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New floristic reports from the lakes Trichonis and Lisimachia (W Greece)

Abstract

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The study of the wetland flora and vegetation of Lake Trichonis, the largest inland lake of Greece, and of the neighbouring Lake Lisimachia (Etoloakarnania, W Greece) revealed 68 vascular plant taxa previously not reported from the area, which are discussed chorologically. *Hordeum secalinum* and *Ludwigia peploides* subsp. *montevidensis* are reported for the first time from Greece.

Key words: freshwater wetlands, vascular plants, chorology, Sterea Ellas, Nomos of Etoloakarnania.

Introduction

The lakes Trichonis and Lisimachia (Greece, Sterea Ellas, Nomos of Etoloakarnania) belong to the western chain of Greek wetlands running along the coast of the Ionian Sea. Besides extensive coastal delta and lagoon areas the wetland system includes the inland lakes and marshes of Etoloakarnania and Epirus, of which Lake Trichonis is the largest inland lake of Greece. In recent years the wetlands of W Greece, which are all of high ecological and nature conservation value, have suffered significantly from human activities and, according to Psilovikos (1992), the "ratio of extant to extinct wetlands in the western chain is 1 : 25 with a significant loss of wetlands having occurred in the south". The lakes Trichonis and Lisimachia are included in the European Ecological Network Natura 2000 and conservation measures could be applied in the future following their designation as Special Areas for Conservation (SAC).

Previous, incomplete knowledge on the plant diversity of the two examined lakes originates from Halászy (1894, 1901-04), Bornmüller (1928), Koussouris & Diapoulis (1982), Koumpli-Sovantzi (1983) and Koumpli-Sovantzi & Vallianatou (1985). In the frame of a research currently in progress on the wet meadows and reed thickets of the area, initiated by the Department of Environmental and Natural Resources Management, University of Ioannina, a high diversity of vegetation units (habitat types) was revealed, which advanced the floristic knowledge of the area and the documentation of the rich phytodiversity around the two lakes, particularly Lake Trichonis. The present paper lists vascular plant records previously not published from the area and comments on taxa of special phytogeographical interest.

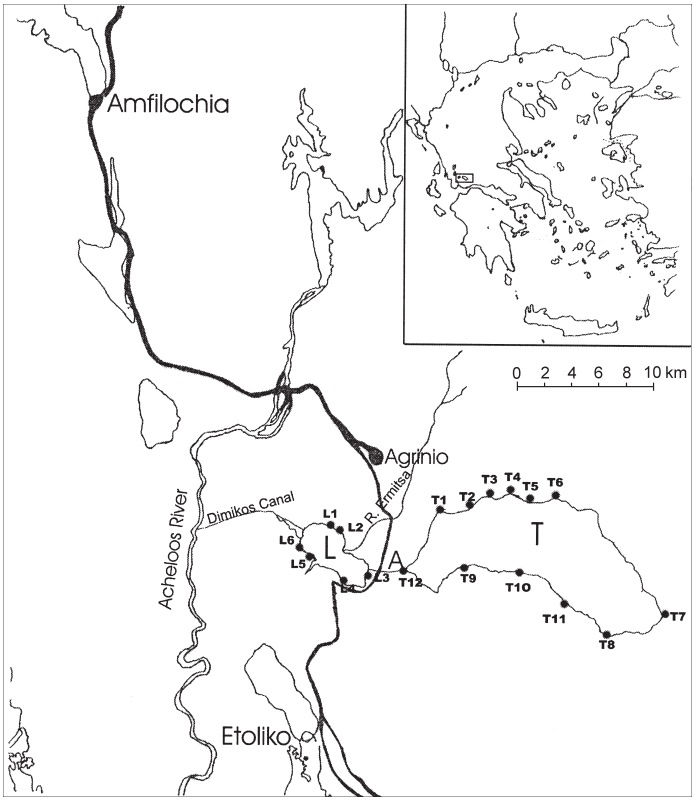

Fig. 1. Map of the lakes Trichonis (T) and Lisimachia (L), connected via the Alampei ditch (A), with the codes of the plant collection localities (see text).

