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The jumping plant-lice (Hemiptera: Psylloidea) of the Tatra National Park

JOWITA DROHOJOWSKA[1], ELŻBIETA GŁOWACKA[2]

Department of Zoology, Faculty of Biology and Environmental Protection,
University of Silesia, Bankowa 9, 40-007 Katowice, Poland,
[1]e-mail: jowita.drohojowska@us.edu.pl, [2]e-mail: eglowacka0@poczta.onet.pl

ABSTRACT. The article provides a list of jumping plant lice of the Tatra National Park (TNP). Field studies were conducted in the years 2001-2007 at 27 sites. Insects were collected by sweeping, beating and visually inspecting the host plants. Psyllids of 46 species of 13 genera of Psyllidae and Triozidae were recorded. This number of species comprises nearly 50% of the Polish fauna of psyllids. Three species were recorded from Poland for the first time.

KEY WORDS: Insecta, Hemiptera, Psylloidea, jumping plant lice, Poland, Tatra National Park.

INTRODUCTION

With only some 2500 species, the jumping plant lice are not a very numerous group of insects (BURCKHARDT & LAUTERER 1997). They are found all over the world. About 350 species have been recorded in Central and Eastern Europe, 190 in Central Europe alone and 110 in Poland (DROHOJOWSKA 2004). They are mainly species feeding on the phloem of dicotyledons (with exception of the genus *Livia* LATREILLE, 1802); their nymphs are able to produce galls or protective wax layers (HODKINSON 1974). The most numerous species are either mono- or oligophagous, but under conditions of stress they may migrate to other plants, mainly coniferous trees. So far, the jumping plant lice fauna of Poland has been investigated extensively only in the Bieszczady National Park and the Gorce National Park (KLIMASZEWSKI 1971, GŁOWACKA & MIGULA 1996, DROHOJOWSKA & KLIMASZEWSKI 2000). Earlier studies from the Polish and Slovak Tatra National Parks are reported in

SMRECZYŃSKI (1954) and LAUTERER (1974). These data were summarized in the catalogue of Polish psyllids (KLIMASZEWSKI 1975). The voucher specimens are difficult to access, being scattered among various collections and often damaged. According to these historical materials, 54 species of jumping plant lice were reported from the Tatras, as stated in the Catalogue of Polish Fauna (KLIMASZEWSKI 1975). The present study contains data referring to the area of the Tatra National Park (TNP), providing a retrospective insight into the group of insects in question and highlighting changes in its composition, probably due to the influence of human activities.

MATERIAL AND METHODS

The study was conducted in the Tatra National Park from July to September in the years 2001-2007. Jumping plant lice were collected mainly by sweeping and checking the host plants, as well as brushing insects into an inverted umbrella. In the autumn, imagines hibernating on coniferous trees were also collected. Both imagines and nymphs were collected. Samples were collected at 27 localities encompassing a diversity of ecosystems and habitat types in the High Tatras, in both the Western and the Eastern Tatras. The locations of the sampling sites together with their numbers are shown schematically on the TNP map (Fig. 1). The Eastern Tatras were represented by 10 localities, the Western Tatras by 17. The numbers allocated to the particular localities shown in the diagram and given below are also mentioned in the text and featured in Tables 1 and 2.

List of localities, georeferencing data and UTM grids.

The Eastern Tatras:

