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Macrophytes in four Alpine Aquatic Ecosystems of N. Pindos (Ipiros, Greece)

By

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With 1 Figure

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Summary

SARIKA-HATZINIKOLAOU M., KOUMPLI-SOVANTZI L. & YANNITSAROS A. 1997. Macrophytes in four alpine aquatic ecosystems of N. Pindos (Ipiros, Greece). – *Phyton* (Horn, Austria) 37(1): 19-30, 1 figure and 1 table. English with German summary.

49 taxa of marsh and water plants (1 moss, 1 horsetail, 18 dicotyledones, 29 monocotyledones) were found in two lakes, one marsh and in one pond in the N. Pindos at an altitude between 1800 and 2200 m. *Callitriche palustris*, *Epilobium collinum* and *Poa compressa* are recorded as new for Ipiros. The presence of *Hippuris vulgaris* in Greece is confirmed. Comments are also given on some taxa, most of them having few previous records from Greece. Some collections of *Potamogeton* aff. *trichoides* are taxonomically problematical.

Zusammenfassung

SARIKA-HATZINIKOLAOU M., KOUMPLI-SOVANTZI L. & YANNITSAROS A. 1997. Die Makrophyten in vier alpinen Feuchtbiosphären des N-Pindus (Epirus, Griechenland). – *Phyton* (Horn, Austria) 37(1): 19-30, 1 Abbildung. – Englisch mit deutscher Zusammenfassung.

49 Taxa von Sumpf- und Wasserpflanzen (1 Moos, 1 Schachtelhalm, 18 Dicotylen, 29 Monocotylen) wurden an zwei Seen, in einem Flachmoor und einem Tümpel im Nord-Pindus in einer Seehöhe zwischen 1800 und 2200 m registriert. *Callitriche*

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palustris, *Epilobium collinum* und *Poa compressa* wurden erstmals im Epirus nachgewiesen. Das Vorkommen von *Hippuris vulgaris* in Griechenland wird bestätigt. Einige Taxa, insbesondere solche, für die bisher nur wenige Angaben aus Griechenland vorlagen, werden kommentiert. Einige Aufsammlungen von *Potamogeton* aff. *trichoides* sind in der taxonomischen Zuordnung problematisch.

1. Introduction

The Greek mountains attract botanists for floristic studies and although our present knowledge of N. Pindos mountain range flora is fairly good, the same is not true of its alpine aquatic flora. Some records of hydrophytes, helophytes and hygrophytes of N. Pindos are found in HALÁCSY 1900–1904, 1908, GOULIMIS 1954, PHITOS 1962, QUÉZEL 1964, 1967, QUÉZEL & CONTANDRIOPOULOS 1965a, 1965b, HARTVIG 1978, STRID & PAPANIKOLAOU 1981, STRID 1986, STRID & TAN 1991, DAHLGREN 1991. Few of these records are referred to plants growing in alpine aquatic ecosystems.

This study, giving for the first time a rather complete list of macrophytes found in four aquatic alpine ecosystems of N. Pindos, also contributes to the floristic knowledge of Ipiros and Greece in general.

The investigated ecosystems lie in the alpine region of Tymfi and Smolikas mountains (N. Pindos, nomos Ioanninon, Ipiros) (Fig. 1).

The mountains Tymfi and Smolikas have a continental mediterranean climate with a maximum of cloud cover and rainfall in summer (KOTINI-ZAMBAKA 1983). They belong to the zones with the highest amount of rainfall in the country (2000 mm year⁻¹) (ZAMBAKAS 1981). The average annual temperature at an altitude of 542 m (Konitsa Meteorological Station) is 14 °C – 15 °C, therefore at an altitude of c. 2000 m, where the examined ecosystems lie, it should be about 9 °C lower.

