

## Typhlocybinæ of broadleaved trees and shrubs in Italy.

### 2. Betulaceae (\*)

#### INTRODUCTION

The subfamily Typhlocybinæ (Homoptera Auchenorrhyncha Cicadellidae) includes many species known as taxonomic entities, but few considered for their host plants and behaviour. The consequent gaps concern mainly the typhlocybine fauna of the Mediterranean countries, where a great part of these small leafhoppers has to be identified and then investigated from several points of view (Vidano & Arzone, 1986). Data concerning our pluriennial investigations on chorology, ecology and ethology of the Italian typhlocybine fauna of broadleaved trees are employed in this paper, which is devoted to the species found on Betulaceae and mainly regards results of observations carried out during the last three years.

As in a previous account dealing with typhlocybinæ found on *Alnus* (Vidano & Arzone, 1981), the various species will be distinguished into categories related to the trophic activity of nymphs. Polyphagous, oligophagous and monophagous species were the categories of typhlocybinæ found associated with Betulaceae. Further investigations on broadleaved trees as host plants of typhlocybinæ are in progress. The next contribution will concern Corylaceae.

#### MATERIALS AND METHODS

The collections of Typhlocybinæ represented in Italian Museums of Natural History were seen but not considered in this paper because lacking of indications concerning host plants. Therefore, all the species mentioned here were investigated through material collected by us

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according to research programmes carried out during a period of 30 years in significant woodlands located in several parts of Italy. Particular attention was devoted to the Betulaceae distributed in Piedmont and other northern Regions: *Alnus glutinosa* (L.) Gaertner (black alder), *A. incana* (L.) Moench (grey alder), *A. viridis* (Chaix) DC. (green alder), and *Betula pendula* Roth (common birch). Adequate investigations were carried out on *A. glutinosa* also in central and southern Regions, Calabria and Sardinia included, on *A. cordata* (Loisel.) Desf. (Neapolitan alder) in Campania and Calabria, on *B. aetnensis* Raf. (Etna birch) in Sicily.

The field investigations had, as a first goal, the preliminary identification of the kind of association with the host plants of the Typhlocybinae species collected on the various Betulaceae. The method of adult samplings, obtained using adequate sweep nets, was adopted as initial or complementary way of ascertainment. In order to determine precise host plant associations of these small and active flying insects, the method of nymph samples collected together with host plant leaves was then used to rear adults in captivity in small containers: glass tubes, Petri dishes, plastic sacks. Botanic preferences or specificities were investigated under laboratory conditions, where the adults were reared starting not only from nymphs but also, when necessary and possible, from eggs.

The basic books by Ribaut (1936) and Ossiannilsson (1981) have been used for the identification of the most part of Typhlocybinae. Krüssmann (1960) and Pignatti (1982) were followed for Betulaceae.

## RESULTS

The Typhlocybinae found on Betulaceae in Italy, altogether forty-seven species, are listed in Table 1. They were subdivided into three groups: species found on Betulaceae as adults only; oligophagous or polyphagous species on broadleaved trees and shrubs; monophagous or oligophagous species within Betulaceae.

The twentythree species found only as adults are regarded as erratic ones. They were sometimes very common, but represented by individuals presumedly coming from nearby broadleaved trees and shrubs in particular during migrations or in windy days: *Edwardsiana avellanae* and *E. staminata* from *Corylus avellana*; *E. diversa* mainly from *Cornus sanguinea* and *C. mas*; *E. flavescens* mainly from *Carpinus betulus*; *E. frustrator* from Corylaceae and other broadleaved trees; *E. hippocastani* mainly from *Acer campestre* and *Ulmus minor*; *E. platanicola* from *Platanus hybrida*; *E. prunicola* from *Salix* spp. and other



