

F. Garbari, A. Giovannini & D. Marchetti

Biosystematics, taxonomy and phytogeography of the Pteridological Flora of the Monte Pisano (NW Tuscany, Italy)

Abstract

Garbari, F., Giovannini, A. & Marchetti, D.: Biosystematics, taxonomy and phytogeography of the Pteridological Flora of the Monte Pisano (NW Tuscany, Italy). — *Bocconea* 16(1): 41-53. 2003. — ISSN 1120-4060.

Monte Pisano includes a group of hills spreading from NW to SE between the Lucca and Pisa plains in NW Tuscany, Central Italy. In spite of its modest height (max. 917 m a.s.l.) and size (20 x 10 km), Monte Pisano shows a rugged morphology with numerous peaks, valleys, slopes and plains, springs and streams. Its geological history, linked to that one of the Apuan Alps, dates back to Palaeozoic era. A wide variety of lithological types, stones ("verrucano" and Saint Giuliano "marble" were used to build the medieval Lucca and Pisa towns), substrates and habitats is offered to visitors, as well as numerous aspects of the anthropic history, i.e. ancient settlements, castles, fortresses, villas and churches remains. During last decades field investigations carried out by many researchers of Pisa University enlarged the knowledge of several naturalistic aspects of Monte Pisano, including the geobotanical ones. Special attention was recently paid to the pteridology of the area. The main result of these investigations may be summarized as follows. Nine species previously documented in PI, FI, SIENA and other Herbaria may be considered as extinct for the area. Among them, *Hymenophyllum tunbrigense*, *Phegopteris connectilis*, *Marsilea quadrifolia*, *Salvinia natans*. The presence of *Dryopteris oreades* is confirmed, together with those of *Oreopteris limbosperma*, *Cheilantes tinaei*, *Asplenium foreziense* and *Ophioglossum azoricum*. A decaploid cytotype (2n=110) of *Isoetes duriei* was identified. The gametophytic generation of *Vandenboschia speciosa*, new to the area, was discovered in a couple of spots. *Salvinia molesta*, a floating invasive tropical fern ("Kariba weed") was identified as new for the exotic flora of Italy. Actually 39 specific units (30% of the pteridological flora of Italy) are present on Monte Pisano; 11 of them are mentioned in the Tuscan Red List of ferns threatened with extinction (in total, 27 for Tuscany).

Introduction

In his famous *Historical-geographical dictionary of Tuscany* Emmanuel Repetti wrote, in 1839: "Situated in between two famous and heavily populated towns [Lucca and Pisa] flanked by two large rivers and the largest lake of Tuscany [Lake Massaciuccoli, from which Giacomo Puccini drew inspiration for many of his operas], clad along the sides and creeks of its valleys with chestnut woods, vineyards and olive groves, populated by a wide number of villages; made charming by frequent palaces and villas [...] the Monte Pisano

can doubtless be considered as one of the most delightful and heavily populated mountains in Italy”.

The Monte Pisano consists of a group of hills, the tallest one reaching 917 metres above sea level in its south-eastern part. The north-western part, the closest to the Apuan Alps, reaches 542 metres above sea level. The Monte Pisano played a very important role in history. Surrounded by level and often swampy grounds, it has offered shelter and sustenance to man (with water and wood, for instance) since the upper Palaeolithic times. Ligurian peoples, Etruscans, Romans, Byzantine people, Longobards have succeeded each other over the ages. With the rise of city-states and seigniories, the Monte Pisano fell prey to the political and military forces of Pisa, Lucca and Florence, often becoming the theatre of relentless battles. Even Dante Alighieri in his *Divine Comedy* speaks of Monte Pisano and rivalries between Pisa and Lucca.

The climatic characteristics of the Monte Pisano have been deeply investigated by the geographers at the University of Pisa. In this short introduction, suffice it to say that the Monte Pisano, in spite of its limited size, shelters Pisa from the cold north-eastern winds and contributes to diversify the temperature, quantity and course of rain in Pisa and Lucca.

To give just an idea of this environmental diversity, at the foot of the mountain, apart from the cultivated areas, there is a typical Mediterranean vegetation, with some features of *garigue* resulting from repeated fires, pasture and other anthropical activities. On the top is a small community of beeches (the top is called *faeta*, beechwood).

As to geology, which has also been deeply investigated by researchers from the University of Pisa since the time of Paolo Savi in 1846, we can briefly state that the Monte Pisano consists of three distinct stratigraphic successions, the two lower ones being metamorphic and the upper one non-metamorphic. The most ancient layers date back to the Palaeozoic age and are the remains of an ancient mountain ridge generated by Ercinic orogeny (Lower Carboniferous), later covered with detrital deposits dating back to between the Upper Carboniferous and the Permian periods. Then, there was the settlement of the so-called “Unità della Verruca” from the Mid-Triassic and the quartzite of the Upper Triassic period (Ippolito 1950; Trevisan 1955; Giannini & Nardi 1965; Rau & Tongiorgi 1974). The schist formations called “Scisti di S.Lorenzo”, lithologically composed of detrital deposits of continental origin, contain a lot of fossil plant remains such as Sphenophyllophyta and Equisetophyta (De Stefani 1901; Rau & Tongiorgi 1974). A rich fauna exists in the Mesozoic formations (Rau & Tongiorgi 1966).

