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AUCHENORRHYNCHA INTRODUCED INTO EUROPE FROM THE NEARCTIC REGION: TAXONOMIC AND PHYTOPATHOLOGICAL PROBLEMS[1]

A. ARZONE, C. VIDANO, A. ALMA

Istituto di Entomologia agraria e Apicoltura, Università di Torino, Italy

ABSTRACT

The species of Auchenorrhyncha introduced into Europe from the Nearctic region are relatively few in comparison with the ones introduced into the Nearctic region from Europe. However, they are noteworthy for various reasons. Following a chronological order, the most significant cases concern the membracid Stictocephala bisonia Kopp & Yonke, the cicadellids Graphocephala fennahi Young, Scaphoideus titanus Ball, Endria nebulosa (Ball), Japananus hyalinus (Osborn), and the flatid Metcalfa pruinosa (Say). S. bisonia, G. fennahi and S. titanus have incurred remarkable taxonomic problems having been pointed out respectively as Ceresa bubalus (Fabricius), G. coccinea (Forster) and S. littoralis Ball. After the description of J. meridionalis Bonfils, a taxonomic complication is involving also J. hyalinus, that is likely native of Japan, where it already had taxonomic vicissitudes. An up-to-date chorological review of these six species shows that the quick diffusion of some of them was caused by nurserymen. From the phytopathological point of view, S. bisonia, S. titanus and M. pruinosa required and are requiring particular attention in northern Italy. As all the above Auchenorrhyncha were probably introduced into Europe by eggs overwintering inside living plants, directions for a more responsible quarantine service in this field are needed.

INTRODUCTION

Insect migration from the zone of origin to other zoogeographical regions may occur in different ways but is certainly favoured by the egg stage. The egg acquires more importance in the diffusion of plant pests when it is laid in plant tissues and is destined to overwinter. The Auchenorrhyncha, wich have a relatively strong ovipositor, often make ovipositions that are difficult to detect and so they elude a normal phytosanitary check. Species, wich are incidentally introduced into new areas, arrive there without the biocoenctic complex that controls their populations in the country of origin and, since they usually do not meet effective natural enemies, they can multiply at a high rate. If such species infest cultivated plants and cause phytopathological problems, they are promptly reported; otherwise their presence may remain unnoticed for a long time. Concerning the introduction into Europe of Auchenorrhyncha from the Nearctic region, some species are considered worthy of attention. Following the chronological order of recordings, the most significant cases regard the membracid Stictocephala bisonia Kopp & Yonke, the cicadellids Graphocephala fennahi Young, Scaphoideus titanus Ball, Endria nebulosa (Ball), Japananus hyalinus (Osborn), and the flatid Metcalfa pruinosa (Say). For each species, the

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involved tissues, number of annual generations, overwintering modalities, and host plants are taken into consideration together with data concerning taxonomic vicissitudes and chorology.

STICTOCEPHALA BISONIA KOPP & YONKE, 1977

Membracis bubalus Say, 1830 (nec bubalus Fabr., 1794)
Ceresa bubalus Fitch, 1851 (nec bubalus Fabr., 1794)
Stictocephala bubalus Caldwell, 1949 (nec bubalus Fabr., 1794)
Stictocephala bubalus Kopp & Yonke, 1973 (nec bubalus Fabr., 1794)

The taxonomic vicissitudes that occurred to this membracid are really unique. When the buffalo treehopper was reported in the Palaearctic region for the first time, it was pointed out as Ceresa bubalus (F.) (Horváth, 1912) and, so called, it continued its diffusion in Europe. On the occasion of the revision of membracids of the tribe Ceresini, the genus Ceresa appeared characterized by the presence of paired rows of spines on the dorsal surface of the posterior arm of the aedeagus, a character absent in the genus Stictocephala. The analysis of the buffalo treehopper's male genitalia led to the new denomination Stictocephala bubalus (Caldwell, 1949).

During the taxonomic revision of the tribe Ceresini, the examination of the specimens of the series of Fabricius, that were kept at the Zoologisk Museum of Copenhagen, revealed a very surprising situation, summarized as follows : no holotype was designated; the type-series of the species Membracis bubalus was composed of two specimens that, according with the International Code of Zoological Nomenclature, became syntypes; these two syntypes were females, a smaller one without label, a bigger one with a small, barely legible scrap of paper with the word bubalus written on it; the treehopper that American authors have been commonly referring to as the buffalo treehopper or Stictocephala (= Ceresa) bubalus F. was not conspecific with either of the specimens of the Fabrician type series; the two specimens of the Fabrician type series were not conspecific with each other; the type specimens appeared to be of central American origin rather than "America boreali" as stated by Fabricius (Kopp & Yonke, 1977). The smaller syntype compared favourably with males and females of Stictolobus minor (Fowler), which is a Central American species; the bigger one, bearing the handwritten bubalus label, cannot be related to any other described species and was designated as the lectotype of the species Membracis bubalus Fabricius. Thus the North American species commonly known as buffalo treehopper remained without scientific name and was described as Stictocephala bisonia (Kopp & Yonke, 1907).