TABLE 1 - Typhlocybiinae found on Betulaceae in Italy

Typhlocybiinae	Betulaceae	Alnus			Betula	
		<i>cordata</i>	<i>glutinosa</i>	<i>incana</i>	<i>viridis</i>	<i>aetnensis pendula</i>
Alebrini						
<i>Alebra albostriella</i> (Fallén)		**		*		*
" <i>wahlbergi</i> (Boheman)		**				*
Empoascini						
<i>Empoasca</i> ( <i>Kybos</i> ) <i>aetnicola</i> (Wagner)					***	
" <i>betulicola</i> Wagner						***
" <i>smaragdula</i> (Fallén)		***	***	***		
<i>Empoasca alsiosa</i> Ribaut		*				*
" <i>decipiens</i> Paoli		*	*			*
" <i>solani</i> (Curtis)		*	*	*		*
" <i>vitis</i> (Göthe)		**	**	**	**	**
Typhlocybini						
<i>Fagocyba alnisuga</i> Arzone			***			
" <i>cruenta</i> (Herrich-Schäffer)		**	**	**	**	**
<i>Edwardsiana alnicola</i> (Edwards)				***		*
" <i>avellanae</i> (Edwards)			*			*
" <i>bergmani</i> (Tullgren)					***	
" <i>diversa</i> (Edwards)				*		*
" <i>flavescens</i> (Fabricius)			*			*
" <i>frustrator</i> (Edwards)			*	*		*
" <i>geometrica</i> (Schrank)			***	***	***	
" <i>gratiosa</i> (Boheman)			***			
" <i>helva</i> Arzone			***			
" <i>hippocastani</i> (Edwards)			*	*		
" <i>platanicola</i> (Vidano)		*	*	*		
" <i>prunicola</i> (Edwards)			*	*		
" <i>rosae</i> (Linnaeus)			*	*	*	*
" <i>sardoa</i> Arzone			***			
" <i>soror</i> (Linnavuori)			*	*		
" <i>staminata</i> (Ribaut)			*	*	*	
<i>Eupterycyba jucunda</i> (Herrich-Schäffer)		***	***			
<i>Linnavuoriana decempunctata</i> (Fallén)				***	***	***
<i>Ficocyba ficaria</i> (Horváth)		*	*			
<i>Lindbergina aurovittata</i> (Douglas)		*	*			
<i>Ribautiana cruciata</i> (Ribaut)			*	*		
" <i>debilis</i> (Douglas)			**	*		
" <i>tenerrima</i> (Herrich-Schäffer)			**	*		
<i>Typhlocyba bifasciata</i> Boheman			**	*		*
" <i>quercus</i> (Fabricius)			*	*		**
<i>Eurhadina concinna</i> (Germar)			**			**
<i>Aguriahana stellulata</i> (Burmeister)						**
Erythroneurini						
<i>Alnetoidia alneti</i> (Dahlbom)		**	**	**	**	**
<i>Zygina discolor</i> Horváth			*			*
" <i>flamigera</i> (Fourcroy)		*	*	*		*
" <i>ordinaria</i> (Ribaut)			*	*		*
" <i>rhami</i> Ferrari			*	*		*
" <i>suavis</i> Rey		*	*	*		*
" <i>tiliae</i> (Fallén)		***	***	***		*
<i>Arboridia parvula</i> (Boheman)			*	*		*
" <i>versuta</i> (Melichar)			*	*		*

\* species found on Betulaceae only as adults  
 \*\* oligophagous or polyphagous species on broadleaved trees and shrubs  
 \*\*\* monophagous or oligophagous species within Betulaceae



broadleaved trees; *E. rosae* from *Rosa* spp., *Malus domestica* and other Rosaceae; *E. soror* from unknown host trees; *Ficocyba ficaria* from *Ficus carica* and *Lonicera* spp.; *Lindbergina aurovittata* from *Quercus ilex* and *Q. pubescens*; *Ribautiana cruciata* from *Ulmus minor* and *Rubus* spp.; *Zygina discolor* from *Prunus* spp. and some other Rosaceae; *Z. flammigera* from *Prunus* spp., *Malus domestica* and several other Rosaceae; *Z. ordinaria* from *Salix* spp.; *Z. rhamni* from *Vitis vinifera*; *Z. suavis* from *Frangula alnus* and *Rhamnus* spp.; *Arboridia parvula* from *Rubus* spp. and herbaceous plants of hedges and coppices; *A. versuta* from deciduous *Quercus*. Also *Empoasca alsiosa*, *E. decipiens* and *E. solani* are regarded as erratic species, but coming from various herbaceous plants. *E. soror*, indicated from unknown host trees, was found rarely and never as nymphs; however it seems that *Alnus glutinosa* and *A. incana* could be among its host plants.

The twentyfour species found on Betulaceae both as adults and nymphs are regarded as follows: eleven oligophagous or polyphagous on broadleaved trees, one oligophagous within *Alnus* and *Betula*, four oligophagous within *Alnus*, eight monophagous (Table 1 and Fig. I).

