Journal of Applied Entomology

WILEY

JOURNAL OF APPLIED ENTOMOLOGY

ORIGINAL ARTICLE OPEN ACCESS

First Detailed Record of *Jikradia olitoria* (Hemiptera: Cicadellidae) in the Swiss Southern Alps and Evaluation of Its Current Potential as a Vector of 16SrV-Phytoplasmas

Alan Oggier[1] | Christophe Debonneville[2] | Marco Conedera[1] | Attilio Rizzoli[3]

[1]Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Cadenazzo, Switzerland | [2]Agroscope, Nyon, Switzerland | [3]Agroscope, Cadenazzo, Switzerland

Correspondence: Attilio Rizzoli (attilio.rizzoli@agroscope.admin.ch)

Received: 5 May 2026 | **Revised:** 14 July 2026 | **Accepted:** 2 August 2026

Keywords: epidemiology | flavescence dorée | grapevine pest | nearctic leafhopper | neobiota | vineyard agroecosystem

ABSTRACT

Jikradia olitoria Say is a Nearctic leafhopper that was recently reported in several European countries. Given its role as the vector of phytoplasmas associated with Grapevine Yellows diseases (GYD) in its native range, its presence in European vineyard agroecosystems could represent an important phytosanitary risk. In Europe, the quarantine GYD Flavescence dorée (FD) is widespread and causing important economic losses. Its main vector, *Scaphoideus titanus* Ball, was also introduced from North America. Therefore, investigating the potential role of such new insect species is of crucial importance. In this study, we report the first detailed record of *J. olitoria* in Switzerland, particularly in the Swiss southern Alps. Systematic monitoring conducted over two consecutive years (i.e., 2023 and 2024) using chromotropic traps in seven sites allowed to confirm its widespread presence in the southern Alps, both inside vineyards as well as in the nearby forest edge compartment. Moreover, a subset of the collected specimens was analysed to test potential infection by phytoplasmas associated with FD. No phytoplasma infections have been detected so far. The surveillance and the early detection of new potential vectors remain, however, crucial to mitigate new potential phytosanitary threats for European viticulture.

1 | Introduction

Jikradia olitoria (Say 1830; Synonyms: *Jassus olitorius*, *Coelidia olitoria*; Hemiptera: Auchenorrhyncha: Cicadomorpha: Membracoidea: Cicadellidae: Coelidiinae: Teruliini) is a polyphagous leafhopper native to North and Central America that is known for its wide host range, which includes both woody plants and shrubs (Lowry 1933; DeLong 1948; Chandler and Hamilton 2017). Adults typically measure 6–8 mm in length and are predominantly ochraceous in coloration (Figure 1). Imagoes present a clear sexual dimorphism: males exhibit a darker, more homogeneous pigmentation pattern, whereas females are generally paler and can be recognized by the presence of two wide ivory transverse bands across the forewings (Casiraghi and Poggi 2025). The head is well developed, slightly narrower than the pronotum, and has a broadly rounded anterior margin. The compound eyes are conspicuously large, semiglobular, and cover more than two-thirds of the dorsal head surface. The forewings are elongated, with evident venation and a broadly rounded apical margin. According to Nielson (1979), the male pygofer does not bear caudodorsal or caudoventral processes in lateral view. The aedeagus is elongate, slender, tubular, and asymmetrical, while in lateral aspect, it is broadly curved, tapering to an acute apex. Near the apex, the lateral margin bears numerous short spine-like structures resembling setae, while the gonopore is positioned subapically. Nymphs measure 1–2 mm and are dark brownish, with yellow-green variations visible on the intersegmental membranes (Figure 1).

FIGURE 1 | *Jikradia olitoria* imago specimen after emergence from exuvia (left) and nymphal instar (right) on grapevine leaf. Pictures taken in a vineyard protected with hail nets. [Colour figure can be viewed at wileyonlinelibrary.com]

In its native habitat, *J. olitoria* has been identified as a potential vector of '*Candidatus* Phytoplasma pruni'-related NAGY-IIIβ strains that are associated to the North American Grapevine Yellows disease (NAGY; Beanland et al. 2006; Davis et al. 2015, 2018; Lenzi et al. 2019). As observed also with other phytoplasmas associated with Grapevine Yellows (GY) globally, NAGY phytoplasmas are transmitted by phloem-feeding insect vectors and remain confined to the plant's phloem tissues, disrupting its physiology. This leads to symptoms such as yellowing or reddening of the leaves, stunted growth, and failure of grape development (Pearson et al. 1985; Wolf 2015). These are the same general symptoms associated with other GY diseases which are triggering important losses in viticulture, such as Flavescence dorée (FD; Caudwell 1957), Bois noir (Daire et al. 1997; Sforza et al. 1998), and Australian Grapevine Yellows (Magarey and Wachtel 1986).

In Europe, *J. olitoria* was first identified in 2010 in northern Italy by Nielson et al. (2014) and has been since then sporadically observed in southwestern France (Albre and Gibernau 2019), Austria (Kunz et al. 2025), and Spain (Casiraghi and Poggi 2025). Importantly for southern Switzerland, Casiraghi and Poggi (2025) also reported a single record related to Canton Ticino from the citizen science platform iNaturalist. The sporadic detection on traps deployed in European winegrowing regions and records from citizen science platforms suggest at least a transient presence potentially due to accidental introductions, while its status as a fully established and reproducing population remains uncertain, including for the Swiss southern Alps. This echoes the historical invasion pattern of *Scaphoideus titanus* Ball, the main vector (primary epidemic grapevine-to-grapevine vector) of the phytoplasmas associated with FD, which also began with sporadic and localized detections in France before broadly spreading across much of the winegrowing areas of the European continent with suitable climatic conditions for the insect species (Bonfils and Schvester 1960; Chuche and Thiéry 2014; Jermini et al. 2014; Gonella et al. 2024).

