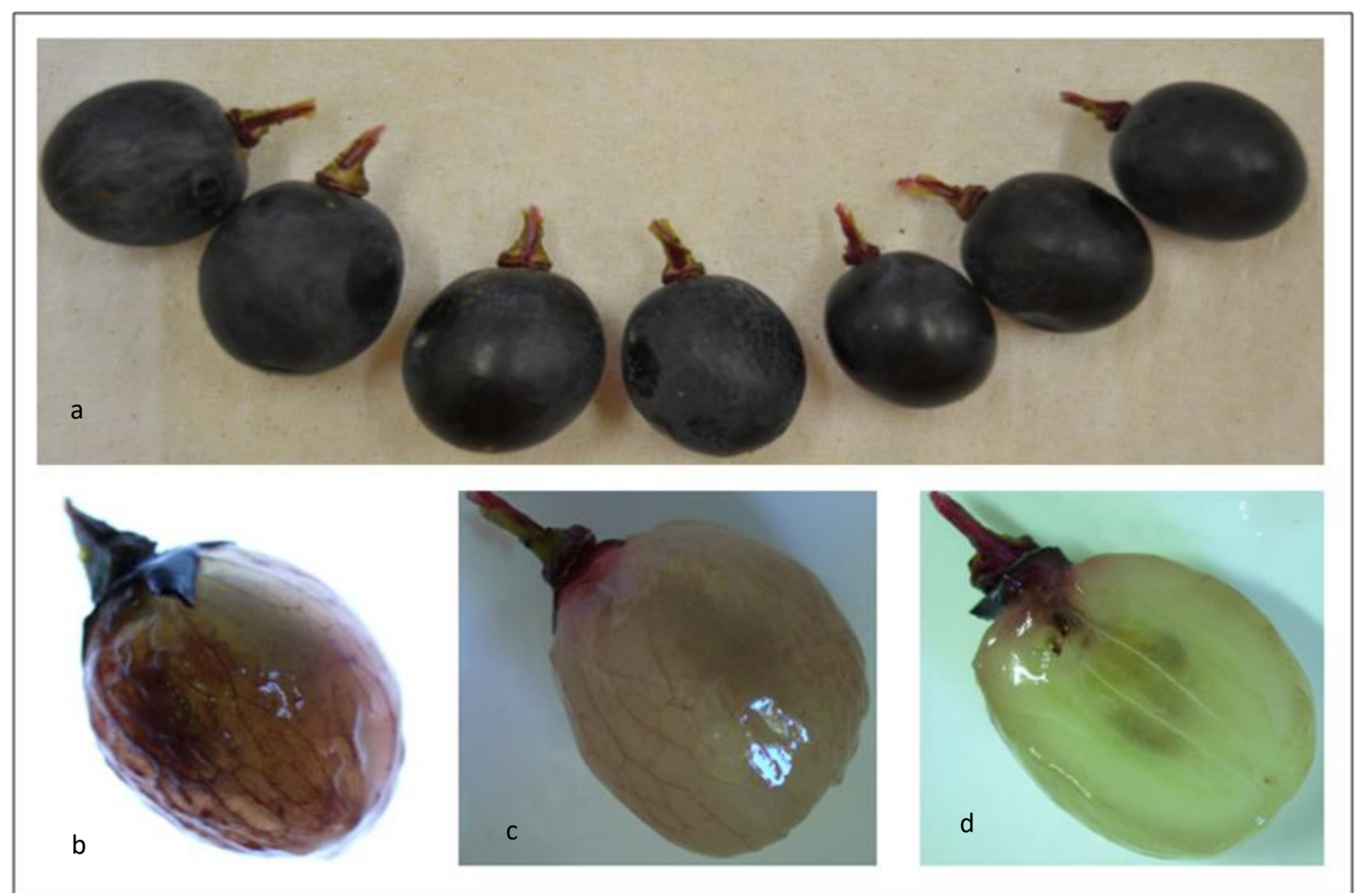
Outline: The experiments performed in this study showed a lack of xylem flow from the plant to the berry during post-véraison, but did not allow clarifying whether this is due to a vessel/tracheid breakage or not. It allowed to state that the xylem back-flow in post-véraison berries is unlikely.

Our results clearly show that vines gradually lose the ability to deliver water to the berries via pedicel during ripening. The xylematic back-flow is active in the pre-véraison but not in the post-véraison berries. Furthermore, the CFDA experiments show the absence of flow from the plant to the berry and vice versa at berry maturity.

