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On the presence in Europe of two *Illinoia* aphids of North American origin (Homoptera, Aphididae)

Abstract - Two aphids belonging to the genus *Illinoia* and native from the Nearctic Region (USA) are recorded from France and other Western European countries. *I. morrisoni* (Swain), known to live on numerous conifers, can be frequently found on Cupressaceae and particularly on *Cupressus arizonica*, on which it has been observed in France. Unlike the former species, *I. liriodendri* (Monell) is monophagous on the tuliptree, *Liriodendron tulipifera* (Magnoliaceae), which is an urban as well as a forest tree of interest in the area. Some morphological characters which are useful for the identification of the two species are illustrated and elements concerning their biology in the newly colonized area are discussed.

Résumé - *Sur la présence en Europe de deux* Illinoia, *aphides d'origine Nord-Américaine (Homoptera, Aphididae).*

Deux pucerons du genre *Illinoia,* originaires de la région Néarctique (USA) sont signalés en France et dans d'autres pays d'Europe de l'Ouest. *I. morrisoni* (Swain) est connu sur de nombreux Conifères, fréquent sur Cupressacées et, en particulier, sur *Cupressus arizonica*. *I. liriodendri* (Monell) est, au contraire, spécifique du tulipier de Virginie, *Liriodendron tulipifera* (Magnoliacées), arbre qui présente de l'intérêt, tant dans un contexte urbain, que forestier. Quelques éléments concernant leur identification, leur morphologie, ainsi que leur biologie dans l'aire nouvellement envahie sont présentés.

Riassunto - *Sulla presenza in Europa di due afidi del genere* Illinoia *di origine nord-americana (Homoptera, Aphididae).*

Viene segnalata in Francia e altri paesi europei occidentali la presenza di due afidi Macrosifini del gen. *Illinoia* di origine neartica. Una di tali specie, *I. morrisoni* (Swain) vivente su numerose Conifere e particolarmente Cupressacee, è stata rilevata in Francia soprattutto su *Cupressus arizonica*. L'altra entità, *I. liriodendri* (Monell), è invece monofaga sulla Magnoliacea *Liriodendron tulipifera* (albero dei tulipani), pianta di interesse ornamentale e forestale. Su entrambe tali specie

vengono riportate notizie relative alla loro morfologia, alla diffusione nei paesi di recente acquisizione e al loro comportamento bio-ecologico.

Key words: *Illinoia liriodendri, Illinoia morrisoni*, new records, France, Italy.

INTRODUCTION

Two aphid species of North American origin, *Illinoia liriodendri* (Monell) and *I. morrisoni* (Swain), have been detected in France and other Western European countries starting from several years ago. The former species was recorded recently from Italy (Limonta, 2001), while the latter one is known from England since an almost long time (Eastop, 1962; Prior, 1975).

Both aphids appear to be locally rather common in the mentioned countries, and can be likely present, even not yet detected, in other Western European countries, including the North Mediterranean areas, where they represent potential pests due to their direct and indirect injuries to the host plants.

COLLECTING DATA AND EPIDEMIOLOGY

In France, *I. liriodendri* has been firstly collected in Nantes (Loire-Atlantique) during spring 1998. Here the aphid severely infested numerous large 40-years-old tuliptrees, *Liriodendron tulipifera* L. (Magnoliaceae), grown along avenues and public squares. There, in 2000 and 2001, the aphid population has been sampled fortnightly by the staff of the city technical service. From July 2001 the presence of the same aphid was detected in many places of South-Western France (*i.e.* Mixe near Bayonne, Pyrénées Atlantiques; Onard near Mont-de-Marsan, Landes; other localities in the departments of Ariège and Tarn), where tuliptrees have been planted for testing their interest as timber trees. From the same year onward, other collections have been made in different French areas, such as Allevard (Isère), in the district of Rennes, and recently (2005) in Cote d'Azur (Alpes Maritimes). In Italy, this species appears to be widespread in the Northern regions (Lombardy, Piedmont), while attempts to find it in more southern areas along the peninsula and the main islands (Sicily, Sardinia) have failed till now. The same aphid was collected by one of us (S.B.) in England at Kew Garden in London in September 2003 and furthermore sampled there on the same tuliptree plants by V.F. Eastop (pers. comm.).

Unlike the following species (*q.v.*), *I. liriodendri* has not been apparently trapped up to now by the suction trap networks operating in the same European countries where the aphid has already been detected on plants.

The second species, *I. morrisoni*, has been observed for the first time in France on *Cupressus arizonica* Greene at Pégomas (Alpes-Maritimes) in June 1995, and subsequently both in the same locality (1999, 2001) and at Mougins (Alpes-Maritimes)

(1999). In addition, several alate viviparous have been caught by means of 12.2m suction traps (Rothamsted type) in Brittany. A first specimen has been trapped in 1979. Then, after a surprising period of about ten years without catches, other single alates have been sampled at Rennes-Le Rheu and Landerneau (Finistère).

In Italy, the same species is known since 1988, on the base of a few alates trapped by a Rothamsted suction trap set at Pozzuolo del Friuli, Udine province (P.G. Coceano pers. comm.; Coceano & Petrovic, in press). Nevertheless, no samples have been collected on its host plants in the same area.

MORPHOLOGY

Morphology of both *I. liriodendri* and *I. morrisoni* is well known since their original description, as quoted in the following literary references. Nevertheless, the two species are little known in W-Europe, where they are spreading after their accidental introduction. Therefore, the following notes can help the identification of both apterae and alate viviparous morphs.