The geobotanical aspects

The first plant collections date back to Luca Ghini and Andrea Cesalpino, the founders of the first and second Botanical Gardens of Pisa, respectively, in the 16th century (Garbari, Tongiorgi Tomasi & Tosi 1991) though a substantial list of plants was not published before 1789 by Giorgio Santi, who was the prefect (i.e. director) of the Gardens of Pisa until 1814, when his pupil Gaetano Savi became prefect himself. Savi published his *Flora Pisana* in 1798, recording many species from the Monte Pisano. Then, in his *Botanicon Etruscum*, he added a wide number of findings (1808-1825). Records of plants from the Monte Pisano were collected in works by B. Puccinelli, O. Beccari, F. Parlatore, E. Levier, S. Sommier,

T. Caruel and E. Baroni in the 19th century. A series of contributions started in 1974 and co-ordinated by F. Garbari remarkably increased the knowledge of flora. In 1990, a checklist by Del Prete, Balderi & Garbari listed 874 tracheophyte units which actually existed in the area, 32 of which were pteridophytic.

This paper concerns the results obtained from more than two years' surveys, started in 1999 and specifically devoted to ferns and allied groups. Weekly on-the-spot investigations led to the collection of many samples, now in Pisa's Herbarium with duplicates also in the private herbaria of A. Giovannini and D. Marchetti.

Samples from the Herbaria of Pisa (PI), Florence (FI) and Siena (SIENA) have also been reviewed. Some species have been cultivated under controlled conditions in the Botanical Gardens of Pisa and some of their biosystematic aspects have been investigated.

The nomenclature used, taxonomy and the systematic reference picture are those which have recently been developed and proposed by one of us, D. Marchetti, entrusted with the preparation of the section on Italian pteridophytes for the new edition of Sandro Pignatti's *Flora d'Italia* and author of an analytical key for their identification, which has already been published (Marchetti 1994a).

For each species a table with information on the ecology, altimetric position, general biogeography and distribution in Italy plus Corsica was worked out. All the established stations of the most significant species have been marked on a map. The mentioned data are all available at the Department of Botanical Sciences, Biosystematic Laboratory, Pisa University.

The species

Thirty-nine cryptogamic vascular plants, out of the approximately 130 existing in the Italian flora, have been observed and collected on the Monte Pisano: four species of *Equisetum* (*E. ramosissimum*, *E. palustre*, *E. arvense* and *E. telmateia*), one of *Selaginella* (*S. denticulata*), one of *Isoetes* (*I. duriei*) and three of *Ophioglossum* (*O. lusitanicum*, *O. azoricum* and *O. vulgatum*). Thirty are ferns.

Here are a few comments on the species which are most significant or have some interesting feature.

Isoetes duriei Bory

Perhaps the most common species of the genus in Italy, even if not common in Tuscany, *I. duriei* is listed as "vulnerable" in the Regional Red List of plants faced with the danger of extinction (Conti, Manzi & Pedrotti 1997). Very similar to *I. hystrix* in its morphological features, it is clearly different in its megaspore characters, number of rows and guard cells length of the stomata and, as recently evidenced by Troia (2001) and Cesca & Peruzzi (2001), for the ploidy level: *I. hystrix* is diploid, *I. duriei* is polyploid (Troia & Bellini 2001).

Chromosomes were counted in the young male sporangia of *Isoetes duriei* from the Monte Pisano. The plant is $2n=110$, i.e. decaploid, and not pentaploid as in Calabria (Cesca

& Peruzzi 2001) or dodecaploid as in Sicily. This finding has been recently published (Giovannini, Garbari & Marchetti 2001).

Ophioglossum azoricum C. Presl

This is one of the most significant species in the Italian flora. Apart from the Monte Pisano, *O. azoricum* had been identified only in two other stations in the Apuan Alps (Ferrarini & Marchetti 1994). Surveys conducted in the latter two areas did not confirm the presence of this species, and the two Apuan stations are believed to have been irretrievably destroyed (Marchetti, unpublished). For the Monte Pisano, there is a sample (*sub O. vulgatum* f. *ambiguum*) dated 1862, presumably collected by Paolo Savi, and one collected by Odoardo Beccari in the same year (now in Pisa's and Florence's Herbaria, respectively) and many recent findings concerning the Sella del Monte Cotrozzi, where the presence of the plant was confirmed. A population of several hundreds specimens was observed in March 2001 on the Monte Penna, where *O. vulgatum* is also present, so, based on these researches, the presence of *O. azoricum* in Italy cannot be guaranteed but in two areas of the Monte Pisano, with quite substantial populations. Its current status in the Italian Red List is LR (lower risk), though more accurate checks are being conducted to review its status and develop some effective methods for the preservation of this plant.