Due to the limited options for vector control measures, usually based on insecticide applications, and the ongoing threats posed by GY associated with non-native vectors, assessing the ability of lesser-known or newly introduced leafhopper species to transmit GY diseases represents a key issue of modern GY management strategies. In this context, the early detection and the assessment of a potential involvement of *J. olitoria* in phytoplasma transmission within European vineyards, in particular with '*Candidatus* Phytoplasma vitis' belonging to the taxonomic subgroups 16SrV-C and 16SrV-D and associated with the FD disease (Firrao et al. 2004; Lee et al. 2004; Jeger et al. 2016), represent key steps to prevent the establishment of new vector-pathogen complexes that could undermine current FD management strategies.

Regarding the vineyard agroecosystem of the Swiss southern Alps, the arrival of *J. olitoria* has been considered very likely due to the close proximity to northern Italy. The record reported by Casiraghi and Poggi (2025) which was retrieved on the citizen science platform iNaturalist could only suggest an occasional and sporadic presence in Canton Ticino and was indexed after the first on-field observations and the beginning of the research activities presented in this study. This article aims at presenting a first detailed account of the current distribution of *J. olitoria* in the Swiss southern Alps and at exploring its potential role in the epidemiology of FD as a putative vector of 16SrV-phytoplasmas (i.e., to assess its ability to acquire FDp and FDp-like phytoplasmas).

2 | Materials and Methods

2.1 | Study Area and Experimental Design

The study area is represented by the winegrowing area of the Swiss southern Alps. In the area, two GY are known: Bois noir and Flavescence dorée (Schaerer et al. 2007). Flavescence dorée (FD) was first reported in Switzerland in 2004 and is by far the most widespread and problematic GY for viticulture in the region, despite the systematic implementation of the mandatory control measures, that is, insecticide applications targeted at the main vector, *S. titanus*, and removal of the infected grapevines (Jermini et al. 2014). Moreover, alternative epidemiological cycles involving plant species present in the

landscape surrounding vineyards, such as *Corylus avellana* Linnaeus and *Alnus glutinosa* Linnaeus, together with alternative vectors, such as *Orientus ishidae* Matsumura (i.e., insects capable of acquiring and transmitting FDp beyond the primary vector *S. titanus* and, thus, the primary epidemiological cycle) complicate disease management (Casati et al. 2017; Rizzoli et al. 2021).

In 2023 and 2024, seven vineyards and their surrounding landscape (mostly consisting of forest) across the Canton of Ticino were surveyed for the presence of leafhoppers using yellow sticky traps (YST; Rebell Giallo, Andermatt Biocontrol AG; Figure 2) as part of ongoing efforts to monitor the population abundance of FD phytoplasma vectors. Of the 7 sites, 5 were monitored at low resolution with 10 YST per site (6 hung in the vineyard on the highest wire of the training system and 4 installed on a wooden pole in the landscape), while the sites of Avegno and Bedano were investigated at higher resolution with 30 and 49 YST, respectively (Table 1). In 2023, the presence of *J. olitoria* adult specimens was determined between August and October. The following year, the sampling period was extended from June to October. YST were replaced weekly.

2.2 | Leafhopper Collection and Processing

After collecting and replacing YST, the material was transported to the laboratory and stored at 5°C for a maximum of 2 days before insect identification and further processing. Specimens on YST were examined under a stereo microscope (Olympus SZX16 with SDF PLAPO 1XPF objective lens) and identified using the determination key by Nielson et al. (2014). A subset of *J. olitoria* specimens was detached from YST using Glurex forte (50%–100% D-Limonene [v/v], Andermatt Biocontrol AG, Grossdietwil, Switzerland), washed in 70% Ethanol (v/v) and transferred into tubes containing 99% Ethanol (v/v) in pools of five individuals. The tubes were then stored at −20°C until molecular analysis.

2.3 | Hatching Experiment

To test the ability of *J. olitoria* to oviposit in grapevine bark, a hatching experiment was conducted in 2024 and 2025 using grapevine wood collected from the Giornico site. This site was selected due to the consistently high number of *J. olitoria* captures recorded in 2023. In November 2023 and 2024, grapevine wood was collected, separated depending on plant part (trunk and fruiting cane) and transported to the research facility in Cadenazzo, where it was stored at 4°C. At the end of April 2024 and 2025 wood samples were grouped according to plant part (i.e., trunk and fruiting cane), weighted, and placed into separate rearing cages (160 μm nylon mesh, 120 × 50 × 50 cm; BugDorm, MegaView Science Co. Ltd., Taichung, Taiwan). To prevent egg desiccation, the wood was moistened every other day. Air temperature in the experimental room was recorded at 2-h intervals using a data logger (HOBO Pro v2 U23-001, Onset Computer Corporation, Bourne, MA, USA).

Oviposition was assessed indirectly through the collection of freshly hatched nymphs to avoid egg damage and simplify species identification (Chuche and Thiéry 2009; Oggier et al. 2025). To this end, two potted broad bean plants (*Vicia faba* var. major 'Aqua Dulce'; seeds obtained from Sativa Rheinau AG, Switzerland) were placed into each cage as a food source for the emerging nymphs. The plants were watered weekly and replaced when necessary. Cages were inspected every other day until the end of June when no additional hatchings were observed for two consecutive weeks. Newly emerged nymphs were collected using an electric aspirator (InsectaVac Aspirator, BioQuip Products Inc., USA), identified to species level under a stereomicroscope following Nielson et al. (2014), and preserved in ethanol at −20°C for subsequent molecular analysis.

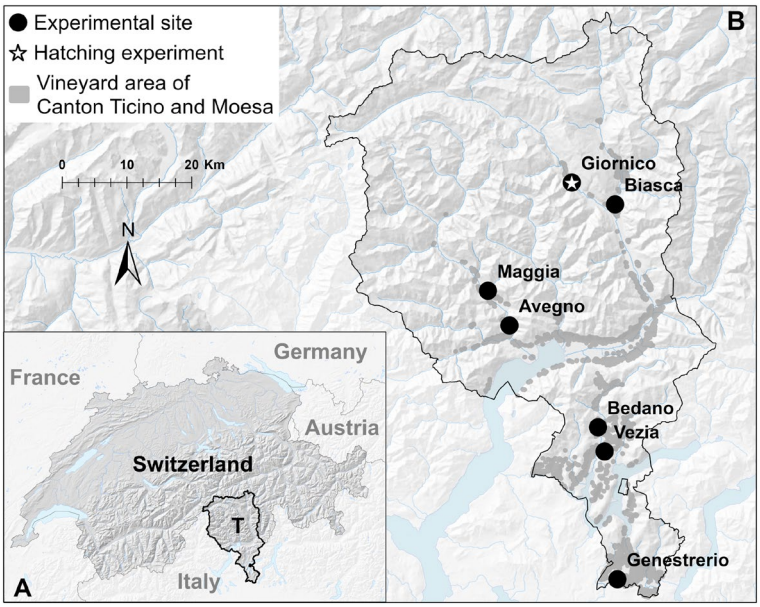

FIGURE 2 | Geographic distribution of experimental sites. (A) Location of the study area within Switzerland; T: Canton Ticino. (B) Black dots: Sites included in the monitoring network; white star: Site where pruned grapevine wood was sampled to perform hatching experiments. [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 1 | *Jikradia olitoria* total captures divided by plot and trap type, mean captures per trap and ratio between the two sampling years.