Study area

Abiotic characteristics. – Lake Trichonis (38°34'N, 21°30'E) covers 96.9 km^2 and is the largest natural lake in Greece in terms of size and water volume (3×10^9m^3). The lake's perimeter is 51 km and the maximum water depth 58 m. Lake Lisimachia (38°34'N, 21°23'E) is located 2.8 km to the west of Lake Trichonis (Fig. 1), with a surface area of 13.2 km^2, a perimeter of 17 km and a maximum depth of c. 9 m. Lake Lisimachia is connected to Lake Trichonis and the River Acheloos via the Alampei ditch and the Dimikos canal, respectively. Originally thought to be oligotrophic lakes (Koussouris 1978, Overbeck & al. 1982), some of the vascular plants found here such as *Myriophyllum spicatum, Potamogeton pectinatus* and *Ranunculus trichophyllus* usually indicate eutrophic and mesotrophic conditions (Koumpli-Sovantzi 1983). The geomorphology of the surrounding area can be characterized as mostly flat, and only a small part is semi-mountainous.

Both lakes are the result of a post-alpine tectonic subduction created mainly by two fault systems of E-W and NW-SE direction. A secondary fault system positioned perpendicularly to that defines the area's hydrographic network of mainly seasonal flowing water channels and small streams. In addition, the presence of the crossed fault systems and the tectonic plates of the Pindos Zone favour the selective movement of groundwater and the formation of springs and sinkholes, which all contribute to the water reserves of the hydrological basin. The borders of the hydrological basins of the lakes are defined towards NE and E by the massif of Mt Panetoliko, towards S-SW by Mt Arakinthos and towards W by the basin of River Acheloos.

Vegetation of the lakes Trichonis and Lisimachia. – In the littoral and supralittoral zone of both lakes *Berula erecta, Nasturtium officinale, Lythrum junceum, Carex distans* and *Veronica angallis-aquatica* dominate the herbaceous layer. In the shrub layer of the supralittoral zone *Vitex agnus-castus* and *Rubus sanctus* prevail, while *Platanus orientalis*, *Salix alba* and *Populus alba* dominate the tree layer.

In the upper sublittoral zone of Lake Trichonis, wherever alluvial deposits occur, the emergent rhizophytes *Phragmites australis* and *Typha domingensis* dominate. Reed bed vegetation grows nearly around the entire perimeter of the lake (except its NE and SE sections) and are interrupted only in areas of intense human influence. On the S side of the lake, particularly in the mid sublittoral zone, floating-leaved *Nymphaea alba* grows in protected areas in front of the reed beds. Lastly, in the lower sublittoral zone, with water depths greater than 2 m, various submerged macrophytes develop.

In the littoral and supralittoral zone of Lake Lisimachia the herbaceous layer includes as dominating taxa, apart from those mentioned for Lake Trichonis, *Cyperus longus, Paspalum paspaloides* and the newly recorded *Ludwigia peploides* subsp. *montevidensis*. The shrub and tree layers are as described for Lake Trichonis. In the upper sublittoral zone *Phragmites australis* dominates in a zone that extends along the perimeter of the lake. In the mid sublittoral zone the submerged rhizophyte *Potamogeton nodosus* thrives only locally, while in the upper sublittoral zone the submerged macrophytes *Myriophyllum spicatum* and *Najus marina* prevail.

Material and methods

The new floristic data presented here are based on collections and observations during floristic, phytosociological and ecological field work in the area shown in Fig. 1, from May to October of 2001 through 2003, carried out by the first author aiming at a landscape ecology monograph of the region entitled “Ecology and management of the wet meadows and reed-beds in lakes of Western Greece”. All the herbarium material is deposited in the herbarium of the Department of Environmental and Natural Resources Management, University of Ioannina, selected duplicates are deposited at the herbarium of the Botanic Garden and Botanical Museum Berlin-Dahlem (B).