S. bisonia is very eclectic from the dietetical point of view. In order to complete its annual cycle, it needs at least two host plant species : a woody one for ovipositions and a herbaceous one for the larval development. Ovipositions, that cause fearful cauline injuries, occur in 1-3 years old branches of broad-leaved trees and shrubs. Apple, pear, peach, poplar and willow are preferred; however, in the various infested areas, many other woody hosts belonging to the families Betulaceae, Corylaceae, Fagaceae, Platanaceae, Juglandaceae, Salicaceae, Ulmaceae, Rosaceae, Rutaceae, Vitaceae, Ebenaceae, Oleaceae, and Caprifoliaceae are involved.

Cultures of alfalfa (Medicago sativa) and of red clover (Trifolium pratense) represent the best food for nymphs; however, in non

dry environments, they may develop at the collet of many other herbaceous plants having glabrous or not much hairy stems and belonging to various families, such as Gramineae, Polygonaceae, Caryophyllaceae, Violaceae, Papilionaceae, Convolvulaceae, Solanaceae, Scrophulariaceae, Verbenaceae, Labiatae, Plantaginaceae, Compositae. S. bisonia is a univoltine species and overwinters in the egg stage (Table 1).

There are three kinds of infestation through which the buffalo treehopper may be responsible of the arising of phytopathies. Among them, the most common one has

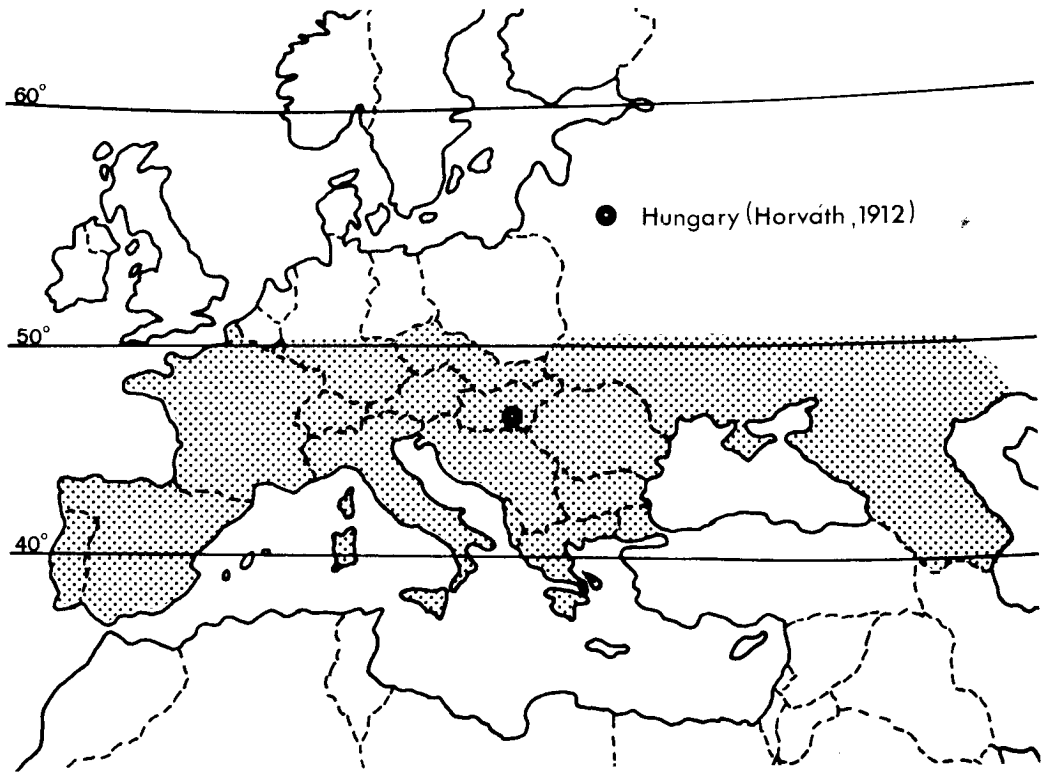

Fig. 1. European chorology of Stictocephala bisonia Kopp & Yonke

the females in reproductive activity as pathogenic agents that, because of their characteristic egg-layings, induce the appearance of evident cauline alterations in woody plants. Less known is the kind of infestation connected to the trophic activity of larval stages, the attacks of which involve exclusively herbaceous plants. The third kind of infestation has the adults in trophic activity as agents, that are polyphagous but, in certain areas where they reproduce, they cause particular cauline and foliar alterations in Vitis.