			Total captures		Mean captures/YST ± SE				
Plot	Trap type	YST/plot	2023[a]	2024[b]	N YST (2023)	Mean ± SE (2023)	N YST (2024)	Mean ± SE (2024)	Ratio 2024/2023
Avegno	L	15	11	44	165	0.07 ± 0.03	270	0.16 ± 0.03	2.29
	V	15	8	36	160	0.05 ± 0.02	267	0.13 ± 0.03	2.60
Bedano	L	35	45	379	385	0.12 ± 0.02	626	0.61 ± 0.06	5.08
	V	14	12	87	154	0.08 ± 0.02	250	0.35 ± 0.08	4.38
Biasca	L	4	0	0	44	0	72	0	0
	V	6	0	0	65	0	108	0	0
Genestrerio	L	4	29	77	44	0.66 ± 0.19	72	1.07 ± 0.26	1.62
	V	6	4	2	65	0.06 ± 0.05	104	0.02 ± 0.01	0.33
Giornico	L	4	127	131	44	2.89 ± 0.77	72	1.82 ± 0.29	0.63
	V	6	1109	2679	64	17.33 ± 3.09	107	25.04 ± 3.60	1.45
Maggia	L	4	1	1	44	0.02 ± 0.02	72	0.01 ± 0.01	0.50
	V	6	0	0	66	0	108	0	0
Vezia	L	4	24	28	44	0.55 ± 0.18	72	0.39 ± 0.11	0.71
	V	6	105	117	64	1.64 ± 0.27	108	1.08 ± 0.18	0.66

Abbreviations: L, landscape YST; N YST, overall number of processed YST throughout the experiment in 2023 and 2024, respectively; V, vineyard YST; YST/plot, yellow sticky traps installed in each plot.
[a]Short sampling period (August to October).
[b]Extended sampling period (June to October).

2.4 | Nucleic Acid Extraction and Molecular Analysis

Insects were homogenized in 900 µL of extraction buffer (3% Cetyltrimethylammonium bromide CTAB, 1.4 M NaCl, 25 mM EDTA, 100 mM Tris–HCl, 2% β-Mercaptoethanol, pH 8.0) and shaken for 30 min at 600 rpm and 65°C. A total of 900 µL of Chloroform/Isoamylalcohol were added, homogenized by vortexing for 5 s and centrifuged for 5 min at 3000× g. The aqueous layer was carefully transferred to a new tube, mixed with an equal volume of cold Isopropanol, and incubated for 60 min at −20°C for nucleic acid precipitation. Precipitated material was recovered by 2 min of centrifugation at 10,000× g and washed with 1 mL of 70% Ethanol. The pellet was dried overnight at room temperature and resuspended into 100 µL of PCR-grade water.

The presence of 16SrV-phytoplasmas was detected using a duplex qPCR method, modified from that described by Oggier et al. (2023). This allowed for the simultaneous detection of 16SrV-phytoplasmas and the eukaryotic 28S rDNA of the insects (Mittelberger et al. 2020), applied with a final volume of 15 µL using a GoTaq Probe qPCR kit (Promega) and CFX96 thermocycler (Bio-Rad); *map* gene was amplified by nested PCR as described in Arnaud et al. (2007).

2.5 | Insect DNA Barcoding

Universal primers LCO-1490 (5′-GGT CAA CAA ATC AAA AGA TAT TGG-3′) and HCO-2198 (5′ TAA ACT TCA GGG TGA CCA AAA AAT CA-3′) (Folmer et al. 1994) were used to amplify the 5′-end portion of the Cytochrome Oxydase I (COI), under the following conditions: 2 min initial denaturation, followed by 35 cycles of 30 s denaturation at 95°C, 45 s annealing at 42°C, and 1 min elongation at 72°C, followed by a final extension of 8 min at 72°C. All amplification reactions were performed using GoTaq G2 Flexi polymerase (Promega). Following quality control via electrophoresis on a 1% agarose gel, the PCR products were purified by ultrafiltration with NucleoFast 96 PCR plates (Macherey-Nagel). The products were sent to Fasteris (Switzerland) for forward and reverse sequencing using Sanger technology. The species was assigned by blasting the amplicon against the public COI-5P animal library from BoldSytems BarcodeID (https://id.boldsystems.org; accessed in January 2026).

3 | Results

3.1 | *Jikradia olitoria* Presence and Abundance in Southern Switzerland

Captures of *J. olitoria* across seven plots revealed substantial spatial variability within the study area. A total of 1475 individuals were captured in 2023 (short sampling period: August–October), increasing to 3581 specimens in 2024 (extended sampling period: June–October; Table 1). When restricting the comparison to the same sampling window (August–October), captures approximately doubled from 2023 to 2024 (refer to Figures S1–S2 for the population dynamics within the vineyard and landscape compartments and Table S1 for the raw data).

The Giornico site accounted for most captures in both years (83.8% of all specimens captured in 2023 and 78.5% in 2024, respectively). Bedano was the second most affected site, with 523 individuals captured across both years. Most adults were trapped in landscape YST, and a 4.8-fold increase in mean captures per trap from 2023 to 2024 indicated a clear population increment that was consistent across habitats. In Avegno, captures doubled and, although absolute numbers remained rather low relative to other sites, the consistent rise suggests a moderate local population increase. Captures in Genestrerio also showed a moderate increase, predominantly within the landscape compartment. On the other hand, although captures remained higher in the vineyard in Vezia, the 2024 population was consistently lower across the site with both trap types showing a decline in captures. Biasca and Maggia showed no or negligible captures, respectively.

