

# Stoneflies (Plecoptera) of the Świętokrzyski National Park (Central Poland)<sup>1</sup>

W. Kittel<sup>2</sup>

Fifteen stonefly species were found in the streams of the Świętokrzyski National Park (Łysogóry chain of the Świętokrzyskie Mts); among them *Protonemura intricata*, *Pr. praecox* and *Leuctra hippopus* were found for the first time in this area. Clear difference between the stonefly fauna of the northern and southern slopes were observed.

**Plécoptères du Parc National Świętokrzyski (Pologne centrale).**

Quinze espèces de Plécoptères ont été récoltées dans les cours d'eau du Parc National Świętokrzyski (Chaîne Łysogóry des Montagnes Świętokrzyskie); parmi elles, *Protonemura intricata*, *Pr. praecox* et *Leuctra hippopus* ont été trouvées pour la première fois dans cette région. L'auteur a observé de nettes différences entre la faune des versants nord et celle des versants sud.

## 1. — Introduction

The Łysogóry, the highest chain (up to 611 m a.s.l.) of the Świętokrzyskie Mountains, are old hercynian eroded mountains and are built of Cambrian quartzite rocks. The highest parts of the Łysogóry chain are covered with dense forest (the so-called « Virgin Fir Forest ») composed mainly of fir, with an admixture of pines, spruces, beeches and maples. This forest together with some adjacent meadow areas constitute the Świętokrzyski National Park.

On the slopes of Łysogóry chain, especially on the northern side, there are numerous springs, forming streams that flow down into the main Świętokrzyskie Mountains rivulets: Lubrzanka, Belnianka and Pokrzywianka (Fig. 1). The streams have a considerable grade.

In the upper forested sectors, the current is swift and the bottom is stony, whereas in the lower meadow areas, the current velocity declines and the sedi-

ments change to gravel, sand and even mud. The streams draining the northern slopes are in general distinctly shorter than the streams of the southern slopes.

In summer the mean temperature of the springs is about 8°C. In this season the temperature of the forest sectors of the streams is also rather low, reaching 11-13°C. In the open areas of fields and meadows the water temperature can surpass 20°C.

Material was collected qualitatively from 1972 to 1982 by using a Surber-net in the streams and by searching for imagines in the vegetation along the banks. The present study is a continuation of the earlier work (Wojtas 1974, Kittel et al. 1980, Kittel 1981, 1982).

## 2. — Results

The material collected in 43 stations (Fig. 1) included 184 samples with 4 798 specimens of Plecoptera belonging to 15 species (Tab. I). Three species, namely *Protonemura intricata*, *Pr. praecox* and *Leuctra hippopus* were discovered for the first time in the Łysogóry chain. The total number of Plecoptera found in the whole Świętokrzyskie Mts area reaches now 23 species (Wojtas 1974, Kittel 1982, present paper).

1. These studies were supported by the Polish Academy of Sciences as part of Project MR-II-3. This paper is presented in memory of the late Prof. F. Wojtas.

2. Department of General Zoology, Institute of Environmental Biology, University of Łódź, 12/16 Banacha St. 90-237 Łódź, Poland.

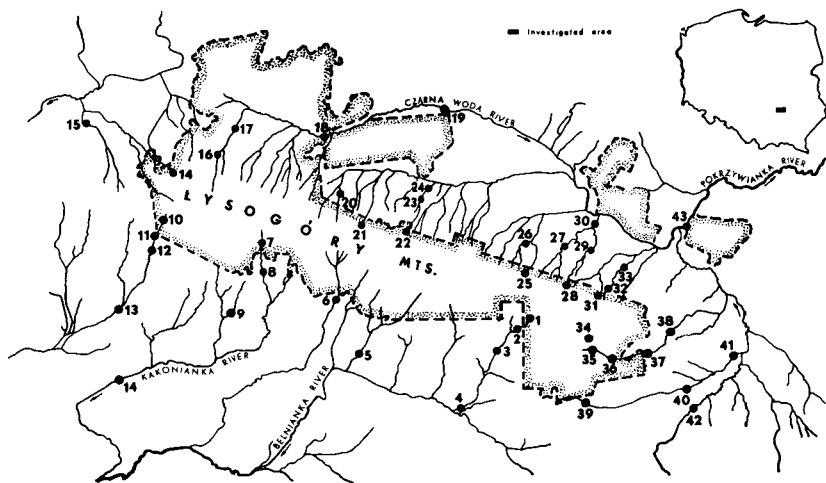


Fig. 1. Location of the collecting stations in the Świętokrzyski National Park.