1. ***Illinoia liriodendri*** (Monell)

Apterous viviparous female. Body spindle-shaped, 1.90-2.70 mm in length (average of 26 measured specimens, 2.39 mm), pale yellowish-green, with darker head and slightly wax powdered. Head with well developed lateral frontal tubercles and a very low median tubercle. Antennae blackish except for their pale basal part (joints I-II and basal portion of III joint), 1.28-1.52 longer than body; III joint bearing 0-4 secondary rhinaria confined on its basal one fourth length (11 specimens out of 26 examined, which are apparently true apterae, have 1-4 rhinaria at least on one antenna, while the remaining specimens are without rhinaria); VI joint with processus terminalis 4.60-6.70 (average of 12 specimens 5.93) of its basal part. Antennal hairs all short and rather blunt apically, 10-20 μm on III joint or 0.30-0.50 of its basal articular diameter of maximum length. Rostrum reaching at its maximum extension the ideal line between the second and third coxae; it has a short conical apical joint, which is 0.68-0.88 of the second joint of hind tarsus and bears 3-6 (usually 4) supplementary hairs, in addition to the three subapical primary pairs. Legs with femora basally concolour to body and gradually darkening towards their apex; tibiae mostly blackish, except for their paler median portion. Hind tibiae 0.74-0.88 of body length, with rather pointed hairs, which on outer side of their median part are up to 20-35 μm or 0.48-0.88 of tibial diameter at the same point. First tarsal joints with 3:3:3 hairs. Second hind tarsal joint distinctly shorter (0.60-0.90) than the basal part of VI antennal joint. Siphunculi blackish, with a paler basal part, slightly curved outwards and very little swollen on their distal one third (ratio of maximum diameter at the incrassed part/minimum basal width 1.03-1.23); reticulated distal area 0.10-0.13 of the siphuncular total length. Cauda

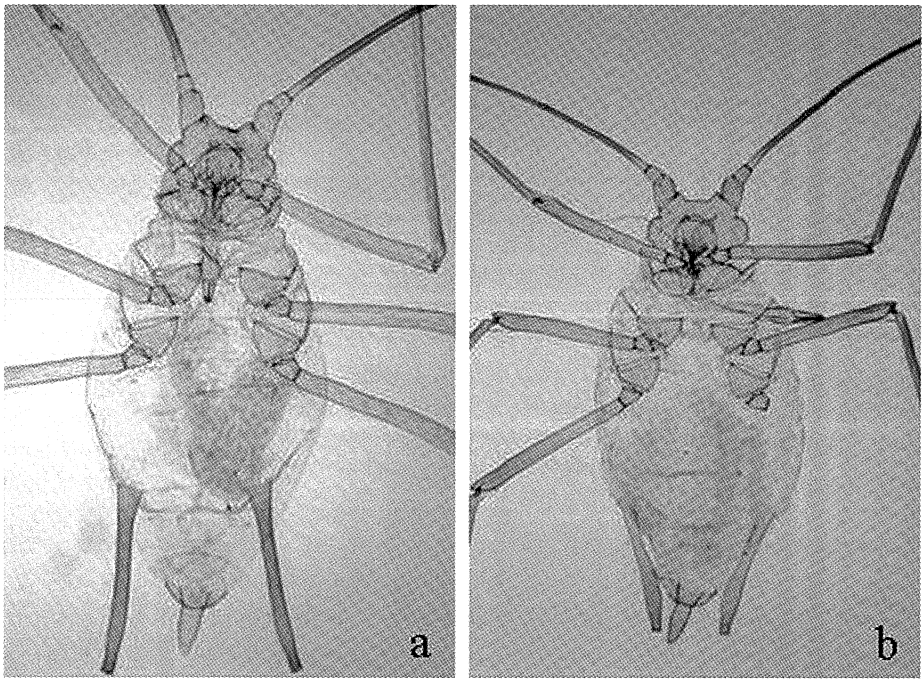

Fig. 1 - *Illinoia liriodendri* (Monell) (a) and *I. morrisoni* (Swain) (b): apterous viviparous females from miscroscopic slides.

pale greenish and 0.32-0.40 of siphuncular length; it is finger-shaped with a rather tapering apex and bears 6-9 (most frequently 7 or 8) marginal and subapical setae. No dorsal body sclerifications are evident. Marginal and spinal tubercles on abdomen lacking. Dorsal body hairs moderately pointed at apex; their length is: 18-30μm on frons, 8-16μm on 2nd-3rd abdominal tergites, 25-45μm on 8th urotergite, which bears 5-7 hairs. Genital plate with 2 main discal setae and 8-10 smaller marginal ones.

Alate viviparous female. Body length 2.00-2.40 mm; head and thorax brownish, abdomen green. Wings with transparent membrane and brownish veins and pterostigma. Antennae entirely blackish, 1.65-1.80 longer than body; III joint bearing 14-22 secondary rhinaria aligned more or less in a single row for most of its length; VI joint with processus terminalis 5.18-6.75 of its basal part. Reticulate distal area of the siphunculi up to 0.12-0.18 of siphuncular length. Dorsal abdominal sclerifications consisting of very faintly sclerified marginal spots on 2nd-4th segments, ante- and post-siphuncular small sclerites and a narrow median band on 8th urotergite.

Other morphological characters are more or less similar to those of apterous viviparous female.

