Folia biologica (Kraków), vol. **53** (2005), No 1-2

Recent Data on the Occurrence of Species of the *Paramecium aurelia* Complex in Europe

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Accepted January 25, 2005

PRZYBOŚ E. 2005. Recent data on the occurrence of species of the *Paramecium aurelia* complex in Europe. Folia biol. (Kraków) **53**: 61-63.

Among 15 species of the *Paramecium aurelia* complex known world-wide , 10 have been found in Europe, namely: *P. primaurelia, P. biaurelia, P. triaurelia, P. tetraurelia, P. pentaurelia, P. sexaurelia, P. septaurelia, P. novaurelia, P. dodecaurelia,* and *P. tredecaurelia*. Recent data on the frequency of occurrence of the species in Europe are given in the paper.

Key words: *Paramecium aurelia* species complex, geographical distribution, frequency of species occurrence.

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A paper on the frequency of species occurrence of the *Paramecium aurelia* complex in Europe was published in 1998 (PRZYBOŚ 1998). Conclusions were based on 376 studied habitats. Later, some new data on the subject were presented (PRZYBOŚ & FOKIN 2000). However, recently new species for Europe, i.e. *P. septaurelia* (PRZYBOŚ *et al*. 2004) in Russia and *P. dodecaurelia* in Italy and Germany (PRZYBOŚ & FOKIN 2003) were recorded . New data on the occurrence of other species of the complex in European countries were also published, concerning e.g.: *P. primaurelia* in Greece (PRZYBOŚ & FOKIN 2002), *P. sexaurelia* in Croatia (PRZYBOŚ 2003), *P. biaurelia* in Italy (PRZYBOŚ & FOKIN 2001), *P. biaurelia* and *P. novaurelia* in Ukraine (PRZYBOŚ 2001, 2002), *P. biaurelia, P. tetraurelia, P. novaurelia* in Poland (KOMALA 2000, 2001; KOMALA & PRZYBOŚ 2001; PRZYBOŚ & KOMALA 2000), *P. primaurelia, P. biaurelia, P. triaurelia, P. pentaurelia, P. sexaurelia, P. septaurelia, P. novaurelia* in Russia (PRZYBOŚ *et al*. 2004, and unpublished data), and *P. tetraurelia* in France (unpublished data).

The information presented above justify the publication of a brief review on the occurrence of species of the *P. aurelia* complex in Europe.

Species of *P. aurelia* were identified by mating the investigated clones with the mating types of standard strains of known species (according to SONNEBORN 1970). The paramecia were cultivated on a lettuce medium inoculated with *Enterobacter aerogenes*. The number of investigated habitats and the ratio value (r.v.), i.e. the number of habitats for a defined species to the total number of habitats of the area (zone) were taken into consideration when the frequency of species occurrence was estimated.

Conclusions concerning the occurrence of species of the complex are based at present on a larger number of studied habitats (474 recently, 376 previously). Also, new species for Europe have been discovered.

At present 15 species of the complex are known world-wide (SONNEBORN 1975; AUFDERHEIDE *et al*. 1983), among them 10 from Europe, namely *P. primaurelia, P. biaurelia, P. triaurelia, P. tetraurelia, P. pentaurelia P. sexaurelia, P. novaurelia* and *P. tredecaurelia* (cf PRZYBOŚ 1998; FOKIN & OSSIPOV 1986), and the recently discovered in Europe *P. dodecaurelia* (PRZYBOŚ & FOKIN 2003) and *P. septaurelia* (PRZYBOŚ *et al*. 2004). Data concerning the frequency of occurrence of species of the *P. aurelia* complex in Europe are given in Tables 1, 2 , and 3.

The most intensive investigations among European countries have been conducted in Poland over many years (since 1959). Some conclusions on the frequency of occurrence of particular species of the complex in Europe, especially in the central part of the continent, can be based on data from Poland where 254 habitats were studied among the total number of 474 habitats studied in

Table 1

Recent data on the occurrence of species of the *Paramecium aurelia* complex in Europe