Plant nomenclature basically follows Tutin & al. (1968-80, 1993), Greuter & al. (1984, 1986, 1989) and Davis (1965-85). Terminology of lake zonation follows Wetzel (1983). The species list is in alphabetical order of family, genus, species and subspecies.

The collecting localities around Lakes Trichonis (T) and Lisimachia (L) are restricted to a zone of maximum width 200 m from the lake shores and the collecting dates are summarized below (see also Fig. 1). All localities are situated in Greece, Sterea Ellas, Nomos of Etoloakarnania, Eparchia of Trichonida (T1-T7, L1-L2) or Eparchia of Mesollongi (T7-T12, L3-L6), respectively. Collection numbers (in brackets, in italics) are those of the first author (leg. *Zotos*).

T1: NW of the lake, 2 km from the village Panetolio, a: 4.5.2001, b: 1.7.2001, c: 1.10.2001.
T2: NW of the lake, near the village Kenourgio, a: 4.5.2001, b: 4.7.2001, c: 1.10.2001.
T3: NW of the lake, between the villages Kenourgio and Paravola, a: 4.5.2001, b: 4.7.2001, c: 2.10.2001.
T4: N of the lake, 1 km from the village Paravola, a: 11.5.2001, b: 6.7.2001, c: 2.10.2001.
T5: N-NE of the lake, between the villages Paravola and Pantanassa, a: 11.5.2001, b: 6.7. 2001, c: 2.10.2001.
T6: NE of the lake, in the village Dogri, a: 29.5.2001, b: 6.7.2001.
T7: SE of the lake, in the village Sitaralona, a: 17.5.2001, b: 22.6.2001, c:10.9.2001.
T8: SE of the lake, in the village Kapsorachi, a: 17.5.2001, b: 18.6.2001, c: 10.9.2001.
T9: S-SW of the lake, near the village Grammatikou, a: 19.5.2001, b: 20.6.2001, c: 9.9.2001.
T10: SW of the lake, in the village Trichonio, a: 14.5.2001, b: 18.6.2001, c: 9.9.2001.
T11: SSE of the lake, in the village Dafnias, a:1 4.5.2001, b: 18.6.2001, c: 6.9.2001.
T12: W of the lake, next to the Alampei ditch, a: 14.5.2001, b: 20.6.2001, c: 9.9.2001.
L1: NE of the lake, near the Patoulia area, a:1.5.2001, b: 11.6.2001, c: 4.9.2001.

L2: NE of the lake, 1 km E of location L1, a: 1.5.2001, b: 11.6.2001, c: 23.8.2001.
L3: E of the lake, at the mouth of the ditch Alampei, a: 3.5.2001, b: 13.6.2001.
L4: SSE of the lake, near the village Klisoremata, a: 3.5.2001, b: 13.6.2001, c: 5.9.2001.
L5: SW of the lake, in the area of the old hot springs, a: 3.5.2001, b: 13.6.2001, c: 5.9.2001.
L6: SW of the lake, next to the mouth of River Dimikos, a: 3.5.2001, b: 22.7.2001, c: 6.9. 2001.

Annotated floristic catalogue

Dicotyledoneae

Amaranthaceae

Amaranthus cruentus L. – L1b *(1075),* L5c (*1077*), L6c *(9).*

Boraginaceae

Buglossoides arvensis (L.) I. M. Johnst. (*Lithospermum arvense* L.) – T1a *(1395).* – For generic allocation of this species see Hilger & al. (2005).

Myosotis laxa Lehm. – T1a *(1479).* – Possibly widespread though scattered in wetlands of Greece, already given for many parts of the country by Hayek (1928: 75, as *M. lingulata* Lehm.). Nevertheless, the record is worth mentioning because *M. laxa* often seems to be confused with *M. nemorosa* Besser, which is sympatric with the former all over Greece (see Hayek 1928: 75, as *M. scorpioides* L., *M. strigulosa* Rchb.).

