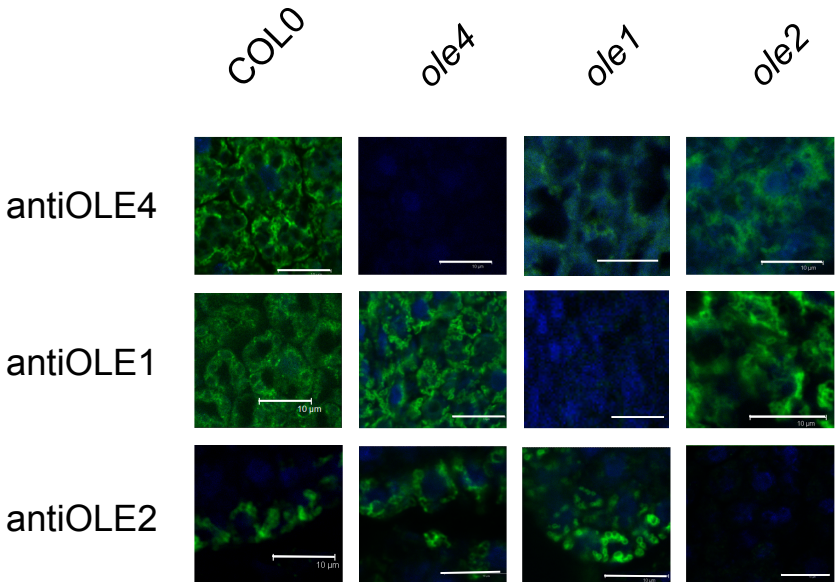
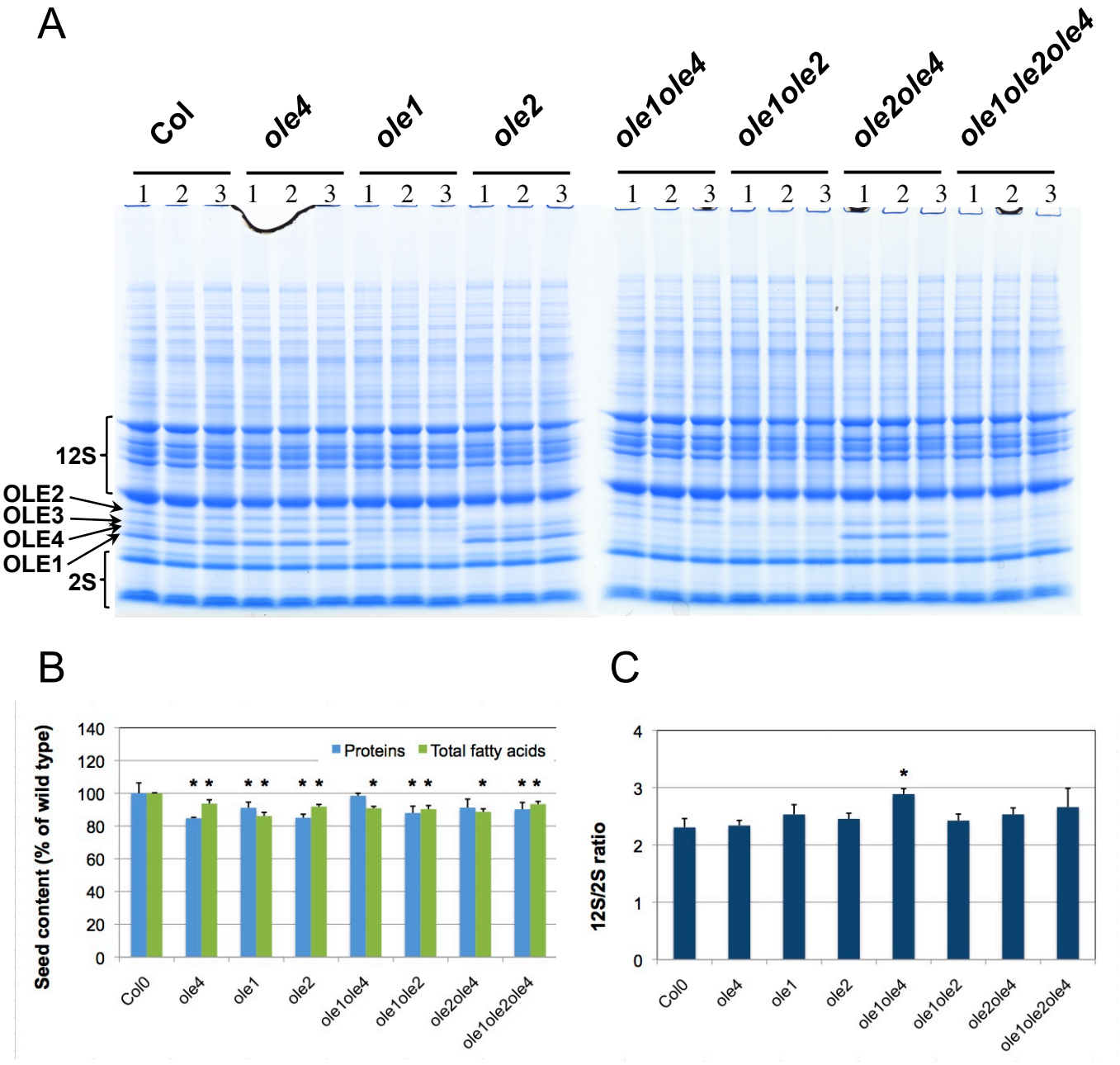