The eleven species found to multiply on Betulaceae and other broadleaved trees are listed in Fig. II. Among them, three on *Alnus cordata*, nine on *A. glutinosa*, three on *A. incana*, three on *A. viridis*, three on *Betula aetnensis*, six on *B. pendula*: *Alebra albostriella* common on *A. glutinosa*, but much more frequent on deciduous *Quercus* and *Castanea sativa*; *A. wahlbergi* also common on *A. glutinosa*, as well as on other broadleaved trees, although showing a strong preference for *Acer campestre*; *Empoasca vitis* very common on *A. glutinosa*, well represented on *A. cordata*, *A. incana*, *A. viridis*, *B. aetnensis*, *B. pendula* and various other broadleaved trees, but better known as a localized pest of *Vitis*; *Fagocyba cruenta* also well represented on all the six Betulaceae and several other trees, but particularly frequent on *Fagus sylvatica*; *Ribautiana debilis* and *R. tenerrima* both represented on *A. glutinosa* and known as oligophagous species preferring *Rubus* spp.; *Typhlocyba bifasciata* not very common on *A. glutinosa* and more represented on *Carpinus betulus*; *T. quercus* represented on ornamental *B. pendula* but common inhabitant of *Quercus robur*; *Eurhadina concinna* (Pl. III, 2) common on *A. glutinosa* and represented on *B. pendula*, although showing a strong preference for deciduous *Quercus*; *Aguriahana stellulata* (Pls I, 3; III, 3) found on *B. pendula* only in Turin parks and on *Prunus avium* in some localities of Piedmont; *Alnetoidia alneti* very common on *A. glutinosa*, well represented on *A. cordata*, *A. incana*, *A. viridis*, *B. aetnensis*, *B. pendula* and several other trees.

Thirteen species were found to multiply only on Betulaceae (Table 1 and Fig. III). *Linnavuoriana decempunctata* (Pls I, 2; III, 1) was