1. The area around Lake Morskie Oko [higher subalpine forest (regiel górny), UTM: DV34];
2. Dolina Roztoki together with Dolina Pięciu Stawów [higher subalpine forest (regiel górny), UTM: DV35, DV25];
3. Peatbog in Dolina Pańszczyca [higher subalpine forest (regiel górny), UTM: DV35];
4. Polana Waksmundzka and Dolina Waksmundzka [higher subalpine forest (regiel górny), UTM: DV35];
5. Rusinowa Polana [lower subalpine forest (regiel dolny), UTM: DV35];
6. The Gęsia Szyja area [higher subalpine forest (regiel górny), UTM: DV35];
7. Dolina Suchej Wody and the surrounding area [higher subalpine forest (regiel górny), UTM: DV25];
8. The Potok Filipczański area [lower subalpine forest (regiel dolny), UTM: DV36];
9. Hala Gąsienicowa [higher subalpine forest/ dwarf-pine zone (regiel górny/ piętro kosodrzewiny), UTM: DV25];
10. The region of Murzasichle [foothill zone/lower subalpine forest (piętro pogórza/regiel dolny), UTM: DV26].

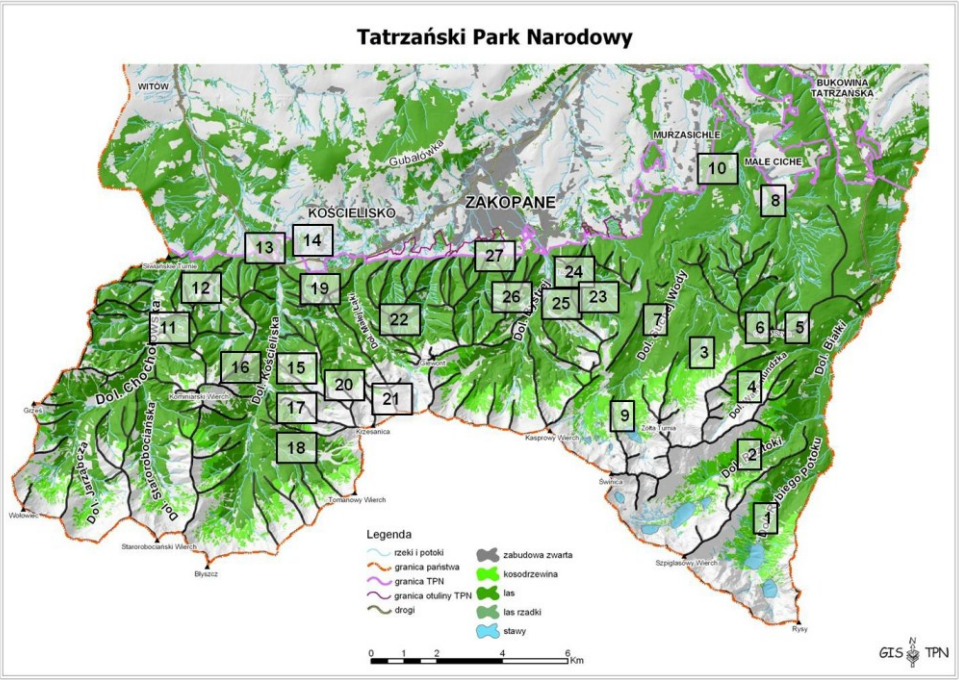

Fig. 1. Map of sampling sites in the Tatra National Park. Their numbers are explained in the list given in Material and methods.
(Source of the background map: http://www.gis.tpn.pl/zawartosc/mapy_gotowce.htm).

The Western Tatras:

11. Dolina Chochołowska and Polana Siwa [lower subalpine forest (regiel dolny), UTM: DV15];
12. Dolina Lejowa [lower subalpine forest (regiel dolny), UTM: DV15];
13. Polana Rogoźniczańska [foothill zone (piętro pogórza), UTM: DV15];
14. Groń [foothill zone (piętro pogórza), UTM: DV15];
15. Dolina Kościeliska [foothill zone/lower subalpine forest (piętro pogórza/regiel dolny), UTM: DV15];
16. Hala na Stołach [higher subalpine forest (regiel górny), UTM:DV15];
17. Wąwóz Kraków [lower subalpine forest/ higher subalpine forest (regiel dolny/regiel górny), UTM: DV15];
18. Dolina Tomanowa [higher subalpine forest (regiel górny), UTM: DV15];
19. Droga nad Reglami and Przysłop Miętusi [lower subalpine forest (regiel dolny), UTM: DV15];