2. Material and Methods

The present study is based on plant material collected from sites in and around the water bodies, during the six visits (10 days in total) in the years 1989–1994. Some measurements of the water temperature, pH, conductivity and depth were also made (Table 1). The conductivity measurements were made by a portable equipment type of S-T-C Mod. 33, Yellow Spring Instruments and the pH by the type WTW D 812 Weidmuller electrode.

The plant list is mainly based on Maria SARIKA-HATZINIKOLAOU and Ioannis BAZOS collections and the vouchers are deposited in their herbaria which are kept in ATHU. The collector names, abbreviated by the letters S. H. and B. respectively, are followed by the collecting numbers appearing on the list after the ecosystems studied and the corresponding collecting dates. In addition to the above mentioned collections, a small one, by the students Georgios PANTAZIS, Antonios LAZARIS and Gabriil KOTOLAS has been used in this study. This collection is kept in herb. L. KOUMPLISOVANTZI; in our list the collectors of these specimens are cited under the abbreviation P. & al. herb. K. S.

Table 1.

Minimum and maximum water temperature, conductivity and pH of the investigated ecosystems, coming from 31 measurements (Drakolimni Smolika 4, Drakolimni Tymfis 11, Lakka Tsoumani 5, Loutsa Rompozi 11) taken at different depths from where the plant specimens were collected.

	Depth m	Temperature °C	Conductivity µmhos	pH
Drakolimni	0.20–0.50	15–18	30–60	6.7–7.8
Smolika	(11. 8. 1991)	(11. 8. 1991)	(11. 8. 1991)	(11. 8. 1991)
Drakolimni	0.20–0.50	18–20	30–60	7.9–9.0
Tymfis	(4. 7. 1992)	(4. 7. 1992)	(4. 7. 1992)	(4. 7. 1992)
	0.20–1.50	18–21	30–70	8.2–8.7
	(14. 7. 1994)	(14. 7. 1994)	(14. 7. 1994)	(14. 7. 1994)
Lakka	0.15–0.70	13–22	98–176	6.9–7.5
Tsoumani	(5. 7. 1992)	(5. 7. 1992)	(5. 7. 1992)	(5. 7. 1992)
Loutsa	0.20–0.80	8–18	20–65	5.9–7.4
Rompozi	(5. 7. 1992)	(5. 7. 1992)	(5. 7. 1992)	(5. 7. 1992)
	0.20–0.80	8–10	25–62	5.8–6.2
	(15. 7. 1994)	(15. 7. 1994)	(15. 7. 1994)	(15. 7. 1994)

The nomenclature of *Pteridophyta* and *Spermatophyta* follows GREUTER & al. 1984, 1986, 1989 or TUTIN & al. 1968–1980, 1993.

A total of 49 taxa are given, 14 of which have already been presented at the 13th Congress of the Hellenic Society of Biological Sciences, Iraklio, Kriti, May 1991 (YANNITSAROS & al. in press).

3. The Ecosystems

The four ecosystems studied, are numbered here in the same manner as in Fig. 1. For some measurable parameters see Table 1.

1. – Lake Drakolimni Smolika (40°5'2" N 20°53' E) is of glacial and fault tectonic origin. Its bottom is uniquely composed of impermeable ophiolitic rocks; water inflow only by precipitation and mainly by melted snow; altitude 2200 m. Water conductivity 30–60 µmhos. 17 taxa observed. Dominant: *Eleocharis palustris*.

2. – Lake Drakolimni Tymfis (39°59'41" N 20°46'12" E) is of glacial and karstic origin. Its bottom is composed of limestone and flysch, with impermeable bottom only on flysch area; water inflow by precipitation, melted snow and underground karstic spring; 2.5 km NNE of Astraka summit; altitude 2050 m. Water conductivity 30–70 µmhos. 11 taxa observed. Dominants: *Sparganium angustifolium*, *Eleocharis palustris*, *Sagittaria sagittifolia*.

3. – Lakka Tsoumani marsh (39°59'20" N 20°45'34" E), on a substratum of contemporary weathering deposits; 1.8 km NNE of Astraka summit; altitude 1800 m. Water conductivity 98–176 µmhos, the highest of all localities. 20 taxa registered. Dominants: *Carex rostrata*, *C. acuta*.

