

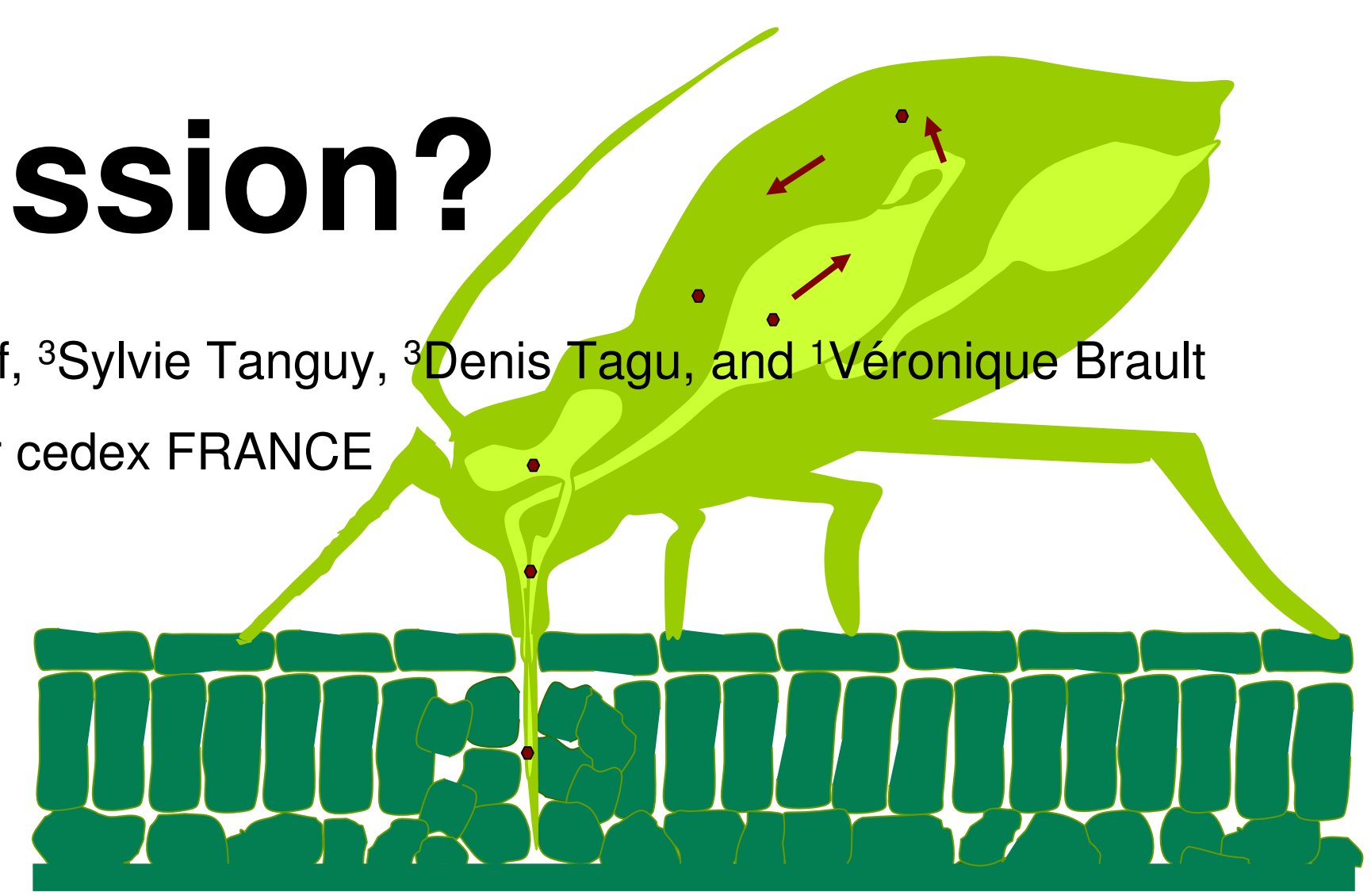
What's new in polerovirus transmission?