Interestingly, in Giornico and Vezia, most captures took place in the vineyard (i.e., 88.9% and 94.6% of all specimens captured in the two sites during 2023 and 2024, respectively), whereas in the other sites with *J. olitoria* presence, specimens were mainly collected in the surrounding landscape rather than in the vineyard.

3.2 | Hatching Experiment and Verification of Species Identity

A total of 23 *J. olitoria* nymphs hatching from grapevine wood were recorded over the 2-year period (Table 2, Table S2), with most hatching events occurring in the second half of May. Most hatched nymphs were found in the cages hosting wood sampled from the trunk portion. In 2025, hatching events on grapevine increased noticeably with respect to 2024, including hatchings from the fruiting canes (Table 2). DNA barcoding performed using the mitochondrial Cytochrome c Oxidase subunit I (COI) gene on a subset of newly emerged nymphs allowed verification of species identity. Two sequences were submitted to BOLD (https://boldsystems.org/; Ratnasingham et al. 2024) under Process Identification numbers (Process ID) JKCH001-25 and JKCH002-25 and to GenBank under Accession numbers PX712184 and PX712185.

TABLE 2 | *Jikradia olitoria* hatching events divided by year and wood structural part. For the hatching experiment, grapevine wood was collected from the Giornico site due to the large *J. olitoria* adult population observed in 2023.

Year	Grapevine structural part	Mass [kg]	Hatching events	Hatching events/kg
2024	Trunk	14.03	10	0.71
	Fruiting cane	5.43	0	0
2025	Trunk	3.75	9	2.40
	Fruiting cane	7.37	4	0.54

3.3 | Molecular Analysis for 16SrV-Phytoplasma Infection

In 2023, a subset of 94 *J. olitoria* adult specimens, collected from YST in both vineyard and landscape habitats in 5 out of 7 sites (excluding Biasca and Maggia), were grouped into 20 pools and tested for 16SrV-phytoplasma infection. qPCR screening identified four pools as positive; however, all exhibited high quantification cycle values ($Cq > 35$), and subsequent nested PCR (*map* gene) failed to confirm the presence of phytoplasma DNA. These findings suggest that the initial qPCR signals likely represented false positives rather than true infections. In 2024, a subset of 102 *J. olitoria* specimens were individually analysed and resulted negative to 16SrV-phytoplasma infection.

4 | Discussion

The present study provides the first official record of *J. olitoria* for Switzerland and detailed evidence of an established population in the Swiss southern Alps. Results of the field investigations and of the successful hatching experiments from grapevine wood unequivocally indicate that the species is not merely a transient visitor but can complete its life cycle in the vineyard agroecosystem of the study area. The hatching experiment confirmed the role of grapevine, especially the trunk wood, as a reproductive host in the European context. The prevalence of nymph emergence from trunk wood rather than fruiting cane further suggests a preference for thicker or older bark tissue that may provide more favourable conditions for development as previously observed for *S. titanus* when comparing 1 versus ≥ 2-year-old wood (Chuche and Thiéry 2014). The increase in hatching frequency between 2024 and 2025 could reflect the observed increase in captures between 2023 and 2024 in the Giornico site. The important and consistent captures in the vineyards of Giornico and Vezia confirm a strong potential for association with cultivated grapevine habitats similarly to *S. titanus* (Gonella et al. 2024). The markedly higher abundance observed in Giornico compared with other sites suggests that this location may represent the point of the species' initial accidental introduction or at least where a major introduction event could have taken place. This hypothesis is further supported by the proximity of a major trans-Alpine highway connecting Italy to northern Europe, including a road freight traffic control checkpoint, which could facilitate unintentional transport. In the remaining experimental sites, a south to north spread along ecological corridors seems more likely, as indicated by the higher capture rates on YST located within forest compartments and the confirmed presence in the neighbouring Italian region of Lombardy since 2010 (Nielson et al. 2014). Moreover, the absence of captures in rather peripheral and northwards sites, such as Maggia or Biasca, further supports this interpretation.

The recorded widespread presence of *J. olitoria* in the study area and its hypothesized natural migration patterns represent a potential increase of the likelihood of accidental phytoplasma acquisition from plant species in the landscape, where woody species such as *A. glutinosa* and gone-wild grapevines have already been reported to be infected with epidemic FD phytoplasma (FDp) strains (Rizzoli et al. 2021; Oggier, Conedera, et al. 2024). At the current state, molecular analyses revealed

TABLE 3 | Insect vectors of '*Candidatus* phytoplasma vitis' associated with grapevine's Flavescence dorée in Europe.

Insect species	Epidemic *map*-type genotype associated to FD	Insect vector competence	Associated plant species involved in (alternative) FDp cycle	Country (region)	References
Scaphoideus titanus (Ball)	M54, M38, M50, M12, M51	Main vector	*Vitis* spp.	Austria, Bulgaria, Croatia, Czech Republic, France, Germany, Hungary, Italy, Montenegro, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Switzerland	Schvester et al. (1962), Chuche and Thiéry (2014), Malembic-Maher et al. (2020)
Dictyophara europaea (Linnaeus)	M51	Alternative vector	*Clematis vitalba*	Italy, Serbia	Filippin et al. (2009), Malembic-Maher et al. (2020), Pedrelli et al. (2024)
Orientus ishidae (Matsumura)	M38, M50, M54	Alternative vector (not yet confirmed for M54)	*Alnus glutinosa*, *Corylus avellana*, *Vitis* spp.	Italy, Switzerland, Germany, France	Lessio et al. (2016), Casati et al. (2017), Malembic-Maher et al. (2020), Rizzoli et al. (2021), Jarausch et al. (2023), Oggier, Conedera, et al. (2024), Jarausch et al. (2026)
Allygus spp. (Fabricius)	M38, M50	Alternative vector	*Alnus glutinosa*	Germany, France	Malembic-Maher et al. (2020), Jarausch et al. (2023, 2026)
Lamprotettix nitidulus (Fabricius)	M38	Alternative vector	*Alnus glutinosa, Clematis vitalba*	France (Alsace), Germany (Palatinate)	Jarausch et al. (2026)
Oncopsis alni (Schrank)	M38, M50 (and Vectotype I not compatible with *S. titanus*)	Alternative vector	*Alnus glutinosa*	Alder-associated cycle in Germany and other alder habitats. Can transmit Alder yellows-related phytoplasmas from alder to alder and occasionally from alder to grapevine. Not regarded as an epidemiologically relevant vector of FD in vineyards.	Maixner et al. (2000), Arnaud et al. (2007), Malembic-Maher et al. (2020), Jarausch et al. (2026)
Euscelidius variegatus (Kirschbaum)	Used in experimental systems; no indication of vector role in nature.	Putative vector	n.d.	NA	Canuto et al. (2023), Trivellone et al. (2026)