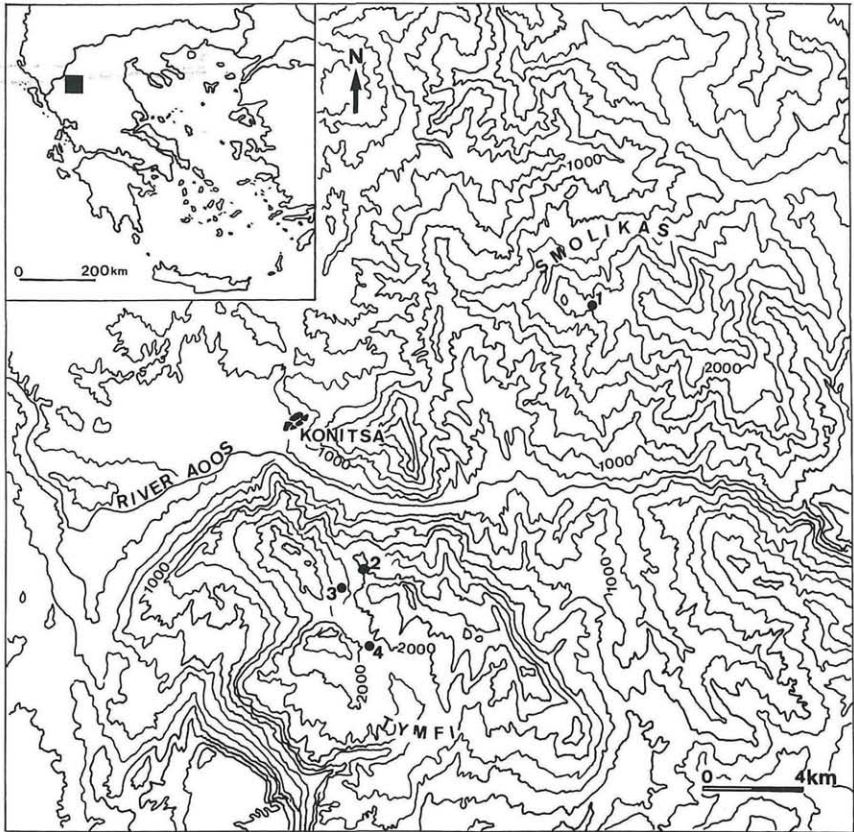


Fig. 1. Map of N. Pindos showing position of the investigated ecosystems. - 1 = Drakolimni Smolika. 2 = Drakolimni Tymfis. 3 = Lakka Tsoumani. 4 = Loutsa Rompozi. - Equidistance of contour lines: 200 m.

4. - Loutsa Rompozi pond ($39^{\circ}58' N 20^{\circ}46'17'' E$), on a flysch substratum; 1.5 km SEE of Astraka summit; altitude c. 1900 m. Water conductivity 20–25 μmhos . 15 taxa observed. Dominants: *Sparganium angustifolium*, *Eleocharis palustris*.

There is a significant dissimilarity in their floristic composition which can be attributed to the above mentioned differences and also probably due to the other differences concerning the ionic composition of their water.

4. Plant List

Bryophyta

Amblystegiaceae

Leptodictyum riparium - Loutsa Rompozi (24. 9. 1989, P. & al. herb. K. S. 4033).

Pteridophyta

Equisetaceae

Equisetum palustre – Lakka Tsoumani (24. 9. 1989, P. & al. herb. K. S. 4028; 8. 7. 1990, B. 18; 20. 10. 1990, B. 34; 5. 7. 1992, S. H. 1019).