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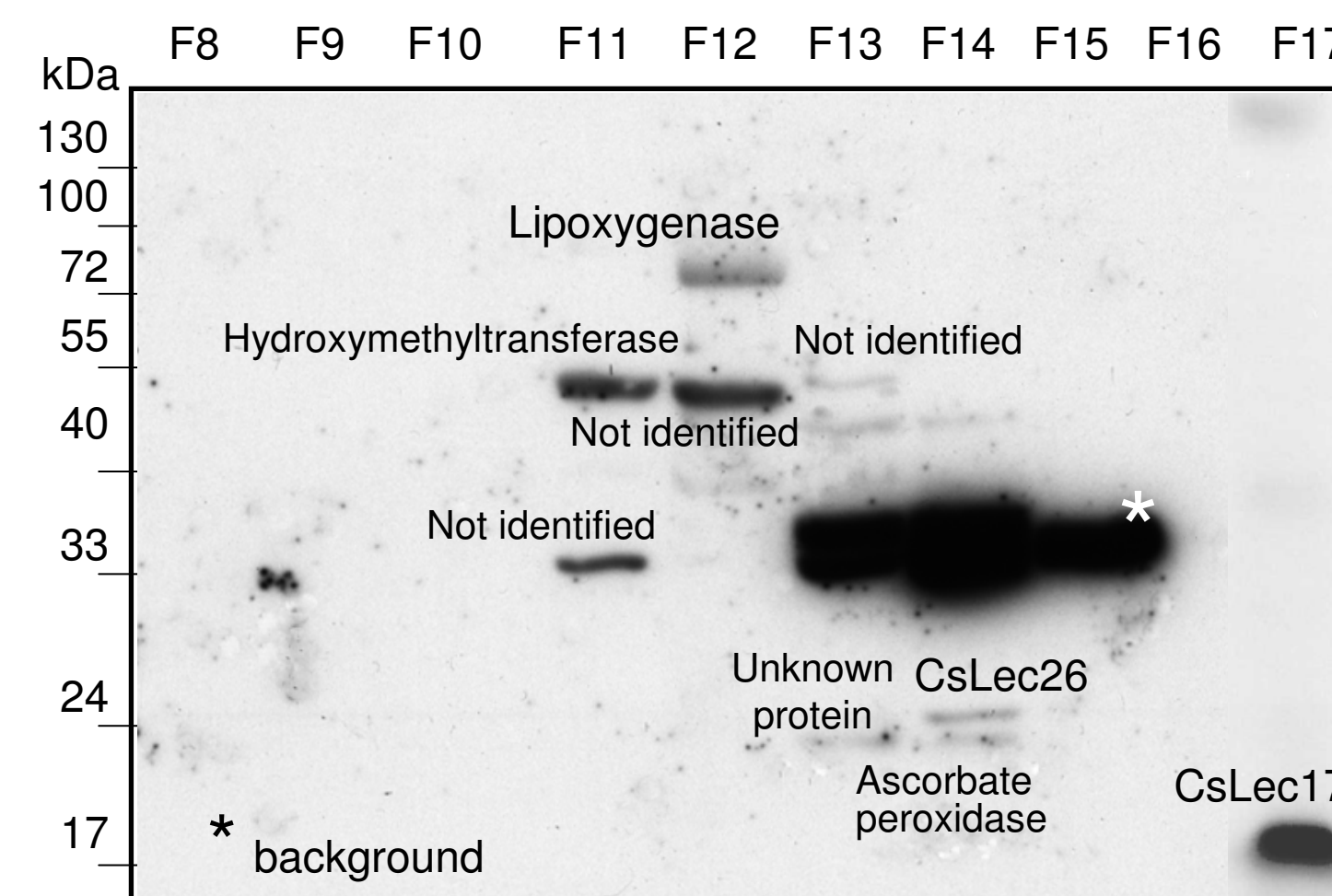
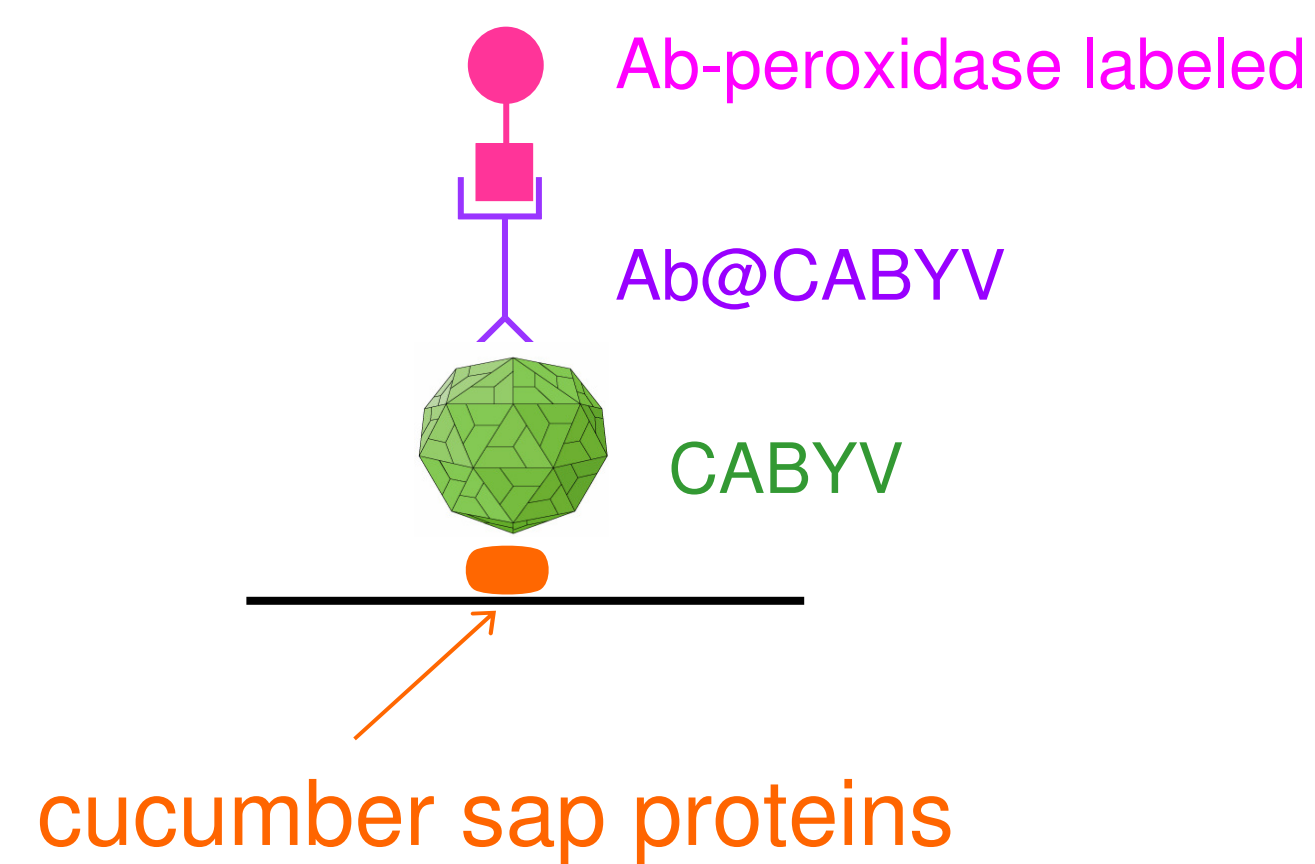
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Poleroviruses (*Luteoviridae* family) are phytoviruses strictly transmitted by phloem-feeding aphids in a circulative and non propagative mode. In the transmission cycle, the three partners, the plant, the virus and the aphid, play a crucial role. The results presented thereafter summarize recent data related to polerovirus transmission by aphids.