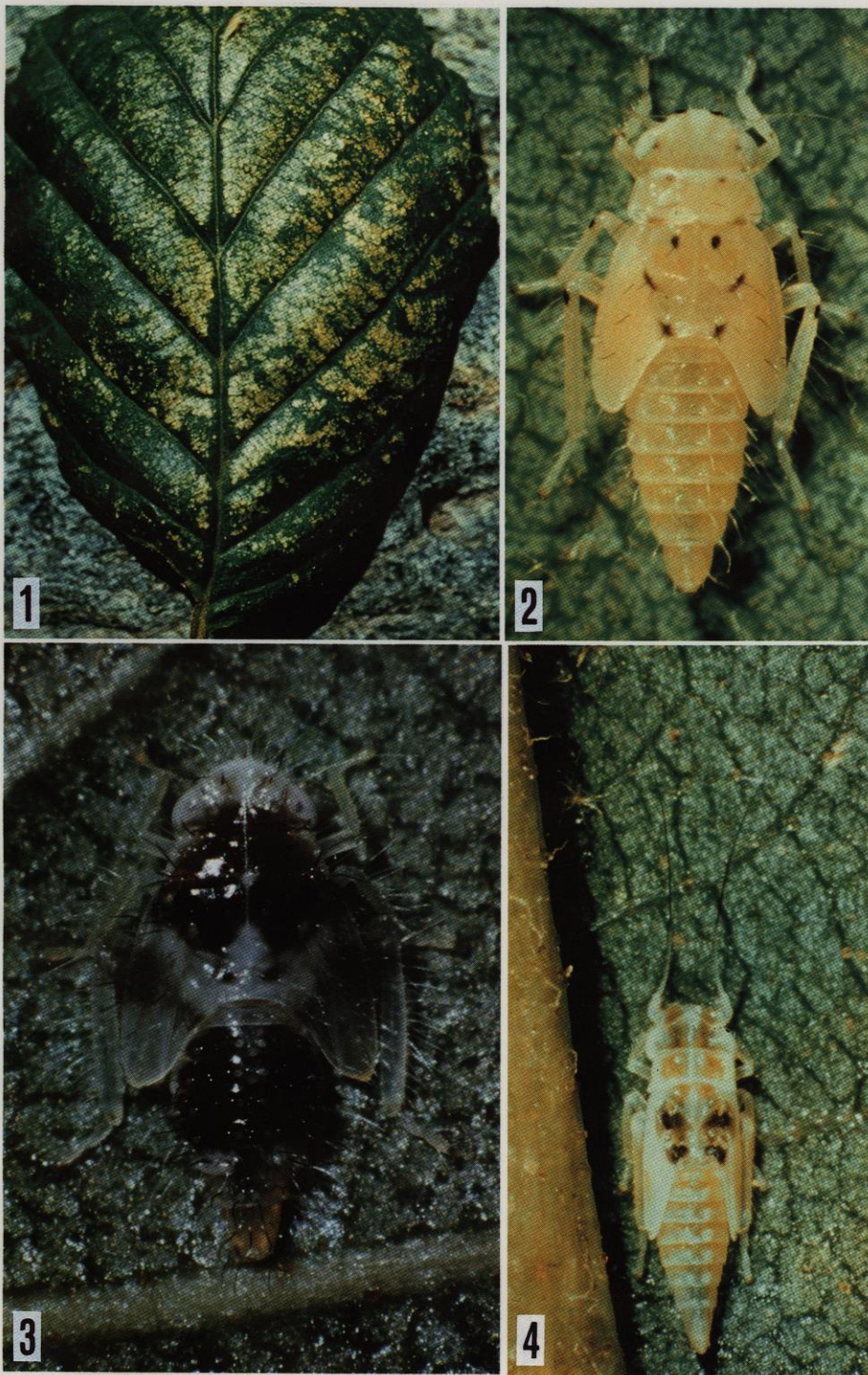


PLATE I. — Typhlocybinae of Betulaceae. 1, Dechlorophyllations by typhlocybines in a leaf of *Alnus incana*. — Fifth instar nymphs of: 2, *Linnavuoriana decempunctata* (nat. length mm 2.7); 3, *Aguriahana stellulata* (mm 2.8); 4, *Zygina tiliae* (mm 2.2).



oligophagous within Betulaceae, having been reared from *A. incana*, *A. viridis* and *B. pendula*. Four were oligophagous within *Alnus*: *Empoasca (Kybos) smaragdula* (Pl. II, 1) and *Edwardsiana geometrica* (Pl. II, 2) on *A. glutinosa*, *A. incana*, *A. viridis*; *Eupterycyba jucunda* (Pl. II, 4) on *A. cordata* and *A. glutinosa*; *Zygina tiliae* (Pls I, 4; III, 4) on *A. cordata*, *A. glutinosa* and *A. incana*. Eight species proved to be monophagous: *E. aetnicola* on *B. aetnensis*; *E. betulicola* on *B. pendula*; *Fagocyba alnisuga*, *E. gratiosa* (Pl. II, 3), *E. helva* and *E. sardoa* on *A. glutinosa*; *E. alnicola* on *A. incana*; *E. bergmani* on *A. viridis*.

About the Italian chorology of the twentyfour Typhlocybinae reared from Betulaceae, the more localized species were: *E. aetnicola* in Sicily; *E. betulicola*, *F. alnisuga*, *E. alnicola*, *E. helva* and *A. stellulata* in Piedmont; *E. sardoa* in Sardinia; *E. bergmani* and *L. decempunctata*