Angiospermae – Dicotyledones

Callitrichaceae

Callitriche brutia – Loutsas Rompozi (24. 9. 1989, P. & al. herb. K. S. 4034; 8. 7. 1990, B. 9; 5. 7. 1992, S. H. 1028; 15. 7. 1994, S. H. 1324a). Rare in Greece. Recently reported, under the name *C. pedunculata* DC., from Lake Kalodiki, Ipiros (SARIKA-HATZINIKOLAOU & al. 1994). Notes on its presence in Greece are given by SARIKA-HATZINIKOLAOU & al. 1996.

Callitriche palustris – Drakolimni Tymfi (19. 10. 1990, B. 25), Lakka Tsoumani (24. 9. 1989, P. & al. herb. K. S. 4029; 20. 10. 1990, B. 32). New to Ipiros. Neither SCHOTSMAN 1972 nor GREUTER & al. 1984 mention this species from Greece though it has previously been recorded as *C. verna* L. (HALÁCSY 1900, PETKOFF 1910, HAYEK 1927, RECHINGER 1943, STEPHANIDES 1940, 1948a, PHITOS 1960).

Caryophyllaceae

Cerastium cerastoides – Drakolimni Smolika (11. 8. 1991, S. H. 755).

Cerastium fontanum subsp. *triviale* – Lakka Tsoumani (5. 7. 1992, S. H. 1006).

Silene pusilla subsp. *tymphaea* – Loutsas Rompozi (5. 7. 1992, S. H. 1030). Apparently a rare species in Greece, previously reported only from the mountains Tymfi (QUÉZEL & CONTANDRIOPOULOS 1965b, MELZHEIMER 1986) and Olympos (MELZHEIMER 1986).

Silene roemeri – Lakka Tsoumani (5. 7. 1992, S.H. 1017).

Compositae

Achillea abrotanoides – Loutsas Rompozi (5. 7. 1992, S. H. 1034). A rare species in Greece, restricted to some mountains in the north, viz. Tymfi (GOULIMIS 1954, QUÉZEL & CONTANDRIOPOULOS 1965b, FRANZÉN 1991), Epáno Arena and Gramos (FRANZÉN 1991), Voras (VOLIOU 1979).

Doronicum columnae – Loutsas Rompozi (5. 7. 1992, S. H. 1034).

Elatinaceae

Elatine alsinastrum – Loutsas Rompozi (24. 9. 1989, P. & al. herb. K. S. 4037; 8. 7. 1990, B. 11; 15. 7. 1994, S. H. 1324). A threatened species in Greece with a scattered distribution. It was recently reported as new to Ipiros (SARIKA-HATZINIKOLAOU & al. 1993, SARIKA-HATZINIKOLAOU & al. 1994, YANNITSAROS & al. in press).

Hippuridaceae

Hippuris vulgaris – Lakka Tsoumani (24. 9. 1989, P. & al. herb. K. S. 4023; 8. 7. 1990, B. 17; 20. 10. 1990, B. 31; 5. 7. 1992, S. H. 1025). According to GREUTER & al. 1986 the species is absent and reported erroneously from Greece including Kriti, although there are previous records from Ipiros and the Ionian island of Kerkyra (STEPHANIDES 1948a, 1948b, QUÉZEL & CONTANDRIOPOULOS 1965a, QUÉZEL 1967). Our gatherings confirm the presence of the species in Greece.

Onagraceae

Epilobium collinum – Loutsia Rompozi (5. 7. 1992, S. H. 1036; 15. 7. 1994, S. H. 1325). *E. collinum* is new to Ipiros and not common in Greece; it is a species with occurrence on some mountainous localities only in Macedonia, viz. Chortiatis (GANIATSAS 1938), Vitsi, Voras, Pisoderion, Vrontous (SNOGERUP 1986). According to SNOGERUP 1986 the species is erroneously reported from Evoia by RECHINGER 1961 and from Tymfristos by GANIATSAS 1940.

Plantaginaceae

Plantago atrata – Loutsia Rompozi (5. 7. 1992, S. H. 1039).

Plantago media subsp. *pindica* – Drakolimni Tymfis (5. 7. 1992, S. H. 1007).