20. Hala Miętusia, Wantule and Dolina Miętusia [lower subalpine forest (regiel dolny), UTM: DV15];
21. The Czerwone Wierchy [higher subalpine forest/dwarf-pine zone /alpine zone (regiel górny/piętro kosodrzewiny/piętro hal), UTM: DV25];
22. Dolina Strążyska [lower subalpine forest (regiel dolny), UTM: DV25];
23. The area around the Kopieniec [lower/higher subalpine forest (regiel dolny/górny), UTM: DV25];
24. Przełęcz Nosala, Polana Olczyska and Nosal [lower subalpine forest (regiel dolny), UTM: DV25];
25. Dolina Jaworzynki and Boczań [lower subalpine forest (regiel dolny), UTM: DV25];
26. The Kalatówka area [foothill zone (piętro pogórza), UTM: DV25];
27. The area around the ski jumping hills [foothill zone (piętro pogórza), UTM: DV25].

The systematics of jumping plant lice in the present study has been adopted from OSSIANNILSSON (1992), and the chorological elements are after GŁOWACKA & MIGULA 1996. The entire material can be found in the authors' collection.

Legal restrictions regarding the acquisition of material for research (limits on the number of specimens collected) from the TNP precluded more detailed analyses. It was practically impossible to obtain a representative sample for such a large area, or to collect materials on a long-term basis for comparative studies, especially in the case of species not previously recorded in the TNP. The samples collected and data are insufficient to perform basic analyses to determine the species capacity and species richness of this area; it is also impossible to compile a detailed description of the biodiversity of the local faunas within the biotopes, taking into account the various aspects of environmental changes observed.

RESULTS AND DISCUSSION

The specimens of jumping plant lice collected in the Tatra National Park belong to 13 genera of Psyllidae (Table 1) and Triozidae (Table 2); a total of 46 species were identified. From the qualitative point of view, this number is high, encompassing half of the psyllid species that have been recorded in Poland so far. An earlier study by SMRECZYŃSKI (1954) covered the whole area of the Tatras, i.e. an area much larger than the one focused on in the present study. The absence of 8 species, listed previously from the Tatra Mts. in the first extensive study of Polish jumping plant lice, is due to the fact that they are associated mainly with plants which are very rare in the TNP, or with willows, some of which have been removed from the localities where they used to grow. Moreover, altitudinal zonation in the mountains results in a diversification of the psyllid fauna according to particular zones (GŁOWACKA 1989). Strictly montane species begin to appear in the upper subalpine

forest zone. In both the lower subalpine forest and the foothill zones, psyllids can be collected only in small numbers, and the species encountered are also common in other regions of Poland. As far as the subalpine and alpine zones are concerned, psyllid species are not very numerous even though their host plants are present (GŁOWACKA 1989). Among the species collected, the alpine ones are represented by *Trioza schranki* FLOR 1861, and *T. senecionis* (SCOPOLI 1763). The latter species had previously been reported only from the Gorce Mountains and the Sudetes (GŁOWACKA 1989, GŁOWACKA & MIGULA 1996). *Trioza tatrensis* KLIMASZEWSKI, 1965 is a typical montane species recorded exclusively in the Tatras. It is oligophagous, feeding on various *Hieracium* spp., i.e. plants encountered in the other Polish mountain ranges as well, but it has never yet been collected in other localities.

Table 1. Psyllidae identified in the Tatra National Park, the localities where they were recorded and their chorological categorization.