(Continues)

TABLE 3 | (Continued)

Insect species	Epidemic *map*-type genotype associated to FD	Insect vector competence	Associated plant species involved in (alternative) FDp cycle	Country (region)	References
Phlogotettix cyclops (Mulsant & Rey)	16SrV-phytoplasmas detected (*map* genotype not reported)	Putative vector	*Clematis vitalba*	Austria	Strauss and Reisenzein (2018), Guerrieri et al. (2023)
Fieberiella florii (Stal)	M38	Putative vector	n.d.	France (Alsace), Germany (Palatinate)	Jarausch et al. (2026)
Japananus hyalinus (Osborn)	M38	Putative vector	*Acer campestre*, *Acer pseudoplatanus*	Switzerland (Ticino), Germany (Upper Rhine)	Belgeri et al. (2021), Jarausch et al. (2026)
Hishimonus hamatus (Kuoh)	16SrV-phytoplasmas detected (*map* genotype not reported)	Putative vector	n.d.	Switzerland (Ticino)	Belgeri et al. (2021)
Graphocephala fennahi (Young)	16SrV-phytoplasmas detected (*map* genotype not reported)	Putative vector	n.d.	Switzerland (Ticino)	Belgeri et al. (2021)
Synophropsis lauri (Horvath)	M38	Putative vector	*Alnus glutinosa*	Germany (Upper Rhine)	Jarausch et al. (2026)
Hyalesthes obsoletus (Signoret)	*map*-FD3	Putative vector	n.d.	Switzerland (Ticino)	Casati et al. (2017)
Thamnotettix dilutior (Kirschbaum)	*map*-FD2	Putative vector	n.d.	Switzerland (Ticino)	Casati et al. (2017)
Jikradia olitoria (Say)	n.d.	Putative vector (suspected)	*Vitis* spp.	Italy (North), France (Southwest), Austria, Spain, Switzerland (Ticino)	Nielson et al. (2014), Albre and Gibernau (2019), Kunz et al. (2025), Casiraghi and Poggi (2025), this paper

Note: Insect species categorized according to their vector competence, that is, main vector: Primary epidemic grapevine-to-grapevine vector; alternative vector: FD phytoplasma acquisition and transmission confirmed in laboratory and supported by data collected in the field and usually involving other plant species; putative vector: Only FDp and/or FDp-like genotypes acquisition confirmed, no indication of ability to transmit FDp to receipient plant. Associated plant species involved in alternative FDp cycle do not represent the complete and known range of host plant species for the listed insect species. Only major and epidemic *map*-type genotypes are listed. For further details on *map*-type gene and grouping (i.e., FD1, FD2, and FD3) and vectotype related gene *VmpA*, refer to Malembic-Maher et al. (2020).

no evidence of 16SrV-phytoplasma infections in the tested specimens (Table 3). However, the rather important presence of *J. olitoria* in vineyards and its ability to complete its life cycle in the same compartments warrant continued surveillance. The species is a vector of the NAGYIIIβ strain associated with NAGY (Lenzi et al. 2019), and its proximity to grapevines or other plant species infected with FDp could provide opportunities for natural pathogen acquisition and transmission. Given the parallels with the early invasion dynamics of *S. titanus*, which also began with sporadic detections before becoming the key vector of FDp (Chuche and Thiéry 2014), *J. olitoria* may pose a similar risk in the future if suitable ecological and epidemiological conditions converge.

The quick establishment of *J. olitoria* in southern Switzerland underscores the importance of enhancing and adapting territorial surveillance schemes beyond *S. titanus* by including other potentially harmful insect species, which are often ignored and thus not included in the official lists provided by the national plant protection services. In fact, other allochthonous species such as *O. ishidae*, *Osbornellus auronitens* Provancher, and *Erasmoneura vulnerata* Fitch were already able to colonize the study area very quickly (beside *O. auronitens*) and were not included in any official list of quarantine or harmful pests (Guglielmino 2005; Nickel 2010; Jermini et al. 2014; Trivellone et al. 2017; Rizzoli et al. 2020). In the particular case of *O. ishidae*, this East Palearctic species has become an additional player in the epidemiology of FD (Table 3; Casati et al. 2017; Malembic-Maher et al. 2020; Rizzoli et al. 2021; Jarausch et al. 2023; Oggier, Conedera, et al. 2024), and has adapted to acquire additional phytoplasmas, such as '*Candidatus* Phytoplasma ulmi' (Oggier, Debonneville, et al. 2024).

Long-term studies on *J. olitoria* in the study area combining field surveys, molecular diagnostics, and experimental transmission trials will be essential to clarify its epidemiological relevance. Phenology, habitat association, and oviposition behaviour suggest that existing monitoring protocols used for other leafhopper species, such as *S. titanus*, can be readily employed to track the population dynamics of *J. olitoria* as well. At the same time, the tools and infrastructure for phytoplasma detection are also widely used and available. Ultimately, early risk assessment is particularly critical given the potential for synergistic interactions among multiple leafhopper and host plant species in sustaining phytoplasma reservoirs within complex vineyard agroecosystems.

Author Contributions

Christophe Debonneville: investigation, methodology, validation, writing – review and editing, resources. **Attilio Rizzoli:** conceptualization, funding acquisition, methodology, validation, writing – review and editing, project administration, supervision, resources. **Alan Oggier:** conceptualization, investigation, writing – original draft, visualization, formal analysis, data curation, methodology, software. **Marco Conedera:** funding acquisition, resources, project administration, validation, supervision, writing – review and editing.