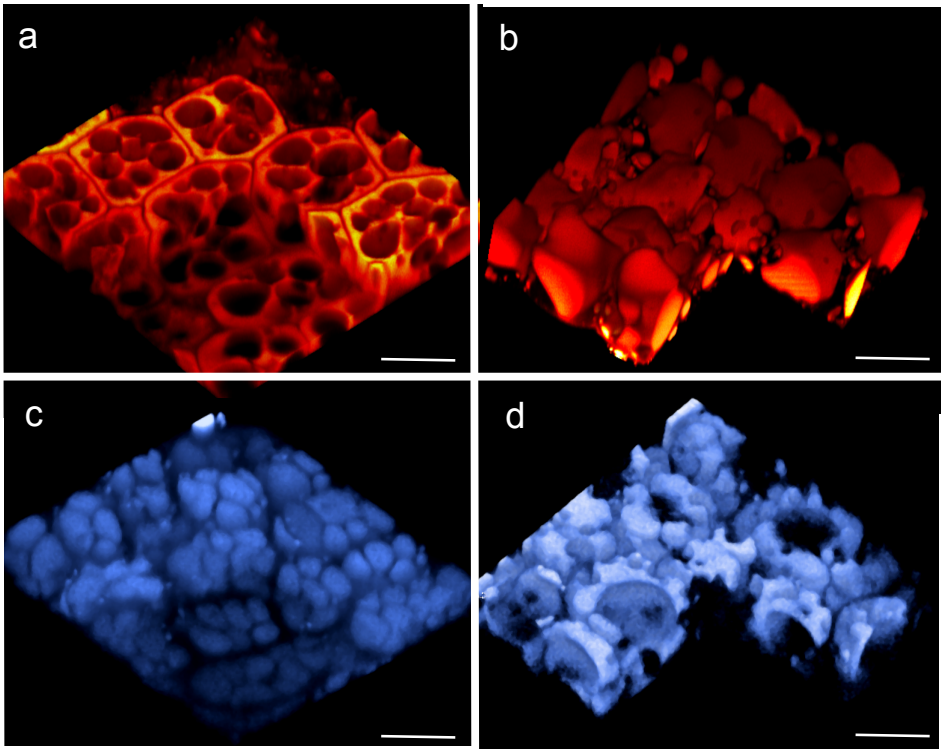