List of species	Localities	Chorological category	Notes
Psyllidae			
Liviinae			
Livia juncorum (LATR.)	12, 23	P	
Aphalarinae			
Aphalara exilis (WEB. & MOHR)	11, 21	P	*
Aphalara sp.	10		◆,■
A. polygoni FRST.	15, 16, 18, 19, 24, 25, 27	P	*
A. rumicicola KLIMASZ.	13, 15, 18, 23	ES	*
Craspedolepta latior WAGNER	11,13	ES	*
C. (*Magnaphalara*) *nervosa* (FRST.)	11, 13, 18, 20, 25	P	*
C. (*M.*) *flavipennis* (FRST.)	4, 5, 9, 20, 22, 23	ES	*
C. (*M.*) *sonchi* (FRST.)	20, 24, 26	ES	*
C. (*M.*) *nebulosa* (ZETT.)	9	P	*
Neocraspedolepta subpunctata (FRST.)	9, 13, 15,19	P	*
Tetrafollicula omissa (WAGNER)	11,13	ES	*
Rhinocolinae			
Rhinocola aceris (L.)	11	ES	
Strophingiinae			
Strophingia ericae (CURTIS)	9	P	*

Diaphorininae			
Psyllopsis fraxinicola (FRST.)	8, 10, 13, 15, 23, 24	H	*
P. fraxini (L.)	15, 20, 22, 24	P	*
Psyllinae			
Psylla (*Psylla*) *alni* (L.)	1, 5, 6, 8,13, 15, 19	H	
P. (*P.*) *fusca* (ZETT.)	1, 13, 22, 25, 26	E	*
P. (*Asphagidella*) *buxi* (L.)	25	C	
Baeopelma foersteri (FLOR)	13, 22, 25	P	
Cacopsylla (*Cacopsylla*) *sorbi* (L.)	4, 6, 7, 11, 12, 13,15, 19, 25	E	*
C. (*C.*) *mali* (SCHMIDB.)	1, 13	P	*
C. (*T.*) *melanoneura* (FRST.)	13	ES	*
C. (*T.*) *pruni* (SCOPOLI)	13	ES	
C. (*H.*) *myrtilli* (WAGNER)	2, 3, 4, 9, 18	BM	*
C. (*H.*) *ambiqua* (FRST.)	9, 11, 15, 24, 25	H	*
C. (*H.*) *nigrita* (ZETT.)	16	E	*

Notes: the numbers in the Localities column are explained in the Materials and Methods section; Chorological categories: BM – Boreo-montane; C – Cosmopolitan; E – European; EM – Euro-montane; ES – Euro-Siberian; H – Holarctic; P – Palearctic. * – species identified in the Tatra National Park; • – species new to the Tatra National Park; ◆ – species new to Poland; ■ – species not identified.

The species list given in Table 2 includes species that have not been reported from the Tatras or from Poland before. These are species rarely encountered in Europe and then almost exclusively in mountain regions, i.e. *Trioza laserpitii* BURCKHARDT et LAUTERER, 1982; *T. tripteridis* BURCKHARDT, CONCI, LAUTERER et TAMANINI, 1991; *Bactericera parastriola* CONCI, OSSIANNILSSON et TAMANINI, 1988.

Comparison of the number of psyllid species recorded in the Tatras with that encountered in other mountain regions of Poland shows that the Tatra Mountains have the highest number (Table 3). This list also includes species not reported so far from any other Polish mountain ranges, despite the presence of their host plants. 25 of these species are associated with herbaceous plants, 17 with trees, 3 with shrubs and 1 – *Livia juncorum* (LATREILLE, 1798) – with monocotyledons. The disparities regarding the numbers of species collected in the Polish and the Slovak Tatras are surprising. In his study of the jumping plant lice of Tátranski Narodny Park, LAUTERER (1974) recorded 44 species, 11 of which have not been encountered in the Polish part of the Park Tatras. However, 26 species

have been recorded exclusively in the Polish Tatras.