Pteris cretica L.

This species, preferably growing in acidic substrates but also tolerant of calcareous ones, is quite rare in Italy. It exists on the Monte Pisano, with just a few specimens, along the Rio della Valle del Convento di Rupe Cava, where sericitic schists and calcareous schists outcrop. It has been found for the first time on August 2nd, 1990, and has now been reconfirmed.

Hymenophyllum tunbrigense (L.) Sm.

This species exists only on the Apuan Alps, with many stations, some of which have been only recently discovered and thoroughly investigated (Ferrarini & Marchetti 1994). There are only approximate indications about the Monte Pisano, on which a lot of material exists in the Herbaria of FI, PI, RO, SIENA, LUCCA etc., dating back to the mid-19th century: despite thirty years of thorough researches, none of us has ever been able to find this plant again, and now we believe it is to be considered as extinct in this area.

Vandenboschia speciosa (Willd.) G. Kunkel

Another species of the family Hymenophyllaceae is *V. speciosa*, the only European fern whose gametophytic generation not only is perennial, but also produces some specialised structures for vegetative propagation. The gametophyte lives independent of the sporophyte, but sometimes small young sporophytes among the gametophyte filaments can be

found (Loriot & al. 2003). The sporophyte of *Vandenboschia* exists in Italy only along a few streams flowing to the Rio Serra on the Apuan Alps (Ferrarini & Marchetti 1994). Gametophytic generation is relatively frequent in many areas of Central (Jérôme, Rasbach & Rasbach 1994) or Southern Europe (Bizot 2000). It consists of branched filaments of elongated and intertwined cells making up a sort of felt. When hydrated, they are bright green, while, when dehydrated, they shrink and turn a slightly metallic brown. The microhabitats of the gametophytes are deep cracks in the rock or small moist, but not wet, caves. A few gametophytes were found out in these surroundings in August 2000, along the Rivers San Pantaleone and Tanali, at different levels. This was the first time this species had been found in this area.

Cheilanthes tinaei Tod. (= *C. corsica* Reichst. & Vida)

This extremely rare species exists on the Monte Pisano in one station only (Valle delle Fonti near Asciano village); it was already known in literature from 1870 as *Cheilantes odora* (Fiori 1943; Ferrarini & al. 1986) and has been therefore reconfirmed. Its specimens are located both on rocks and on a few walls of a terraced olive grove below.

Cheilanthes acrostica (Balb.) Tod.

The only finding on the Monte Pisano is a sample from Florence's Herbarium (*sub C. fragrans* var. *acrostica* Tod., leg. Narducci, FI), quoted by Fiori (1943). In our investigations, hampered by the rocky surroundings, we could not find this plant. The environmental conditions seem to be quite well preserved: we are therefore rather optimistic about the presence of this species, though no actual evidence has been found.

Polypodium vulgare complex

P. cambricum L., the most thermophilous diploid unit, is quite common on the Monte Pisano. On the Lucca-oriented side of the mountain, it vegetates only at very low levels (replaced by *P. interjectum* at higher levels), while on the Pisa-oriented side it reaches over 550 m a.s.l.

P. interjectum Shivas is common in the woods of the Monte Pisano, from the foot to the highest levels. On the Lucca-oriented side, from approximately 650 m upwards, it lives together with *P. vulgare*, the tetraploid unit whose presence has been confirmed only by our research. The previously collected specimens, now in PI and FI, refer to the above mentioned species.

Thelypteris palustris Schott

Due to its ecology, this species cannot live on the Monte Pisano. Common in the areas near Lake Bientina, Lake Sibolla and the marshlands of the plains along the Pisan and Lucchese coasts, this fern is represented by one sample only, which was collected by

Rossetti in 1897 (FI) from the *Sphagnum* communities from the Rio Visona di Compito of the Monte Pisano, an area which was not confirmed by our research. In 1980, it was however found between Panicale and Prato Ceragiola, in a bog moss along with *Drosera rotundifolia*, *Alisma plantago-aquatica*, etc. The bog moss was later destroyed by buildings and water channels, and *Thelypteris* disappeared. In September 2000, two specimens were found in the so-called Bottaccio di Tanali, where a hygrophyle plain wood, now decreasing due to the anthropic impact, is located. The fate of this plant in the near future can be easily foreseen.

Phegopteris connectilis (Michx.) Watt.

This species, which in Italy is typical of wet and shadowy woody areas and the mossy and siliceous rocks of the Alps and northern Apennines, has disappeared from its station (chestnut woods in the highest parts of the Valle del Rio Visona di Compito, between the Monte Serra – the tallest mount in the Monti Pisani – and the spur of S. Allago, where it was found in 1877 by Rossetti, and whose sample is now in FI).