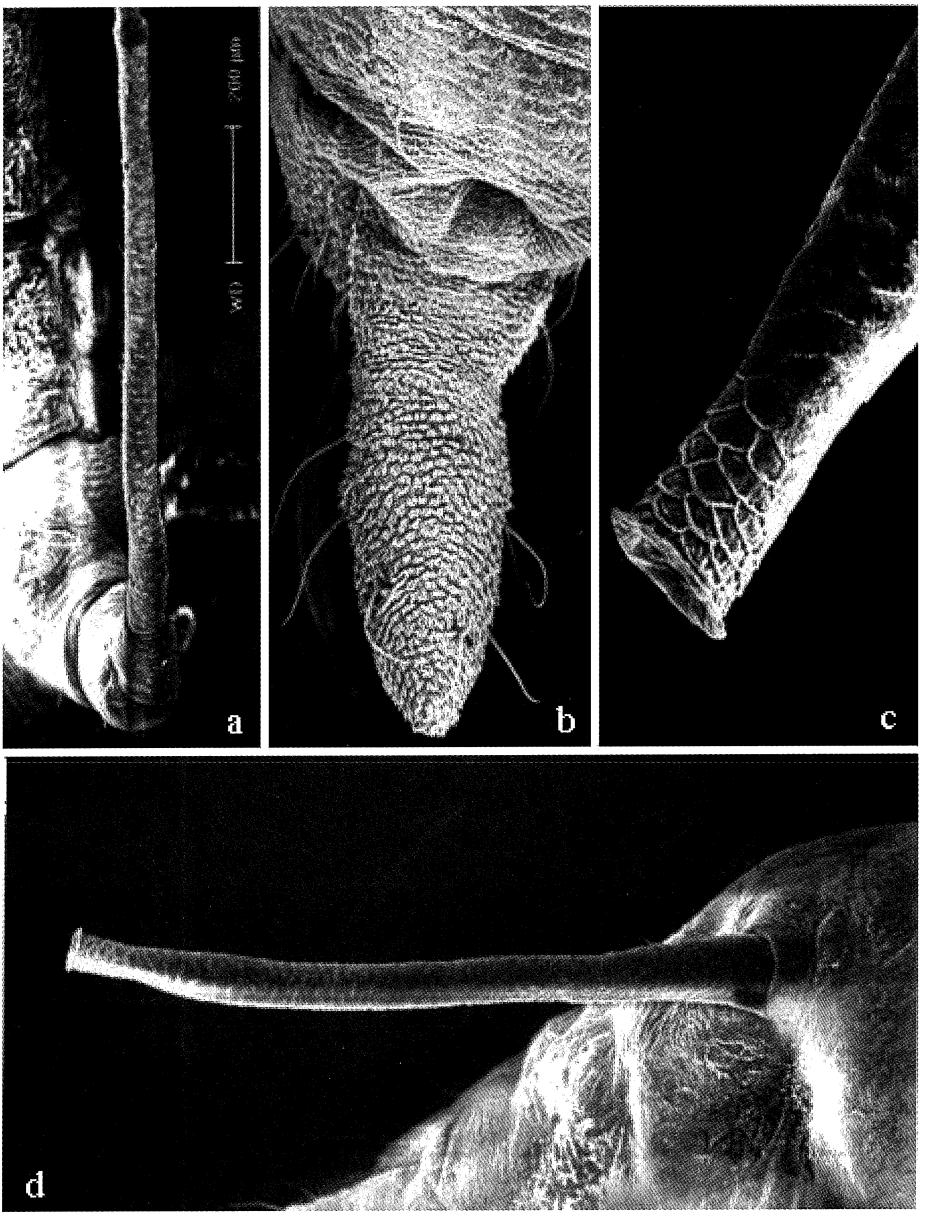

Fig. 2 - *Illinoia liriodendri* (Monell), apterous viviparous female: a. III antennal joint; b. cauda; c. distal part of siphunculus; d. siphunculus.

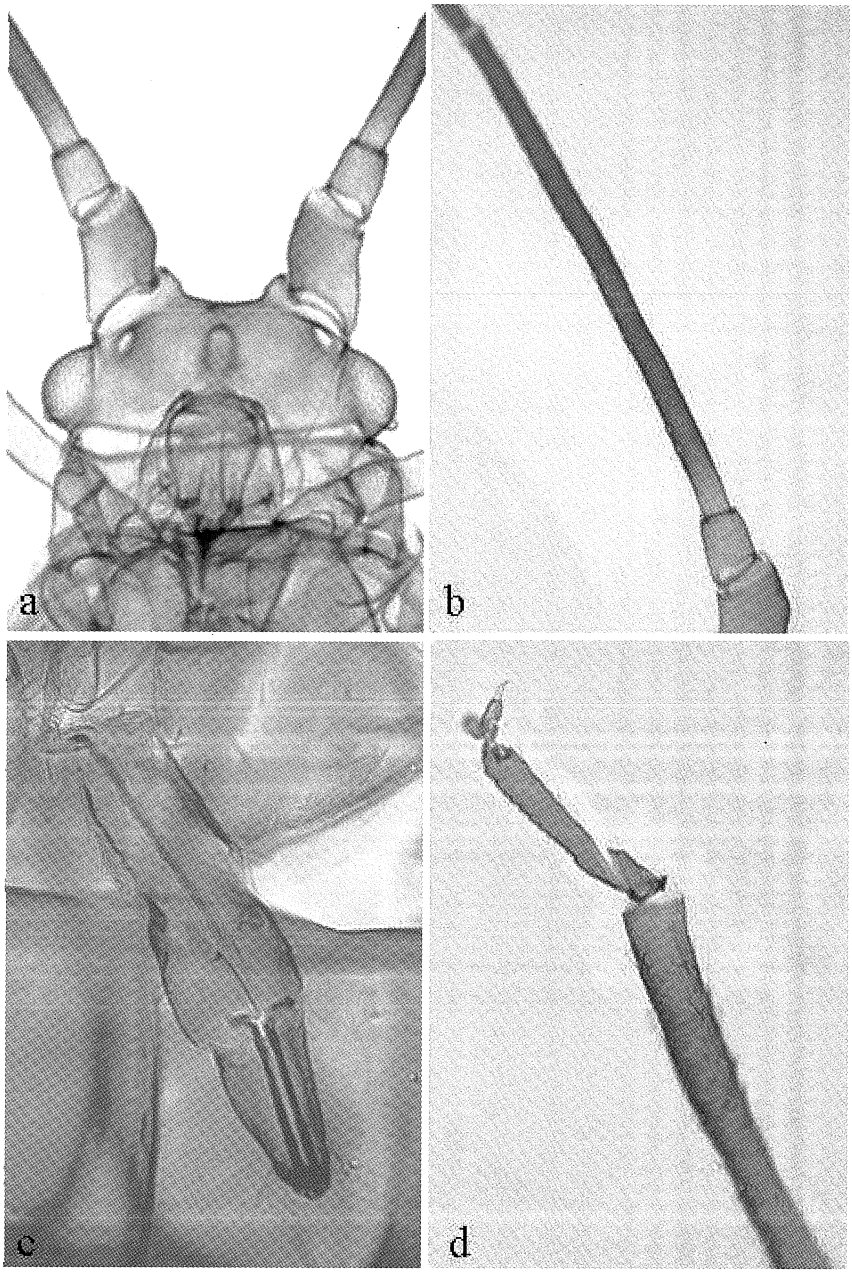

Fig. 3 - *Illinoia liriodendri* (Monell). Alate viviparous female: a. head; b. III antennal joint; c. rostrum; d. distal part of tibia and tarsus of hind leg.