Undoubtedly, S. bisonia must be feared first of all for the attacks of females on young fruit plants. Each female lays more than 100 eggs embedding them, by means of the strong ovipositor, into the thickness of the bark of branches that are 0.8-2 cm in diameter. Eggs are laid one next to the other, in groups of 6-12 that

have a crescent shape and two opposed groups form an indefinite oval. Oviposition wounds, usually in opposed couples, are 2 mm deep and 3-4 mm long. Besides the phloem also the cambium is reached; often even the peripherical layers of the xylem are touched. Consequent morphological and physiological alterations damage not only the involved organs but the whole plant, especially if attacks are repeated year after year. Egg-laying wounds are particularly noxious in young trees, but quite serious alterations may be caused also in nursery plants. S. bisonia adults are very attracted by grapevine, but much more for feeding than for egg-laying.

About phytopathies caused by young instars feeding punctures, annular stranglings near the collet in M. sativa and T. pratense are recorded. These leguminous forage plants are infested only near fruit-trees and other woody plants where the species overwinters. However, the luxuriant growth of alfalfa and red clover cultures always masks the losses due to the feeding activity of the membracid nymphs.

Grapevine is not a host plant for young instars, but is one of the preferred plants by adults for feeding. The grapevine organs involved by suction punctures of adults are the still green seasonal canes as well as stalks, peduncles and tendrils. Sometimes, mouth stylet punctures even reach the xylem, but generally they stop in the phloem or better in the cribrose tissue. If they are made in one or more radial or spiralar series, as it usually happens, the affected organ reacts in a sudden and characteristic way : at the level of the trauma, an annular strangling originates together with a necrosis; afterwards, close hyperplastic and hypertrophic swellings arise. As the xylem remains healthy while an annular ring of phloem tissue has its seive tubes damaged, the organs that are distal to the trauma continue to be supplied with xylem sap but cannot let the phloem sap flow downward any more. Owing to the excessive accumulation of organic substances, sugars in particular, the leaves of the cane above the strangling undergo downward rolling, thickening, brightness, reddening (in red or black grapes) and yellowing (in white grapes). Moreover, always distally to these cauline alterations, the herbaceous canes swell abnormally, remaining green for a long time; then they redden or yellow, but do not mature (Vidano, 1964a).

The original native range of the buffalo treehopper was probably eastern and midwestern North America, but since it oviposits in young twigs of nursery stock, the species has been inadvertently introduced into the western states, Hawaii and Europe (Kopp & Yonke, 1977). Concerning Europe, S. bisonia was reported for the first time in Hungary (Horvath, 1912), then in many other countries by several authors who are successively recorded (Ricci, 1976), afterwards in Czechoslovakia (Okali, 1974) and in Portugal (Quartau, 1981) as shown in Fig. 1, in which Spain and Portugal are completely shaded, although few reports are given, as well as Austria for which no report is known, likely due to the lack of observations (Table 2).

GRAPHOCEPHALA FENNAHI YOUNG, 1977

Cicada coccinea Forster, 1771
Graphocephala coccinea (Forster, 1771)

G. fennahi was introduced into Europe from North America probably by means of overwintering eggs and has had its nomenclatorial vicissitudes, being once confused

with G. coccinea (Forster, 1771). The latter, which is distributed America from Panama to Canada and reported for various ornamental plants (Young, 1977), showed to be linked to the Ericaceae Rhododendron spp. and Kalmia latifolia with two generations per year and overwintering as eggs embedded under the leaf epidermis in Pennsylvania (Wheeler & Valley, 1980). The considerable problem of nomenclature was cleared by the authoritative statement of Young (1977) who distinguished, above all on the analysis of the male genitalia, G. coccinea, a Centre-North American species, from G. fennahi, a new North American species introduced into Europe.