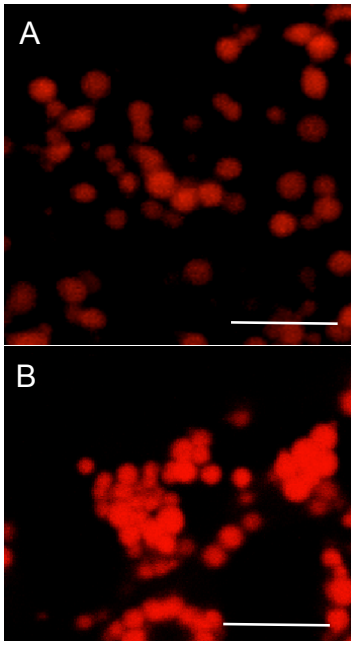
Supplemental Figure S1. Validation of antibodies specificity on sections of developing siliques of mutants affected in one oleosin. Blue: DAPI signal, green: Alexa 488.
Bar = 10 µm.



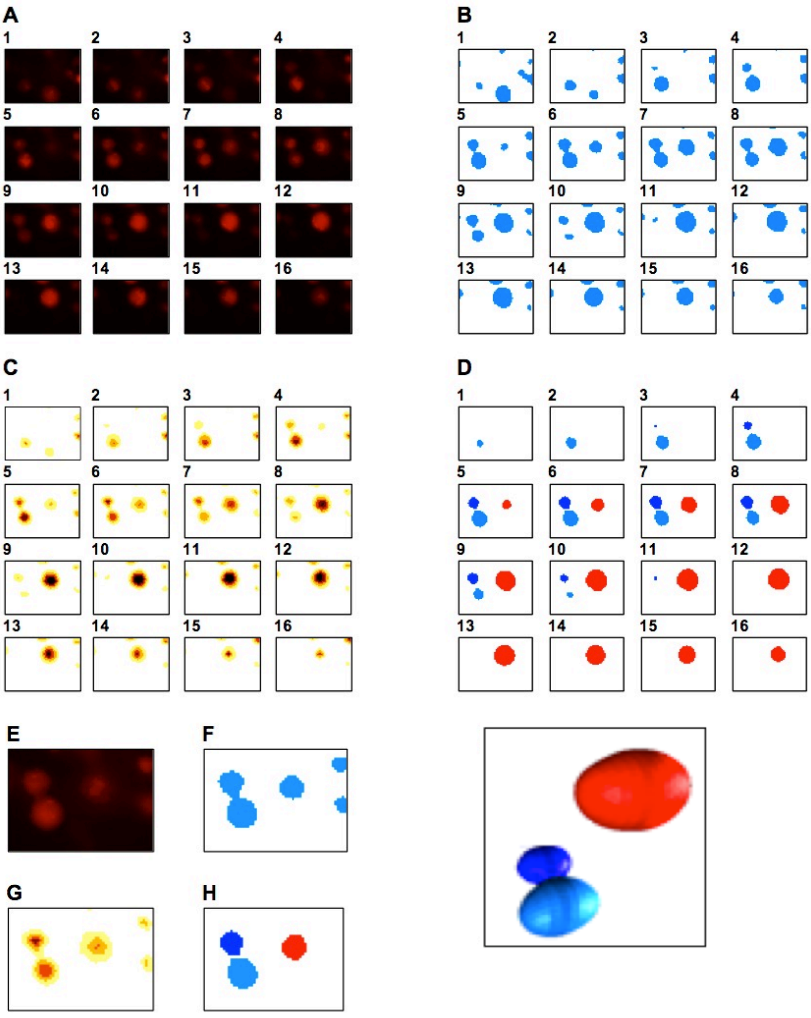
Supplemental Figure S2. Effect of oleosin(s) deficiency on protein content. (A) Protein profiles of wild-type and oleosin mutants seeds. (B) Seed content in storage compounds. (C) 12S/2S storage proteins ratio. Proteins extracted from 4 mature seeds were separated on 4-12% NuPAGE® (Invitrogen) and stained with Coomassie blue. Total fatty acids were determined by GC following direct transmethylation.(*; $p<0.05$).



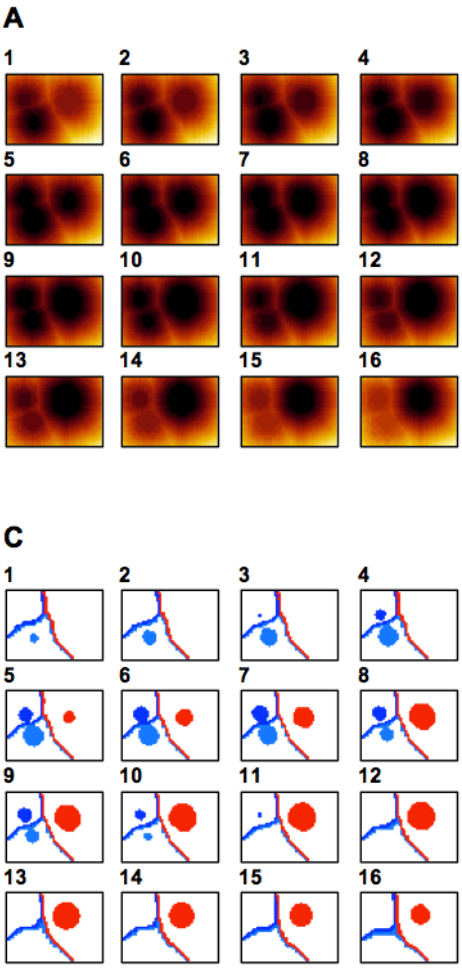
Supplemental Figure S3. 3D reconstruction of storage lipid and protein accumulation in WT and *ole1ole2* mutant background in 1-hour imbibed seeds. In red lipids stained with Nile Red, in blue fluorescence of storage proteins. (a) Col0, Nile Red, (b) *ole1ole2*, Nile Red, (c) Col0, proteins, (d) *ole1ole2*, proteins. Bar = 10µm.