The species composition of jumping plant lice in the Tatras is similar to that of the other mountain ranges in Poland as regards their chorological characteristics. Palaearctic species are the most numerous (35%), followed by Euro-Siberian species (28%). 11% and 9% of the species are of European and European-montane origin respectively. Boreo-montane species (6.5%) are represented by *Cacopsylla myrtilli*, *Bactericera parastriola* and *Trioza rotundata*, and European-montane species (9%) by *Trioza tatrensis, T. laserpitii, T. schranki* and *T. senecionis.* Holarctic species make up 6.5% of the whole; only 4% of species are cosmopolitan.

Table 2. Triozidae identified in the Tatra National Park, the localities where they were recorded and their chorological categories.

List of species	Localities	Chorological category	Notes
Triozidae			
Bactericera femoralis (FRST.)	4, 6, 7, 9, 11, 18, 19, 20, 21, 23, 24	ES	*
B. bohemica (ŠULC.)	15, 16, 20	ES	*
B. reuteri (ŠULC)	1, 15, 27	ES	
B. albiventris (FRST.)	11, 15	P	
B. striola (FLOR)	9, 15, 18, 21	P	*
B. parastriola OSSIAN.	20	BM	*●
B. curvatinervis (FRST.)	11, 16, 20, 25	P	*
B. nigricornis (FRST.)	4, 16, 24, 26, 27	P	*
Trioza urticae (L.)	1, 2, 4, 5, 8, 9, 11, 12,13, 15, 17, 19, 20, 24	C	*
T. tripteridis BURCKH.	20	P	*● ◆
T. dispar (LÖW)	16	ES	*
T. tatrensis KLIMASZ.	11, 16	EM	*
T. flavipennis FRST.	4, 5, 9, 20, 22	E	*
T. rotundata FLOR	7, 11, 24, 26	BM	*
T. cirsii LÖW	12	P	*
T. anthrisci BURCKH.	1, 15, 16, 19, 21	ES	*●
T. laserpitii BURCK. & LAUT.	24	EM	*● ◆

T. schranki FLOR	16	EM	*
T. senecionis (SCOP.)	16	EM	*•
T. rumicis LÖW	4, 5,11, 23, 24, 25	E	*

Notes: the numbers in the Localities column are explained in the Materials and Methods section; Chorological categories: BM – Boreo-montane; C – Cosmopolitan; E - European; EM – Euro-montane; ES – Euro-Siberian; H – Holarctic; P – Palearctic. * – species identified in the Tatra National Park; • – species new to the Tatra National Park; ◆ – species new to Poland.

Table 3. The numbers of Psyllidae species in the Polish mountains, their percentage share in the Polish fauna and the data source.

Mountains	Number of species	Percentage of the Psylloidea fauna	References
Silesian and Żywiec Beskids	56	50%	GŁOWACKA 1979
Gorce	54	49%	GŁOWACKA, MIGULA 1996
Pieniny	28	25%	KLIMASZEWSKI 1967
Tatras	58	53%	SMRECZYŃSKI 1954
Bieszczady	50	45%	KLIMASZEWSKI 1971, DROHOJOWSKA & KLIMASZEWSKI 2000.
Sudetes	53	48%	GŁOWACKA 1989

NOTES ON RARE SPECIES

Trioza tripteridis BURCKHARDT, CONCI, LAUTERER ET TAMANINI, 1991

Material

Wantule 15.07.2007; leg. E. Głowacka. Nymphs and newly hatched imagines were collected from the undersides of leaves of *Valeriana sambucifolia*.

Host plants

Various species of *Valeriana* (*V. tripteris*, *V. montana*, *V, officinalis*).

Distribution

The species inhabits European mountains (Austria, the Czech Republic, Italy, Romania, Switzerland, Bosnia). The species is new to the Polish fauna.

Biology

The insects are encountered at altitudes of 800-1400 m in northern Europe and, for example, at 1400-2075 m in Italy. Adult forms hibernate in coniferous trees. In the middle of June they move onto their host plants. Females lay eggs in flower buds. They feed on the

undersides of leaves. Adult individuals of the next generation appear in July. The species completes one generation per year (BURCKHARDT et al. 1991).