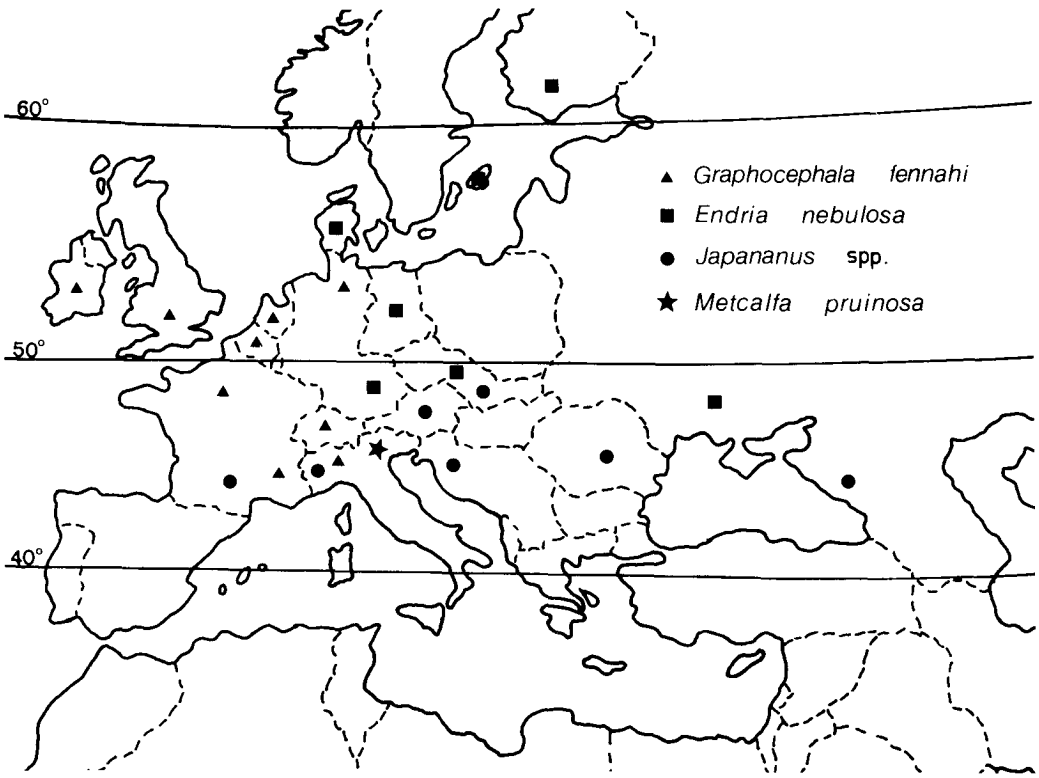

Fig. 2. European chorology of Graphocephala fennahi Young, Endria nebulosa (Ball), Japananus spp., and Metcalfa pruinosa (Say)

For what concerns nomenclatorial vicissitudes, it is necessary to keep in mind that, recently, within the G. coccinea complex, 7 species were identified (Hamilton, 1985) : G. coccinea (Forster, 1771), G. coccinea quadrivittata (Say, 1830), G. picta (Walker, 1851), G. taliformis (Walker, 1851), G. idonea (Fowler, 1900), G. fennahi Young, 1977, G. constricta Hamilton, 1985. Consequently, G. coccinea confused with G. fennahi should be considered as G. coccinea quadrivittata.

From the reports of many authors, this plant sucker appears to be bound to Rhododendron spp., but some indications of other host plants are deceptive. In Italy, G. fennahi was found in all stages only on ornamental Rhododendron.

Adults were found sometimes also on other shrubs, in particular on Azalea spp., but always close to Rhododendron. Nymphs need tender shoots and leaves in growth for their development; adults, even if dwelling also on the lower leaf surface, prefer the upper surface and insert the stylets into the middle vein to feed. Nymphs and adults are xylem suckers. Eggs are laid in the perulae of Rhododendron flower buds where they overwinter (Table 1). Subproximal and medial perulae mostly are involved. There is one generation per year (Vidano et al., 1986).

Feeding punctures do not cause necroses in the tissues. More or less diffused brownings appear instead in the flower bud bearing eggs. The perulae, at the level of each ovipositor's piercing, show necrotized areas that mark the position of the endophytic eggs. Sometimes, such necrotized areas are remarkably expanded and apparently due to alterations caused by a pathogenic agent. Nevertheless, even if the leafhopper (under the name G. coccinea) was repeatedly associated to the transmission of the fungus Pycnostysanus azaleae (Peck) Mason (Viennot-Bourgin, 1981), no traces of the cryptogam were reported in Italy. Even in the cases of heavy attacks, the blossoming of the involved flower buds is not damaged because only the perulae are affected and, after all, they usually fall during anthesis (Vidano et al., 1986).

G. fennahi seems originary of south-western North America and is thought to have been introduced into Europe with imported nursery stock. The first report for Europe concerns England (China, 1935), then The Netherlands, Switzerland, Ireland, France, Belgium, Italy (Vidano et al., 1986). It is present also in northwestern Germany, according with unpublished data (Remane, in litteris) and our personal collectings (Fig. 2, Table 2).

