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Phytocoenological behaviour, distribution and conservation of *Trichomanes speciosum* Willd. (*Pteridophyta*) in the south of the Iberian Peninsula

Andrés V. PÉREZ LATORRE[a], M. Jesús CANO[b], Baltasar CABEZUDO[a] & Juan GUERRA[b]*

[a]Departamento de Biología Vegetal (Botánica), Facultad de Ciencias, Universidad de Málaga, P. O. Box 59, E-29080 Málaga, España

[b]Departamento de Biología Vegetal (Botánica), Facultad de Biología, Universidad de Murcia. Avda. Rector F. Sabater, Campus de Espinardo, Murcia, España, E-mail jguerra@um.es

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Abstract – We studied south-Iberian populations of *Trichomanes speciosum* Willd. (= *Vandenboschia speciosa* (Willd.) Kunkel) (*Hymenophyllaceae*), an endangered filmy fern which appears in Annex II of the Directive 92/43 EC, as a species for which special conservation zones (ZEC) should be designated. In the southern Iberian Peninsula it is restricted to "Los Alcornocales" Natural Park (Cádiz and Málaga provinces, Andalusia region). It grows in nine populations (24 sub-populations), some of which contain very few individuals (2-4 sporophytes). Its habitat corresponds to the most humid and shaded parts of relict lauroid forests (*Rhododendron ponticum*). We describe as new the bryo-pteridophytic community of which it forms part (*Homalio lusitanicae-Trichomanietum speciosi* ass. nova), that colonises hollows and cavities of rocks exposed to water splashes and drips in the ravines within the lauroid forest. The phytogeographical importance of the bryophytic synusia that accompanies *Trichomanes* is pointed out. We propose a specific area within the Natural Park that should be set aside for conservation of this bryo-pteridophytic community, probably the best in continental Europe for sporophytes of *Trichomanes*.

***Hymenophyllaceae,* populations / ecology / phytosociology / bryo-pteridophytic community / *Homalia lusitanica* / Spain**

Resumen – Se han estudiado las poblaciones suribéricas de *Trichomanes speciosum* Willd. (= *Vandenboschia speciosa* (Willd.) Kunkel) (*Hymenophyllaceae*), un helecho amenazado que aparece en el Anexo II de la Directiva 92/43CEE, como especie para la cual se deben designar zonas especiales de conservación (ZEC). Su distribución está restringida al Parque Natural de "Los Alcornocales" (provincias de Cádiz y Málaga, Andalucía), presentando

* Correspondence and reprints: avperez@uma.es

nueve poblaciones (24 sub-poblaciones), algunas de las cuales contienen muy pocos individuos (2-4 esporofitos). Su hábitat se corresponde con las zonas más húmedas y sombrías de los bosques lauroides relícticos de la zona (*Rhododendron ponticum*). Se describe la nueva asociación brio-pteridofítica de la cual forma parte (*Homalio lusitanicae-Trichomanietum speciosi* ass. nova), que coloniza huecos y cavidades de rocas expuestas a salpicaduras de agua y goteos en los cursos de agua dentro del bosque lauroide. Es destacable la importancia fitogeográfica de la sinusia briofítica que acompaña a *Trichomanes*. Proponemos un área específica dentro del Parque Natural que debería ser asignada para la conservación de esta comunidad brio-pteridofítica, probablemente la mejor en Europa continental para esporofitos de *Trichomanes*.

***Hymenophyllaceae* / poblaciones / ecología / fitosociología / comunidad brio-pteridofítica / *Homalia lusitanica* / España**