Oreopteris limbosperma (Bellardi ex All.) Holub

The presence of *O. limbosperma* is a pleasant surprise, confirmed in the only station of Rio Visona di Compito, 350 m above sea level, since the only specimen had been found by D. Marchetti in 1982. This plant is extremely rare in the near-by Tuscan-Emilian Apennines, according to a recently published work (Bonafede & al. 2001), but not in the Apuan Alps (Ferrarini & Marchetti 1994).

Asplenium trichomanes complex

For this very complicated group, it must be noticed that the diploid biotype of *A. trichomanes* L. subsp. *trichomanes* was found in two stations only, at more than 600 metres above sea level, on acidic rocks on the Lucca-oriented side. The tetraploid *A. trichomanes* subsp. *quadrivalens* D. E. Meyer was found to be extremely common.

Asplenium foreziense Legrand

The plant is present in few stations on the south-western side of the Monte Pisano, where it is always together with the common *A. obovatum* Viv. subsp. *lanceolatum* (Fiori) P. Silva, which it hybridises with to produce *A. x slepiae* nothosubsp. *slepiae*. The latter grows sometimes in the stations where both parents live (for instance in the Valle delle Fonti, near Asciano).

Asplenium onopteris L.

The species is common both on siliceous and carbonatic substrates. In Italian flora,

A. onopteris, *A. cuneifolium* subsp. *cuneifolium* and *A. adiantum-nigrum* subsp. *adiantum-nigrum*, in one of its serpentine forms, form a group of closely related and morphologically poorly differentiated taxa. They are not thoroughly known yet. The presence of species related to ultramafic substrates on the Monte Pisano has to be ruled out and the actual presence of *A. adiantum-nigrum* remains uncertain. All the samples examined seem to be related, once again, to *A. onopteris*.

Asplenium septentrionale (L.) Hoffm. subsp. *septentrionale*

The plant used to exist on the Monte Pisano, as evidenced by a herbarium sample dated 1843, collected by Parlatore and now in FI, and one dated 1864, by Paolo Savi, now in PI. A sample collected in 1973 by Marchetti and Ferrarini near the River Fossacieca, where this species has now disappeared, due to building restoration works, is preserved in SIENA. A fourth finding by F. Balderi, on the Monte Comunale, has not been confirmed, and all efforts to find this plant have been useless, also due to the difficulty to explore the rocks where it is assumed to live.

Let's leave aside such very or rather common species as *Pteridium aquilinum*, *Asplenium ruta-muraria*, *Ceterach officinarum*, *Phyllitis scolopendrium*, *Athyrium filix-femina*, *Polystichum setiferum*, *Blechnum spicant*, *Adiantum capillus-veneris*, *Anogramma leptophylla* and *Osmunda regalis*. Just a few words on *Dryopteris filix-mas*, frequent but not common only above 600 metres a.s.l. on the northern side of the Monte Serra. It lives together with *Dryopteris oreades*. Specimens looking halfway between these two species, whose spores seem to be all abortive, have been observed. This seems to suggest the hybrid *D. x mantoniae* Fraser-Jenkins & Corley, but further biosystematic investigations will be required to support such assumption.

Dryopteris affinis (Lowe) Fraser-Jenkins

Three subspecies of *D. affinis*, an apomictic species, are present: the diploid *D. a.* subsp. *affinis*, the triploid *D. a.* subsp. *borreri* (Newman) Fraser-Jenkins and the triploid *D. a.* subsp. *cambrensis* Fraser-Jenkins, at slightly differing stations (the last one is a bit more microthermic than the others).

Dryopteris oreades Fomin

Before we mentioned this unit, an European-Caucasian orophyte whose distribution has already been explained in detail by Marchetti (1994b). This author also found it on the Monte Pisano, based on a sample, now in SIENA, collected in 1912 by Andreucci (*sub Nephrodium filix-mas* Rich.) on the very top of the Monte Serra, at 916 m a.s.l. Considering many television relay stations have been built on the top of the Monte Serra, one could hardly hope it could ever be found again. Several clusters of this plant were found just under the top of the Monte Serra in August 2000, reconfirming its presence. The plant was recently found for the first time also in Liguria (Bernardello, 2000) in the upper Valle d'Aveto.

Dryopteris dilatata (Hoffm.) A. Gray

This species was collected by Arcangeli in 1864 (*sub Aspidium hastulatum*, FI) in some unknown place on the Monte Pisano, but was later found in other stations of the area (at least ten). The density of the population of this species is peculiar. Very few specimens exist in each station (between 1 and 5) and in one instance only (near River Tanali) did the specimens exceed the number of eighty. The same applies to the Apuan Alps (D. Marchetti, unpubl.).

Heterosporous ferns are the last species we are going to cover here.

Marsilea quadrifolia L.