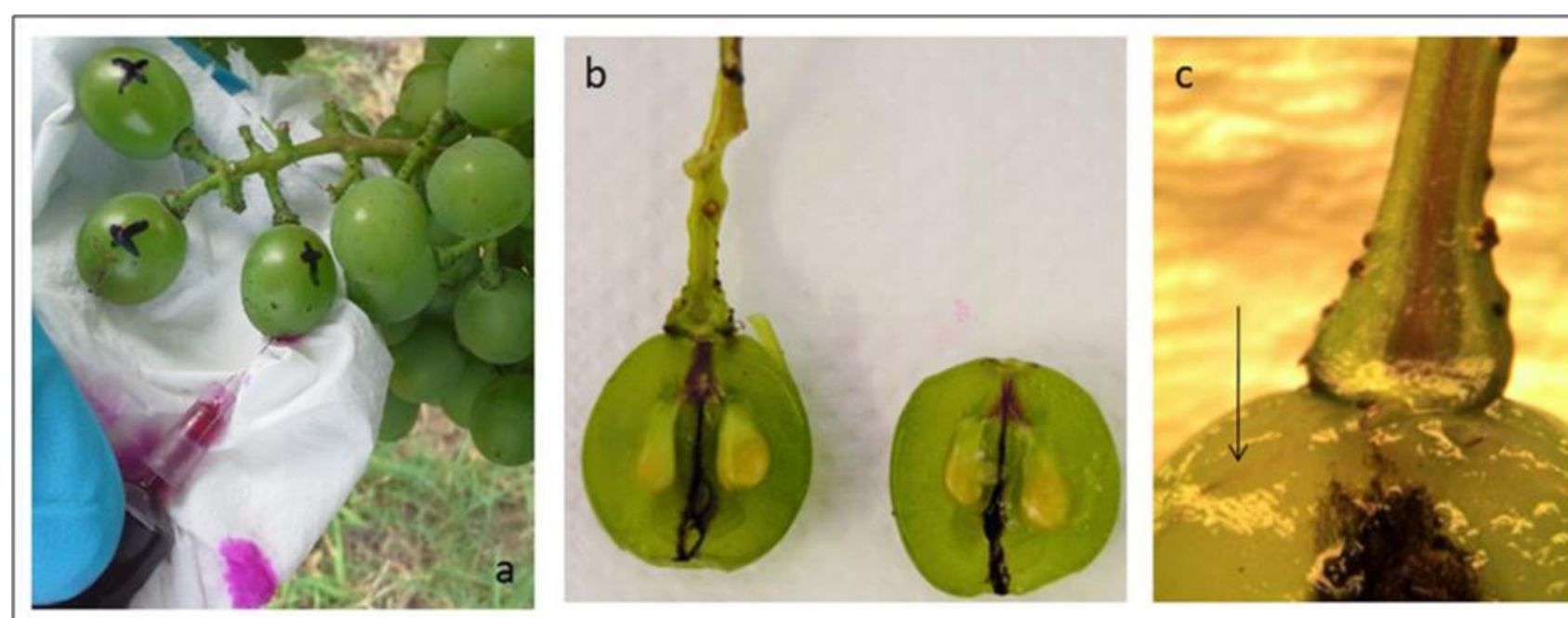
In cv Shiraz véraison berry dehydration dynamics become pivotal: in pre-véraison there is a 'plant/berry' and 'berry/plant' water communication, whereas in post-véraison this connection apparently disappears.