INTRODUCTION

Trichomanes speciosum Willd. (= *Vandenboschia speciosa* (Willd.) Kunkel) (*Hymenophyllaceae*) is one of the most endangered ferns that grow in the Iberian Peninsula. It is characterised by discontinuous distribution, scarce habitats, singular sporophytic and gametophytic forms and special morphological features. The sporophyte of *T. speciosum* has a branched creeping rhizome and translucent fronds made up of only one layer of cells between the veins. It is a strictly hygrophilous species since its survival depends on water that flows or oozes over the substrate, and on environmental humidity. Although its main distribution area is typically Macaronesian (Azores, Madeira, Canary Islands), it also reaches Oceanic areas of W and Central Europe (mainly as gametophyte) and the Iberian Peninsula (mainly as sporophyte) (Huck, 1997; Rumsey & Vogel, 1998; Krippel 2001). In the Iberian Peninsula it is restricted to the Cantabrian Fringe, western Pyrenees and mountain ranges in Andalusia near the Strait of Gibraltar (Rumsey & Vogel, 1998; Cabezudo *et al*., 2000); moreover there is one isolated population in NW Portugal. Its present status of conservation has to be seen as "vulnerable" in the Iberian Peninsula and Andalusia (Cabezudo *et al*., 2000; Pérez Latorre *et al*., 2000b; VV. AA., 2000), therefore, it is important to know more about its biology and phytogeographical distribution. It is also considered as endangered and protected under various categories in the European countries (Ratcliffe *et al*., 1993; Rumsey *et al.*, 1999), being included in Annex II of the Directive "Habitat" (EC 1992). In the south of Spain this fern grows near Algeciras (Andalusia) in a greatly original area as regards its bryophytic and cormophytic flora and vegetation (Allorge & Allorge, 1945; Gil *et al*., 1985; Deil, 1994; Ojeda *et al*., 1996; Pérez Latorre *et al*., 1996, 1999; Guerra *et al*., 2003) and where it is possible to find some communities and relict synusia in the heart of lauroid woods similar to the Macaronesian laurisilvas (Gil & Guerra, 1981; Galán de Mera *et al*., 1996; Pérez Latorre *et al*., 2000a, 2000c).

The object of this work was to study the populations of *T. speciosum* in Andalusia: to describe the bryo-pteridophytic communities in which it appears, to evaluate its floristic, ecological and chorological characteristics, to give basic population data and phenology and to propose a priority area for the conservation of the community in which it grows, as well as its threat status.

MATERIALS AND METHODS

Environment and covering vegetation. The lauroid forests where *Trichomanes speciosum* grows are found in topographically singular places characterized by ravines containing continuously flowing streams fed by high rainfall and frequent mists in a very warm, oceanic thermal regime. In the headwaters of these streams a relict wood-shrubby community exists, with lauroid characters (evergreen, glabrous, glossy mesophilous leaves) characterized by *Rhododendron ponticum* L. accompanied by eco-morphologically similar bushes such as *Ilex aquifolium* L., *Laurus nobilis* L., and other hydrophilic trees like the endemic *Frangula alnus* subsp. *baetica* (Willk. & Reverchon) Devesa. This community is included in the association *Scrophulario laxiflorae-Rhododendretum pontici* Pérez Latorre, Galán de Mera and Cabezudo 2000 (order *Rhododendretalia ponticae* Pérez Latorre, Galán de Mera and Cabezudo 2001, class *Pruno-Lauretea azoricae* Oberdorfer *ex* Rivas Martínez, Arnaiz, Barreno and Crespo 1977), whose representation in the western Mediterranean region is confined to the Iberian Peninsula (Pérez Latorre *et al*., 2000a). In the heart of these lauroid woods several bryophytic and bryo-pteridophytic synusia of relict and paleobiogeographic interest grow (Gil & Guerra, 1981). These include epiphytic communities such as *Neckero laevifoliae-Porelletum canariensis* and *Neckero pumilae-Ulotetum calvescentis,* which grow in zones where mists are common, and *Pterogonio gracilis-Davallietum canariensis* epiphytic on *Quercus* spp. (Pérez Latorre *et al*., 2000c). However, the synusia with *Trichomanes speciosum* are confined to an ecologically more restricted vegetation type (Fig. 2) corresponding to the subassociation *Scrophulario-Rhododendretum pontici culcitetosum macrocarpae* Pérez Latorre, Galán de Mera and Cabezudo 2000, where these lauroid woods are enriched by hyper-hygrophilous ferns of palaeotropical origin (*Culcita macrocarpa* K. Presl., *Diplazium caudatum* (Cav.) Jermy and *Pteris incompleta* Cav.).

Population and phytocoenological studies. The populations were located from 1998 to 2001 by visiting potential biotopes (suitable ecological environments) of *Trichomanes speciosum* in Los Alcornocales Natural Park (Cádiz and Málaga provinces, Spain) (Fig. 1), where all the known populations of this species in the south of the Iberian Peninsula are found. Individuals of *T. speciosum* growing in the riparian biotopes of the same geographical and topographical mountain range were chosen for population structure studies. Counting individuals of this species was a relatively complicated process, since all the fronds belonging to one continuous rhizome with its greater or lesser number of branches had to be isolated and individualized. To ascertain the degree of development and the capacity of habitat occupation, the number and size of fronds were recorded for 12 individuals, concentrating the study on those best-preserved population that presented the greatest number of individuals.