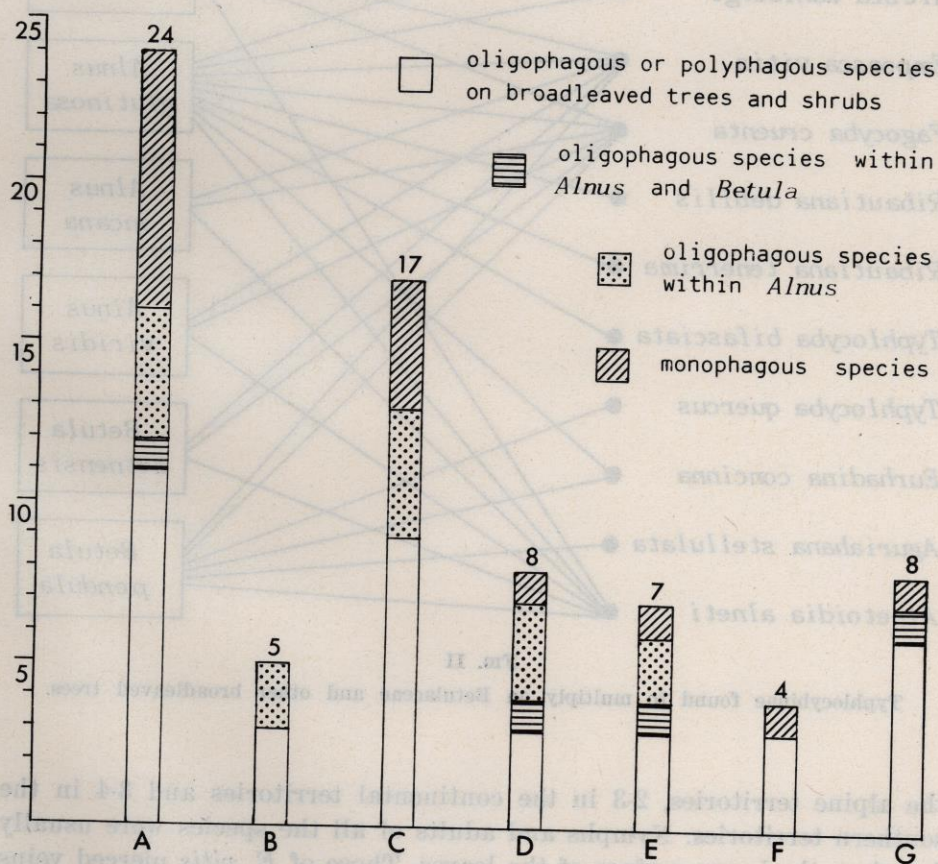


FIG. I

Total numbers of Typhlocybinae species reared from Betulaceae (A), *Alnus cordata* (B), *A. glutinosa* (C), *A. incana* (D), *A. viridis* (E), *Betula aetnensis* (F), *B. pendula* (G). (Data from Table 1).



in alpine territories of northern Italy. The other species were more diffused: *E. geometrica* and *E. gratioiosa* in northern Italy; *T. bifasciata* in northern and central Italy; *A. wahlbergi*, *E. smaragdula*, *T. quercus*, *E. concinna* and *Z. tiliae* in continental Italy; *E. jucunda* and *R. debilis* in continental Italy and Sardinia; *F. cruenta* in continental Italy and Sicily; *A. albostriella*, *E. vitis*, *R. tenerrima* and *A. alneti* in all Italy (Sardinia and Sicily included).

The overwintering of the above twentyfour species took place in the adult stage for *E. vitis*, *L. decempunctata* and *Z. tiliae* and in the egg stage for the other species. The generations per year were 1-2 in

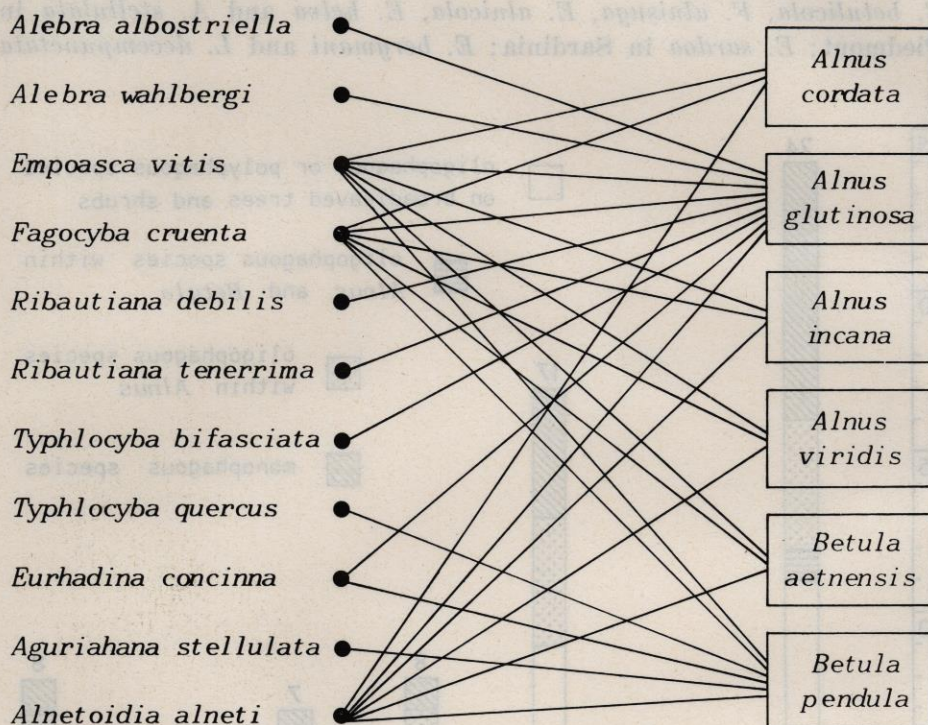


FIG. II

Typhlocybinae found to multiply on Betulaceae and other broadleaved trees.