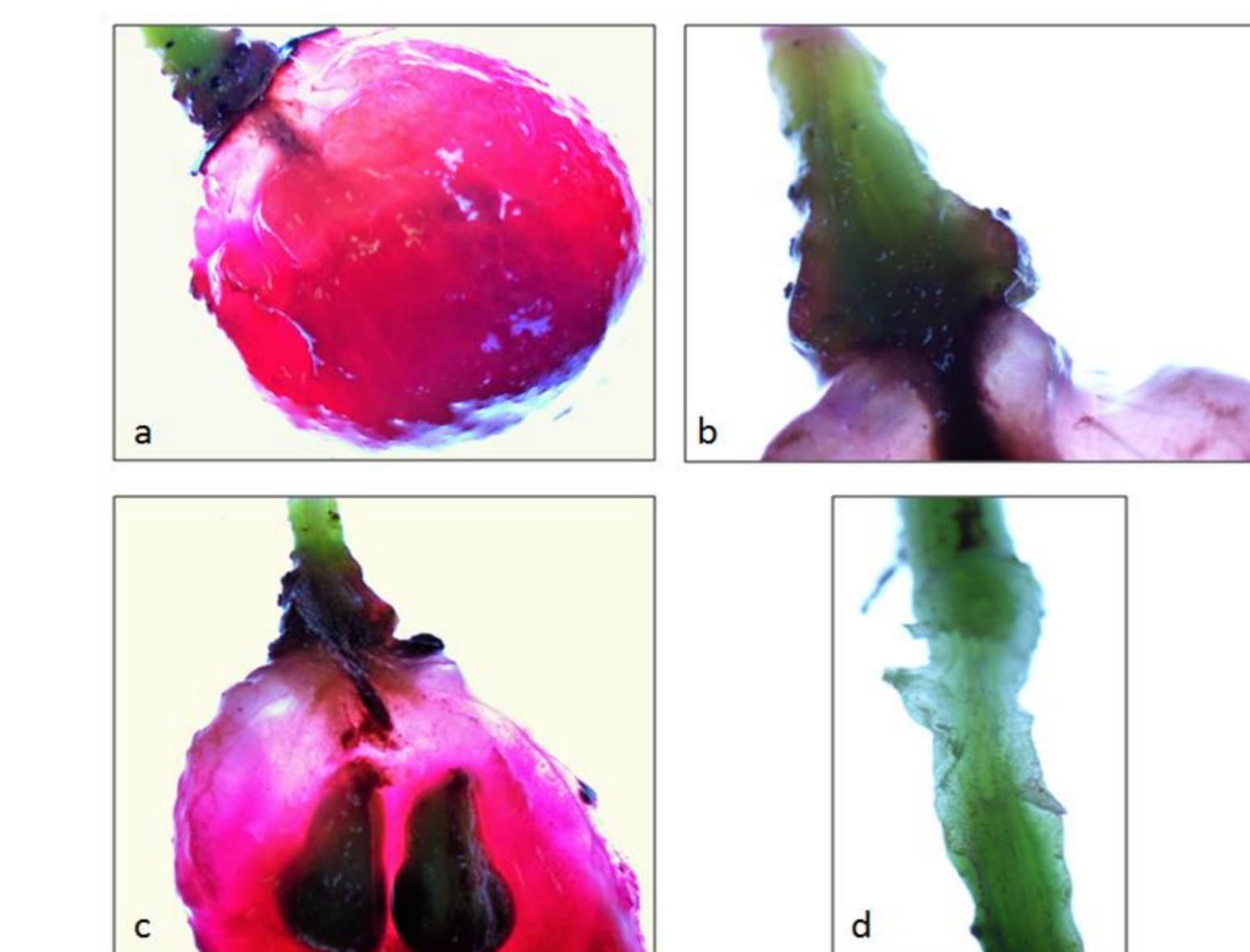
At 45 DAA: Fuchsin acid absorption by a wing of the bunch. a), b) and c) Berries in which fuchsin acid is entering via some peripheral bundles. d) The entering of fuchsin acid into the berry via some peripheral and central bundles. e) Staining of the peripheral vasculature. f) Seed staining.