Virus partners in phloem

During ingestion, aphids sample virions in sieve tubes along with sap. Therefore, any sap protein bound to virions will be acquired by the insects and could potentially be involved in the transmission process. We developed Far-western blot to identify sap proteins able to bind purified *Cucurbit aphid borne yellows virus* (CABYV, *Polerovirus*).



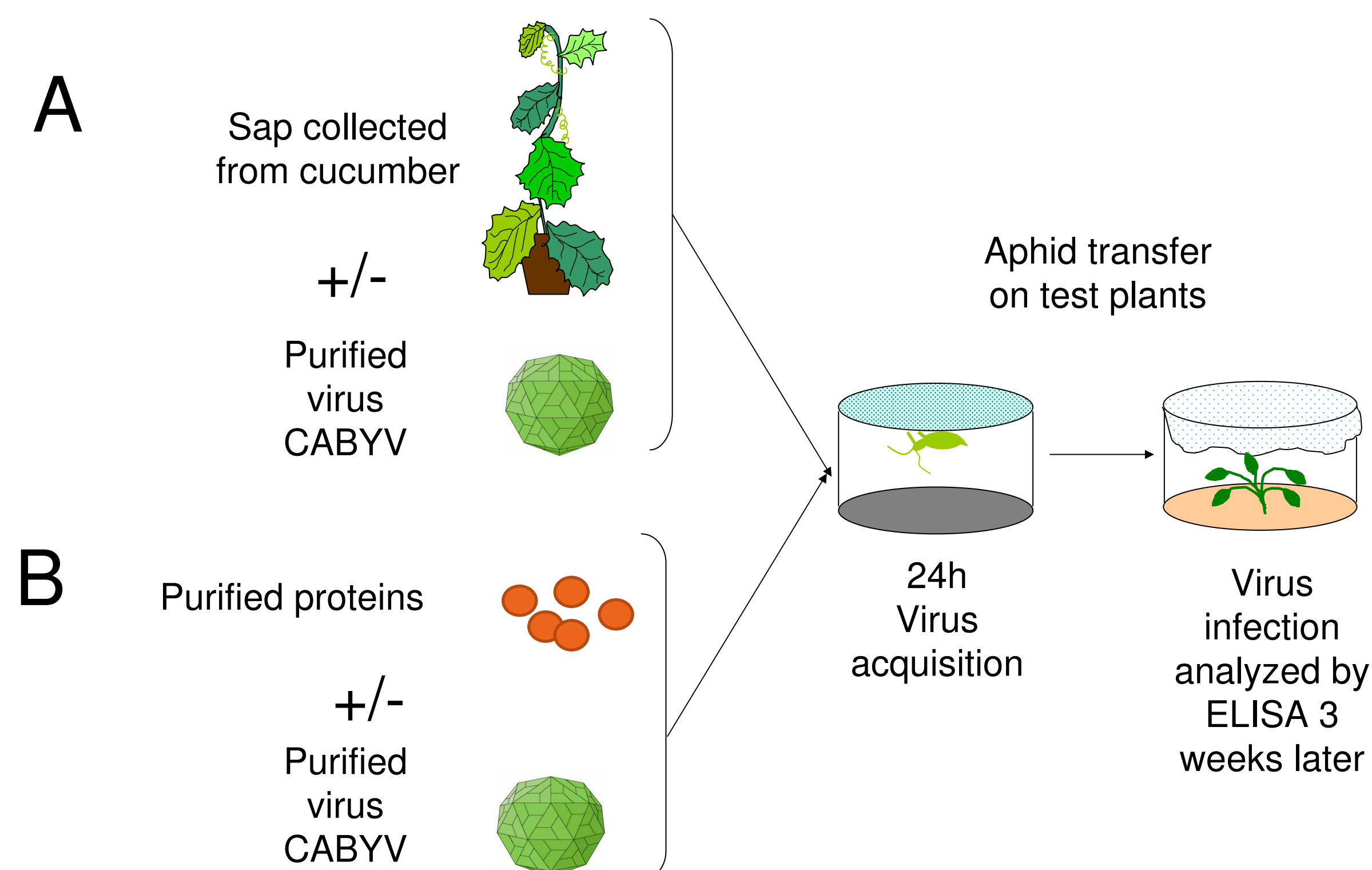
Sap proteins obtained after size fractionation by exclusion chromatography

- About 20 sap proteins able to bind CABYV *in vitro*
- Phloem lectins CsLec26 and CsLec17 (Phloem protein 2 family, PP2) among the candidates

Bencharki B., Mol Plant Microbe Interact. 2010

Phloem proteins involved in aphid transmission

Transmission experiments were designed to assess the role of sap extract or purified phloem proteins on virus transmission by aphids.



Nb. of inf. pl. / total Nb of pl. inoc

| | | |
|---|-------------------------------|-----------------|
| | CABYV | 2/72 (3%) |
| A | CABYV + sap | 31/52 (60%) |
| B | CABYV + AtPP2-A1 ^a | 50/75 (71%) |
| | CABYV + AtPP2-A2 ^b | 18/20 (90%) |
| B | CABYV + BSA | 28/42 (67%) |
| | CABYV + Casein | 10/10 (100%) |
| | CABYV + Lyzosome | 9/10 (90%) |
| | CABYV + Cyto C ^c | 8/10 (80%) |
| | CABYV + Carbonic anhydrase | 10/10 (100%) |
| | CABYV + LcH ^d | 0/9 (0%) |
| | CABYV + MPA ^e | 0/9 (0%) |

- Stimulating factor of virus transmission by aphids in cucumber sap

- Stimulating effect of both lectins from *A. thaliana*
Other lectins (LcH, MPA) are toxic for aphids