To identify taxa for phytosociological study, individuals were collected in each locality studied and placed in the herbaria of the Universities of Málaga (MGC) and Murcia (MUB). The nomenclature of the bryophytes is based on Corley *et al*. (1981) and Grolle & Long (2000), while cormophytes were identified by reference to Flora Vascular de Andalucía Occidental (Valdés *et al*., 1987), except in the case of some species for which the author is cited in the text.

For the phytocoenological study, the Braun Blanquet (1979) sigmatist method was used, although, because of the protonematic growth of the bryophytes and the presence of rhizomes in the fern, we only used the abundance-dominance

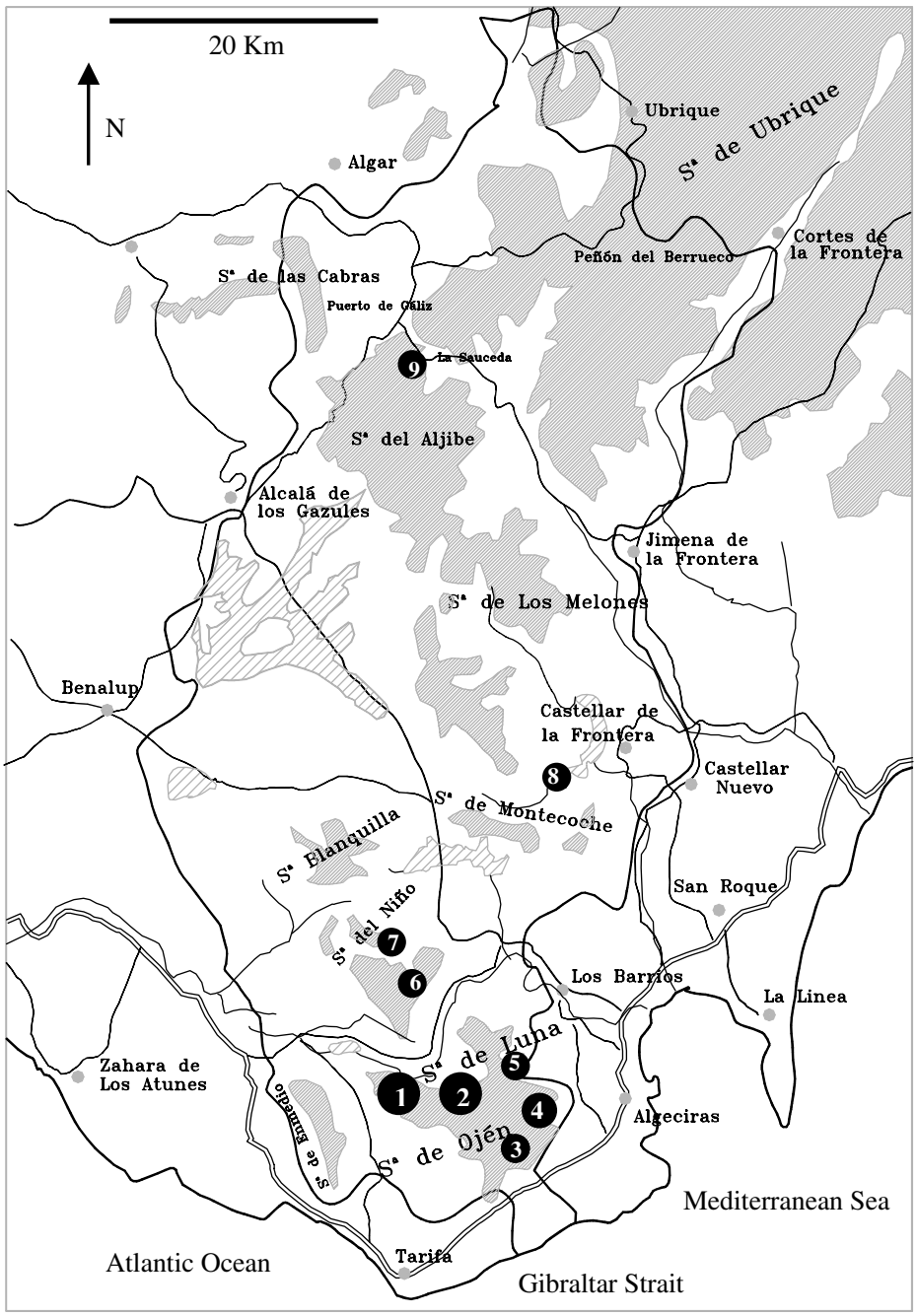

Fig. 1. Distribution of *Trichomanes speciosum* in southern Spain (24 subpopulations detected in 9 localities). Proposed Special Conservation Zone (ZEC): black dots numbered 1, 2, 3, 4 and 5. Size of dots indicates the relative importance of populations. Los Alcornocales Natural Park border: thick line; dense striped area corresponds to mountains over 300 m.

Fig. 2. General view of the biotope colonized by the bryo-pteridophytic community *Homalio lusitanicae-Trichomanietum speciosi* Pérez Latorre, Cano, Cabezudo & Guerra ass. nova.

index. The syntaxonomic nomenclature is based on the Code of Phytosociological Nomenclature (Weber *et al*., 2000).

During an annual cycle, a phenological study was made based on Orshan (1989) but adapted to ferns; monthly visits (14 in total) being made to record frond buds, fronds without sporangia, fronds with mature sporangia and senescent fronds. The population visited for this study was selected among the best developed in the area.

RESULTS AND DISCUSSION

Distribution and size of individuals. The species is basically distributed throughout the southern ranges of the Natural Park and to a much lesser extent in the north (Fig. 1). *Trichomanes speciosum* was found growing in nine populations (Table 1), with a total of approximately 200 individuals distributed in 24 subpopulations. Except for site nº 8 (Sierra de Montecoche) where only the gametophyte phase