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Leaf rollers (Lepidoptera Tortricidae) found on poplars (*Populus* spp.) in Sofia Region, Bulgaria

Abstract - In the years 1997 and 1998 investigations were performed on the species composition and structure of a tortricid complex (Lepidoptera Tortricidae) on poplars (*Populus* spp.) at three places of the Sofia region - Sofia, Kokaljane and Jeleznitsa. Larvae and pupae of leaf rollers were collected from poplar trees and stump sprouts and were brought in the laboratory where they were reared to adults at room temperature (18 - 22°C). As a result of this investigation, 14 species of leaf rollers were recorded as follows: *Archips betulana* (Hbn.), *A. crataegana* (Hbn.), *A. podana* (Scop.), *A. rosana* (L.), *A. xylosteana* (L.), *Pandemis heparana* (Den. & Schiff.), *P. cerasana* (Hbn.), *Ptycholoma lecheana* (L.) (Tortricinae), *Cydia exquisitana* (Rbl.), *Gypsonoma aceriana* (Dup.), *G. dealbana* (Fröl.), *G. minutana* (Hbn.), *Hedia salicella* (L.) and *Pseudosciaphila branderiana* (L.) (Olethreutinae). Eight species - *A. betulana*, *A. podana*, *A. rosana*, *C. exquisitana*, *G. dealbana*, *P. cerasana*, *P. lecheana* and *P. branderiana* were reported for the first time on poplars in Bulgaria. In tortricid complex studied *G. aceriana* (69.0%) was the dominant species. *C. exquisitana*, *G. minutana* and *P. cerasana* were subdominant and the remaining species were less numerous. *C. exquisitana* is xylophagous - its larvae feed under the bark of poplar trees. The first instar of *G. aceriana* develops on leaves of poplars. After the first moult larvae enter the young twigs. The population density of *G. aceriana* is highest in Sofia, where an average of 9.2 larvae/m of sprouts have been recorded in 1997. The insect infested 23.0 - 93.7% of the twigs of poplars. The larvae of *G. minutana* live and feed between two or more leaves held together by silky threads. The larvae of the remaining species roll the leaves. With the exception of *G. aceriana*, all of the tortricid species occurred in low population densities and did not reach pest status throughout the period of this study.

Riassunto - *Ricamatrici fogliari (Lepidoptera Tortricidae) raccolte su pioppi* (Populus *spp.) nella regione di Sofia, Bulgaria.*

Negli anni 1997 e 1998 sono state effettuate ricerche sul complesso delle Tortrici (Lepidoptera Tortricidae) presenti su pioppi (*Populus* spp.) in tre località della regione di Sofia, precisamente Sofia, Kokaljane e Jeleznitsa. Le larve e le pupe di queste ricamatrici fogliari sono state raccolte da piante e germogli di pioppo e allevate in laboratorio a temperatura di 18-22°C. Sono state individuate 14 specie, precisamente: *Archips betulana* (Hbn.), *A. crataegana* (Hbn.), *A. podana* (Scop.),

A. rosana (L.), *A. xylosteana* (L.), *Pandemis heparana* (Den. & Schiff.), *P. cerasana* (Hbn.), *Ptycholoma lecheana* (L.) (Tortricinae), *Cydia exquisitana* (Rbl.), *Gypsonoma aceriana* (Dup.), *G. dealbana* (Frön.), *G. minutana* (Hbn.), *Hedia salicella* (L.) e *Pseudosciaphila branderiana* (L.) (Olethreutinae). Otto specie - *A. betulana*, *A. podana*, *A. rosana*, *C. exquisitana*, *G. dealbana*, *P. cerasana*, *P. lecheana* e *P. branderiana* - sono qui riferite per la prima volta su pioppo in Bulgaria. Nel complesso dei Tortricidi studiato, *G. aceriana* (69.0%) è risultata la specie dominante. *C. exquisitana*, *G. minutana* e *P. cerasana* sono da considerare subdominanti, mentre le residue sono poco numerose. *C. exquisitana* è xilofaga in quanto le larve si alimentano sotto la corteccia. La prima età larvale di *G. aceriana* si sviluppa sulle foglie del pioppo. Dopo la prima muta la larva entra nei giovani germogli. La densità di popolazione di *G. aceriana* è risultata più elevata a Sofia, dove nel 1997 sono state raccolte una media di 2 larve/m di germoglio. Gli insetti infestano dal 23 al 93.7% degli apici vegetativi dei pioppi. Le larve di *G. minutana* si alimentano tra due o più foglie collegate tra loro da fili sericei. Le larve delle altre specie arrotolano le foglie, come è caratteristica di molti Tortricidi. Con l'eccezione di *G. aceriana*, tutte le specie sono apparse con ridotte popolazioni e nel corso delle due annate non sono da considerare come importanti avversità del pioppo.