the alpine territories, 2-3 in the continental territories and 3-4 in the southern territories. Nymphs and adults of all the species were usually found on the lower surface of the leaves. Those of *E. vitis* pierced veins and were classified as phloem feeders. All the other ones were mesophyll feeders and caused characteristic dechlorophyllations (Pl. I, 1). The consequent white spots showed by the involved leaves were well represented here and there, mainly in the dense part of the foliage protected





1



2



3



4

PLATE II. — Typhlocybinae of Betulaceae. 1, *Empoasca smaragdula* ♀ (nat. length mm 4.6). 2, *Edwardsiana geometrica* ♀ (mm 4.2). 3, *E. gratiosa* ♀ (mm 3.5). 4, *Eupterycyba jucunda* ♀ (mm 4.3).



from sun and wind. Remarkable dechlorophyllations were sometimes evident on *A. glutinosa* and mainly due to *F. cruenta*, *A. alneti* and *Z. tiliae*. Abundant white spots were often observed on ornamental *B. pendula* involved by mixed populations of *E. betulicola*, *T. quercus* and *A. stellulata*.

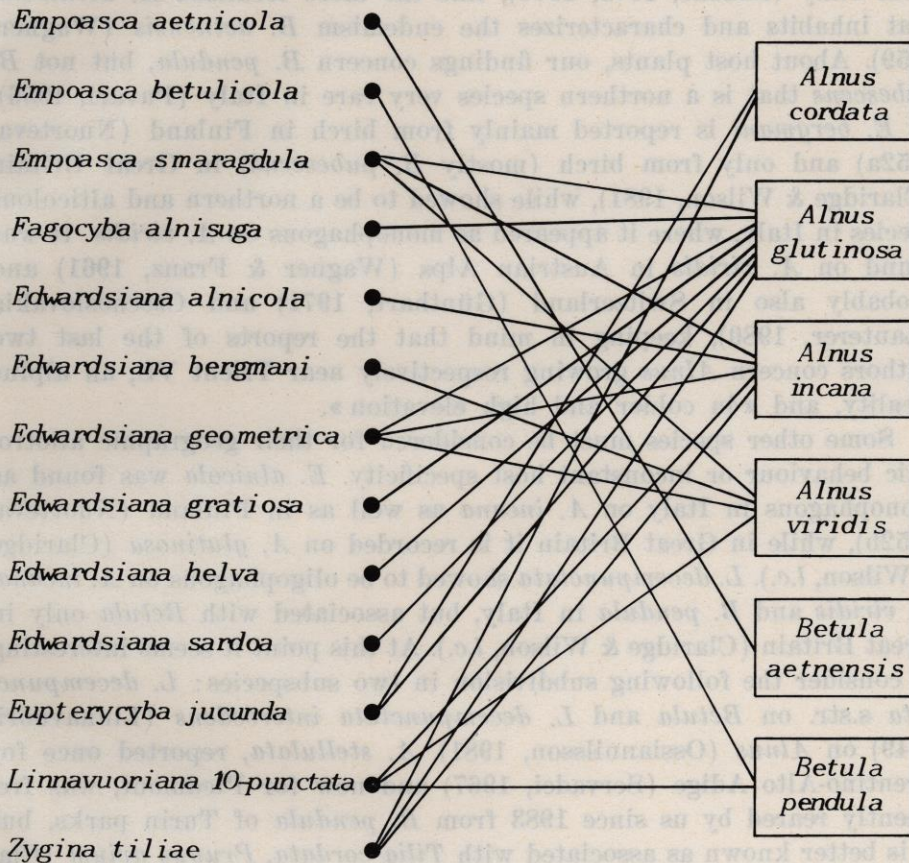


FIG. III

Typhlocybinae found to multiply only on Betulaceae.