Acknowledgements

The authors wish to thank Riccardo Battelli of the Plant Protection Service of Canton Ticino and the winegrowers for the collaboration and for granting access to their property. Open access publishing facilitated by Agroscope, as part of the Wiley - Agroscope agreement via the Consortium Of Swiss Academic Libraries.

Funding

This work was supported by the Swiss Federal Office for Agriculture FOAG (grant number 627003160).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data are available at https://doi.org/10.16904/envidat.728

References

Albre, J., and M. Gibernau. 2019. "Diversity and Temporal Variations of the Hemiptera Auchenorrhyncha Fauna in the Ajaccio Region (France, Corsica)." *Annales de la Société Entomologique de France (Nouvelle Série)* 55: 497–508. https://doi.org/10.1080/00379271.2019.1688189.

Arnaud, G., S. Malembic-Maher, P. Salar, et al. 2007. "Multilocus Sequence Typing Confirms the Close Genetic Interrelatedness of Three Distinct Flavescence Dorée Phytoplasma Strain Clusters and Group 16SrV Phytoplasmas Infecting Grapevine and Alder in Europe." *Applied and Environmental Microbiology* 73, no. 12: 4001–4010. https://doi.org/10.1128/AEM.02323-06.

Beanland, L., R. Noble, and T. K. Wolf. 2006. "Spatial and Temporal Distribution of North American Grapevine Yellows Disease and of Potential Vectors of the Causal Phytoplasmas in Virginia." *Environmental Entomology* 35: 332–344. https://doi.org/10.1603/0046-225X-35.2.332.

Belgeri, E., A. Rizzoli, M. Jermini, E. Angelini, L. Filippin, and I. E. Rigamonti. 2021. "First Report of Flavescence Dorée Phytoplasma Identification and Characterization in Three Species of Leafhoppers." *Journal of Plant Pathology* 1, no. 1: 375. https://doi.org/10.1007/S42161-021-01012-Y.

Bonfils, J., and D. Schvester. 1960. "Les Cicadelles (Homoptera Auchenorhyncha) Dans Leurs Rapports Avec la Vigne Dans le Sud-ouest de la France." *Annales Des Epiphyties* 3: 325–336.

Canuto, F., S. Duret, M.-P. Dubrana, et al. 2023. "A Knockdown Gene Approach Identifies an Insect Vector Membrane Protein With Leucin-Rich Repeats as One of the Receptors for the *VmpA* Adhesin of Flavescence dorée Phytoplasma." *Frontiers in Cellular and Infection Microbiology* 13. https://doi.org/10.3389/fcimb.2023.1289100.

Casati, P., M. Jermini, F. Quaglino, et al. 2017. "New Insights on Flavescence dorée Phytoplasma Ecology in the Vineyard Agro-Ecosystem in Southern Switzerland." *Annals of Applied Biology* 171: 37–51. https://doi.org/10.1111/aab.12359.

Casiraghi, A., and F. Poggi. 2025. "Primera Cita Del Cicadélido Neártico *Jikradia olitoria* (Say, 1831) (Hemiptera: Cicadellidae) en España y Actualización de su Distribución en Europa." *Graellsia* 81: e772. https://doi.org/10.3989/graellsia.2025.v81.772.

Caudwell, A. 1957. "Deux Années D'étude Sur la Flavescence Dorée, Nouvelle Maladie Grave de la Vigne." *Annales D'amélioration Des Plantes* 4: 359–363.

Chandler, D. S., and K. G. Hamilton. 2017. "Biodiversity and Ecology of the Leafhoppers (Hemiptera: Cicadellidae) of New Hampshire." *Transactions of the American Entomological Society* 143, no. 4: 773–971. https://doi.org/10.3157/061.143.0408.

Chuche, J., and D. Thiéry. 2009. "Cold Winter Temperatures Condition the Egg-Hatching Dynamics of a Grape Disease Vector."

Die Naturwissenschaften 96: 827–834. https://doi.org/10.1007/s00114-009-0541-x.

Chuche, J., and D. Thiéry. 2014. "Biology and Ecology of the Flavescence dorée Vector *Scaphoideus titanus*: A Review." *Agronomy for Sustainable Development* 34: 381–403. https://doi.org/10.1007/s13593-014-0208-7.

Daire, X., D. Clair, W. Reinert, and E. Boudon-Padieu. 1997. "Detection and Differentiation of Grapevine Yellows Phytoplasmas Belonging to the Elm Yellows Group and to the Stolbur Subgroup by PCR Amplification of Non-Ribosomal DNA." *European Journal of Plant Pathology* 103: 507–514. https://doi.org/10.1023/A:1008641411025.

Davis, R. E., E. L. Dally, Y. Zhao, et al. 2015. "Unraveling the Etiology of North American Grapevine Yellows (NAGY): Novel NAGY Phytoplasma Sequevars Related to '*Candidatus* Phytoplasma Pruni'." *Plant Disease* 99: 1087–1097. https://doi.org/10.1094/PDIS-11-14-1185-RE.

Davis, R. E., E. L. Dally, Y. Zhao, and T. K. Wolf. 2018. "Genotyping Points to Divergent Evolution of '*Candidatus* Phytoplasma Asteris' Strains Causing North American Grapevine Yellows and Strains Causing Aster Yellows." *Plant Disease* 102: 1696–1702. https://doi.org/10.1094/PDIS-10-17-1690-RE.

DeLong, D. M. 1948. "The Leafhoppers, or Cicadellidae, of Illinois (Eurymelinae-Balcluthinae)." *Bulletin of the Illinois Natural History Survey* 24, no. 2: 97–376. https://doi.org/10.21900/j.inhs.v24.196.

Filippin, L., J. Jović, T. Cvrković, et al. 2009. "Molecular Characteristics of Phytoplasmas Associated With Flavescence dorée in Clematis and Grapevine and Preliminary Results on the Role of *Dictyophara europaea* as a Vector." *Plant Pathology* 58, no. 5: 826–837. https://doi.org/10.1111/j.1365-3059.2009.02092.x.