Trioza laserpitii BURCKHARDT ET LAUTERER, 1982

Heterotrioza (*Dyspersa*) *apicalis* (Förster, 1848): KLIMASZEWSKI 1975, p. 269 (pars).

Material

Nosal 16.07.2007, leg. E. Głowacka. Numerous larvae and single adults were collected from the undersides of leaves of *Laserpitium latifolium.*

Distribution

A species found locally in Central Europe (Slovakia, Switzerland, Austria, Romania, Italy); also reported from Sweden. Reported for the first time from Poland.

Biology

The species hibernates in the adult stage on coniferous trees (BURCKHARDT & LAUTERER 1982). In spring females fly to their host plants and lay eggs on the open leaves. The species completes only one generation per year (HODKINSON 2009).

Trioza tatrensis KLIMASZEWSKI, 1965

Material

Hala na Stołach 09.09.2001; 20.09.2007; leg. E. Głowacka. Numerous insects were collected from coniferous trees.

Host plants

Oligophagous, feeding on various species of *Hieracium* spp.

Distribution

Encountered locally in European mountains (Norway, Austria, Switzerland, northern Italy, France, Romania, Slovakia). The species is rare in Poland: so far it has been reported only from the Tatras.

Biology

Hibernation probably in the adult stage, on coniferous trees; nymphs unknown (OSSIANNILSSON 1992).

Trioza senecionis (SCOPOLI,1763).

Material

In the vicinity of Hala na Stołach 11.09.2001; 20.09.2007, leg. E. Głowacka. Numerous nymphs and a single imago were collected from *Senecio nemorensis.*

Distribution

The species is also known from Slovakia, Switzerland and Romania. In Poland it has been reported from the Sudetes (GŁOWACKA 1989) and the Gorce Mountains (GŁOWACKA & MIGULA 1996).

Biology

Hibernation in the adult stage, on coniferous trees. In spring, after copulation females lay eggs on the undersides of the leaves of host plants; the nymphs live there in aggregations. Egg laying strongly distorts the leaf surfaces (KLIMASZEWSKI 1975). Single imagines appear towards the end of September. The species completes one generation per year.

Bactericera parastriola CONCI, OSSIANNILSSON ET TAMANINI, 1988

Bactericera striola (FLOR, 1861): GŁOWACKA & MIGULA 1996, p. 26

Material

Polana Miętusia 07.09.2001; 15.09.2007; leg. E. Głowacka. Adult individuals were collected from *Salix caprea.*

Host plants

Various species of *Salix*.

Distribution

Reported from Sweden, Romania, Switzerland and Italy (LAUTERER 2001). This is the first record of this species in Poland.

Biology

The adult insects hibernate, flying to coniferous trees in autumn. Nymphs have not yet been found. The species probably completes one generation per year (CONCI et al. 1996).

Trioza anthrisci BURCKHARDT, 1986

Material

Adults insects were collected from coniferous trees on Hala na Stołach; 07.09.2001 from herbaceous plants on the Czerwone Wierchy; 08.09.2001 from herbaceous plants in Dolina Lejowa;, 18.07.2005 adult insects and larvae were collected from *Chaerophyllum hirsutum* on Droga nad Reglami, 18.07.2005 also from *Chaerophyllum hirsutum* in Dolina Kościeliska.

Host plants

An oligophage feeding on *Anthriscus sylvestris*, *Heracleum sphondylinum* and probably other plants from the family *Daucaceae* (LAUTERER 2001).

Distribution

The species has been found in Scandinavia (except Denmark), the Czech Republic, Slovakia, Switzerland, Austria, Ukraine and Russia as far east as Siberia. In Poland it has been recorded in the Gorce Mountians (GŁOWACKA & MIGULA 1996).

Biology

These insects pass the winter as imagines. In spring females lay eggs on the undersides of leaves. They complete one generation per year (HODKINSON 2009).

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