An extensive morphological description of *I. liriodendri*, including drawings, is given by Davis (1909), who moved it to the genus *Macrosiphum* from the Monell's original description as *Siphonophora*; he gave details on viviparous morphs (alate and apterous), including notes on a pinkish colour variety (*I. liriodendri* var. *rufa* Monell), in addition to the description of oviparous female and alate male. Hottes & Frison (1931) included the same taxon in a key to the species of *Macrosiphum*, s.l., from Illinois.

The presence of *I. liriodendri* is very easy to be recognized on its host plant, because of its abundant production of a very sticky honeydew. It is the only aphid specialised to live on tuliptree and there should be no problem in separating it from the few very polyphagous aphid species that can be found on this plant (Blackman & Eastop, 1994).

2. ***Illinoia morrisoni*** (Swain)

Apterous viviparous female. Body spindle-shaped, 1.55-2.20 mm in length (1.50-2.85 mm from other published data), from dark green to yellowish-green in colour, with brownish antennae (except a short pale basal part of III joint), legs, siphunculi (except the pale basal third) and cauda. Head slightly pigmented, with well developed and diverging lateral frontal tubercles, but lacking the median frontal one. Antennae slightly longer (1.05-1.35) than body and having the flagellum (III-VI joints) more heavily pigmented comparatively to joints I-II and the even paler basal part of III joint; the latter bearing 0-3 (up to 6 from literary data) secondary rhinaria, confined on its basal fourth (on 8 specimens out of 14 available apterae there are no rhinaria on both antennae). Processus terminalis of VI joint relatively short, in comparison to several other species in the same aphid genus, being it in average about four times longer (observed range 3.50-4.40) than the basal part of the same joint. Antennal hairs blunt apically and very short, at least on flagellar joints; they are 6-10 μm of maximum length on III joint, or 0.16-0.35 of its basal articular diameter. Rostrum reaching behind the third coxae, showing a conical and more intensively pigmented last joint which is usually a little shorter or subequal (0.88-1.02) to the second joint of hind tarsi and bears 6-8 supplementary hairs (up to 12 in the literature) in addition to the three primary distal pairs. Legs with femora gradually more pigmented towards their distal part; tibiae and tarsi uniformly pigmented and darker than femora. Hind tibiae 0.60-0.82 of body and bearing rather short and mostly blunt hairs: those on outer side, in the median portion of tibiae, are maximally about 15-25 μm or 0.34-0.65 of tibial diameter at the same point. First tarsal joint chaetotaxy usually 3:3:3, though some specimens show up to 4 or 5 hairs on one or more legs. Second joint of hind tarsus rather long comparatively to other species of the same genus, being it about as long as (0.90-1.08) the basal part of VI antennal joint. Siphunculi about one third (0.29-0.40) of body, clearly more pigmented on their distal two thirds than at

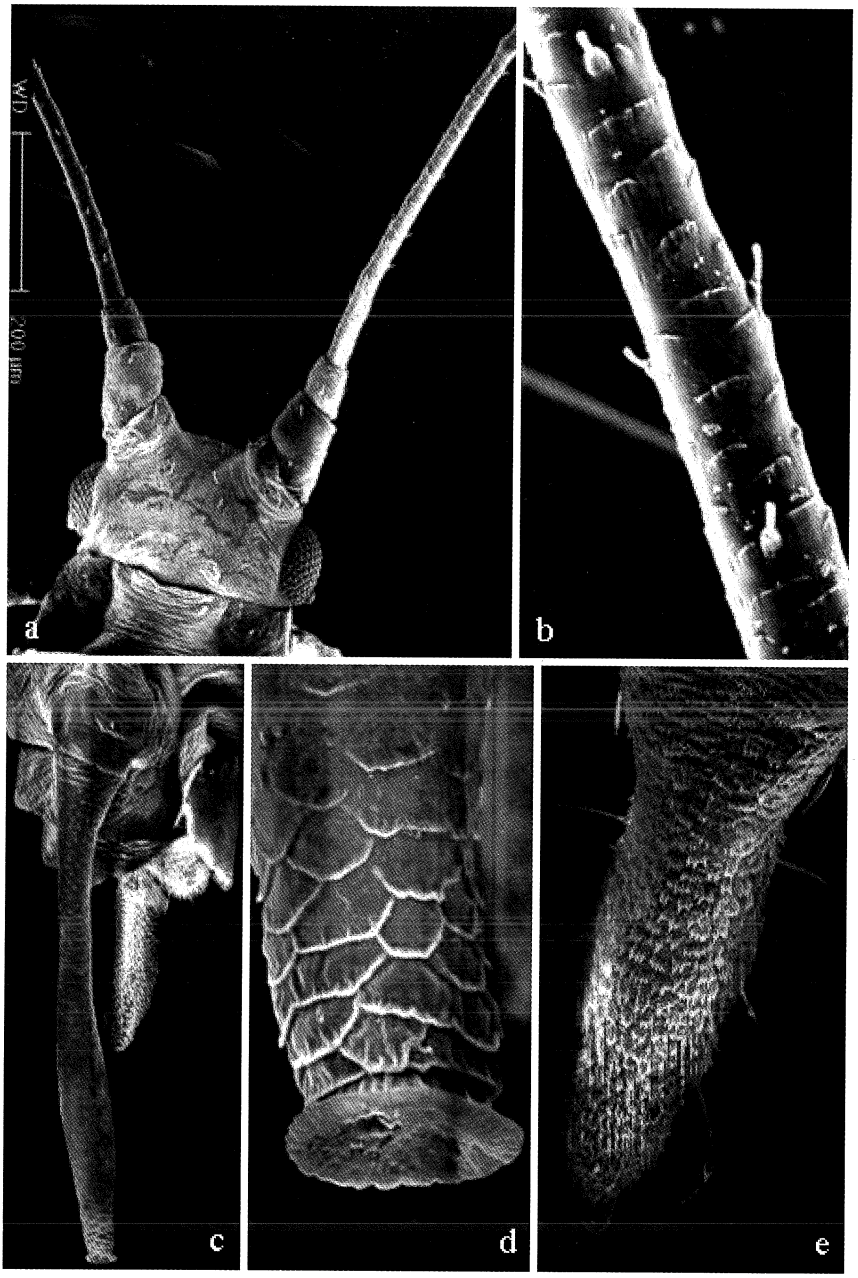

Fig. 4 - *Illinoia morrisoni* (Swain), apterous viviparous female: a. head and part of antennae; b. part of III antennal joint; c. siphunculus and cauda; d. distal part of siphunculus; e. cauda.