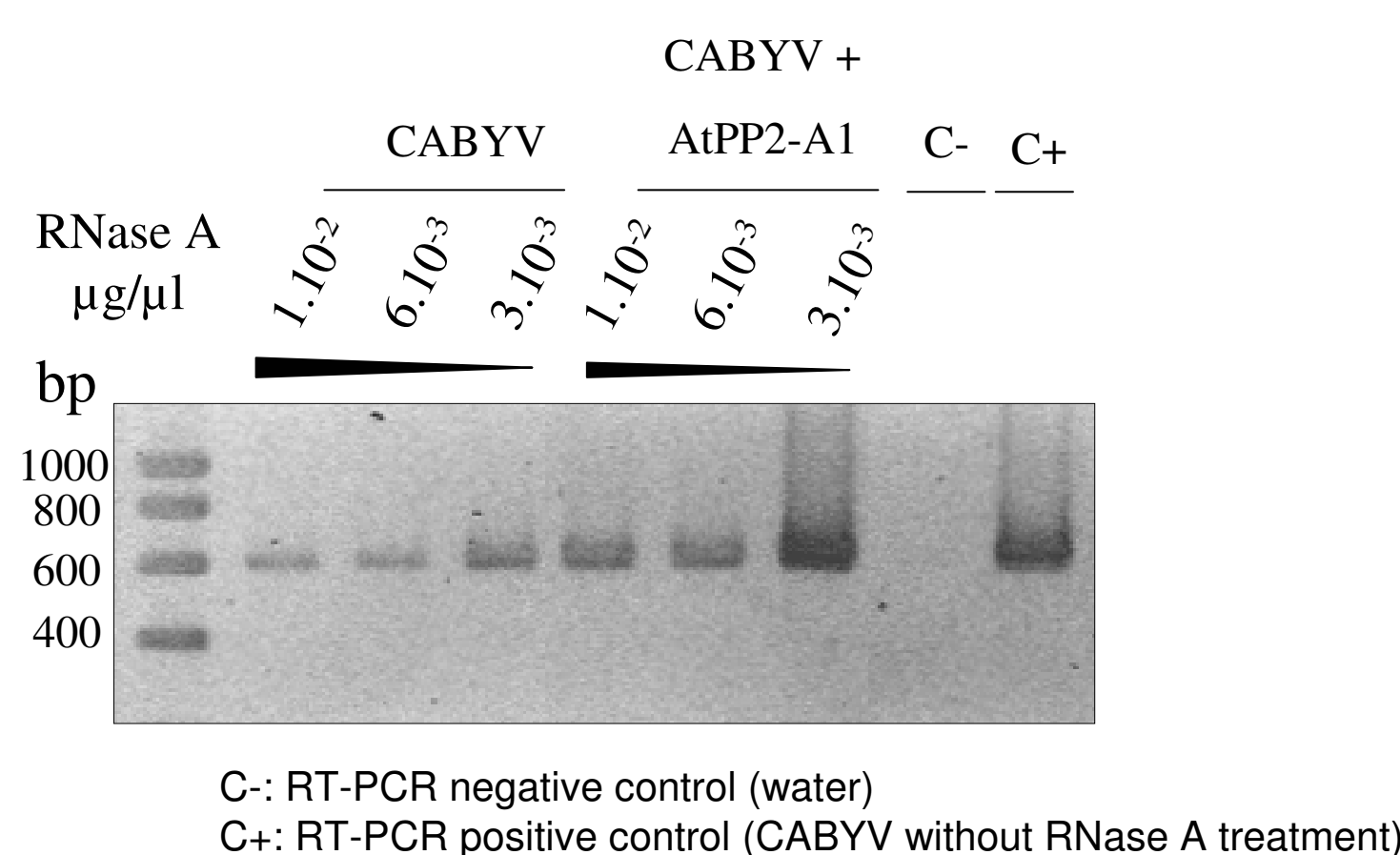
- Stimulatory effect not limited to phloem proteins

^alectin from *A. thaliana*, ortholog of CsLec26
^blectin *A. thaliana*, ortholog of CsLec17
^cCytochrome C
^dlectin from *Lens culinaris*
^electin from *Maclura pomifera*