Compositae

Anthemis arvensis L. subsp. *arvensis* – T8b *(1307),* T9b (*1308*), T7b *(1309),* T10a *(1392).*
Anthemis cotula L. – T1b (*1394*).
Carduus pycnocephalus L. – T12a *(1279),* T10a *(1440),* T1b *(1313).*
Cichorium intybus L. subsp. *glabratum* (C. Presl) Wagenitz & Bedarff – T10c *(1332),* L4c *(1326),* L2b *(1288).* – For taxonomy and nomenclature of this taxon see Wagenitz & Bedarff (1989).
Coleostephus myconis (L.) Rchb. f. – T1c *(1393).* – For generic allocation of this species see Greuter & al. (2003).
Eupatorium cannabinum L. – L5c *(1373),* L6c *(1390).*
Filago eriocephala Guss. – T9b *(1302).*
Glebionis segetum (L.) Fourr. (*Chrysanthemum segetum* L.) – T6a *(1396).* – For taxonomy and nomenclature of this species see Brummitt (1998), Greuter & al. (2003) and Turland (2004).
Picris altissima Delile – T9b *(1399).*

Cruciferae

Rapistrum rugosum (L.) All. – T1a *(1435).*

Dipsacaceae

Knautia integrifolia (L.) Bertol. – T12a *(1235),* T10a *(1236),* T9b *(1236).*

Guttiferae

Hypericum perforatum L. – T2b *(1217),* T3b *(1218),* T9b *(1219),* T10b *(139).*

Leguminosae

Bituminaria bituminosa (L.) C. H. Stirt. (*Psoralea bituminosa* L.) – T10b *(91).*
Dorycnium rectum (L.) Ser. – T8c *(1416).*
Lathyrus hirsutus L. – T10b *(1402),* T11b *(1403),* L5b *(1430),* L3b *(1431),* L4b *(1432),* T12b *(1433).*
Medicago lupulina L. – T2a *(671),* T12a *(672),* L5b *(673),* T1b *(674).*
Securigera securidaca (L.) Degen & Dörfl. – T10b *(637),* T1b *(638),* T2b *(639),* T10b *(95).*

Trifolium angustifolium L. – T8b *(712),* T2b *(725),* T7b (*726*), T3b *(101),* T3c *(105).*
Trifolium stellatum L. – T2b *(721),* T3b *(722),* T4b *(723),* T12b *(100).*
Trigonella balansae Boiss. & Reut. (*T. corniculata* (L.) L.) – T7b *(640),* T12a *(96).*
Vicia lutea L. subsp. *lutea* – T2a *(632),* T5a *(633),* T10a *(634),* L4a *(635),* T12a *(636),* L2b *(111).*

Onagraceae

Ludwigia peploides subsp. *montevidensis* (Spreng.) Raven – L3b *(69).* – A taxon native to South America, extending from Brasil and Uruguay to Argentina and Chile, introduced and established in E Australia and New Zealand, and locally naturalized in W Europe (Raven 1963, Fabris 1966, Tutin & al. 1968, Zuloaga & Morrone 1999). New to Greece, at the same time the first record of the species for the Balkan Peninsula, according to Tutin & al. (1968: 308). Only recently, *Ludwigia peploides* was reported from S Turkey (Göktürk & Sümbül 1998).

Polygonaceae

Rumex crispus L. – L6b *(1441).*

Primulaceae

Asterolinon linum-stellatum (L.) Duby – T11a *(1243).*

Rubiaceae

Galium palustre L. – T10c *(792),* T12b *(1404).* – A species with its southern distribution limit in Greece (Schuler 2004: 144). Its distribution in Greece is not exactly known because of possible confusion with *G. elongatum* C. Presl and *G. debile* Desv. *G. palustre* is known from Epirus in NW Greece (Drakolimni in Mt Timfi and Lakka Tsoumani marsh, Sarika-Hatzinikolaou 1999; Acheron delta, Georgiadis & al. 1997) and in N central Greece (Pinios delta, Eleftheriadou & al. 1995). The species occurs also in the mountains, southwards to Mt Iti (Strid & Tan 1991: 304).