Polygonaceae

Polygonum arenastrum – Lakka Tsoumani (24. 9. 1989, P. & al. herb. K. S. 4030).

Ranunculaceae

Ranunculus trichophyllus subsp. *trichophyllus* – Drakolimni Tymfis (7. 7. 1990, B. 1; 12. 8. 1990, S. H. 199; 5. 7. 1992, S. H. 1000), Lakka Tsoumani (24. 9. 1989, P. & al. herb. K. S. 4025; 8. 7. 1990, B. 16; 12. 8. 1990, S. H. 192; 20. 10. 1990, B. 22; 4. 7. 1992, S. H. 1002).

Saxifragaceae

Saxifraga taygetea – Loutsia Rompozi (5. 7. 1992, S. H. 1037; 15. 7. 1994, S. H. 1332).

Scrophulariaceae

Limosella aquatica – Drakolimni Tymfis (24. 9. 1989, P. & al. herb. K. S. 4042), Loutsia Rompozi (24. 9. 1989, P. & al. herb. K. S. 4036; 8. 7. 1990, B. 7; 5. 7. 1992, S. H. 1026; 15. 7. 1994, S. H. 1322). Rare in Greece and first

reported from Mt. Tymfi (QUÉZEL & CONTANDRIOPOULOS 1965b). Since then the species has been recorded from the same mountain (QUÉZEL 1967, RAUS 1991, SARIKA-HATZINIKOLAOU & al. 1993) and also from a few other mountains, viz. Epano Arena, Karava, Annitsa (RAUS 1991), Oiti (GUSTAVSSON 1978, RAUS 1991), Vermio (FRANZÉN 1980, RAUS 1991) and Dirfys, Steni (SARIKA-HATZINIKOLAOU & al. 1993). WEBB 1972 does not mention *L. aquatica* from Greece, while he lists *L. tenella* QUÉZEL & CONTANDR. as a Greek endemic species; but the latter is considered as a form of *L. aquatica* by CASPER & KRAUSCH 1981 and RAUS 1991. Our specimens have leaves with linear oblong to elliptic spathulate lamina which are characteristic of the typical species.

Veronica beccabunga – Lakka Tsoumani (24. 9. 1989, P. & al. herb. K. S. 4027; 8. 7. 1990, B. 13; 12. 8. 1990, S. H. 186).

Angiospermae – Monocotyledones

Alismataceae

Sagittaria sagittifolia – Drakolimni Tymfis (24. 9. 1989, P. & al. Herb. K. S. 4045; 7. 7. 1990, B. 3; 12. 8. 1990, S. H. 200a; 5. 7. 1992, S. H. 1001; 14. 7. 1994, S.H. 1310a).

Cyperaceae

Blysmus compressus – Drakolimni Smolika (11. 8. 1991, S. H. 763), Lakka Tsoumani (8. 7. 1990, B. 12; 12. 8. 1990, S. H. 187; 5. 7. 1992, S. H. 1016).

Carex acuta – Lakka Tsoumani (8. 7. 1990, B. 19; 5. 7. 1992, S. H. 1022).

Carex caryophyllea – Lakka Tsoumani (5. 7. 1992, S. H. 1014a).

Carex echinata – Lakka Tsoumani (5. 7. 1992, S. H. 1011), Drakolimni Smolika (11. 8. 1991, S. H. 752).

Carex nigra – Drakolimni Smolika (11. 8. 1991, S. H. 751).

Carex ovalis – Drakolimni Smolika (11. 8. 1991, S. H. 745).

Carex paniculata – Drakolimni Smolika (11. 8. 1991, S. H. 750).

Carex rostrata – Lakka Tsoumani (8. 7. 1990, B. 15; 12. 8. 1990, S. H. 182; 5. 7. 1992, S. H. 1021). A rare species in Greece restricted to its northern part; known from a few mountains, viz. Vrontous, Rodopi (STRID & FRANZÉN 1982, HARTVIG 1991b), Voras (STRID & PAPANIKOLAOU 1981), Tymfi, Dobro Pole (HARTVIG 1991b). According to HARTVIG 1991b a record from Peloponnisos by SIBTHORP & SMITH 1813 is probably incorrect.