Key words: Bulgaria, leaf rollers on poplars, Tortricidae, species composition, bioecological features

INTRODUCTION

The herbivorous entomofauna of *Populus* spp. in Bulgaria is very diverse and includes more than 150 insect species from different systematic groups (Buresh & Lazarov, 1956; Tsankov *et al.*, 1965; Keremidchiev, 1966; 1968; Daskalova, 1968; Bencheva, 1994; Georgiev & Delkov, 1997). Most of these herbivorous populations occur in low densities and usually do not act as pests. There are also species which periodically increase in density and cause serious damage to poplar plantations. Some leaf rollers (Lepidoptera, Tortricidae) are outbreak species which are very serious pests in the broad-leaved forests.

The complex of tortricids in poplar ecosystems in Bulgaria was the subject of these investigations. There is scant information in Bulgarian entomological literature about leaf rollers associated with poplars; until now only some species have been found as phytophagous of *Populus* spp. in the country - *Gypsonoma sociana* (Hw.) (syn. *G. neglectana* Dup.) (Daskalova, 1963; Keremidchiev, 1966), *G. aceriana* (Dup.) (Daskalova, 1963; Balov & Chernev, 1963; Chernev *et al.*, 1969; Bencheva, 1994; Georgiev & Delkov, 1997), G. *minutana* (Hbn.) (Keremidchiev, 1966), *Archips xylosteana* (L.) (Keremidchiev, 1966; Bencheva, 1994; Georgiev & Delkov, 1977), *Pandemis heparana* (Den. & Schiff.) (Kolev, 1970), and *Hedia salicella* (L.) (Georgiev & Delkov, 1997).

The aim of this study was to determine the species composition, the structure of the complex, and some bioecological features of leaf rollers on poplars in the region of Sofia.

MATERIALS AND METHODS

The investigations were done during 1997 and 1998; the biological material was collected from poplar trees and poplar stump sprouts in two residential areas of Sofia ("Slatina" and "Darvenitsa"), in the arboretum of Forest Research Institute, and in outskirts of the villages Kokaljane and Jeleznitsa.

Sofia is situated at 550 m altitude, Kokaljane is situated in the valley of Iskar river 12 km south-east of Sofia (620 m altitude) and Jeleznitsa at 20 km south of Sofia in the Vitosha mountains at 1000 m altitude. Some characteristics of the areas are given in Table 1. Most of the collections were done in 1997. Basing on the material sampled an analysis was made of the species structure and population density of the tortricid complex in the region.

After collection, the larvae and pupae of leaf rollers were transferred to the Forest Research Institute at Sofia where they were separated according to species and reared to the adult stage at room temperature (18 - 22°C). The larvae of leaf rollers were fed with fresh poplar leaves in glass dishes covered with gauze. As the specimens pupated they were placed in test tubes and petri dishes in which the humidity was increased by cotton pads soaked in water.

The larvae of the poplar twig borer, *Gypsonoma aceriana* (Dup.), were collected after the first moult and penetration into young twigs. Laboratory rearing was done in petri dishes, 10 - 20 caterpillars were allowed to develop in the top parts of tender twigs 3 - 5 cm long. The larvae of the other xylophagous species, like *Cydia exquisitana* (Rbl.), were reared in branch and stem sections in glass cylinders covered with gauze.

During the collection of the larvae the population density and the phenological stage of development were recorded for each species. In young poplar plantations larvae were recorded from one-meter branches of 10 trees - 3 each from the lower, middle, and upper part of the crown. The branches were cut with pruning shears. On mature poplars the pest density was recorded only in the lower part of the crown at 4 m above the ground. For better comparison, in all experimental areas the densities of tortricids were presented by the average values.

RESULTS

As a result 14 species of leaf rollers (Lepidoptera, Tortricidae) were recorded from poplar in the region of Sofia, (Table 2).