the paler basal part, and distinctly swollen on distal half (maximum width 1.60-1.90 of the more basal minimum diameter); reticulated distal area, behind the rather distinctive apical flange, covering 0.08-0.12 of the total siphuncular length. Cauda finger-shaped, slightly tapering towards apex, just paler than siphunculi and 0.40-0.50 of their length; it bears typically 7 hairs, of which three pairs displaced laterally plus a single subdistal one. Dorsal body hairs quite short and more or less blunt apically; their length range: 12-20 µm on frons, 8-14 µm on 2nd-3rd urotergites and 16-30 µm on 8th urotergite; the latter bearing 5-6 hairs. Genital plate with 2 main discal setae and 7-10 smaller ones around its distal margin. No dorsal sclerified areas are either on thorax and abdomen. Very small marginal tubercles are occasionally present on some of the urites 2nd-5th, in addition to 1 or 2 spinals on 8th urotergite.

Alate viviparous female. Body 2.00-2.20 mm (from only two available specimens); head and thorax brownish and abdomen green in colour. Antennae entirely brown, except for a paler very short basal portion of III joint; the latter bearing 3-10 secondary rhinaria more densely located on the basal third. Wings with entirely transparent membrane and brownish veins and pterostigma. Siphunculi yet pale at base, with reticulated area a bit more extensive (0.10-0.13 of siphuncular length) than in the apterous form. Abdominal dorsal sclerifications consisting of rather pigmented marginal roundish spots on 2nd-4th segments and smaller intersegmental muscle sclerites on 1st-5th tergites. Ante- and post-siphuncular sclerites small and little evidenced, while a narrow and more or less pigmented median band is present on 8th urotergite. Other morphological features are very much like those of the apterous morph.

In addition to the quite extensive original description of *I. morrisoni* (Swain, 1918), further data on its morphology are given by Gillette & Palmer (1934), Palmer (1952) and MacGillivray (1958), who ascribed the species to the genera *Nectarosiphon*, *Amphorophora* (second and third references) and *Masonaphis*, respectively. The latter Author described also *Masonaphis* (*Ericobium*) *pseudomorrisoni* sp.n. (actually considered as synonym of *I. morrisoni*) as a distinct taxon living on *Juniperus scopulorum*, giving some morphological details on its amphigonic morphs (oviparous female and alate male) in addition to the apterous viviparous description. Short accounts were also given by Prior (1975), who quoted that immature forms of *I. morrisoni* "looked very like immature of *Macrosiphum euphorbiae* Thomas with a darker green longitudinal stripe and waxy bloom on the body".

I. morrisoni is actually very easy to distinguish from other aphids living on *Cupressus* and belonging to the genera *Cinara, Stomaphis* and *Siphonatrophia*. However, in spite of its rather large size, this aphid is not easy to be detected on infested plants, being its colour very close to the one of *Cupressus arizonica* foliage.

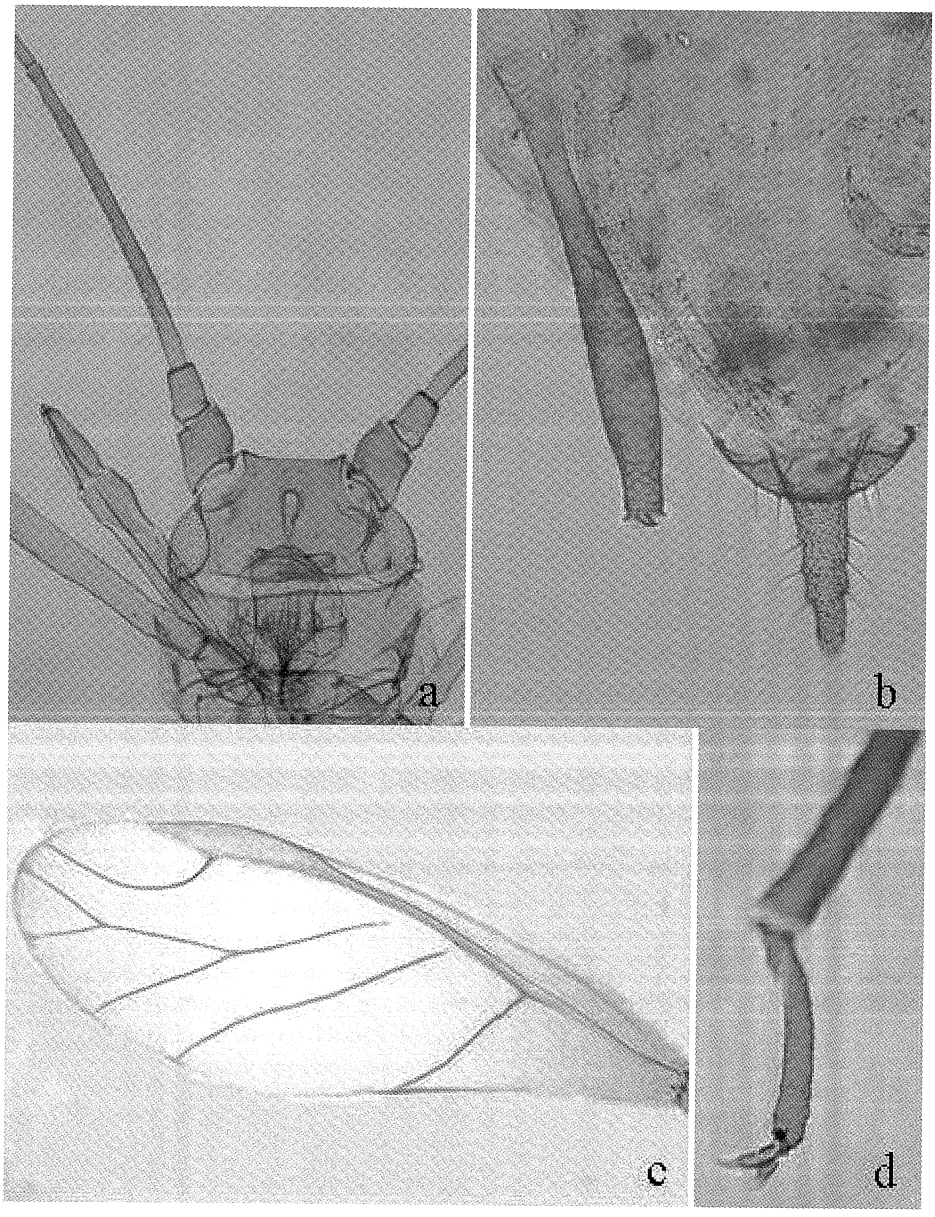

Fig. 5 - *Illinoia morrisoni* (Swain). Alate viviparous female: a. head and rostrum; b. siphunculus and cauda; c. fore wing; d. distal part of tibia and tarsus of hind leg.