Firrao. 2004. "'*Candidatus* Phytoplasma', a Taxon for the Wall-Less, Non-Helical Prokaryotes That Colonize Plant Phloem and Insects." *International Journal of Systematic and Evolutionary Microbiology* 54: 1243–1255. https://doi.org/10.1099/ijs.0.02854-0.

Folmer, O., M. Black, W. Hoeh, R. Lutz, and R. Vrijenhoek. 1994. "DNA Primers for Amplification of Mitochondrial Cytochrome c Oxidase Subunit I From Diverse Metazoan Invertebrates." *Molecular Marine Biology and Biotechnology* 3, no. 5: 294–299.

Gonella, E., G. Benelli, N. Arricau-Bouvery, et al. 2024. "*Scaphoideus titanus* Up-To-The-Minute: Biology, Ecology, and Role as a Vector." *Entomologia Generalis* 44: 481–496. https://doi.org/10.1127/entomologia/2023/2597.

Guerrieri, E., V. Forte, E. Belgeri, et al. 2023. "Presence and Distribution of Known, Alternative and Putative Insect Vectors of Phytoplasmas Associated With "Flavescence Doree" Disease in Northeast Italy." *Phytopathogenic Mollicutes* 13: 29–30. https://doi.org/10.5958/2249-4677.2023.00015.4.

Guglielmino, A. 2005. "Observations on the Genus *Orientus* (Rhynchota Cicadomorpha Cicadellidae) and Description of a New Species: *O. amurensis* N. Sp. From Russia (Amur Region and Maritime Territory) and China (Liaoning Proivince)." *Marburger Entomologische Publikationen* 3, no. 3: 99–110.

Jarausch, B., C. Abidon, S. Biancu, et al. 2026. "The Role of Reservoir Plants and Alternative Vectors for the Spread of Flavescence dorée (FD) Phytoplasmas in FD-Free Regions: *Lamprotettix nitidulus* Identified as a New Vector." *Journal of Pest Science* 99, no. 1: 35. https://doi.org/10.1007/s10340-025-02009-7.

Jarausch, B., A. Markheiser, W. Jarausch, et al. 2023. "Risk Assessment for the Spread of Flavescence dorée-Related Phytoplasmas From Alder to Grapevine by Alternative Insect Vectors in Germany." *Microorganisms* 11: 2766. https://doi.org/10.3390/microorganisms11112766.

Jeger, M., C. Bragard, D. Caffier, et al. 2016. "Risk to Plant Health of Flavescence dorée for the EU Territory." *EFSA Journal* 14: e04603. https://doi.org/10.2903/j.efsa.2016.4603.

Jermini, M., S. Schaerer, H. Johnston, et al. 2014. "Dix ans de flavescence dorée au Tessin." *Revue Suisse de Viticulture, d'Arboriculture et d'Horticulture* 46: 222–229.

Kunz, G., E. Kern, E. Lind, et al. 2025. "New and Remarkable True Hoppers (Hemiptera, Auchenorrhyncha) From Austria, With a Special Focus on Styria." *Natura Styriaca* 1: 354–361.

Lee, I.-M., D. E. Gundersen-Rindal, R. E. Davis, K. D. Bottner, C. Marcone, and E. Seemüller. 2004. "'*Candidatus* Phytoplasma Asteris', a Novel Phytoplasma Taxon Associated With Aster Yellows and Related Diseases." *International Journal of Systematic and Evolutionary Microbiology* 54: 1037–1048. https://doi.org/10.1099/ijs.0.02843-0.

Lenzi, P., T. M. Stoepler, D. J. McHenry, R. E. Davis, and T. K. Wolf. 2019. "*Jikradia olitoria* ([Hemiptera]: [Cicadellidae]) Transmits the Sequevar NAGYIIIβ Phytoplasma Strain Associated With North American Grapevine Yellows in Artificial Feeding Assays." *Journal of Insect Science* 19, no. 1: 1. https://doi.org/10.1093/jisesa/iey124.

Lessio, F., L. Picciau, E. Gonella, et al. 2016. "The Mosaic Leafhopper *Orientus ishidae*: Host Plants, Spatial Distribution, Infectivity, and Transmission of 16SrV Phytoplasmas to Vines." *Bulletin of Insectology* 69, no. 2: 277–289.

Lowry, P. R. 1933. "Cicadellidae Leafhoppers of New Hampshire." *Ohio Journal of Science, Columbus* 33: 59–80.

Magarey, P. A., and M. F. Wachtel. 1986. "Grapevine Yellows: A Widespread, Apparently New Disease in Australia." *Plant Disease* 70: 694. https://doi.org/10.1094/PD-70-694d.

Maixner, M., W. Reinert, and H. Darimont. 2000. "Transmission of Grapevine Yellows by *Oncopsis alni* (Schrank) (Auchenorrhyncha: Macropsinae)." *Vitis* 39, no. 2: 83–84.

Malembic-Maher, S., D. Desqué, D. Khalil, et al. 2020. "When a Palearctic Bacterium Meets a Nearctic Insect Vector: Genetic and Ecological Insights Into the Emergence of the Grapevine Flavescence dorée Epidemics in Europe." *PLoS Pathogens* 16, no. 3: e1007967. https://doi.org/10.1371/journal.ppat.1007967.

Mittelberger, C., L. Obkircher, V. Oberkofler, et al. 2020. "Development of a Universal Endogenous qPCR Control for Eukaryotic DNA Samples." *Plant Methods* 16: 53. https://doi.org/10.1186/s13007-020-00597-2.

Nickel, H. 2010. "First Addendum to the Leafhoppers and Planthoppers of Germany (Hemiptera: Auchenorrhyncha)." *Cicadina* 11: 107–122.

Nielson, M. W. 1979. "A Revision of the Subfamily Coelidiinae (Homoptera: Cicadellidae) Iii. Teruliini, New Tribe." *Pacific Insects Monograph* 35: 1–329.

Nielson, M. W., R. S. Zack, F. Poggi, and H. Nickel. 2014. "New Leafhopper Species of *Jikradia* From Mesoamerica With New Records, Revised Key to Species, Distribution, Origin, and Checklist (Hemiptera: Cicadellidae: Coelidiinae: Teruliini)." *Revista de Biología Tropical* 62: 1375–1383. https://doi.org/10.15517/rbt.v62i4.12943.