The phytophagous insects belong to 7 genera of two subfamilies as follows: *Archips betulana* (Hübner, 1787), *A. crataegana* (Hübner, 1799), *A. podana* (Scopoli, 1763), *A. rosana* (Linnaeus, 1758), *A. xylosteana* (Linnaeus, 1758), *Pandemis heparana* (Denis & Schiffermüller, 1775), *P. cerasana* (Hübner, 1786), *Ptycholoma lecheana* (Linnaeus, 1758), *Cydia exquisitana* (Rebel, 1889), *Gypsonoma aceriana* (Duponchel, 1843), *G. dealbana* (Frölich, 1828), *G. minutana* (Hübner, 1799), *Hedia salicella* (Linnaeus, 1758) and *Pseudosciaphila branderiana* (Linnaeus, 1758) (Table 2).

Table 1 - Characteristics of the areas studied.

Locality	Host-plant			Collections of the biological material	
	poplar species (group)	origin	years	number	period, date
	Populus deltoides Marsh.	poplar ornamental trees	25-30	9	11.05-06.09.1997
Sofia (Slatina)	*Populus* x euramericana (Dode) Guinier	poplar stump sprouts	2-3	9	11.05-06.09.1997
			3-4	2	25.03-18.05.1998
Sofia (Darvenitsa)	*Populus deltoides* Marsh.	poplar ornamental trees	25-30	3	12.05-22.07.1997
Sofia (Forest Research Institute)	*Populus* x euramericana (Dode) Guinier	plantation	8	7	15.05-15.07.1997
	Populus x euramericana (Dode) Guinier	poplar ornamental trees	36	1	29.05.1997
	Populus x euramericana (Dode) Guinier	plantation	5	6	19.05-23.07.1997
Kokaliane	*Populus* x euramericana (Dode) Guinier	plantation	4	7	17.05-17.07.1997
			5	1	23.05.1998
Jeleznitsa	*Populus* x euramericana (Dode) Guinier	plantation	7	5	24.05-17.07.199
	Populus tremula L.	natural forest stand	3-5	5	24.05-17.07.1997

Most of the moths were reared from pupae collected from hybrid poplars of the euramericana-group, *Populus* x euramericana (Dode) Guinier. Only *G. aceriana* was found on *Populus deltoides* Marsh. in the region of Sofia. The trees of *P. deltoides* in Sofia were also severely attacked by some species of Gelechiidae and Macrofrenata (Lepidoptera) (Georgiev & Beshkov, unpublished).

Eight species - *A. betulana*, *A. podana*, *A. rosana*, *C. exquisitana*, *G. dealbana*, *P. cerasana*, *P. lecheana* and *P. branderiana* - were reported for the first time on poplars in Bulgaria (Table 2).

In 1997 and 1998 *G. aceriana* was the dominant species in the common tortricid complex on poplars representing 69.0% of tortricids collected (Table 2). Three species were subdominant (*C. exquisitana* - 9.0%, *G. minutana* - 6.2% and *P. cerasana* - 3.7%); the other leaf roller species were not numerous.

In 1997 nine tortricid species are established on *Populus* spp. at Sofia and Kokaljane, six species at Jeleznitsa (Table 3). Four species (*G. aceriana*, *H. salicella*, *P. heparana* and *P. cerasana*) were found at all sites studied. *A. crataegana*, *A. podana*, *A. rosana,* and *A. xylosteana* were presented at two locations and *A. betulana*, *G. dealbana*, *G. minutana,* and *P. branderiana* were recorded at only one location. In Sofia, only one species (*G. aceriana*) was dominant. Five species (*A. rosana*, *A. xylosteana, G. aceriana, H. salicella* and *P. cerasana*) were dominant in Kokaljane and four species in Jeleznitsa (*A. xylosteana, G. aceriana, H. salicella* and *P. cerasana*).

With the exception of *G. aceriana* and *G. minutana*, the tortricid species were present in low population densities in 1997 (Fig. 1). *G. aceriana* develops on the leaves of poplars only in the first larval instar, subsequently, the penetrate the young twigs. The larvae of *G. minutana* live and feed between two or more leaves held together with silk in contrast to the larvae of other species, which roll the leaves as a characteristic behaviour of many tortricids. Damages of poplars caused by *C. exquisitana*, a xylophagous pest, were established only in 1998 at Sofia.