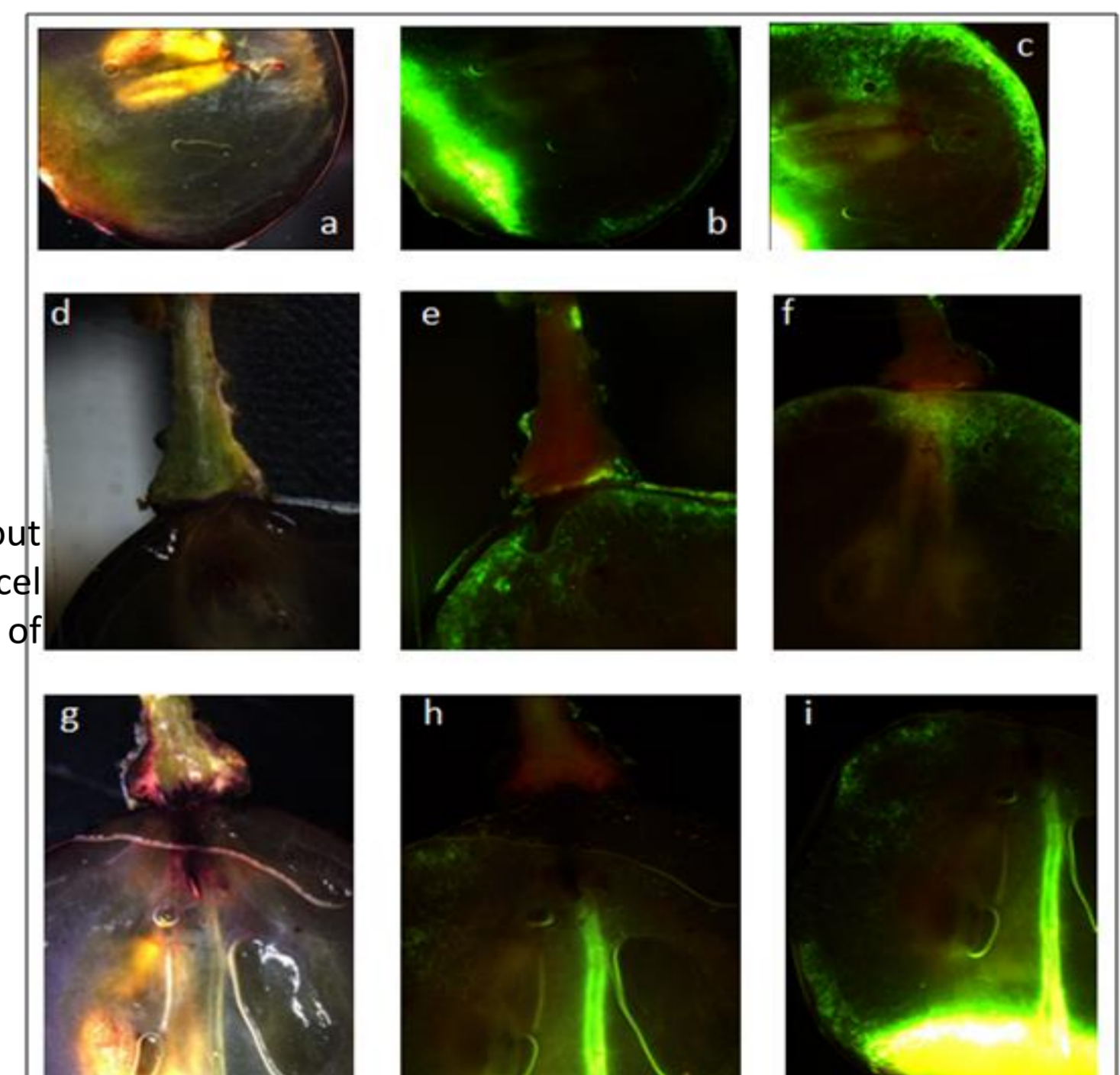
At 116 DAA: Absorption of the fuchsin acid by a bunch wing. a) Berries showing the presence of fuchsin acid in the pedicels. b) and c) Peeled berries showing fuchsin acid distribution in the peripheral bundles. d) Longitudinal section of the berry showing the lack of fuchsin acid staining in the central vasculature.



At 45 DAA: Injected berries. a) The injection technique. b) Fuchsin acid movement inside the central vasculature. c) Fuchsin acid movement in peripheral bundles and entering the pedicel (xylematic back-flow).



At 53 DAA: Fuchsin acid absorption by the berry. a) Fuchsin acid absorption technique. b) Visual evidence of the fuchsin acid movement from the berry towards the rachis via the pedicel (xylematic back-flow). c), (d), (e) and (f) Fuchsin acid distribution across peripheral bundles and pedicel: evidence of xylematic back-flow.



At 112 DAA: CFDA absorption by the berry. Observations were performed using a fluorescence microscope. a) Reference of the longitudinally dissected berry. b) and c) CFDA fluorescence and distribution in the peripheral vasculature and diffusion inside the mesocarp in the longitudinally dissected berries. d) Reference of the longitudinally dissected berry plus pedicel. e) and f) CFDA fluorescence and diffusion in the berry mesocarp, without fluorescence in the pedicel. g) Reference longitudinally dissected berry plus pedicel. h) and i) CFDA distribution in the central vasculature without fluorescence in the pedicel of the longitudinally dissected berries (h).

A.C. thanks the ARC and DISAFA, Turin University, for funding the project. Authors are grateful to colleagues of the Viticulture Department of ARC Infruitec-Nietvoorbij for technical support. Authors would also like to thank Prof Ken Shackel (University of California, Davis) for a critical discussion of the results.