Galium rivale (Sm.) Griseb. – T5b *(1405),* L6b *(1406),* L5c *(1408),* T6b *(166).* – Known along rivulets from all over Greece (see Hayek 1930: 445, under *Asperula rivalis* Sm.), but obviously scattered and not common (Georgiadis & al. 1990, Raabe & Koumpli-Sovantzi 2000).

Scrophulariaceae

Scrophularia umbrosa Dumort. – T10a *(29).*
Veronica anagalloides Guss. – L2b *(1436).*

Solanaceae

Datura stramonium L. – L2a *(18).*
Physalis alkekengi L. – L1c *(1443).*
Solanum dulcamara L. – L4a *(23),* T5a *(20).*

Umbelliferae

Daucus guttatus Sm. subsp. *guttatus* – L1b *(827).*
Oenanthe pimpinelloides L. – T7a *(1411),* L6b *(815),* L2b *(816),* L6b *(817),* T9b *(1412),* T1b *(1413).*

Monocotyledoneae

Cyperaceae

Carex hirta L. – L1a *(501),* T1a *(509),* L3a *(548, 1427),* L2a *(51).*
Isolepis cernua (Vahl) Roem. & Schult. (*Scirpus cernuus* Vahl) – T2a *(59).*

Gramineae

Agrostis gigantea Roth – T2b *(9174).*
Avena barbata Link – T7b *(214),* L6b *(215).*