In 1997, population density of tortricid species was highest in the Sofia location (Fig. 1). *G. aceriana* caused considerable damage to street and park poplar trees. The pest density was highest on stump sprouts and young trees, where up to 17.9 larvae/m were recorded. At the sites of Sofia studied 23.0 to 93.7% of tender twigs of the trees were damaged. The rest of the tortricid species were found in low densities, a total of 0.7 larvae/m, and did not cause harmful effects on host plants at Sofia. In the other two locations, Kokaljane and Jeleznitsa, the densities of all tortricid species were low, about 0.2 to 0.3 larvae/m for *G. aceriana* and 2.1 to 0.5 larvae/m for all other species.

DISCUSSION

New tortricids on poplars are either reported faunistically or as pests on other forest and fruit tree species in Bulgaria. In a literature overview, Kolev (1970) indicated that *P. branderiana* (syn. *Sciaphila branderiana* L.) was reported by Lazarov (1949) as a pest on almond (*Amygdalus communis* L.), but the monograph of Lazarov (1949) does not contain such information, nor did Buresh & Lazarov (1956) include *P.*

Table 2 - Species composition and number of tortricid adults found on Populus spp. in Sofia Region.

Subfamily, species	Host plant	Locality	Number of the adults ♂♂	Number of the adults ♀♀	Emergence, date	Percentage
Tortricinae						
* *Archips betulana* (Hbn.)	*Populus* x euramericana	Sofia	2	1	03.06.1997	0.9
Archips crataegana (Hbn.)	*Populus* x euramericana	Sofia	1	1	01-03.06.1997	0.9
	Populus x euramericana	Kokaljane	-	1	23.06.1997	
* *Archips podana* (Sc.)	*Populus* x euramericana	Sofia	1	-	20.06.1997	0.6
	Populus x euramericana	Kokaljane	1	-	08.06.1997	
* *Archips rosana* (L.)	*Populus* x euramericana	Sofia	1	-	14.06.1997	1.9
	Populus x euramericana	Kokaljane	2	3	12-23.06.1997	
Archips xylosteana (L.)	*Populus* x euramericana	Kokaljane	4	1	15-16.06.1997	2.5
	Populus x euramericana	Jeleznitsa	2	1	21.06.-07.07.1997	
Pandemis heparana (Den. & Schiff.)	*Populus* x euramericana	Sofia	-	1	05.06.1997	0.9
	Populus x euramericana	Kokaljane	-	1	12.06.1997	
	Populus x euramericana	Jeleznitsa	-	1	13.07.1997	
* *Pandemis cerasana* (Hbn.)	*Populus* x euramericana	Sofia	1	2	16.06-16.08.1997	3.7
	Populus x euramericana	Kokaljane	4	3	30.05-18.06.1997	
	Populus x euramericana	Jeleznitsa	1	1	18.06-02.07.1997	
* *Ptycholoma lecheana* (L.)	*Populus* x euramericana	Sofia	-	1	27.05.1998	0.6
	Populus x euramericana	Kokaljane	-	1	01.06.1998	
Olethreutinae						
* *Cydia exquisitana* (Rbl.)	*Populus* x euramericana	Sofia	12	17	04-25.05.1998	9.0
Gypsonoma aceriana (Dup.)	*Populus* x euramericana	Sofia	102	93	18.05-25.08.1997	69.0
	Populus deltoides Marsh.	Sofia	9	7	20.05-17.08.1997	
	Populus x euramericana	Kokaljane	2	2	10-19.06.1997	
	Populus x euramericana	Jeleznitsa	3	4	10-19.06.1997	
* *Gypsonoma dealbana* (Frölich)	*Populus* x euramericana	Kokaljane	1	1	10-19.06.1997	0.6
Gypsonoma minutana (Hbn.)	*Populus* x euramericana	Sofia	11	9	22.05-12.08.1997	6.2
Hedia salicella (L.)	*Populus* x euramericana	Sofia	1	-	06.06.1997	2.8
	Populus x euramericana	Kokaljane	1	5	06-19.06.1997	
	Populus x euramericana	Jeleznitsa	1	1	18-19.06.1997	
* *Pseudosciaphila branderiana* (L.)	*Populus tremula* L.	Jeleznitsa	1	-	11.06.1997	0.4

branderiana in their bibliography and catalogue of pests for agriculture and forestry in Bulgaria. There is probably a misidentification in the report of Lazarov (1949) because *P. branderiana* is oligophagous and feeds on poplars (Kuznetsov, 1978) preferring *Populus tremula* L. (Hannemann, 1961; Kuznetsov, 1978; Schwenke, 1978).