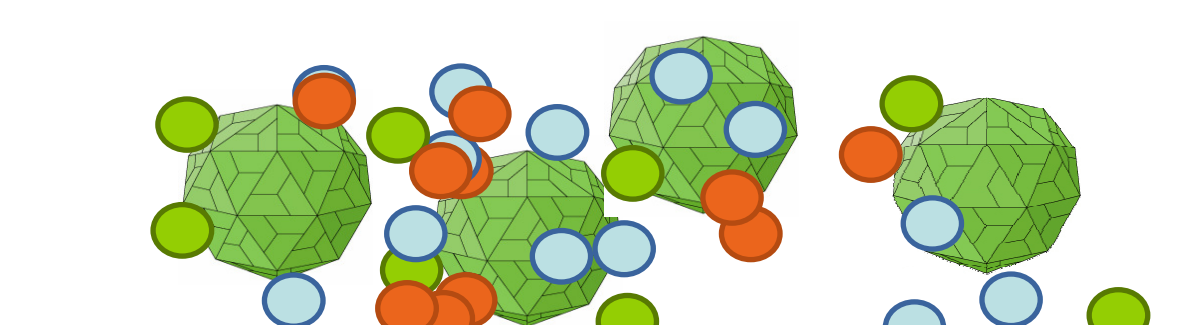
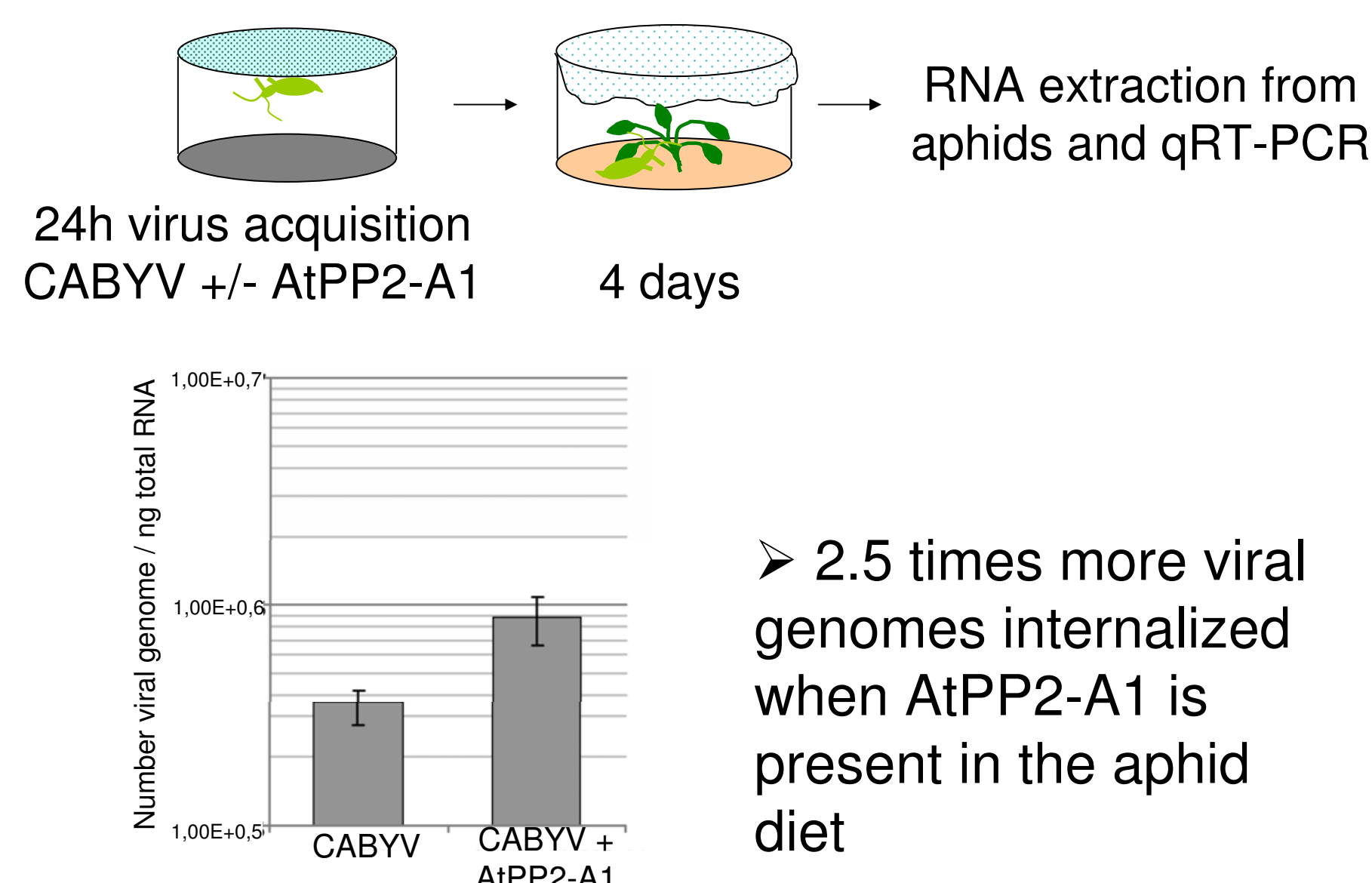
Bencharki B., Mol Plant Microbe Interact. 2010

Effect of a phloem lectin on virus acquisition and stability

Experiments were designed to assess the role of one *A. thaliana* lectin (AtPP2-A1) on virion stability and on virus internalization in aphid cells