The plant has never been found on the Monte Pisano. Many are the herbarium records concerning the wet areas of the flat lands of Lucca and Pisa, but they date back to the nineteenth or first half of the twentieth century. Today, also due to many reclamation works, we have no evidence that the plant still exists in these areas of Tuscany. *Azolla filiculoides* Lam. and *Azolla mexicana* C. Presl (= *A. caroliniana* auct.) probably do not exist either, though they are present in many surrounding wet areas.

The genus *Salvinia* is worth a few more words.

The presence of one *Salvinia*, which could be identified as *S. natans*, based both on herbarium samples and bibliographical data, has been mentioned in many wet areas of western Tuscany since the 16th century. One – extremely common – *Salvinia* was found approximately 40 years ago by one of us (F. G.) at the foot of the Monte Pisano, especially in a ditch called of the “hot water” for the high temperature of its waters of thermal origins, and shown every year to the students of Biological and Natural Sciences as *Salvinia natans*.

A couple of years ago, we decided to check this plant, which had become very invasive during the summer months in many canals of the flat lands around Pisa. After morphological, karyological and ecological considerations, the plant was definitively referred to as *S. molesta* D.S. Mitch., a South American pentaploid sterile floating fern that spreads in tropical and subtropical aquatic ecosystems. Known as “Giant *Salvinia*”, “*Kariba* weed”, “*Aquarium watermoss*” or “*World’s worst weed*”, this plant is a significant danger in any warm, slow-moving body of water of any Continent. This finding seems to be the first one in Italy and possibly the only established one in Europe. Further informations in Garbari, Giovannini & Marchetti (2001). The indigenous *Salvinia natans* L. does not exist any longer in the waters of the flat lands around Pisa, now replaced by this very invasive exotic species.

To conclude, we can say that the specific pteridophytic units of the Monte Pisano are 39, approximately 30% of the Italian pteridological flora. Eleven of them are listed in the Tuscan Red List of ferns threatened with extinction (for a total number of 27 species in Tuscany).

Even if we had to record the loss of some ecologically or bio-geographically important species, such as *Hymenophyllum tunbrigense*, *Phegopteris connectilis*, *Marsilea quadrifo-*

lia and *Salvinia natans*, we believe that the Monte Pisano still deserves plenty of attention also for its pteridophytic as well as phanerogamic features. We have urged some municipal public administrations to enforce, in compliance with the new Tuscan Regional Law on the protection of biodiversity (Tuscan L.R. n.56, April 2000), provisions for the preservation and protection of the biotopes and stations which house the most significant plants.

References

- Bernardello, R. 2000: Segnalazioni Floristiche Italiane: 969. *Dryopteris oreades* Fomin (*Dryopteridaceae*). — Inform. Bot. Ital. **32**(1-3): 50.
- Bizot, A. 2000: *Trichomanes speciosum* Willd. decouvert sur le versant meridional des Vosges (Haute-Saône). — Monde Plantes **469**: 7.
- Bonafede, F., Marchetti, D., Todeschini, R. & Vignodelli, M. 2001: Atlante delle Pteridofite nella Regione Emilia-Romagna. Riconoscimento, distribuzione e note sull'ecologia delle Felci e piante affini in Emilia-Romagna. — Assessorato Agricoltura, Ambiente e Sviluppo sostenibile, Regione Emilia-Romagna. Bologna.
- Cesca, G. & Peruzzi, L. 2001: *Isoetes* (*Lycophytina*, *Isoetaceae*) with terrestrial habitat in Calabria (Italy). New karyological and taxonomical data. — Fl. Medit. **11**: 303-309.
- Conti, F., Manzi, A. & Pedrotti F. 1997: Liste rosse regionali delle Piante d'Italia. — Soc. Bot. Ital. & WWF, Camerino.
- Del Prete, C., Balderi, F. & Garbari, F. 1990: Geobotanical research on Mount Pisano (Tuscany, Italy), VIII. A preliminary checklist of the vascular flora. — Atti Soc. Tosc. Sci. Nat. Mem B, **97**: 121-192.
- De Stefani, C. 1901: Flore carbonifere e permiane della Toscana. — Pubbl. R. Ist. Studi Sup. Pratici Perfezion., Firenze.
- Ferrarini, E., Ciampolini, F., Pichi Sermolli, R. E. G. & Marchetti, D. 1986: Iconographia Palynologica Pteridophytorum Italiae. — Webbia **40** (1): 1-202.
- & Marchetti, D. 1994: Prodrómo alla Flora della Regione Apuana. Parte prima (*Lycopodiaceae-Leguminosae*). — Accademia Lunigianese Scienze "G. Capellini". La Spezia.
- Fiori, A. 1943: Flora Italica Cryptogama. Pars V: *Pteridophyta-Filicinae*. — Soc. Bot. Ital., Firenze.
- Garbari, F., Giovannini, A. & Marchetti, D. 2001: *Salvinia molesta* D. S. Mitchell (*Salvinaceae*) nuova per la flora d'Italia. — Arch. Geobot. **6** (1): 73-78 (2000).
- , Tongiorgi Tomasi, L. & Tosi, A. 1991: Giardino dei Semplici. L'Orto Botanico di Pisa dal XVI al XX secolo. — Pacini ed., Pisa.
- Giannini, E. & Nardi, R. 1965: Geologia della zona nord-occidentale del Monte Pisano e dei Monti d'Oltre Serchio (Prov. di Pisa e Lucca). — Boll. Soc. Geol. Ital. **84** (5): 197-280.
- Giovannini A., Garbari, F. & Marchetti, D. 2001: The chromosome number of *Isoetes duriei* Bory (*Lycopodiophyta*, *Isoetaceae*). — Webbia **56** (1): 219-221.
- Ippolito, F. 1950: Il Monte Pisano. Memorie e note. — Ist. Geol. Appl. Univ. Napoli **3**: 7-48.
- Jérôme, C., Rasbach, H. & Rasbach, K. 1994: Découverte de la fougère *Trichomanes speciosum* (*Hymenophyllaceae*) dans les massif Vosgien. — Monde Plantes **450**: 25-27.
- Loriot, S., Jérôme, C. & Cottignies, A. 2003: Nouvelles découvertes de sporophytes juvéniles dans les populations de gamétophytes indépendants de *Trichomanes speciosum* Willd. — Monde Plantes **478**: 31-32.
- Marchetti, D. 1994a: Chiave per la determinazione delle pteridofite indigene e naturalizzate in Italia. Lista degli ibridi. — Ann. Mus. Civ. Rovereto, Sez. Arch. St. Sc. nat. **9**: 167-192 (1993).
- 1994b: Note su alcune pteridofite di area lunigianese nuove o rare per l'Italia. — Mem. Accad. Lunigianese "G. Capellini" **59**: 127-147 (1989).