Table 1 - Illinoia liriodendri *(Monell): morphometric data of apterous (ns. 1-8) and alate viviparous female (ns. 9-10). Measurements in mm.*

N°	Body length	Antennal lengths					U.r.j. length	Hind tibia length	II h.t. length	Siph. length	Cauda length
		Total length	III	IV	V	VI					
1	2.16	3.05	0.64	0.48	0.57	0.20+0.96	0.106	1.59	0.120	0.66	0.24
2	2.35	2.86	0.72	0.50	0.48	0.17+0.78	0.120	1.96	0.140	0.80	0.28
3	1.94	2.83	0.52	0.44	0.50	0.16+1.01	0.104	1.55	0.124	0.62	0.24
4	2.20	3.25	0.63	0.56	0.58	0.19+1.09	0.108	1.93	0.148	0.77	0.28
5	2.25	3.24	0.65	0.54	0.61	0.18+1.06	0.120	1.98	0.148	0.77	0.25
6	2.68	3.79	0.85	0.61	0.69	0.18+1.21	0.124	2.25	0.160	0.84	0.33
7	2.70	3.46	0.70	0.52	0.64	0.18+1.18	0.120	2.05	0.158	0.85	0.34
8	2.46	3.59	0.82	0.60	0.68	0.18+1.09	0.120	2.12	0.160	0.87	0.31
9	2.32	3.89	0.88	0.68	0.72	0.22+1.14	0.136	2.27	0.168	0.88	0.31
10	2.04	3.37	0.72	0.60	0.67	0.16+1.02	0.124	2.01	0.140	0.73	0.25

Collecting data: ns. 1-5, Milan (Italy), 30.VIII.01 (L. L. leg.); ns. 6-8, London, Kew Garden (England), 09.IX.03 (S.B. leg.); no. 9, Milan (Italy), 17.IV.02 (S.B. leg.); no. 10, Milan (Italy), 30.VI.04 (L.L. leg.). All specimens from *Liriodendron tulipifera.*
Abbreviations: u.r.j.: ultimate rostral joint; II h.t. = second hind tarsomer.

Table 2 - Illinoia morrisoni *(Swain): morphometric data of apterous (ns. 1-8) and alate viviparous female (ns. 9-10). Measurements in mm.*

N°	Body length	Antennal lengths					U.r.j. length	Hind tibia length	II h.t. length	Siph. length	Cauda length
		Total length	III	IV	V	VI					
1	1.90	2.12	0.51	0.33	0.38	0.14+0.59	0.136	1.34	0.152	0.56	0.26
2	1.80	2.12	0.50	0.31	0.37	0.15+0.62	0.144	1.32	0.142	0.66	0.25
3	1.80	1.91	0.42	0.30	0.35	0.14+0.53	0.128	1.24	0.144	0.52	0.26
4	2.21	2.38	0.54	0.34	0.45	0.17+0.68	0.154	1.32	0.160	0.67	0.30
5	1.86	2.10	0.48	0.28	0.38	0.16+0.64	0.140	1.24	0.150	0.62	0.24
6	1.55	2.05	0.51	0.33	0.37	0.15+0.53	0.144	1.32	0.148	0.64	0.27
7	1.65	2.18	0.48	0.33	0.40	0.15+0.65	0.138	1.25	0.148	0.58	0.26
8	1.76	2.21	0.50	0.36	0.41	0.16+0.62	0.152	1.34	0.160	0.69	0.28
9	2.00	2.20	0.50	0.37	0.40	0.15+0.61	0.144	1.39	0.144	0.50	0.23
10	2.16	2.40	0.59	0.39	0.45	0.17+0.63	0.150	1.45	0.142	0.60	0.25

Collecting data: ns. 1-3 & 9, *Cupressus* sp., Ventana (Chile), 20.X.99 (S. Ragusa Di Chiara leg.); ns. 4-8 & 10 all from *Cupressus arizonica*: ns. 4 & 10, Pégomas (France), -.VI.95 (J.D. leg.); no. 5, ibidem, 13.IV.99 (J.-M.R. leg.); ns. 6-8, Mougins (France), 21.VI.99 (J.-M.R. leg.). Abbreviations: u.r.j.: ultimate rostral joint; II h.t. = second hind tarsomer.

TAXONOMY

The genus *Illinoia* Wilson is represented by more than forty Macrosiphine taxa of specific or subspecific rank, subdivided into four subgenera (Remaudière & Remaudière, 1997). Both species here considered, *I. liriodendri* and *I. morrisoni*, belong to the subgenus *Illinoia, s.s.* The genus was taxonomically revised by MacGillivray (1958) under the name *Masonaphis* H.R.L., within which she recognized four different subgenera: *Masonaphis, s.s.*, *Ericobium* MacGill., *Oestlundia* H.R.L. and *Amphorinophora* MacGill. *Illinoia, s.l.*, is of nearctic origin, and the few species presently known in W-Palearctic region (*i.e.* W-Europe) are considered as introduced taxa from North America.

Species included in the genus *Illinoia* are *Macrosiphum*-like aphids characterized by more or less swollen and distally reticulated siphunculi. Nevertheless, in spite of the relative morphological homogeneity among species, the phylogenetic relationships within their host plants remain quite obscure at present; in fact, these are represented by a quite large number of species belonging to not less than a dozen of botanical families (viz. Ericaceae, Asteraceae, Rosaceae, Caprifoliaceae, Magnoliaceae, Liliaceae, Cupressaceae, and others).