- Virions protected against degradation when AtPP2-A1 is present

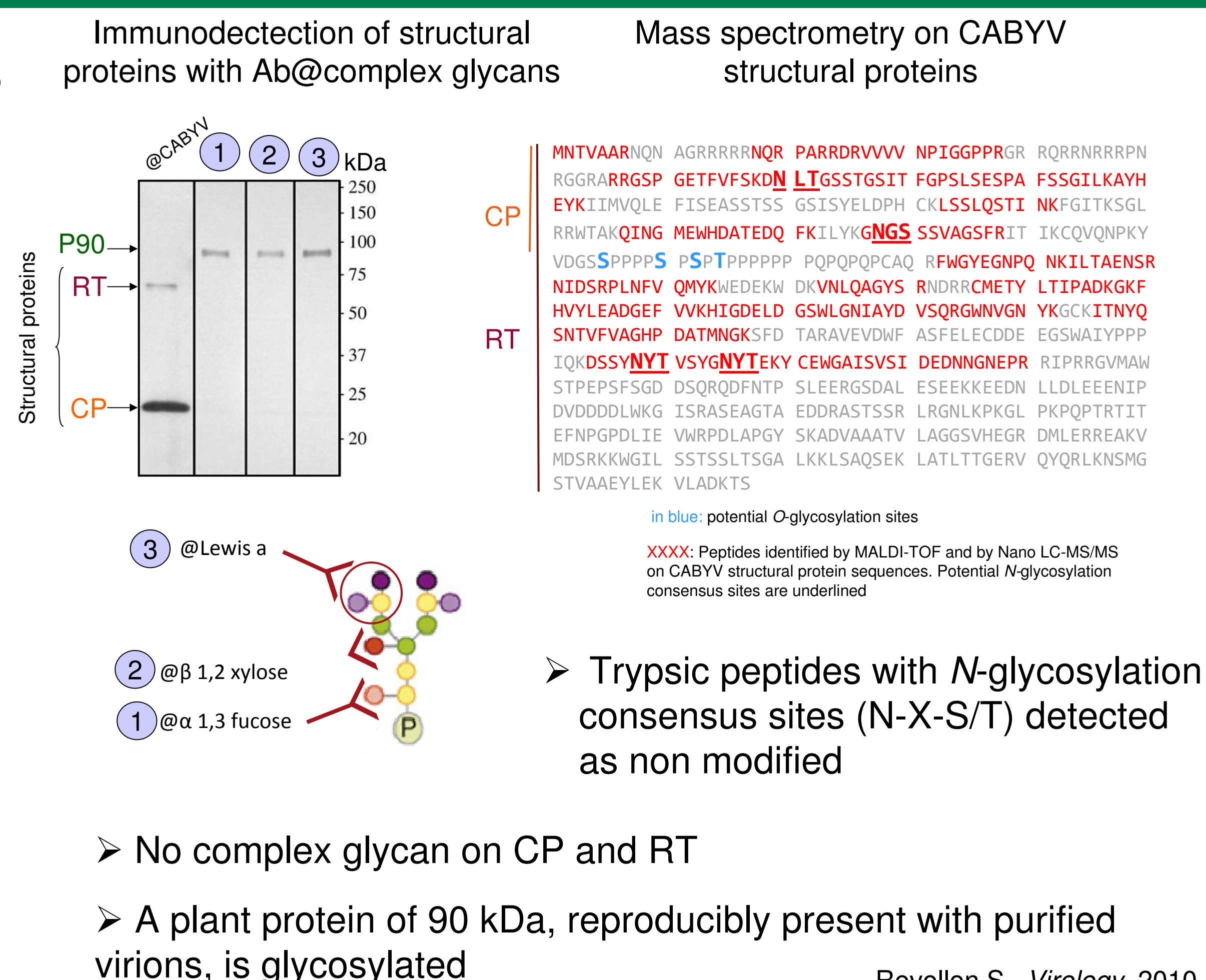


- Ingestion of phloem lectins together with virions: protection against protease activity in aphid digestive tube