Avena byzantina K. Koch – T8a *(217),* T9c *(218),* T3b *(219).*
Avena sterilis subsp. *ludoviciana* (Durieu) Nyman – T12a *(220),* L6b *(221).*
Bromus arvensis L. – T1b *(234).*
Bromus commutatus subsp. *neglectus* (Parl.) P. M. Sm. – T1b *(1480).* – The subspecies is confined to Italy and Greece (Tutin & al. 1980: 187). Obviously rare and undercollected in Greece; one old record, the first one for Greece, by Haussknecht from Thessaly in 1885 (see Haussknecht 1900: 54, cited in Hayek 1932: 212).
Bromus diandrus Roth – T7b *(235),* T1a *(236),* T12a *(237).*
Bromus hordeaceus subsp. *divaricatus* (Bonnier & Layens) Kerguélen (*B. hordeaceus* subsp. *molliformis* (Godr.) Maire & Weiller) – T4b *(239),* T10b *(240),* T1b *(241),* L6b *(242).* – Nomenclature of this taxon according to Kerguélen (1981: 27).
Catapodium rigidum (L.) C. E. Hubb. – T5a *(244),* T9b *(245),* T7b *(246),* T2a *(248).*
Cynosurus echinatus L. – L4a *(266),* L5b *(278),* T10a *(267),* T11a *(268),* T12a *(269),* T9b *(270),* T8b *(271),* T7b *(272),* T5b *(273),* T2b *(275),* T1b *(276).*
Dactylis glomerata L. – L6b *(279).*
Digitaria ciliaris (Retz.) Koeler – T1c *(288),* T5c *(289),* L1c *(290).*
Echinochloa colona (L.) Link – L6c *(294).* – This adventive species is not mentioned for Greece by Tutin & al. (1980: 262). Its status in the investigated area, whether fully established or only erratic and casual, remains open. It has been recorded from the island of Crete (Jahn & Schönfelder 1995).
Echinochloa crus-galli (L.) Beauv. subsp. *crus-galli* var. *crus-galli* – L6c *(295),* L1c *(296),* L2c *(297).* – Spikelets born in regular rows; see next.
Echinochloa crus-galli subsp. *crus-galli* var. *mitis* (Pursh) Peterm. (*E. crus-galli* subsp. *spiralis* (Vasing.) Tzvelev) – T5b *(299),* L1c *(300),* L4c *(301),* L6c *(302),* T1c *(303),* T2c *(306),* T7c *(307),* T8c *(308),* T9c *(311),* T11c *(312),* L2c *(314).* – Spikelets not born in regular rows caused by numerous second order branches of the panicle as keyed out by Cvelev (1983: 998), taxonomy and nomenclature according to 'Index synonymique de la flore de France' (http://www.dijon.inra.fr/flore-france/ea-eq.htm, 21.12.2005).
Gaudinia fragilis (L.) P. Beauv. – T1b *(315),* L1a *(316).*
Hainardia cylindrica (Willd.) Greuter (≡ *Monerma cylindrica* (Willd.) Coss. & Durieu) – L6b *(360).*
Hordeum secalinum Schreb. – L6a *(1478).* – Occurrence in Greece confirmed by this record (queried by Hayek 1929: 234, the species not mentioned for Greece by Tutin & al. 1980: 205).
Lolium rigidum Gaudin subsp. *rigidum* – T9a *(3380),* L6b *(339),* T12a *(340),* T11a *(341),* T8a *(342),* T7a *(343),* L1a (*344*), L2a *(346), T10b (350),* T5b *(352),* L4b *(354),* L3b *(356).*
Lolium temulentum L. – T9a *(359).*
Paspalum dilatatum Poir. – L1c *(367).*
Poa trivialis subsp. *sylvicola* (Guss.) H. Lindb. – L4b *(446),* T10a *(447),* T2a *(448),* L3a *(449),* L2b *(450),* T1b *(452).*
Polypogon viridis (Gouan) Breistr. – T4a *(477),* T2a *(478),* T9b *(479),* T3c *(482),* L5c *(484),* T7b *(485),* T5b *(486).*
Rostraria cristata (L.) Tzvelev – T2a *(487),* T5b *(488).*
Setaria verticillata var. *ambigua* (Guss.) Parl. – L6c *(1450).*
Setaria viridis (L.) P. Beauv. – T5c *(1451),* T11b *(1452).*
Sorghum halepense (L.) Pers. – T12c *(1453),* L3b *(1454),* L6c *(1455),* T1c *(1456),* T11c *(1457),* T12c *(1458).*
Vulpia myuros (L.) C. C. Gmel. – T10a *(1459).*

Juncaceae

Juncus fontanesii subsp. *pyramidatus* (Laharpe) Snogerup – T6b *(1424).* – Rare and undercollected in Greece. First found in Greece near Karditsa and in adjacent Pindos Mts by Haussknecht in 1885 (see Hayek 1932: 133, based on Haussknecht 1900: 32). The taxon is

reported from Epirus (Amvrakikos bay: Sarika & al. 2005), NW Peloponnisos (Strofilia coastal area: Georgiadis & al. 1990, Raabe & Koumpli-Sovantzi 2000), and it was collected in wet places of northern Pilion, E Thessaly (*Raus 2944a,* herb. Raus, det. Snogerup).

Orchidaceae
Serapias vomeracea (Burm.) Briq. – T1a *(1438).*

Conclusions

Our research added 68 hitherto unpublished records to the flora of the lakes Trichonis and Lisimachia and their surroundings. The present research confirmed about 95 % of the hydrophytes identified in previous studies. This constitutes important information on the flora dynamics due to changes that have taken place in recent years, such as extensive agricultural cultivations. These changes also explain the participation of weed species in the present floristic list. The floristic and ecological research of the wetlands of Greece, especially of the ones incorporated in the European Ecological Network "Natura 2000", is essential for a reliable documentation of their biodiversity, as a prerequisite for the application of conservation measures and for the subsequent monitoring at the population/species level to predict, or even steer, threatening effects of land management activities or natural disturbances in these ecologically vulnerable wetlands.

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