The material studied is rather diversified as regards the number, the frequency and the distribution of particular species. This distribution depends on the slope as well as on the biotope characteristics (zones I-III, Tab. I, Fig. 2).

The streams flowing down on both the northern and the southern slope are inhabited in general by the same Plecoptera, however their frequency and abundance are different.

The most frequent and abundant Plecoptera in the whole Łysogóry area were *Nemurella pictetii* and *Leuctra nigra*. Rare species found in few localities and samples were *Protonemura intricata*, *Amphinemura standfussi*, *Nemoura dubitans* and *Rhabdipteryx acuminata*.

Springs and the upper forested sectors of the Łysogóry streams (zone I) are comparatively rich in Plecoptera. Eight species were found on the southern side of Łysogóry chain and 11 species on the northern side. In this zone, in the streams of the nor-

thern slopes, occurred *Amphinemura standfussi* and *Nemoura dubitans* (in the marshy spring of Czarna Woda river) which did not occur in this zone of the southern side; on the other hand *Nemoura cambrica* was encountered there, but was absent on the northern side.

The second zone (II) includes the stream sectors of the transitional forest-meadow zone with a short, initial part of the meadow section (about 100 m).

When comparing this zone with the first zone on the northern slopes it is evident that the forest border is here an important ecological boundary, which is not the case on the southern slopes. On the northern slopes, the species number falls down by 50%, whereas on the southern slopes one can observe a succession: *Diura bicaudata* disappears but three new species appear, *Protonemura intricata*, *Pr. praecox* and *Nemoura flexuosa*.

The streams leaving the forest have somewhat different characters on both sides of the Łysogóry

Table I. — Distribution of the stoneflies in the study area.

BIOTOPES  SPECIES	ZONE I : SPRINGS AND FOREST SECTORS				ZONE II : TRANSITORY ZONE BETWEEN THE FOREST AND MEADOWS				ZONE III : MEADOW AND FIELD SECTORS																
	Southern slopes		Northern slopes		Southern slopes		Northern slopes		Southern slopes		Northern slopes														
	Frequency samples	Dominance specimens	Frequency samples	Dominance specimens	Frequency samples	Dominance specimens	Frequency samples	Dominance specimens	Frequency samples	Dominance specimens	Frequency samples	Dominance specimens													
	N	%	N	%	N	%	N	%	N	%	N	%													
1. <i>Rhabdiopteryx acuminata</i> Klap.	2	4.7	17	0.4	3	7.0	80	1.7	3	7.0	48	1.0	2	4.7	2	0.04	2	4.7	2	0.04	1	2.3	1	0.02	
2. <i>Protonemura subereti</i> (Illies)									1	2.3	1	0.02					1	2.3	7	0.1					
3. <i>Protonemura indicala</i> (Ris)									1	2.3	52	1.1					1	2.3	1	0.02					
4. <i>Protonemura pascuor</i> (Mort.)					2	4.7	40	0.8																	
5. <i>Amphinemura standfussi</i> (Ris)																									
6. <i>Nemoura avicularis</i> Mort.																	2	4.7	8	0.2					
7. <i>Nemoura cambialis</i> Stephens	1	2.3	1	0.02	1	2.3	6	0.1	2	4.7	66	1.4					5	11.6	46	0.9					
8. <i>Nemoura cinerea</i> (Retz.)	4	9.3	17	0.4	6	17.0	121	2.5	3	7.0	46	0.9	2	4.7	41	0.8	10	23.2	198	4.1	4	9.3	270	5.6	
9. <i>Nemoura dubitans</i> Mort.					1	2.3	5	0.1																	
10. <i>Nemoura flexuosa</i> Aubert					1	2.3	1	0.02	2	4.7	74	1.5	1	2.3	3	0.06	3	7.0	21	0.4	3	7.0	48	1.0	
11. <i>Nemurella pictetii</i> Klap.	5	11.6	874	18.2	10	23.2	464	9.5	4	9.3	371	7.7	3	7.0	265	5.5	8	18.6	261	5.4	5	11.6	143	2.3	
12. <i>Leuctra digitata</i> Kempny	1	2.3	6	0.1	2	4.7	11	0.2	3	7.0	52	1.1					3	7.0	22	0.4	2	4.7	11	0.2	
13. <i>Leuctra heppoi</i> Kempny	1	2.3	2	0.04	1	2.3	4	0.08	2	4.7	94	1.9					2	4.7	6	0.1					
14. <i>Leuctra nigra</i> (Olivier)	6	14.0	244	5.1	8	18.6	498	7.0	4	9.3	153	3.2	3	7.0	67	1.4	4	9.3	79	1.6	2	4.7	7	0.1	
15. <i>Diura bicaudata</i> (L.)	1	2.3	1	0.02	2	4.7	20	0.4																	