was found (Rumsey & Vogel, 1998), in all the populations sporophytes were observed, conversely to the situation in the rest of continental Europe, where the gametophyte phase dominates and the sporophyte may not exist (Huck, 1997; Krippel, 2001; Ratcliffe *et al*., 1993; Rumsey *et al*., 1998, 1999). Although the species disperses spores, we do not know if it fails to produce new gametophytes and ends a complete reproductive life cycle (in the laboratory, germination of spores has not been possible using standard methods). This could be critical for the species to migrate to new microsites and for its survival.

The size and age of individuals is deduced from the number of branches produced in the rhizome, which, in turn, determines an extremely variable number of fronds on each individual. The percentage of individuals bearing 3 branches

Table 1. Populations, subpopulations and number of individuals detected in each population of *Trichomanes speciosum* in the south of the Iberian Peninsula (Spain).

Population number	*Locality name*	*Number of individuals (sporophytes)*	*Number of subpopulations*
1	Sierra de Saladavieja	85	4
2	Sierra de Ojén	92	8
3	Sierra de Luna	8	2
4	Valle del Río de la Miel	16	2
5	Sierra de la Palma	4	1
6	Sierra del Niño	5	3
7	Sierra Sequilla	2	1
8	Sierra de Montecoche	Only gametophytes	1
9	Sierra del Aljibe	4	2

is the highest (25%). Mean number of fronds per individual, based on the data collected for one of the best-preserved sub-populations of area 2 (Sierra de Ojén) increases (from 14 to more than a hundred) as number of branches does. The highest number of branches were seen on plants growing in gently sloping places only subjected to splashes, while the least developed examples corresponded to places where the water tended to run freely during torrential rainfall.

Phytocoenology. The floristical, ecological and biogeographical singularity of the synusia characterised by *Trichomanes speciosum* leads us to propose the following association:

Homalio lusitanicae-Trichomanietum speciosi Pérez Latorre, M. J. Cano, Cabezudo and J. Guerra **ass. nova hoc loco** (*Sintypus:* inv. 2, Tab. 2).