MacGillivray (1958) did not deal in her revision with the species *I. liriodendri* (Monell), because the genus *Illinoia* was then considered as a separate one from *Masonaphis*, as quoted by Hille Ris Lambers in a key to Macrosiphine aphids with reticulated siphunculi included in the same paper. She reported *I. morrisoni* within the newly established subgenus *Ericobium* (today quoted as synonym of subg. *Illinoia s.s.*) either as *M. (E.) morrisoni* and *M. (E.) pseudomorrisoni* MacGill., the latter being presently considered as synonym of the former species.

In the field, *I. liriodendri* and *I. morrisoni* unlikely can be confused each other because of their very different host plants. Morphologically – apart from their rather different body size, which on the base of the apterae available to us is on average 1.74 in *I. morrisoni* against 2.39 in *I. liriodendri* – the two aphids can be separated by both apterae and alate viviparous as follows: (a) the ratio processus terminalis/basal part of VI antennal joint is less than 4.50 (range 3.25-4.40) in *I. morrisoni* and more than 4.50 (range 4.60-6.70) in *I. liriodendri*; (b) the ratio ultimate rostral joint/basal part of VI antennal joint is less than 0.80 (range 0.52-0.70) in *I. liriodendri*, and more then 0.80 (range 0.88-1.06) in *I. morrisoni*. Furthermore, the siphunculi are comparatively much less swollen in *I. liriodendri* than in *I. morrisoni*, where the ratio maximum/minimum siphuncular width is less than 1.40 (range 1.02-1.30) in the former, and more than 1.50 (1.58-2.00) in the latter species.

DISTRIBUTION AND BIOLOGY

Both species of *Illinoia* have a nearctic origin and are holocyclic aphids, though at least one of them (*I. morrisoni*) can also develop anholocyclically (Blackman &

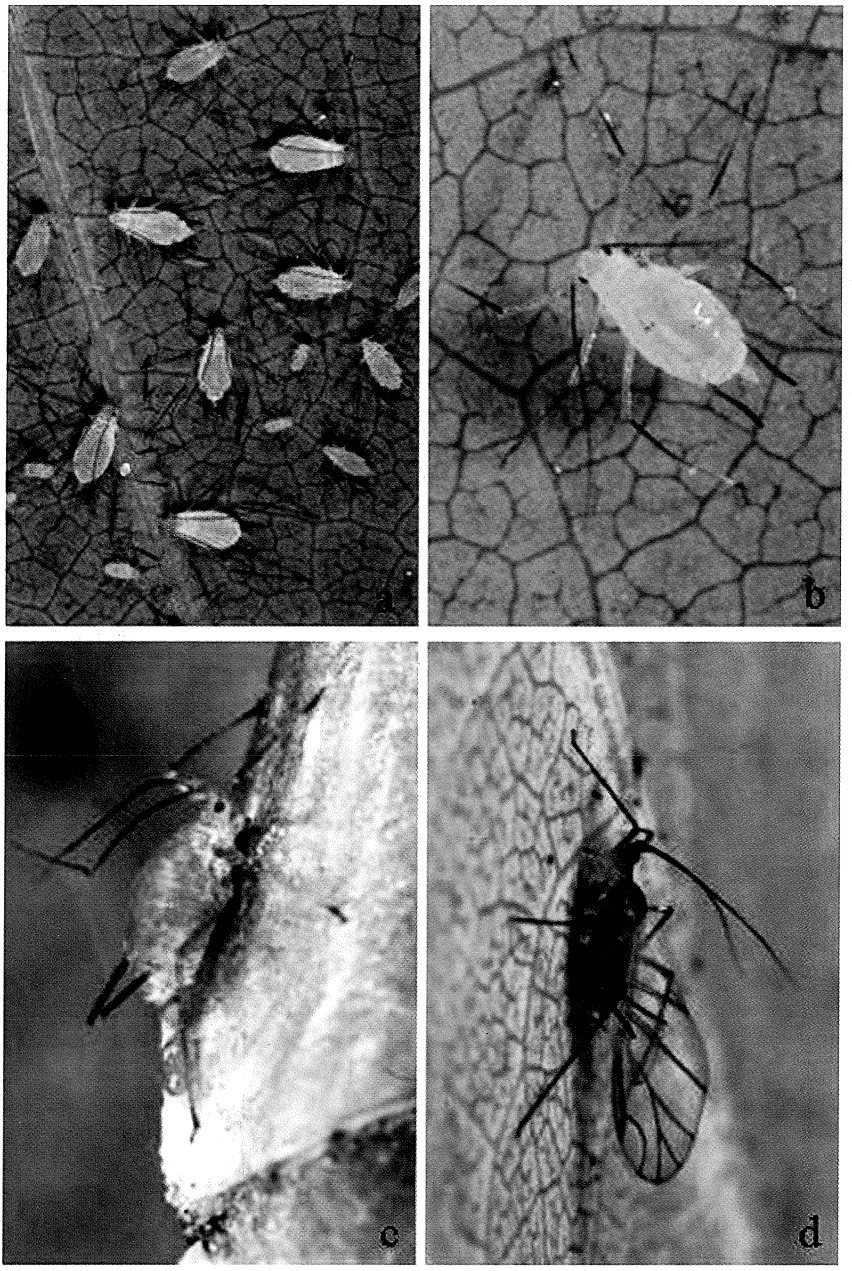

Fig. 6 - *Illinoia liriodendri* (Monell). a. aphid colony on the underside leaf of tuliptree; b. apterous viviparous female; c. oviparous female; d. alate viviparous female.