Total number of stations : 43

Total number of specimens : 4798

Frequency and dominance calculated from these totals.

chain. On the northern slopes, the meadow or field section is comparatively short, often regulated by amelioration ditches. On the southern slopes, these meadow or fields sectors are longer and are generally non modified. This is probably the reason why the plecopteran fauna of the zone III (meadow sectors) is so different on both sides of the chain (6 species on the northern and 11 species on the southern slopes).

### 3. — Discussion

The lower forest border in the mountains is well known as a limit for the occurrence of many animals. This holds true also for Plecoptera as it was observed, among others, by Kamler (1964) and is confirmed in the present results.

According to the Raušer's (1962) classification, the Łysogóry chain belongs to the low mountains. It forms an island-like situation in central Poland as an isolated mountaineous biotope.

Among the 15 species recorded, except *Nemoura dubitans*, all are characteristic of the Central-European mountains, having various geographic

ranges (Illies 1967). A comparison of the list of species of the Łysogóry chain with that of the Sudetic Mts (south-western Poland, Wojtas 1970) shows 12 species in common. Thirteen species were found both in Łysogóry area and the Carpathians (southern Poland and Czechoslovakia, Winkler 1957, Wojtas 1964, Sowa & Szczesny 1967, Krno 1982).

Among the species found in the Łysogóry streams there are some eurytopic species, like *Nemoura cinerea* and *Nemurella pictetii*, but most of them are rather stenotopic. It is clear, among other things, from the fact that only six species were common in both the investigated streams and in the Lubrzanka river (Kittel 1982), one of the largest rivulets of the Świętokrzyskie Mts, flowing at the foot of their principal chains.

Despite the low altitude of the Łysogóry chain, its plecopteran fauna differs from the stonefly fauna of the neighbouring lowland areas. Of the 18 species found in the Pilica river (Kittel 1976) only 8 species occurred also in the Łysogóry. Similarly in the middle course of the Warta river and some of its affluents, Wojtas (1962, 1967) has found 15 Plecoptera species only 3 of which were recorded in Łysogóry streams.