This is a bryo-pteridophytic community characterized by the moss *Homalia lusitanica* Schimp. and the pteridophyte *Trichomanes speciosum*. Other bryophytic species of marked Atlantic and Macaronesian affinity that are frequent in this community are *Heterocladium wulfsbergii* Hagen and *Fissidens serrulatus* Brid. The community is very inconspicuous in the absence of *Trichomanes speciosum*, although the gametophyte may be detected occasionally (Rumsey & Vogel, 1998). *Thamnobryum alopecurum* (Hedw.) Nieuwl. & Gangulee, another component of the community, is a pleurocarpous moss with creeping primary stems that fix the plants in the substrate in a similar way as the branched rhizome of *Trichomanes*. From these primary stems, erect secondary ones arise, which share the same life strategies towards running water. The creeping stems of *Homalia lusitanica* are almost all adnate to the rock surface as in the case of *Riccardia* species. When the community is well developed, it has a basal stratum of pleurocarpous mosses (*Homalia lusitanica*, *Heterocladium wulfsbergii*, *Lepidopilum virens* Card., *Rhynchostegium riparioides* (Hedw.) Cardot) and thalloid liverworts (*Riccardia latifrons* (Lindb.) Lindb., *R. multifida* (L.) Gray), from them, fronds of *Trichomanes* and secondary stems of *Thamnobryum alopecurum* arise. In the best preserved places in the heart of the woods, relict ferns may appear such as *Diplazium caudatum* (Cav.) Jermy belonging to the lauroid wood (*Scrophulario-Rhododendretum pontici*), which harbours the association.

Table 2. *Homalio lusitanicae-Trichomanietum speciosi* ass. nova. (*Platyhypnidio-Fontinaletea*, *Brachythecietalia plumoso-rivularis*, *Brachythecion plumosi*).

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13
Relevé size (m^2)	0.9	0.3	0.6	0.6	0.6	1	0.6	0.9	0.9	0.4	0.3	0.2	0.2
Habitat	A	R	A	S	S	S	S	S	S	S	S	RS	R
Cover (%)	100	60	50	80	90	100	70	80	90	90	100	90	90
Slope (degrees)	0	45	0	0	0	0	30	30	30	0	0	90	90
Altitude (m a. s. l.)	390	400	400	410	360	360	320	330	310	330	340	350	350
Characteristic species of association													
Trichomanes speciosum	3	3	3	4	1	1	1	2	1	1	1	2	2
Homalia lusitanica	1	1	+	.	.	.	2	+	.	1	1	.	.
Characteristic species of alliance, order and class													
Thamnobryum alopecurum	+	3	3	1	.	2	1	.	.	1	2	+	.
Riccardia multifida	1	.	1	+	.	.	.	.	.	.	.	1	+
Rhynchostegium riparioides	.	3	1	.	.	.	.	.	.	1	.	+	1
Heterocladium wulfsbergii	1	1	.	.	2	1	.	.	.	.	.	.	.
Riccardia latifrons	.	.	.	.	.	.	2	1	1	.	.	.	.
Fontinalis antipyretica	.	.	.	.	.	.	.	.	.	.	.	+	1
Hyocomium armoricum	.	.	.	.	.	.	.	.	.	.	.	.	1
Other species													
Fissidens serrulatus	.	.	.	1	3	3	.	1	1	1	2	2	2
Eurhynchium praelongum	1	1	.	2	+	1	.	.	1	+	+	1	.
Pseudotaxiphyllum elegans	.	+	.	+	.	.	.	+	.	.	.	.	.
Calypogeia arguta	.	.	.	+		.	.	.	1	.	.	+	.
Sibthorpia europaea	.	.	.	.	.	.	.	.	+	.	.	+	+
Atrichum undulatum var. *minus*	.	.	.	.	.	.	.	.	.	.	2	1	.
Pellia epiphylla	.	.	.	.	.	.	.	.	.	.	.	2	1
Lepidopilum virens	2	.	.	.	.	.	.	.	.	.	.	.	.
Lophocolea heterophylla	.	+	.	.	.	.	.	.	.	.	.	.	.
Eurhynchium pumilum	.	.	1	.	.	.	.	.	.	.	.	.	.
Diplazium caudatum	.	.	.	.	.	1	.	.	.	.	.	.	.
Plagiomnium affine	.	.	.	.	.	.	1	.	.	.	.	.	.
Eurhynchium speciosum	.	.	.	.	.	.	.	2	.	.	.	.	.
Osmunda regalis	.	.	.	.	.	.	.	.	.	.	.	.	+

Relevé sites: (Cádiz province) 1, 2, 3 y 4: Sierra de Ojén, Los Cebrillos. 5 y 6: Sierra de Saladavieja, Altos del Mariscal. 7, 8, 9, 10 y 11: Sierra de Saladavieja, El Pedregoso. 12 y 13: Sierra de la Palma, Canuto del Prior. Biotope: A = rock in stream, R = oozing rock, S = splashed rock, RS = R+S.