- Rau, A. & Tongiorgi, M. 1966: I Lamellibranchi triassici del Verrucano dei Monti Pisani. Nuova revisione. — *Paleontol. Ital.* **61**: 187-284.
- & — 1974: Geologia dei Monti Pisani a Sud-Est della Valle del Guappero. — *Mem. Soc. Geol. Ital.* **13** (3): 227-408.
- Santi, G. 1789: Analisi chimica delle acque dei Bagni pisani, dell'acqua acidula di Asciano. — Raffaelli ed., Pisa.
- Trevisan, L. 1955: Il Trias della Toscana ed il problema del Verrucano triassico. — *Atti Soc. Tosc. Sci. Nat. Mem., Ser. A*, **62**: 1-30.
- Troia, A. 2001: The genus *Isoetes* L. (*Lycophyta*, *Isoetaceae*): synthesis of karyological data. — *Webbia* **56** (1): 201-218.
- & Bellini, E. 2001: Karyological observations on *Isoetes duriei* Bory (*Lycophyta*, *Isoetaceae*) in Sicily. — *Boccone* **13**: 397-400.

Addresses of the Authors:

F. Garbari, Dipartimento di Scienze Botaniche, Via L. Ghini 5, 56126 Pisa, Italy
 A. Giovannini, Via C. Castracani, Trav. V n. 58, 55100 Lucca, Italy.
 D. Marchetti, Via Isonzo 6, 54100 Massa, Italy.

Appendix – *Specimina selecta* in *Pl. Leg. et det.* A. Giovannini and/or D. Marchetti.

EQUISETACEAE

Equisetum ramosissimum Desf.

S. Giuliano T.me (Pi), nei pressi della stazione ferroviaria, 70 m s.l.m., 01/05/1999 - Fosso dell'Acqua calda, S. Giuliano T.me (Pi), 5 m s.l.m., 18/05/1999.

Equisetum palustre L.

S. Quirico di Guamo (Lu), fonti dell'acquedotto di L. Nottolini, 29/05/2000 - Fosso dell'Acqua calda, S. Giuliano T.me (Pi), 5 m s.l.m., 11/05/1999 - Gattaiola (Lu), lungo un fossato, 11/05/1999.

Equisetum arvense L.

Lungo il Rio Malavolta, Coselli (Lu), 40 m s.l.m., 16/05/2000 - P. ve di Compito lungo la s.s. n° 439, 25 m s.l.m., 30/05/1999 - Gattaiola (Lu), lungo un fossato, 06/04/1999 - *Ibidem*, 16/05/1999.

Equisetum telmateia Ehrh.

Fosso dell'Acqua calda, S. Giuliano T.me (Pi), 4 m s.l.m., 11/05/1999 - S. Maria del Giudice (Lu), lungo la s.s. n° 12, 06/04/1999 - *Ibidem*, 20/06/1999.

SELAGINELLACEAE

Selaginella denticulata (L.) Spring

Frequentissima sul M.te Cotrozzi vicino S. Maria del Giudice – M.te Pisano versante lucchese, 04/04/1999

ISOÉTACEAE

Isoetes duriei Bory

Valle delle Fonti, Asciano (Pi), 11/05/1999 - Loc. Vallegiana ad Asciano (Pi), su terrazzamento di uliveto esposto a sud, ca. 60 m s.l.m., 10/11/1999.