SCAPHOIDEUS TITANUS BALL, 1932

Scaphoideus littoralis Ball, 1932

The species was reported for the Palaearctic region under the name of Scaphoideus littoralis Ball. This name remained until the publication of the revision of the Nearctic species of the genus Scaphoideus. On that occasion, two species described by Ball in 1932 (cyprius and littoralis), five described by DeLong & Mohr in 1936 (amplus, brevidens, diutius, nigrellus, scelestus) and one described by DeLong & Knull in 1971 (aduncus) were put in synonymy with S. titanus (Barnett, 1976). Since then, as the name S. littoralis was deleted, also the European populations assumed the name S. titanus.

S. titanus was reported from various woody and herbaceous plants (Barnett, 1976), but both in Europe (Vidano, 1964b) and in North America (Vidano, 1966) it appeared linked to the grapevine in all its instars. It is univoltine and overwinters in the egg stage. The eggs are laid in the bark of two years old branches. The small, curved and strong ovipositor penetrates obliquely and tangentially the thickness of the bark especially at the level of longitudinal cracks. Youngs and adults remain on the grapevine's lower leaf surface; they insert their mouth stylets into ribs. Sections made at the level of mouth stylet punctures allowed to show that this leafhopper is a phloemomyzous species (Vidano, 1964b) (Table 1).

S. titanus appeared not responsible of foliar alterations caused by its feeding punctures. However, it was found to be the only cicadellid that

transmitted Flavescence dorée to the grapevine (Carle & Moutous, 1967). This disease causes remarkable foliar and cauline alterations. Leaves are affected by margin downward rolling, thickening of the blade that becomes fragile, and sometimes by the characteristical yellowing, especially close to the veins, from which the ampelopathy took name. The canes often show short internodes, become elastic, take a particular S form, stay green for a long time and in the end die. They show structural disorders and necroses inside the phloem and sometimes slight swellings and small brown cortical spots. The affected plants produce grapes

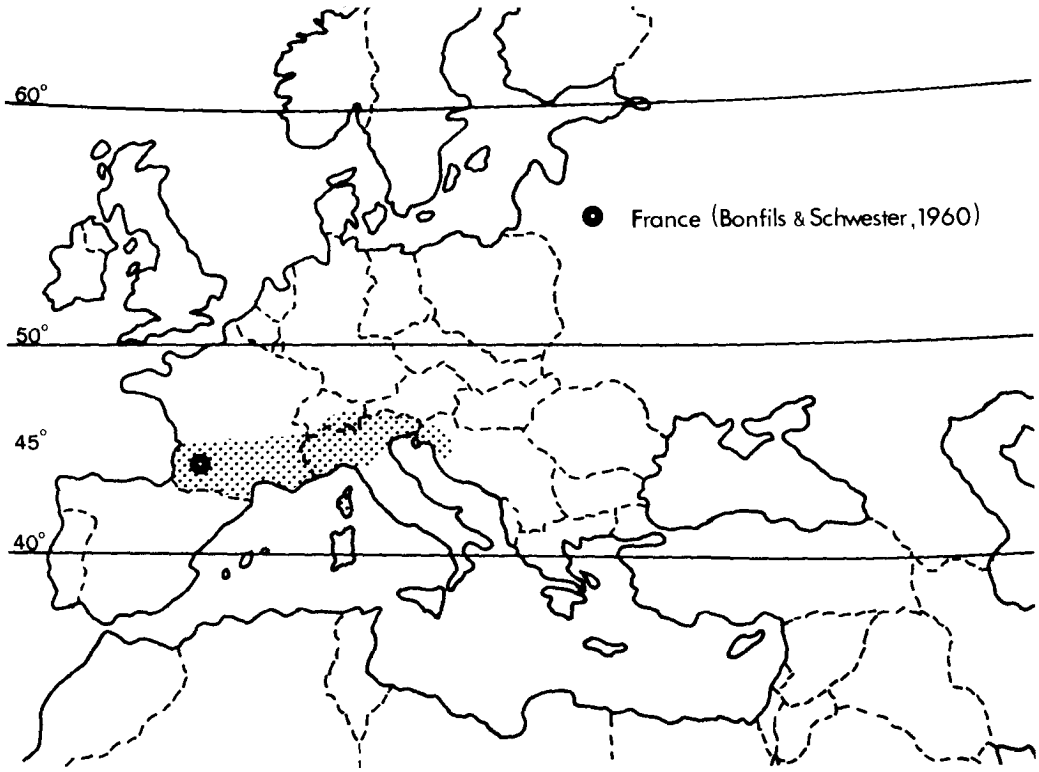

Fig. 3. European chorology of Scaphoideus titanus Ball

that do not ripen or do not produce any at all. Actually, S. titanus is found everywhere in northern Italy as an obligatorily ampelophagous species, but never an infesting one being commonly represented by very few nymphs and adults per grapevine here and there. Foliar and cauline symptoms on grapevine are similar to the ones known for Flavescence dorée and Bois noir, but usually less clear than the ones revealed by Baco 22 A in Armagnac, France. In general, they appear more marked in poorly cultivated vineyards (Vidano et al., 1985).