This hygro-rheophilous community can be included in the alliance *Brachythecion plumosi* (order *Brachythecietalia plumoso-rivularis*, class *Platyhypnidio-Fontinaletea*). This syntaxon includes communities developing on acid, non-Alpine waters, and growing on splashed, amphibious or permanently submerged rocks, generally in ravines of high environmental humidity (Drehwald & Preising, 1991). In northern Iberia (Asturias, Galicia, etc.), where general climatic conditions are wetter, *Trichomanes speciosum* displays a quite different ecology, being found in mesophytic and humicolous (*Cladonio-Lepidozietea reptantis*) rather than hygrophilous-rheophilous communities.

A bryo-pteridophytic community characterised by the gametophyte of *Trichomanes speciosum* was described as *Trichomanietum speciosi* from Central

Europe (Huck, 1997). In this case, the community grows in rocky habitats (caves and rock fissures with high humidity) and the bryophytic stratum differs from *Homalio-Trichomanietum* in including *Calypogeia mulleriana* (Schiffn.) K. Müll., *Mnium hornum* Hedw., *Plagiothecium nemorale* (Mitt.) Jaeg., *P. platyphyllum* Mönk and *Pseudotaxiphyllum elegans* (Brid.) Iwats. Moreover, the association *Trichomanietum speciosi* belongs to a different class (*Cladonio-Lepidozietea reptantis,* order *Lophocoletalia heterophyllae*). Some authors (Ferrarini, 1977; Rumsey *et al*., 1998; Krippel, 2001) think that these habitats (Italy, Central Europe, Luxembourg) would have acted as periglacial (Atlantic period) or Tertiary refuges, the same as the mountains in the south of the Iberian Peninsula. A similar situation (habitats and bryophytes associated) of Tertiary relict refuges has been reported from the eastern United States by Farrar (1998) for *Trichomanes radicans* Sw.

Another community characterised by *T. speciosum* has been recently described as *Mnio horni-Vandenboschietum speciosae* (Rivas Martinez *et al*., 2002) from the north of the Iberian Peninsula (Cantabrian-Atlantic territories) and included in the alliance *Hymenophyllion tunbrigensis* (class *Anomodonto-Polypodietea*). Its bryophytic composition differs clearly from the *Homalio-Trichomanietum* ass. nova in the presence of *Mnium hornum* Hedw., *Diplophyllum albicans* (L.) Dum., *Saccogyna viticulosa* (L.) Dum. and *Jubula hutchinsiae* (Hook.) Dum. among its characteristic species. In contrast, *Homalia lusitanica*, *Thamnobryum alopecurum*, *Heterocladium wulfsbergii* or *Rhynchostegium riparioides,* all of them characteristic species for *Homalio-Trichomanietum* ass. nova, are absent in *Mnio-Vandenboschietum*. However, both associations are linked to wet, riparian habitats (*Rhododendron ponticum*, *Alnus glutinosa* (L.) Gaertn.).

In relation to other plant communities with *T. speciosum*, Sjögren (1997) recognises epiphyllous communities on long lasting fronds of *Trichomanes* in the Azores Islands.

Synusial ecology. The community of *T. speciosum* grows in lauroid woods of *Rhododendron ponticum*, which create micro-ecological conditions of complete shade, constantly high air and soil humidity, minimal day-night temperature range and scant seasonal variations. *Homalio-Trichomanietum* ass. nova appears in small hollows (Fig. 3) between quartz sandstone rocks, where the shade is intense and small waterfalls occur in permanent or semi-permanent streams. These small hollows are wet by splashes or, less occasionally, by oozing water. Very infrequently the community has been seen to be partially inundated by autumn rains. The community very occasionally grows on rocks in the flowing water or in slightly more open micro-biotopes, although, in this case, under a much denser tree cover (near 100% cover) of *Rhododendron*, *Laurus*, *Frangula*, *Ilex,* in shady confined sites. The small biotopes occupied by the community usually lack soil and the species cling directly to the sandstone quartz rocks, to which the community is associated throughout the distribution area of *Trichomanes speciosum* in the south of Spain. The same situation occurs in northern Europe and England with other particular geological substrata. These siliceous sandstones show low pH values and develop oligotrophic sandy soils (data from Andalusian Ministry of Environment).