Eleocharis palustris subsp. *palustris* – Drakolimni Tymfis (24. 9. 1989, P. & al. herb. K. S. 4041; 7. 7. 1990, B. 2; 12. 8. 1990, S. H. 196; 19. 10. 1990, B. 24; 4. 7. 1992, S. H. 997; 14. 7. 1994, S. H. 1310), Lakka Tsoumani (12. 8. 1990, S. H. 189; 20. 10. 1990, B. 33), Loutsas Rompozi (24. 9. 1989, P. & al. herb. K. S. 4038; 8. 7. 1990, B. 6; 20. 10. 1990, B. 28), Drakolimni Smolika

(11. 8. 1991, S. H. 736). This taxon is the only plant in common to the studied ecosystems. The presence of *E. palustris* subsp. *palustris* in Drakolimni Smolika, Drakolimni Tymfis, Loutsa Rompozi (with low conductivity) and Lakka Tsoumani (with higher conductivity) is due to the fact that it is an eurytopic taxon. It is also one of the dominant taxa in these ecosystems.

Eleocharis quinqueflora – Drakolimni Smolika (11. 8. 1991, S. H. 764). The species is apparently not common in Greece and known only from a few mountains in Sterea Ellas, Ipiros and Makedonia (see HARTVIG 1991a).

Gramineae

Agrostis castellana – Drakolimni Tymfis (12. 8. 1990, S. H. 185).

Alopecurus aequalis – Drakolimni Tymfis (14. 7. 1994, S. H. 1309), Lakka Tsoumani (24. 9. 1989, P. & al. herb. K. S. 4031; 8. 7. 1990, B. 14; 5. 7. 1992, S. H. 1012).

Anthoxanthum alpinum – Drakolimni Smolika (11. 8. 1991, S. H. 735).

Deschampsia cespitosa – Drakolimni Smolika (11. 8. 1991, S. H. 749), Lakka Tsoumani (5. 7. 1992, S. H. 1013).

Koeleria splendens – Loutsa Rompozi (7. 7. 1992, S. H. 1033).

Nardus stricta – Drakolimni Smolika (11. 8. 1991, S. H. 746), Drakolimni Tymfis (4. 7. 1992, S. H. 998).

Phleum alpinum – Drakolimni Smolika (11. 8. 1991, S. H. 754).

Poa annua – Loutsa Rompozi (5. 7. 1992, S. H. 1025).

Poa compressa – Lakka Tsoumani (5. 7. 1992, S. H. 1013a). In N Greece it has a scattered distribution, chiefly at montane levels, but no published locality from Ipiros is known to us.

Trisetum flavescens subsp. *flavescens* – Drakolimni Smolika (11. 8. 1991, S.H. 748).

Juncaceae

Juncus alpinus subsp. *alpestris* – Drakolimni Smolika (11. 8. 1991, S. H. 740).

Juncus articulatus – Lakka Tsoumani (12. 8. 1990, S. H. 190), Drakolimni Smolika (11. 8. 1991, S. H. 766).

Juncus inflexus – Drakolimni Smolika (11. 8. 1991, S. H. 765).

Luzula multiflora subsp. *congesta* – Drakolimni Smolika (11. 8. 1991, S. H. 742).

Luzula sudetica – Lakka Tsoumani (5. 7. 1992, S. H. 1015).

Potamogetonaceae

Potamogeton trichoides – Lakka Tsoumani (24. 9. 1989, P. & al. herb. K. S. 4024; 12. 8. 1990, S. H. 191; 5. 7. 1992, S. H. 1003).