Traces of vein browning due to the phloem feeder *E. vitis* were recognized both on *Alnus* and *Betula*, but not marginal burning and related foliar disorders well known for *Vitis*. Preliminary investigations on natural enemies of these typhlocybines revealed that Mymaridae, Dryinidae and Pipunculidae are strongly represented. The egg parasite *Anagrus atomus* appeared to be the most efficient.



DISCUSSION AND CONCLUSION

The number of species of Typhlocybinae reared from Betulaceae in Italy is relatively high in comparison with analogous data concerning other European countries. Among the seventeen species associated with *A. glutinosa*, *F. alnisuga*, *E. helva* and *E. sardoa* are known only from Italy (Arzone, 1975, 1976), like the more localized *E. aetnicola*, that inhabits and characterizes the endemism *B. aetnensis* (Wagner, 1959). About host plants, our findings concern *B. pendula*, but not *B. pubescens* that is a northern species very rare in Italy (Pavari, 1956).

*E. bergmani* is reported mainly from birch in Finland (Nuorteva, 1952a) and only from birch (mostly *B. pubescens*) in Great Britain (Claridge & Wilson, 1981), while showed to be a northern and alticolous species in Italy, where it appeared as monophagous on *A. viridis*. It was found on *A. viridis* in Austrian Alps (Wagner & Franz, 1961) and probably also in Switzerland (Günthart, 1971) and Czechoslovakia (Lauterer, 1980), keeping in mind that the reports of the last two authors concern *Alnus* growing respectively near Trient VS, an alpine locality, and «in colder and high elevation».

Some other species must be considered for their geographic allotropic behaviour or inconstant host specificity. *E. alnicola* was found as monophagous in Italy on *A. incana* as well as in Finland (Nuorteva, 1952b), while in Great Britain it is recorded on *A. glutinosa* (Claridge & Wilson, *l.c.*). *L. decempunctata* showed to be oligophagous on *A. incana*, *A. viridis* and *B. pendula* in Italy, but associated with *Betula* only in Great Britain (Claridge & Wilson, *l.c.*). At this point it seems interesting to consider the following subdivision in two subspecies: *L. decempunctata* s.str. on *Betula* and *L. decempunctata intercedens* (Linnavuori, 1949) on *Alnus* (Ossiannilsson, 1981). *A. stellulata*, reported once for Trentino-Alto Adige (Servadei, 1967) and now for Piedmont, was frequently reared by us since 1983 from *B. pendula* of Turin parks, but it is better known as associated with *Tilia cordata*, *Prunus avium* (Claridge & Wilson, *l.c.*) and some other broadleaved trees (Ribaut, 1936; Ossiannilsson, *l.c.*).

Apart from the polyphagous *E. vitis*, *F. cruenta* and *A. alneti*, that were found associated with all the Betulaceae, and the oligophagous *E. concinna*, that was reared from *A. glutinosa* and *B. pendula*, the Typhlocybinae found to multiply only on Betulaceae showed to be separately inhabiting *Alnus* spp. or *Betula* spp., with the exception of the above discussed *L. decempunctata* which was reared from *A. incana*, *A. viridis* and *B. pendula*. Among the alnicolous species, *E. smaragdula*, *E. geometrica* and *Z. tiliae* appeared associated with three species of *Alnus*. *E. jucunda* and *Z. tiliae*, both true alnicolous species, were not before known from *A. cordata*.



**1****2****3****4**

PLATE III. — Typhlocybinae of Betulaceae. 1, *Linnavuoriana decempunctata* ♂ (nat. length mm 3.5). 2, *Eurhadina concinna* ♀ (mm 4.0). 3, *Aguriahana stellulata* ♀ (mm 4.4). 4, *Zygina tiliae* ♂ (mm 2.8).



According to the catalogue by Nast (1972), the following species have to be considered new for Italy: *E. betulicola*, *E. alnicola*, *E. bergmani*, *E. diversa*, *E. flavescens*, *E. frustrator*, *E. hippocastani*, *E. soror* and *Z. ordinaria*. Moreover the following endemisms must be emphasized: *F. alnisuga* and *E. helva* in Piedmont, *E. sardoa* in Sardinia, and *E. aetnicola* in Sicily.

Although numerous typhlocybinae species were found associated with *Alnus* and *Betula*, these forest trees and shrubs did not show symptoms important from the phytopathological point of view. Likely, in the natural ecosystem, the biological balance due to the action of typical leafhopper parasites was very efficient. The fact that *B. pendula* cultivated as ornamental tree in town parks, far from forest ecosystem conditions, was infested by typhlocybinae species induces to suppose the crisis of leafhopper enemies in an unnatural ecosystem.