Supplemental Figure S4. Distribution of OBs at 12 DAF in WT (A) and *ole2* (B) embryos.
Bar = 4μm



Supplemental Figure S5. Segmentation steps of OBs using the watershed method**.** (A) *x-y* planes of 3D-stack (size: 57x40x16) filtered image I containing two nearest OBs, an isolated one and four OBs touching the borders. (B) Binarization of image I. Two values of threshold were set manually for detecting small and large OBs. (C) The complement of the distance transform of image I. Its minima (dark level) was located on the center of the OB and used as a marker for the watershed immersion. (D) Label image of OBs: each connected component of OB-object voxels was given a specific color. All objects touching borders were suppressed. (E) A selected *x-y* plane from the image I showing the two nearest OBs (F) and its binarization result on overlapped OBs (G), the watershed using the distance transform to perform a separation of OBs (H). (I) 3D rendering of the label image showing quasi-spherical shaped objects.



D

label	*V (µm³)*	*Vc (µm³)*	*DNN (µm)*
001	**0.95**	**11.84**	**0**
002	**0.50**	**9.14**	**0**
003	**2.38**	**25.40**	**0.90**

Supplemental Figure S6. Determination of the Voronoï cells and the Distance to the Next Neighbor (DNN) estimator steps. (A) The distance transform of the background of the previously segmented image I in Figure S4. (B) Label image of the Voronoï cells obtained by performing a watershed immersion on the distance transform of the background. (C) Boundaries of Voronoï cells. Each boundary has the same color level than the OB level. The mid-distance to the nearest neighbor was determined using the minimum of the distance transform (A) across the boundaries. (D) Table showing the volume of each OB, the volume of its Voronoï cell and its DNN.

Supplemental Table SI. Adjusted parameters for the QR statistical analysis of oil body volume and local fraction factors.

Fitted estimate value of OB volume (V_{OB}) and local fraction (φ_{loc}), standard error and *p*-values (*p*) are given for factors affecting oil body volume. Intercept: 7 DAF. DAF: day after flowering.

	Log (V_{OB})		Log (φ_{loc})	
	Estimate ± s.e.	*P*	Estimate ± s.e.	*P*
(Intercept)	- 1.120 ± 0.009	$< 2\ 10^{-16}$	- 2.242 ± 0.008	$< 2\ 10^{-16}$
8 DAF	0.183 ± 0.010	$< 2\ 10^{-16}$	0.230 ± 0.008	$< 2\ 10^{-16}$
9 DAF	0.361 ± 0.009	$< 2\ 10^{-16}$	0.367 ± 0.007	$< 2\ 10^{-16}$
10 DAF	0.705 ± 0.009	$< 2\ 10^{-16}$	0.505 ± 0.007	$< 2\ 10^{-16}$
11 DAF	0.892 ± 0.010	$< 2\ 10^{-16}$	0.685 ± 0.008	$< 2\ 10^{-16}$
OLE1	- 0.091 ± 0.009	$< 2\ 10^{-16}$	- 0.078 ± 0.007	$< 2\ 10^{-16}$
OLE2	0.156 ± 0.007	$< 2\ 10^{-16}$	0.155 ± 0.006	$< 2\ 10^{-16}$
OLE4	- 0.020 ± 0.008	0.005	- 0.053 ± 0.006	$3.32\ 10^{-15}$
OLE1:OLE4	- 0.028 ± 0.013	0.031	0.086 ± 0.011	$2.92\ 10^{-15}$
OLE2:OLE4	- 0.127 ± 0.012	$< 2\ 10^{-16}$	- 0.043 ± 0.010	$1.40\ 10^{-5}$
OLE1:OLE2	- 0.122 ± 0.013	$< 2\ 10^{-16}$	- 0.093 ± 0.011	$< 2\ 10^{-16}$
OLE1:OLE2:OLE4	0.126 ± 0.019	$< 2\ 10^{-16}$	- 0.094 ± 0.016	$7.81\ 10^{-9}$

Supplemental Table S2. Sequences of qRT-PCR primers used in this study

qOLE1-UP	aggcagattgctaaagctgcaac
qOLE1-LOW	actgtgatgagagccggg
qOLE2-UP	aagagcatgatgcctgaaa
qOLE2-LOW	gtgaaaacacatatctaccg
qOLE3-UP	ttctgattataagagtcg
qOLE3-LOW	gatttctggttatctcaa
qOLE4-UP	ctaaagatgctggacaaa
qOLE4-LOW	tttcaaatctattacgcatcaat
qOLE5-UP	acaagaacccatcacgagatgata
qOLE5-LOW	aatgttgtgctgcccatacttagt
EF1-ALPHA A1-UP	agacccgtgagcacgctctactt
EF1-ALPHA-A1-LOW	acggcctcttgggctcgttgatct

Supplemental Video S1. 3D time lapse live-cell imaging of wild-type developing embryos stained with Nile Red.