In the Nearctic region, this species is probably the most widespread of the genus Scaphoideus being reported from 38 states of the U.S.A. and from Canada. It was reported for the first time in Europe from southern France (Bonfils & Schwester, 1960). Reports followed from northern Italy (Vidano, 1964b), the Canton

TABLE 1

Auchenorrhyncha introduced into Europe. Biological data

Species	Involved tissues	Generations	Overwintering	Host plants
FLATIDAE				
Metcalfa pruinosa	phloem	1	egg	weeds and trees
MEMBRACIDAE				
Stictocephala bisonia	phloem	1	egg	weeds and trees
CICADELLIDAE				
Graphocephala fennahi	xylem	1	egg	Rhododendron spp.
Endria nebulosa	phloem	1	egg	grasses
Japananus spp.	phloem	2	egg	Acer spp.
Scaphoideus titanus	phloem	1	egg	Vitis spp.

of Ticino in southern Switzerland (Baggiolini et al., 1968), Corsica (Bonfils & Della Giustina, 1978), and finally Yugoslavia (unpublished data) (Fig. 3, Table 2).

ENDRIA NEBULOSA (BALL, 1900)

Lonatura nebulosa Ball, 1900
Deltocephalus nebulosus DeLong, 1926
Lonatura rotunda Beamer, 1939
Endria rotunda Oman, 1949
Lonatura nebulosa Oman, 1949
Endria rotunda Beirne, 1956

Synonymic vicissitudes of this species occured before it was first reported in Europe; here it was at first named as Endria rotunda Beamer, but immediately re-named E. nebulosa as a new combination (Remane, 1961). The species passed from the genus Lonatura to Deltocephalus until the description of the genus Endria (Oman, 1949). On that occasion, Oman included the species rotunda in the genus Endria and left the species nebulosa in the genus Lonatura. Only later, Kramer (in litteris) returned to this problem and ascertained that E. rotunda Beamer is a synonym of L. nebulosa Ball (Remane, 1961).

E. nebulosa lives on Gramineae of damp localities. It was found on Calamagrostis epigeios, which Remane (1961) considered to be its host plant, but also on Carex spp., especially C. limosa (Lauterer, 1980). Lauterer supposes that the species is rather polyphagous on Poaceae in both the Nearctic and Palaearctic regions, probably also on Cyperaceae, which should favour its distribution. It has one generation per year, overwinters in the egg stage

TABLE 2

Auchenorrhyncha introduced into Europe. Synonymic and chorological data

Species (Original names)	Introduction Country	Year	Chorology Europe	World
MEMBRACIDAE				
Stictocephala bisonia (Ceresa bubalus)	Hungary	1912	AL, BG, CH, CS, D, E, F, GR, H, I, P, R, SU, TR, YU	NR PR
CICADELLIDAE				
Graphocephala fennahi (G. coccinea)	England	1935	B, CH, D, F, GB, I, IRL, NL	NR PR
Scaphoideus titanus (S. littoralis)	France	1960	CH, F, I, YU	NR PR
Endria nebulosa	Germany	1961	CS, D, DDR, DK, S, SF, SU	NR PR
Japananus spp. (J. hyalinus)	Austria	1961	A, CS, F, I, R, SU, YU	NR PR
FLATIDAE				
Metcalfa pruinosa	Italy	1980	I	NR PR

Symbols : A Austria, AL Albany, B Belgium, BG Bulgaria, CH Switzerland, CS Czechoslovakia, D Germany, DDR Oriental Germany, DK Denmark, E Spain, F France, GB Great Britain, GR Greece, H Hungary, I Italy, IRL Ireland, NL Holland, P Portugal, R Rumania, S Sweden, SF Finland, SU Soviet Union, TR Turkey, YU Yugoslavia NR Nearctic Region, PR Palaearctic Region

and is probably phloemomyzous species (Table 1).