Oggier, A., M. Conedera, C. Debonneville, O. Schumpp, and A. Rizzoli. 2024. "Gone-Wild Grapevines in Forests Host Phytoplasma Genotypes Linked to Grapevine's Flavescence dorée Epidemics in Cultivated Vineyards and Competent Vectors." *Journal of Plant Pathology* 106: 1537–1548. https://doi.org/10.1007/s42161-024-01775-0.

Oggier, A., M. Conedera, M. Jermini, C. Debonneville, O. Schumpp, and A. Rizzoli. 2023. "Gone-Wild Grapevines in Forests May Act as a Potential Habitat for 'Flavescence Dorée' Phytoplasma Vectors and Inoculum." *Journal of Applied Entomology* 147: 777–789. https://doi.org/10.1111/jen.13169.

Oggier, A., M. Conedera, and A. Rizzoli. 2025. "Habitat Management as an Integrative Strategy for Flavescence dorée: A Case Study of Wild-Growing Common Hazels Hosting the Alternative Vector *Orientus ishidae* (Hemiptera: Cicadellidae)." *Journal of Economic Entomology* 118, no. 6: 3094–3102. https://doi.org/10.1093/jee/toaf249.

Oggier, A., C. Debonneville, M. Conedera, O. Schumpp, and A. Rizzoli. 2024. "First Detection of '*Candidatus* Phytoplasma Ulmi' in Switzerland and in *Orientus ishidae* Matsumura, 1902." *Alpine Entomology* 8: 29–34. https://doi.org/10.3897/alpento.8.115588.

Pearson, R. C., R. M. Pool, D. Gonsalves, et al. 1985. "Occurrence of Flavescence dorée-Like Symptoms on "White Riesling" Grapevines in New York, U.S.A." *Phytopathologia Mediterranea* 24: 82–87.

Pedrelli, A., M. Carli, A. Panattoni, et al. 2024. "Investigating a New Alarming Outbreak of Flavescence dorée in Tuscany (Central Italy): Molecular Characterization and *Map* Gene Typing Elucidate the Complex Phytoplasma Ecology in the Vineyard Agroecosystem." *Frontiers in Plant Science* 15: 1489790. https://doi.org/10.3389/fpls.2024.1489790.

Ratnasingham, S., C. Wei, D. Chan, et al. 2024. "BOLD v4: A Centralized Bioinformatics Platform for DNA-Based Biodiversity Data." *Methods in Molecular Biology* 2744: 403–441. https://doi.org/10.1007/978-1-0716-3581-0_26.

Rizzoli, A., R. Battelli, M. Conedera, and M. Jermini. 2020. "First Record of *Erasmoneura vulnerata* Fitch, 1851 (Hemiptera, Cicadellidae, Typhlocybinae) in Switzerland." *Alpine Entomology* 4: 151–156. https://doi.org/10.3897/alpento.4.53967.

Rizzoli, A., E. Belgeri, M. Jermini, M. Conedera, L. Filippin, and E. Angelini. 2021. "*Alnus glutinosa* and *Orientus ishidae* (Matsumura, 1902) Share Phytoplasma Genotypes Linked to the 'Flavescence Dorée' Epidemics." *Journal of Applied Entomology* 145: 1015–1028. https://doi.org/10.1111/jen.12933.

Schaerer, S., H. Johnston, P. Gugerli, et al. 2007. "Flavescence Dorée in Switzerland: Spread of the Disease in Canton of Ticino and of Its Insect Vector, Now Also in Cantons of Vaud and Geneva." *Bulletin of Insectology* 60: 375–376.

Schvester, D., G. Moutous, and P. Carle. 1962. "*Scaphoideus titanus* Ball. (Homopt. Jassidae) cicadelle vectrice de la Flavescence dorée de la vigne." *Revue de Zoologie Agricole et Appliquée* 10, no. 12: 118–131.

Sforza, R., D. Clair, X. Daire, et al. 1998. "The Role of *Hyalesthes obsoletus* (Hemiptera: Cixiidae) on the Occurrence of Bois Noir of Grapevines in France." *Journal of Phytopathology* 146: 549–556. https://doi.org/10.1111/j.1439-0434.1998.tb04753.x.

Strauss, G., and H. Reisenzein. 2018. "First Detection of Flavescence dorée Phytoplasma in *Phlogotettix cyclops* (Hemiptera, Cicadellidae) and Considerations on Its Possible Role as Vector in Austrian Vineyards." *IOBC-WPRS Bulletin* 139: 12–21.

Trivellone, V., F. Canuto, G. Lucetti, et al. 2026. "Tracking the Early Spatio-Temporal Dynamics of Phytoplasma Multiplication Within Its Leafhopper Vector." *Microbiology* 172, no. 4. https://doi.org/10.1099/mic.0.001700.

Trivellone, V., M. Mitrović, C. H. Dietrich, and I. Toševski. 2017. "*Osbornellus auronitens* (Hemiptera: Cicadellidae: Deltocephalinae), an Introduced Species New for the Palaearctic Region." *Canadian Entomologist* 149, no. 5: 551–559. https://doi.org/10.4039/tce.2017.7.

Wolf, T. K. 2015. "North American Grapevine Yellows." In *Compendium of Grape Diseases, Disorders, and Pests*, edited by W. F. Wilcox, W. D. Gubler, and J. K. Uyemoto, 2nd ed., 111–113. American Phytopathological Society Press.

Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Figure S1:** Seasonal population dynamics of *Jikradia olitoria* in the vineyard canopy based on yellow sticky trap captures in 2023 and 2024. **Figure S2:** Seasonal population dynamics of *Jikradia olitoria* in the landscape surrounding vineyards based on yellow sticky trap captures in 2023 and 2024. **Table S1:** *Jikradia olitoria* captures on yellow sticky traps placed inside the vineyard canopy (trap type = V) and in the landscape around vineyards (trap type = L) in 2023 and 2024. **Table S2:** Hatching events of *Jikradia olitoria* nymphs from grapevine plant material sampled in Giornico (gio).