#### SUMMARY

Among fortyseven species of Typhlocybinae commonly present as adults on Betulaceae (*Alnus cordata*, *A. glutinosa*, *A. incana*, *A. viridis*, *Betula pendula* and *B. aetnensis*), twentythree were regarded as erratic ones and represented by individuals coming from nearby broadleaved trees and shrubs during migrations or in windy days. Twentyfour species consisting of adults reared from nymphs in captivity were subdivided into two categories: Typhlocybinae able to multiply on Betulaceae and other broadleaved trees and shrubs (*Alebra albostriella*, *A. wahlbergi*, *Empoasca vitis*, *Fagocyba cruenta*, *Ribautiana debilis*, *R. tenerrima*, *Typhlocyba bifasciata*, *T. quercus*, *Eurhadina concinna*, *Augurihana stellulata* and *Alnetoidia alneti*); Typhlocybinae found to multiply on Betulaceae only (*Empoasca aetnicola*, *E. betulicola*, *E. smaragdula*, *Fagocyba alnisuga*, *Edwardsiana alnicola*, *E. bergmani*, *E. geometrica*, *E. gratiosa*, *E. helva*, *E. sardoa*, *Eupterycyba jucunda*, *Linnavuoriana decempunctata* and *Zygina tiliacae*). The thirteen Typhlocybinae of the last category showed to be oligophagous within *Alnus* and *Betula* (one species), oligophagous within *Alnus* (four species), monophagous (eight species). Four of the eight monophagous species were indicated as endemisms of Piedmont (*F. alnisuga* and *E. helva* on *A. glutinosa*), Sardinia (*E. sardoa* on *A. glutinosa*), and Sicily (*E. aetnicola* on *B. aetnensis*). Data on life history, kind of feeding activity, consequent leaf symptoms and role of natural enemies have been given and discussed.

Key words: Typhlocybines, Alders, Birches, host preferences, host specificity.

### Typhlocybinae di latifoglie arboree e arbustive in Italia.

#### 2. Betulaceae

#### RIASSUNTO

Fra quarantasette specie di Typhlocybinae comunemente presenti come adulti su Betulaceae (*Alnus cordata*, *A. glutinosa*, *A. incana*, *A. viridis*, *Betula pendula* e *B.*



*aetnensis*), ventitre vennero considerate come erratiche e rappresentate da individui provenienti da vicine latifoglie arboree ed arbustive per migrazioni o a causa di giornate ventose. Ventiquattro specie relative ad adulti allevati da ninfe furono suddivise in due categorie: tiflocibini capaci di moltiplicarsi su betulacee e altre latifoglie arboree ed arbustive (*Alebra albostricella*, *A. wahlbergi*, *Empoasca vitis*, *Fagocyba cruenta*, *Ribautiana debilis*, *R. tenerrima*, *Typhlocyba bifasciata*, *T. quercus*, *Eurhadina concinna*, *Aguriahana stellulata* e *Alnetoidia alneti*); tiflocibini capaci di moltiplicarsi soltanto su betulacee (*Empoasca aetnicola*, *E. betulicola*, *E. smaragdula*, *Fagocyba alnisuga*, *Edwardsiana alnicola*, *E. bergmani*, *E. geometrica*, *E. gratiosa*, *E. helva*, *E. sardoa*, *Eupterycyba jucunda*, *Linnavuoriana decempunctata* e *Zygina tiliae*). Le tredici specie di tiflocibini dell'ultima categoria dimostrarono di essere oligofaghe entro *Alnus* e *Betula* (una specie), oligofaghe entro *Alnus* (quattro specie), monofaghe (otto specie). Quattro delle otto specie monofaghe (*F. alnisuga*, *E. helva* ed *E. sardoa* su *A. glutinosa* ed *E. aetnicola* su *B. aetnensis*) vengono indicate come endemismi di Piemonte (*F. alnisuga* ed *E. helva* su *A. glutinosa*), Sardegna (*E. sardoa* su *A. glutinosa*) e Sicilia (*E. aetnicola* su *B. aetnensis*). Dati su cicli biologici, tipo di attività trofica, conseguenti sintomi fogliari e incidenza dei limitatori naturali sono stati forniti e discussi.

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