It is an exoanthropic species, living on grasses not exploited by man, always far away from human settlements and field cultures; it has a different ecological character from other introduced species which are mostly euryoecious, polyphagous and, above all, confined to plant species cultivated by man (Lauterer, 1980). E. nebulosa does not give phytopathological problems; perhaps for this reason it eludes observation and is collected only in captures for faunistic purposes.

The species is spread in Canada and north-central states of the U.S.A. The first report for Europe was in Germany (Remane, 1961). Then it was recorded in U.S.S.R. (Emeljanov, 1967) and here and there for Denmark, Sweden, Finland, Czechoslovakia, German D.R. (Ossiannilsson, 1983) (Fig. 2, Table 2). Recently the species is thought not to be introduced from North America, but a truly

holarctic one, which was overlooked for rather a long time due to its hidden way of life (Remane, in litteris).

JAPANANUS SPP.

Platymetopius hyalinus Osborn, 1900
Japananus hyalinus (Osborn, 1900)
Platymetopius cinctus Matsumura, 1914
Platymetopius aceri Matsumura, 1914
Japananus aceri (Matsumura, 1914)
Japananus meridionalis Bonfils, 1981

The description of J. hyalinus (as Platymetopius) was made from specimens collected in Washington upon an introduced species of maple. Osborn (1900), considering strange that the species should have been so long overlooked if a native form, thought that it could be an introduced species brought with some of the exotic plants. In fact, it may be a palaearctic species, probably Japanese in origin, introduced into the Nearctic region. This opinion was re-expressed when, dividing the genus Platymetopius, the genus Japananus was formed. In this manner, the author clearly pointed out that it should be a species of Asiatic origin (Ball, 1931). The recent description of J. meridionalis in southern France, made from male specimens caught on sticky panels without analyzing females (Bonfils, 1981), further complicates the situation of this species (or species--group). The comparison of J. hyalinus specimens from Czechoslovakia and U.S.A. confirmed the identity of their male genitalia. Major differences came from the shape of the anterior margin of the head. Considering the identity of male terminalia and the remarkable variability of the head shape, it is necessary to re-examine, by comparing a great quantity of material from different populations, whether or not J. meridionalis fits within the variation range of J. hyalinus (Lauterer, 1984). The problem of J. aceri from Japan and Asiatic U.S.S.R. still remains. This species would be easily separated from J. hyalinus through the form of the female pregenital urosterna (Vilbaste, 1968). However, it must not be forgotten that J. aceri was set in synonymy with J. hyalinus (Asahina et al., 1959). For these reasons, awaiting a necessary explanation, this entity is indicated as Japananus spp.

The genus Japananus seems connected to the Japanese maple (Acer palmatum) on which it sucks the phloem, but it was found also on many other Acer species besides Prunus cerasus (Mac Nay, 1961), Carpinus and other broadleaved trees (Dlabola, 1961), in the undergrowth of lowland forests (Lauterer, 1984). Nevertheless, except for Acer spp., it probably only strays onto other woody plants. Overwintering takes place in the egg stage, each egg being laid singly just under the bark close to a bud on the recently grown part of the twig. The egg is firmly embedded in the tissue which becomes brownish adjoining it. The species is reported to have one generation per year in Europe which occurs rather late (Lauterer, 1980). In Italy it shows two generations annually (unpublished data) (Table 1).

In spite of the marked preference for Acer spp., its occasional abundance and two annual generations, Japananus spp. does not cause alterations worthy of mention on its host plants. Moreover, as symptoms of sufference are missing on the plants, the infestations are unnoticed also for the mimicry of this leafhopper that has nymphs and adults of a green-yellowish colour with dark

spots and streaks.

Japananus spp. was reported from Austria for the first time in Europe (Wagner & Franz, 1961), then from Rumania (Dlabola, 1961), Czechoslovakia, France, U.S.S.R., Yugoslavia (Lauterer, 1984). It is also in Italy (unpublished data) (Fig. 2, Table 2).

METCALFA PRUINOSA (Say), 1830

Ormenis pruinosa Say, 1830

Chronologically, M. pruinosa is the last Nearctic Auchenorrhyncha reported for Europe. In its original country it lives on over 30 plant species belonging to numerous genera, among which many cultivated ones : Vitis, Citrus, Persica, Ficus, Punica, Carica, and several ornamental ones. In Italy, it spread mainly on Rubus idaeus, Ligustrum ovalifolium and Urtica dioica. Among the plants of economic importance, it may develop on apple, grapevine, peach, hazelnut and lemon. Furthermore, it colonized many trees and shrubs, such as Betula pendula, Laurus nobilis, Robinia pseudacacia, Aesculus hippocastanum, Tilia cordata, Platanus hybrida, Rosa spp., and Magnolia grandiflora (Zangheri & Donadini, 1980).