Potamogeton sp.- Drakolimni Tymfis (12. 8. 1990, S. H. 198; 19. 9. 1990, B. 21; 14. 7. 1994, S. H. 1311a), Loutsa Rompozi (8. 7. 1990, B. 8; 20.

10. 1990, B. 26; 5. 7. 1992, S. H. 1027). Our material has open stipules and a habit more similar to that of *P. trichoides*, but the four carpels observed in the only fruiting specimen (B. 8) are characteristic of the species *P. obtusifolius* and *P. berchtoldii*. Further collections from the area could give a solution to the problem.

Sparganiaceae

Sparganium angustifolium – Drakolimni Tymfis (24. 9. 1989, P. & al. herb. K. S. 4044; 7. 7. 1990, B. 4; 19. 10. 1990, B. 23; 4. 7. 1992, S. H. 999; 14. 7. 1994, S. H. 1311), Loutsa Rompozi (24. 9. 1989, P. & al. herb. K. S. 4032; 20. 10. 1990, B. 27). *S. angustifolium* is a very rare species in the Balkans (see HARTVIG 1978); in Greece previously reported only from Petritsi (Makedonia) by ZAGANIARIS (1940, as *S. affine* SCHNIZL.) and Mt. Smolikas (Ipiros) by HARTVIG 1978. *S. angustifolium* dominates in Drakolimni Tymfis and Loutsa Rompozi; it is known that this species inhabits oligotraphent waters and is a characteristic species of the Alliance Isoetion lacustris NORDHAG. 1937 which is cited in the Class Littorelletea BR.-BL. & TX. 1943 (OBERDORFER & DIERSSEN 1992). This Class is exclusively found in waters with conductivity < 100 µmhos (WIEGLEB 1976, 1978) and till now it has not been reported from Greece.

5. Discussion

The flora of 4 alpine aquatic ecosystems of N Pindos (Drakolimni Smolika, Drakolimni Tymfis, Lakka Tsoumani, Loutsa Rompozi) consists of 49 taxa (41 species, 8 subspecies) which belong to *Bryophyta* (1), *Pteridophyta* (1) and *Spermatophyta-Angiospermae* (47). The proportion of monocotyledonous to dicotyledonous plants is 1:0.62; it is in accordance with the corresponding relationship appearing in other aquatic floras (HUTCHINSON 1975). *Cyperaceae* and *Gramineae* are the richest families (in number of taxa).

From a chorological point of view we notice the following:

a. *Callitriche palustris*, *Epilobium collinum* and *Poa compressa* are new to Ipiros. – **b.** *Callitriche brutia*, *C. palustris*, *Achillea abrotanoides*, *Silene pusilla* subsp. *tymphaea*, *S. roemeri*, *Elatine alsinastrum*, *Hippuris vulgaris*, *Epilobium collinum*, *Plantago media* subsp. *pindica*, *Limosella aquatica*, *C. rostrata*, *Eleocharis quinqueflora*, *Poa compressa*, *Sparganium angustifolium* are rare or undercollected taxa in Greece. – **c.** *Callitriche brutia* and *C. palustris* are not mentioned for Greece in TUTIN & al. 1972 and in GREUTER & al. 1986, although they have been previously recorded from some localities in the country. We confirm their presence in Greece.

In respect of the life forms of Tracheophytes (species and subspecies) we can distinguish terrestrial plants (29 taxa), helophytes (12 taxa) and hydrophytes (7 taxa). The terrestrial plants consist of annual, biennial or

perennial herbs (23 Hemicryptophytes, 2 Therophytes, 2 Geophytes, 2 Chamaephytes). Among the helophytes there are 7 Hemicryptophytes, 3 Geophytes and 2 Therophytes. The hydrophytes fall into 2 categories of growth forms: Ephidates (*Sagittaria sagittifolia*, *Sparganium angustifolium*) and hyphydates (*Callitriche brutia*, *C. palustris*, *Ranunculus trichophyllus* subsp. *trichophyllus*, *Potamogeton* sp., *Potamogeton trichoides*).

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