OPHIOGLOSSACEAE

Ophioglossum lusitanicum L.

Roccioni di verrucano in loc. C. Mirteto sul M.te Conserva, Asciano (Pi), ca.150 m s.l.m., 23/11/2000.

Ophioglossum azoricum C. Presl

Sella di M.te Cotrozzi, versante lucchese del M.te Pisano, 240 m s.l.m., 18/05/2000 - Sommità di M.te Penna (M.te Pisano), ca. 542 m s.l.m., marzo 2001.

Ophioglossum vulgatum L.

Sommità di M.te Penna (M.te Pisano), 540 m s.l.m. 04/05/2000.

OSMUNDACEAE

Osmunda regalis L.

S. Maria del Giudice, Rio S. Pantaleone, 130 m s.l.m., 02/06/1999.

PTERIDACEAE

Pteris cretica L.

Rio di Cerasomma sotto il Convento di Rupe Cava, ca. 250 m s.l.m., M.te Pisano vers. Lucchese, 31/08/2000.

HEMIONITIDACEAE

Anogramma leptophylla (L.) Link

Fonti dell'acquedotto, S. Quirico di Guamo (Lu), 21/05/2000 - Valle del torrente Noce (ad est dell'abitato di Oliveto T.me), su muretti a secco sulla sinistra del torrente, 21/05/2000.

ADIANTACEAE

Adiantum capillus-veneris L.

Coselli (Lu), su un muretto lungo un ruscello in via Malavolta (a 2 m dal ruscello), 16/05/2000.

HYMENOPHYLLACEAE

Vandemboschia speciosa (Willd.) G. Kunkel

Rio S. Pantaleone, loc. Molinaccio, S. Maria del Giudice, ca. 240 m s.l.m., 28/07/2000 (solo gametofito) - Rio S. Pantaleone, ramo più a nord, S. Maria del Giudice (Lu), ca. 300 m s.l.m., 18/09/2000 - Rio Tanali, 75 m s.l.m., 14/09/2000.

HYPOLEPIDACEAE

Pteridium aquilinum (L.) Kuhn subsp. *aquilinum*

S. Maria del Giudice lungo la s.s. 12, in un incolto, 65 m s.l.m., 20/06/2000.

SINOPTERIDACEAE

Cheilantes tinaei Tod.

Asciano (Pi), roccioni della Valle delle Fonti, 110 m s.l.m., 11/05/1999.

POLYPODIACEAE

Polypodium vulgare L.

Tra Pian bello e la vetta di M.te Serra (M.te Pisano), 750 m s.l.m., 01/07/2000 - Poco sotto la sommità del M.te Serra (M.te Pisano), 900 m s.l.m., 05/08/2000.

Polypodium cambricum L.

Asciano (Pi), Valle delle Fonti su muretto a secco poco al di sopra le ultime abitazioni, 150 m s.l.m., 22/10/2000 - Nel sottobosco lungo il sentiero (n.011) che va da Ripafratta al M.te Maggiore (Lu), 150 m s.l.m. 13/05/2000.

Polypodium interjectum Shivas

Rio ad est del Rio di C. la Polla vicino al punto quotato 212 m s.l.m., Cerasomma (Lu), 20/02/2000. Agnano (Pi), su un muretto, 100 m s.l.m., 30/05/2000.

THELYPTERIDACEAE

Oreopteris limbosperma (Bellardi ex All.) Holub

Affluente di destra del Rio Visona di Compito (Lu), 250 m s.l.m., 27/06/2000.

ASPLENIACEAE

Asplenium trichomanes L. subsp. *trichomanes*

Valle del Rio Visona di Compito vicino al Colle di Calci (M.te Pisano), 625 m s.l.m., 05/08/2000

- Alta valle del Rio Visona di Compito sul versante lucchese del M.te Pisano, 620 m s.l.m., 24/09/2000.

Asplenium trichomanes L. subsp. *quadrivalens* D. E. Mey.

Loc. Gabella presso Calci (Pi), ca. 110 m s.l.m., 23/05/2000 - M.te S. Giuliano, versante pisano (esp. sud), ca. 200 m s.l.m., 01/05/2000.

Asplenium foreziense Legrand

M.te Faeta versante sud, Asciano (Pi), 350 m s.l.m., 11/05/1999 - Asciano (Pi), Valle delle Fonti sul M.te Conserva, 200 m s.l.m., 11/05/1999.

Asplenium obovatum Viv. subsp. *lanceolatum* (Fiori) P. Silva

Parte alta della valle del Rio S. Pantaleone, S. Maria del Giudice (Lu), 12/08/2000 - Fonti dell'acquedotto a S. Quirico di Guamo (Lu), su muretto a secco, 35 m s.l.m., 29/05/2000 - Cima di Vorno (Lu), 150 m s.l.m., 11/05/1999 - Vorno via di Valle, punto quotato 296 m s.l.m., su muretto di un uliveto, 25/06/2000.