M. pruinosa has one generation per year and overwinters as eggs laid in cracks in the bark or inside the buds of trees and shrubs. The egg is inserted by means of the strong ovipositor without a given pattern. Nymphs develop on the tender shoots and on the lower leaf surface, adults live on shoots or woody stems (Duso, 1984) : both are phloemomyzous (Table 1).

In its original country, M. pruinosa is not considered economically important. Also during the first appearance in Venetia, it was not associated with a remarkable damage. The trophic activity of the young instars at low population density does not cause evident alterations on the infested plant; but the infestation assumes, a different meaning with high density populations, as recently observed. The assembling of nymphs prevents a normal growth of vegetative shoots and a massive number of adults in summer is the cause of a considerable production of honeydew and consequent development of sooty moulds. Such phenomena have appeared in avenues, gardens and vineyards. In particular, the symptoms on grapevine are similar to that caused by Planococcus citri (Risso) (Coccoidea). Vineyards are more affected if near to Acer, Robinia or Rubus hedges that are infestation pockets and favour the passage of the species to cultivated plants. Flower and nursery gardens are frequently affected and undergo damage from honeydew and sooty moulds (Duso, 1984).

This is a widely distributed species in North America from Canada to U.S.A. until Mexico. In Europe, it is reported only for North-East Italy (Zangheri & Donadini, 1980), and here the flatid is rapidly diffusing, probably also helped by its wide polyphagy (Fig. 2, Table 2).

CONCLUSIONS

The species of Auchenorrhyncha introduced into Europe from the Nearctic region are relatively few in comparison with the ones introduced into the Nearctic region from Europe. The most noteworthy of these latter species are the cercopid Philaenus spumarius (L.), the cicadellids Rhytidodus decimusquartus (Schrank),

Aphrodes bicinctus (Schrank), many typhlocybines of the genera Alebra, Dikraneura, Forcipata, Notus, Empoasca, Edwardsiana, Linnavuoriana, Ribautiana, Typhlocyba, Eupteryx, Aguriahana, Zygina, the deltocephalines Neoaliturus tenellus (Baker), Macrosteles spp., Elymana sulphurella (Zetterstedt), Cicadula spp., Psammotettix spp. On the contrary, the few references to the occurrence of Cicadella viridis (Linnaeus) in the Nearctic region are probably wrong (Young, 1977); also the report for Empoasca vitis (Göthe) (Nast, 1972) was supposed incorrect (Vidano & Arzone, 1983).

Concerning the Nearctic species introduced into Europe, the most worrying species is S. bisonia that, due to its vast polyphagy, spread uniformly especially in areas between the 40th and 50th parallels, endangering fruit-groves and vineyards. Only the introduction in Italy from U.S.A., the acclimatization and distribution of its specific oophagous parasite, the Mymarid Polynema striaticorne Girault, were effective to control this pest (Vidano & Meotto, 1968). Now in Europe, P. striaticorne is spreading satisfactorily and S. bisonia is not a serious problem any more.

S. titanus diffused less rapidly and less extensively. Its area of distribution extends astride the 45th parallel and slowly progresses eastwards. The ecological necessities of this species seem to refrain its populations from becoming numerous; but the possibility of the transmission to Vitis of Flavescence dorée MLO makes even the few specimens become dangerous. Actually, the pluriennial investigations carried out in Piedmontese vineyards with grapevines affected or suspected to be affected by Flavescence dorée were not sufficient to prove that the disease was transmitted by the very common S. titanus. On the other hand, affected grapevine series in Piedmontese, Venetian and Sicilian vineyards were recognized as clearly infected through graft (Vidano et al., 1985).

Though it arrived recently, M. pruinosa is requiring particular attention in northern Italy, owing to the quickness of its diffusion. In a few years, it colonized a wide territory in North East Italy provoking mostly aesthetic damages to plants, without any autochthonous enemy to control it. The solution of the new serious phytopathological problem is perhaps through the importation of specific enemies from the originary country.

The further three species appear to be less dangerous : G. fennahi, monophagous on Rhododendron spp., that grow only in particular climatic and pedological zones; Japananus spp., linked to localized ornamental plants; E. nebulosa, living on wild grasses. These three species show a scattered and tendentiously northern distribution; E. nebulosa penetrates even beyond the 60th parallel (Fig. 2). The up-to-date chorological review of these six species shows that the quick diffusion of some of them was caused by nurserymen. In any case, as all above Auchenorrhyncha were probably introduced into Europe by eggs overwintering inside living plants, directions for a more responsible quarantine service in this field are needed.

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