C. exquisitana was found by Drjanovsky (1906) in the same region, Vitosha mountains near to Sofia, at 600 - 800 m a.s.l. The larvae of the species feed under the bark of *Salix* spp. and *Populus* spp. (Kuznetsov, 1978).

A. podana is known from Bulgaria as pest on fruit trees (Nikolova, 1959). Our investigations confirmed the report of Kolev (1970) that the species did not occur in high population densities.

G. dealbana is established in some regions of the country but, until present, the species was found only on the leaves of apple trees (*Malus* sp.) (Kolev, 1970).

In the present investigations *G. aceriana* and *G. minutana* were found as the most numerous tortricids on poplars in the region of Sofia. *G. aceriana* was reported earlier as a common pest on ornamental poplar trees at Sofia (Georgiev & Delkov, 1997), showed by infestation results in forking and other deformities of the top parts of the stems and branches of trees. *G. aceriana* is bivoltine, but in alternating years a third generation can develop (Georgiev, 1992). Only two generations of *G. aceriana* were recorded in 1997. The other species of the genus, *G. minutana*, also develops two generations. For *G. minutana*, a synthetic pheromone with high specificity of attraction was produced (Velcheva & Milkova, 1989).

A. rosana is widely spread in Bulgaria (Kolev, 1970). It has a relatively broad host plant range including some forest and shrub species - *Tilia* spp., *Crataegus* spp., *Syringa vulgaris* L. (Nikolova, 1959), *Salix* spp. and *Ligustrum vulgare* L. (Kolev,

Table 3 - Percentages of tortricid species in different localities in 1997.

Species	Locality		
	Sofia	Kokaljane	Jeleznitsa
A. betulana	1.2	0	0
A. crataegana	0.8	3.1	0
A. podana	0.4	3.1	0
A. rosana	0.4	15.6	0
A. xylosteana	0	15.6	18.7
P. heparana	0.4	3.1	6.3
P. cerasana	1.2	21.9	12.5
G. aceriana	87.0	12.5	43.7
G. dealbana	0	6.3	0
G. minutana	8.2	0	0
H. salicella	0.4	18.8	12.5
P. branderiana	0	0	6.3

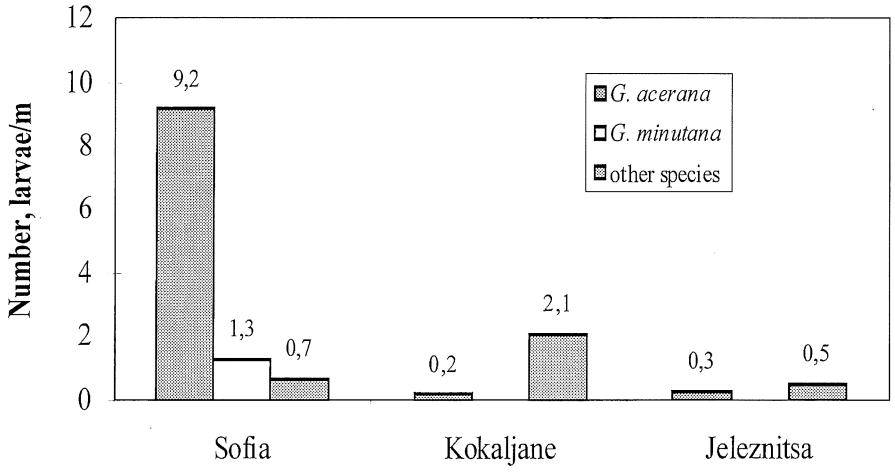

Fig. 1 - Average number of the tortricids in Sofia region in 1997.

1970). *P. lecheana* and *P. cerasana* are known in Bulgaria as pests of many fruit tree species (Nikolova, 1959; Kolev, 1970).

The tortricid complex on broad-leaved trees usually is very unstable by species composition, structure and population density (Angelova, 1987). With the exception of *G. aceriana*, no negative effects caused by tortricid species on poplars were found in this study. However, most of the recorded leaf rollers are with outbreak population dynamics and it is possible that in appropriate conditions they could become pests of the poplars.

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