Asplenium onopteris L.

Via Sodini, Massa Macinaia (Lu), in sottobosco, 50-60 m s.l.m., 20/05/2000 - Buti (Pi), su un muro in prossimità del Rio Magno, 85 m s.l.m., 09/08/2000 - Uliveti nella parte alta delle valle del Rio S. Pantaleone, S. Maria del Giudice (Lu), 12/08/2000.

Asplenium ruta-muraria L. subsp. *ruta-muraria*

M.te Cotrozzi (M.te Pisano) a S. Maria del Giudice (Lu), 04/04/1999.

Ceterach officinarum Willd subsp. *officinarum*

S. Maria del Giudice (Lu), M.te Penna, 11/05/1999.

Phyllitis scolopendrium (L.) Newman subsp. *scolopendrium*

In prossimità di un ruscello in loc. C. la Polla, Cerasomma (Lu), 70 m s.l.m., 20/02/2000 - Pozzuolo (Lu), Fosso della Mandria, 160 m s.l.m., 02/06/1999.

ATHYRIACEAE

Athyrium filix-femina (L.) Roth

Loc. C. Stanghetta (Vorno) lungo un rio vicino al bivio per S. Allago (M. Pisano), 400 m s.l.m., 25/06/2000 - A metà strada tra il bivio per Buti e il trivio sommitale di M.te Serra (M. Pisano), 750 m s.l.m., 01/07/1999 - Rio affluente di sinistra del Rio di Vorno, Vorno (Lu), 400 m s.l.m., 10/05/2000.

DRYOPTERIDACEAE

Polystichum setiferum (Forssk.) Woyn.

Abbondante nei rii in prossimità di Buti (Pi), 09/08/2000.

Dryopteris filix-mas (L.) Schott

Affluente di sinistra del Rio Visona di Compito sul versante lucchese del M.te Pisano, 350 m s.l.m., s.d. - Castagneto vicino al convento di Rupe Cava (Lu), 270 m s.l.m., 13/05/2000 - Tra il laghetto di Coselli e M.te Le Corna (M.te Pisano), punto quotato 397 m s.l.m., 24/06/2000.

Dryopteris affinis (Lowe) Fraser-Jenk. subsp. *affinis*

Massa Macinaia (Lu), via Sodini lungo il rio, 50 m s.l.m., 20/05/2000 - Lungo il Rio Malavolta,

Coselli (Lu), 60 m s.l.m., 16/05/2000 - Loc. il Grottone, Pozzuolo (Lu), 300 m s.l.m., 08/05/2000 - Vorno (Lu), affluente del Rio di Vorno, 10/05/2000.

Dryopteris affinis (Lowe) Fraser-Jenk. subsp. *borreri* (Newman) Fraser-Jenk.

Rio Visona di Compito, suo affluente di sinistra, versante lucchese del M.te Pisano, 220 m s.l.m., 30/04/2000 - Lungo il Rio Malavolta, Coselli (Lu), 50 m s.l.m., 16/05/2000.

Dryopteris affinis (Lowe) Fraser-Jenk subsp. *cambrensis* Fraser-Jenk

Affluenti del Rio di Vorno in loc. Ghiaccetto, Vorno (Lu), 300 m s.l.m., 10/05/2000 - Massa Macinaia (Lu), via Sodini, lungo il rio, 50 m s.l.m., 20/05/2000 - Rii del M.te Faeta (M.te Pisano), Fosso di Selvavecchia, 575 m s.l.m., 10/05/2000.

Dryopteris oreades Fomin

Sommità di M.te Serra, versante lucchese, 910 m s.l.m., 27/06/2000.

Dryopteris dilatata (Hoffm.) A. Gray

M.te Pisano, affluente di destra del Rio Visona di Compito compreso tra il Rio Sassabodde e il Rio Vallone di Botra, 200 m s.l.m., 30/06/2000 - M.te Cucco (M.te Pisano), loc C. Cucco, rio più a sud, 50 m s.l.m., 25/08/2000 - M.te Pisano, Rio Tanali, ramo più a sud verso Vallin di Pipa, 100 m s.l.m., 14/09/2000.

BLECHNACEAE

Blechnum spicant (L.) Roth

S. Lorenzo a Vaccoli (Lu), loc la Piaggina, 02/06/1999 - Vorno (Lu), affluenti del Fosso di Vorno, loc. C. Ghiaccetto, 400 m s.l.m., 10/05/2000 - Rio di Malavolta, Coselli (Lu), 60 m s.l.m., 16/05/2000.

SALVINIACEAE

Salvinia molesta D. S. Mitch.

Fosso dell' Acqua calda, S. Giuliano T.me (Pi), 5 m s.l.m., 11/05/1999 - Ibidem, 18/05/1999 - Fosso Vicinaia, Asciano (Pi), 3 m s.l.m., settembre 2000.