Region (temperature zone)	Country	Number of habitats of the particular species of the complex studied in the following countries										Total
		P. prim-aurelia	*P. bi-aurelia*	*P. tri-aurelia*	*P. tetr-aurelia*	*P. pent-aurelia*	*P. sex-aurelia*	*P. sept-aurelia*	*P. nov-aurelia*	*P. dodec-aurelia*	*P. tredec-aurelia*	
Northern	Sweden		2						2			3*
	Norway		1									1
	Finland		2		1				2			5
	Russia**	14	7	5		7	4	11	10			51*
Central	Great Britain	1	3		1				2			7
	Poland	56	61	3	11				123			254*
	Ukraine	2	4	5					10			21*
	Czech Republic		13	2	1				9			21*
	Slovakia	3			6							7*
	Germany		7	1			2		7	1		18*
	France	1	1		1				1		1	5
	Holland				1							1
	Switzerland	1										1
	Hungary	13	5			1			9			27*
Southern	Croatia						2					2
	Italy	4	4		1					1		10
	Greece	2					1					1
	Bulgaria	2	3		1				1			5*
	Romania	2	4	2		1			4			12*
	Spain	11	7	3	4	1	2		4			22*
Total		112	124	21	28	10	10	11	184	2	1	474

* some species appear together in one habitat.

** habitats studied in Russia are situated in northern and central regions of Europe.

Table 2

Occurrence of species of the *P. aurelia* complex in different zones in Europe

Zone	Number of studied habitats of species										Total
	P. prim-aurelia	*P. bi-aurelia*	*P. tri-aurelia*	*P. tetr-aurelia*	*P. pent-aurelia*	*P. sex-aurelia*	*P. sept-aurelia*	*P. nov-aurelia*	*P. dodec-aurelia*	*P. tredec-aurelia*	
Northern	14	12	5	1	7	4	11	14	–	–	60
Central	77	94	11	21	1	2	–	161		1	362
Southern	21	18	5	6	2	5	–	9	1	–	52
Total	112	124	21	28	10	11	11	184	2	1	474

Table 3

Frequency of occurrence of species of the *P. aurelia* complex in different zones in Europe

Zone	Ratio value of particular species										Total number of studied habitats
	P. prim-aurelia	*P. bi-aurelia*	*P. tri-aurelia*	*P. tetr-aurelia*	*P. pent-aurelia*	*P. sex-aurelia*	*P. sept-aurelia*	*P. nov-aurelia*	*P. dodec-aurelia*	*P. tridec-aurelia*	
Northern	0.23	0.20	0.08	0.016	0.117	0.07	0.18	0.23	–	–	60
Central	0.21	0.26	0.03	0.06	0.002	0.005	–	0.44	0.003	0.003	362
Southern	0.40	0.35	0.09	0.12	0.04	0.09	–	0.17	0.019	–	52
Total ratio value	0.24	0.26	0.04	0.06	0.02	0.02	0.02	0.39	0.004	0.002	474

Europe, and 362 in its central zone. However, different numbers of habitats were studied in particular zones, the most numerous were from the central zone (Table 2).

Among species of the *P. aurelia* complex present in Europe, *P. novaurelia* dominates over other species (found in 184 habitats, r.v. 0.39); *P. biaurelia* was found also in numerous habitats (124, r.v. 0.26); *P. primaurelia* is very characteristic, being found in 112 habitats, (r.v. 0.24). Other species are relatively rare, *P. tetraurelia* was found in 28 (r.v. 0.06) and *P. triaurelia* in 21 habitats (r.v. 0.04). *P. pentaurelia* and *P. sexaurelia* are very rare species, detected in 10 and 11 habitats, respectively (r.v. for both 0.02). A separate group comprises species discovered in single localities, such as *P. dodecaurelia* found in two habitats (Italy, Elba Island and Germany, Münster; r.v. 0.004), and species found in one region only, e.g. *P. septaurelia* (Russia, Lower Volga Basin; 11 habitats, r.v. 0.02) and in one locality only as *P. tredecaurelia* (France, Paris; r.v. 0.002).

The most common is *P. novaurelia* followed by *P. biaurelia* and *P. primaurelia* (Tables 1, 2, and 3) in all of Europe. *P. pentaurelia* seems to be rather limited to the warm zone of Europe (Russia, Lower Volga Basin; Hungary; Romania; Spain) as well as *P. sexaurelia* (Russia. Lower Volga Basin; Germany; Croatia; Greece; Spain).

It seems that future investigations, especially in zones other than the central one, may bring more data on the frequency of occurrence of the *P. aurelia* species complex in Europe.

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