Bencharki B., Mol Plant Microbe Interact. 2010

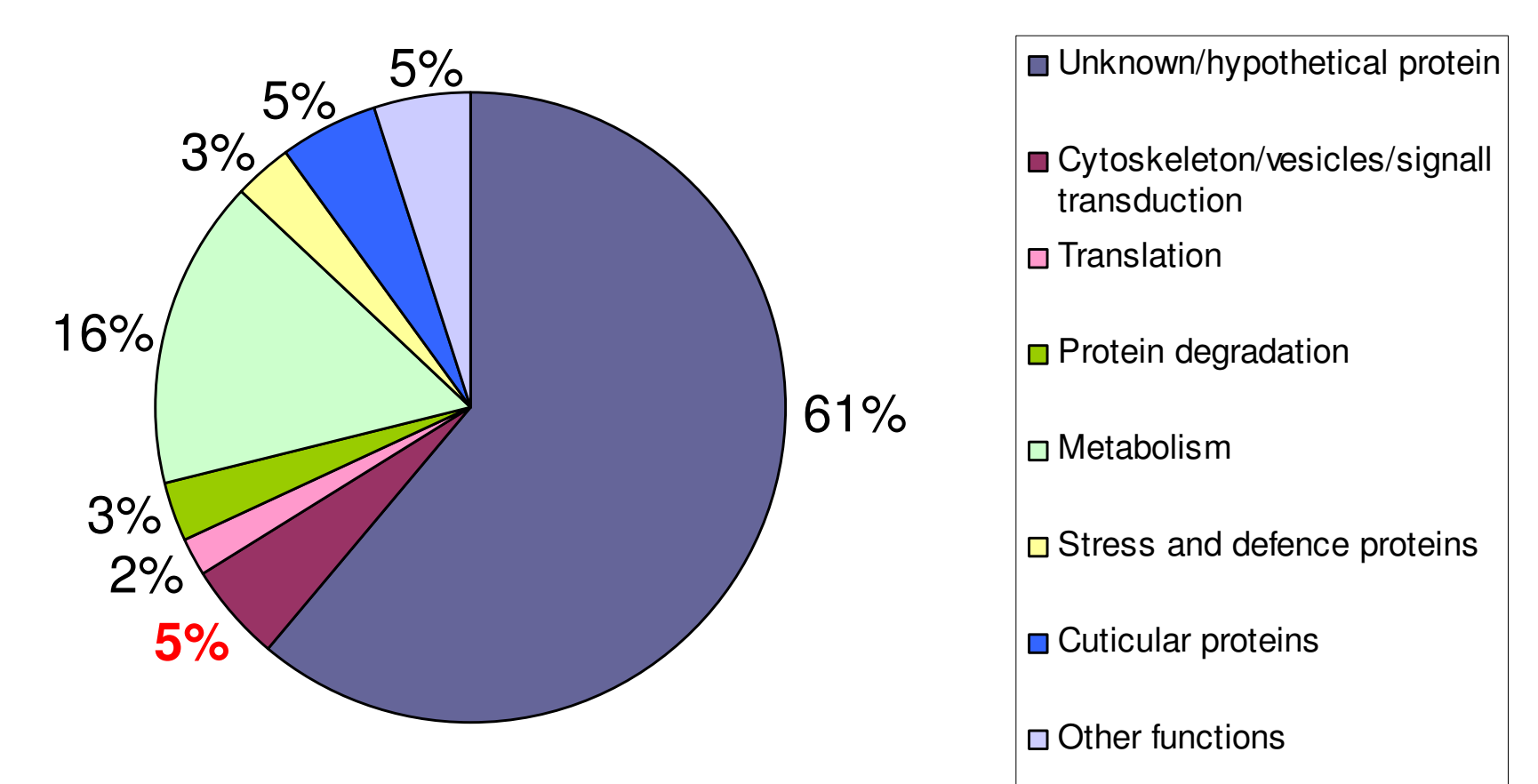
Absence of sugar residues on structural proteins of poleroviruses: glycosylation not involved in aphid transmission

Glycosylation of *Turnip yellows virus* (TuYV, *Polerovirus*) was previously reported and this modification was supposed to be involved in virus transmission by aphids. Several techniques were developed to more precisely assay the glycosylation status of CABYV (lectin binding assay, immunodetection of glycans, mass spectrometry, site directed mutagenesis of N-glycosylation sites. Only some of them are illustrated.



The virus hijacks in aphid a constitutive endocytosis-exocytosis mechanism without heavily perturbing cell metabolism

After virus uptake in the phloem, virions successively cross intestinal and accessory salivary cells before being released in the plant. We conducted a transcriptomic analysis of intestinal genes of the pea aphid *Acyrtosiphon pisum* following uptake of *Pea enation mosaic virus* (*Enamovirus*, *Luteoviridae*).



7166 transcripts analysed (20% of the aphid genome): 128 significantly regulated but limited levels of regulation: maximum of downregulation of 3.45 fold and of upregulation 1.37 fold

Only 5% of regulated genes involved in intracellular trafficking, endocytosis or signal transduction

- The virus hijacks a constitutive endocytosis-exocytosis mechanism at the intestinal level without heavily perturbing cell metabolism

Brault V., J. Gen. Vir., 2010