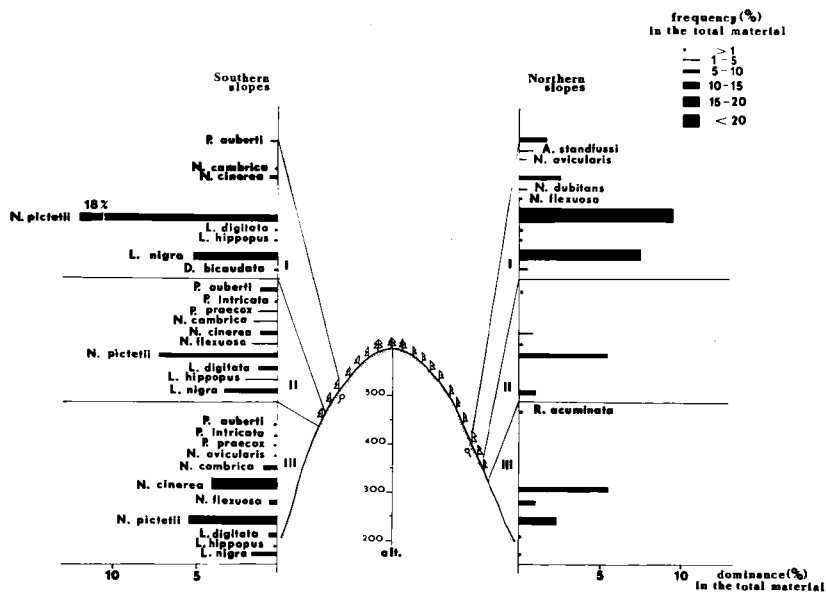


Fig. 2. Frequency and abundance of species in the three investigated zones on the slopes of the Łysogóry chain.

#### Literature cited

- Illies (J.). 1967. — Plecoptera, in *Limnofauna Europaea*. G. Fischer Verlag, Stuttgart : 220-229.
- Kamler (E.). 1964. — Badania nad Plecoptera Tatr. *Pol. Arch. Hydrobiol.* 12 (25), 1 : 145-184.
- Kittel (W.). 1976. — Widelnice (Plecoptera) rzeki Pilicy. Cz. I. faunistyczna. *Zesz. Nauk. UL*, II, 9 : 79-118.
- Kittel (W.). 1981. — *Rhabdiopteryx acuminata* Klap. 1905 (Plecoptera, Taeniopterygidae) w Gorach Świętokrzyskich. *Acta Univ. Lodz., Folia Zool. et Anthropol.*, 1 : 127-133.
- Kittel (W.). 1982. — Widelnice (Plecoptera) rzeki Lubrzanki. *Acta Univ. Lodz., Folia Limnol.*, 1 : 39-49.
- Kittel (W.), Niesiolowski (S.) & Wiedenska (J.). 1980. — Widelnice, meszki i pijawki (Plecoptera, Simuliidae, Hirudinea) wybranego potoku Łysogór. *Acta Univ. Lodz., Zesz. Nauk. UL*, II, 33 : 155-188.
- Krno (I.). 1982. — Struktura a dynamika makrozoobentosu rzeki Lupianki a jej přítokov (Nizke Tatry). *Biologické práce, Veda VSAV, Bratislava*, 28 (2) : 1-128.
- Raušer (J.). 1962. — Zur Verbreitungsgeschichte einer Insekten-dauergruppe (Plecoptera) in Europa. *Prace Brnenske základny Ceskoslovenske Akademie Ved*, 34 : 281-383.
- Sowa (R.) & Szczesny (B.). 1970. — Widelnice (Plecoptera) i chruszciki (Trichoptera) Babiej Góry. *Ochr. Przr.*, 35 : 221-268.
- Winkler (O.). 1957. — Plecoptera slovenska (Faunisticko-systematická studía). *Biologické práce, Bratislava, Veda, VSAV*, 3 : 1-96.
- Wojtas (F.). 1962. — Widelnice (Plecoptera) rzeki Grabi. *Prace Wyd. Mat.-Przr. LTN* : 77 : 1-24.
- Wojtas (F.). 1964. — Widelnice (Plecoptera) Tatr i Podhala. *Lódz, Univ. Lódzki* : 1-29.
- Wojtas (F.). 1967. — Widelnice (Plecoptera) środkowego odcinka górnej Warty i jej dopływów. *Zesz. Nauk. UL*, II, 25 : 3-11.
- Wojtas (F.). 1970. — Przyczynki do poznania fauny widelnic (Plecoptera) Sudetów. *Zesz. Nauk. UL*, II, 40 : 31-35.
- Wojtas (F.). 1974. — Doniesienie o faunie widelnic (Plecoptera) Łysogór. *Zesz. Nauk. UL*, 56 : 21-22.