Eastop, 1994). *I. liriodendri* is known from the N-E of U.S.A. (Illinois, Missouri, Washinghton D.C.), where it is very probably widespread around the native area of its sole known host plant species, *Liriodendron tulipifera* (Davis, 1909; Hottes & Frison, 1931). It has been introduced in recent years in Japan (Sugimoto, 1999) and Europe (Limonta, 2001). In the latter continent the species appears to be holocyclic as well, overwintering as egg on the twigs of its deciduous host plant. In France (Nantes) and Italy (Milan) young specimens appear at the end of March on the newly hatched leaves. Two weeks after the opening the buds, the aphid population becomes visible on the trees while the leaves grow. About 1% of the underside of the leaves appeared infested on May 10th 2001 in Nantes; colonies were mainly present on the lower part of the trees, containing adult apterae and nymphs of alate form. Occasionally, alate viviparae can appear earlier in the year: one specimen was, in fact, collected on April 17th 2002 in an urban area in Milan. The population grows up until the beginning of July and progressively sets on the higher parts of the trees, where specimens can also colonize the upper part of the leaves; percentage of alates increases inside colonies. At the end of June, the aphid population can be at its highest density and more than 50% of the leaves can be infested. Specimens produce a visible "rain" of honeydew droplets. The honeydew of *I. liriodendri* is particularly abundant and sticky; in urban areas it falls down on the pavement and parked vehicles. Very abundant sooty mould develops on the honeydew spread on the leaves. The aphid colonies may host many natural enemies: fungal diseases, parasitoids and predators.

In August and September, the aphid population usually drops down and alates disappear or are strongly reduced in number. At beginning of October, colonies were observed on less than 10% of the leaves and were still visited by natural enemies. At the end of this month aphid specimens can be found on less than 1% of the leaves. The first oviparae were detected during the last decade of October in the years 2000 and 2001 in Nantes, where an oviparous female was seen after leaves fall, on November 11th 2001. Owerwintering of the species has been studied separately at Le Rheu, near Rennes, on isolated tuliptrees, where amphigonic morphs (oviparous females and males) were observed in November (2002, 2004) and eggs have been laid during the same month in 2005.

As to the other species, *I. morrisoni,* very little has been directly observed on its bionomics either in France and Italy, where most of its records are, in fact, represented by a few trapped alates. The aphid is well known in some W-United States, such as Colorado and California (Swain, 1918; Palmer, 1952; MacGillivray, 1958); from there it was likely introduced into other countries in N-Europe (Blackman & Eastop, 1994) and S-America (a sample from Chile, now in the collection of S.B., was collected on *Cupressus* sp. by Prof. S. Ragusa Di Chiara). Its host plants are represented by several Coniferous species, mostly Cupressaceae of several genera and occasionally of different families.

The aphid has a holocyclic life cycle on those host plants, as quoted by the detection of its amphigonic morphs (MacGillivray, 1958), while apparently it can be also anholocyclic in California (Blackman & Eastop, 1994). The aphid life cycle is not

yet known in Europe, where it is likely anholocyclic, though one alate male was found in an unusual period (April 13th 1999) mixed to a few apterae viviparous in a sample collected by one of us (J.M.R.) at Pégomas (France).

DISCUSSION AND CONCLUSION

The first place in Europe where *I. liriodendri* was introduced, around 1995, is probably the port of Nantes, with its large tuliptrees population. The species has never been caught in the suction traps network set in Brittany, but the host tree was quite rare till recently in that region. The large populations produced in Nantes have probably spread over the country, to the different places where we have found the aphid in 2001. During this year, it has been also found in different places around Milan, in North Italy (Limonta, 2001). Thus, we can hypothesize an invasion from Nantes to Milan in five years.

Planted in parks in Europe since the 18th century, consideration has started to be given to the tuliptree, as a street-tree or a wood producing plant (particularly in S-W France), during the middle of the 20th century (Timbal, 1991). One of its main advantages was the absence of pests (Aureau & Bartoli, 1991). At the moment, *I. liriodendri* is the first pest of the tuliptree introduced into Europe. More than 100 species of insects can live on this plant in the Eastern USA; four of them are considered economically threatening (Burns, 1970). Although frequent in natural stands, *I. liriodendri* is not one of them. However, the large production of honeydew is, from now on, a real drawback for the presence of tuliptrees in an urban environment, as it has been stressed in California (Dreistadt, 1987). Residents walking and parking under the trees complain and the city technical services have to treat at least once a year (during the second half of June in the conditions of Nantes), which is always problematic in such an environment.

On this abundant resource we have observed the complete set of aphids natural enemies, with Coccinellids, Chrysopids, Syrphids, bugs, Hymenoptera parasites and hyperparasites and parasitic fungi. They all have to be compared to the species which have been surveyed in the area of origin of the host (mainly Eastern USA) during the implementation of an IPM program against this pest in California (Zuparko & Dahlsten, 1993).

As for *I. morrisoni,* it has been apparently introduced first in England, where it has been observed at Kew Gardens, near London, on *Sequoia sempervirens* in 1960, and later on in a greenhouse in Surrey, on *Cupressus macrocarpa* and *Taxodium distichum* (Eastop, 1962; Prior, 1975). In more recent years, catches of this aphid by suction traps either in France (Brittany) and Italy (Udine province) show a probable

settlement in those regions and the permanence of potential contaminants, even at a low level.

In addition, our observations on cypress prove the settlement of *I. morrisoni* in the N-Mediterranean area from 1995, the species remaining inconspicuous, probably also at a low population level. Here the aphid can likely survive anholocyclically, even when winter conditions are not particularly mild.

The timing of these observations is consistent with the hypothesis of a progressive colonisation from Britain to Western France and then to the Mediterranean from West to East.

I. morrisoni is an oligophagous species. It has not been reported as a major pest of Cupressaceae and other Coniferous plants. As far as the genus *Cupressus* in the Mediterranean area (where it is economically very important) is concerned, and after the recent introduction of *Siphonatrophia cupressi* (Rabasse *et al.*, 2005), the set of known possible aphids on this tree is now almost complete (Rabasse & Lyon, 1982).

In conclusion, the introduction of these two congeneric and rather similar N-American aphid species allows some comparisons. These examples show that - in the long list from the grapevine phylloxera to the western corn rootworm - North-America remains an important source of potentially harmful pests for transatlantic introduction into Europe. At the moment, one of the two *Illinoia* seems to be more dangerous than the other one and even capable of hampering some uses of its host-plant. If necessary, our results show once again the interest of a suction traps network for the early detection of newly introduced aphids (Hullé *et al.*, 1966).

The speed of invasion by these two similar aphids appears to be very different, since *I. liriodendri* quickly spread in only about 6 years on a quite large area in SW-Europe, whereas *I. morrisoni* spent nearly 45 years to cover more or less the same area, even though it could have encountered much more potential hostplants on its way.

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