Synchorology. Up to now endemic to the Natural Park of Los Alcornocales (Aljíbico sector, Tingitano-Onubo-Algarviense phytogeographical province *sensu* Pérez Latorre *et al.*, 1996, 1999). The distribution area of this

Fig. 3. Detail of a rock covered by bryophytes and *Trichomanes speciosum* (relevé number 12).

community is clearly influenced by the combined chorology of *Homalia lusitanica* and *Trichomanes speciosum* (SW of Europe and Macaronesia). The former's distribution includes Macaronesia, the Atlantic seaboard of Europe, including the Iberian Peninsula, and sporadically Yugoslavia and Italy, where it is a very rare and relict species (Düll, 1985). Given the absence of *H. lusitanica* in Great Britain and the presence there of a different combination of bryophytes, we consider the British community of *Trichomanes speciosum* as a different syntaxon (Ratcliffe *et al.*, 1993). The Macaronesian-Atlantic character of *Homalio-Trichomanietum* ass. nova is equally enhanced by *Calypogeia arguta* Nees & Mont., *Heterocladium wulfsbergii* (Crundwell & Smith, 2000), *Lepidopilum virens* and the cormophytes *Diplazium caudatum* and *Sibthorpia europaea* L.

Synphenology. As regards phenology, the bryophytic synusia, as a whole, is always present during the year. On the other hand, *Trichomanes* shows four clearly differentiated phases:

a - bud ("fiddlehead") phase (about 3 cm long), practically throughout the year. Most bud forms are seen at the end of autumn and in winter with a small proportion in summer.

b - juvenile frond phase (developed fronds but without sporangia). The juvenile fronds are more abundant at the end of winter, with a minimum in summer.

c - mature fronds (developed fronds with fertile sporangia). The mature fronds with sporangia are more frequent in spring and at the beginning of summer, with a minimum in winter,

d - old fronds (developed fronds with empty sporangia). Old fronds are more abundant in winter, being more or less constant in number during the rest of the year.

Fronds in all three phases can be seen throughout the year and mature fronds may last alive 14 months at least. However, these phenological data should be confirmed in the future through surveys over longer time- intervals.

Conservation, risks and proposal. The conservation of this community is necessarily linked to the overall conservation of the biotopes where it develops. We recommend that a Special Conservation Zone (NATURA 2000 European Community, "Habitats" Directive 92/43) should be set up to include the areas where exist the best populations of this species (mountain ranges in the triangle Facinas-Los Barrios-Algeciras: Sierras de Luna y Ojén, Fig. 1). The most important risks for this species involve forestry for extracting cork (from *Quercus suber*) and the degradation of the *Rhododendron* woods due to the uncontrolled introduction of herbivores for hunting. The extraction of water from the headwaters of the streams, and the contamination of soils and waters produced by nearby petrochemical industries are negative impacts. Maintaining the hydrology of the streams should be given special emphasis, due to the critical need of permanent moisture for the community survival. Sensitivity of the species to desiccation depends much on the recharging of water controlled by the forest cover. On the other hand, uncontrolled collection of fronds has been noticed. The natural risks arise from the scarcity of populations and potential biotopes (lauroid forests linked to permanent streams) and their topographical isolation. If the populations are ancient, all of the individuals are probably biotype clones due to genetic drift, that means, remnants of many past cycles of expansion and recession. The irregular rainfall due to the Mediterranean climate, in which the streams sometimes dry up completely, causes extreme water stress or may produce strong floods. In both cases the pteridophytic stratum may disappear. We think that the status of "Critically Endangered (CR)" (UICN 2001) should be assigned to *T. speciosum*. Its protection would imply the protection of a unique assemblage (Molesworth-Allen, 1977), including other relict pteridophytes (*Culcita macrocarpa*, *Diplazium caudatum* and *Pteris incompleta*) and the original forest of *Rhododendron ponticum*, which has been already included in the Annex I of the Habitats Directive 92/43CEE. On the other hand, when compared with other extra-Iberian localities, this area (Fig. 1) is almost the unique in developing and conserving sporophytes of *Trichomanes speciosum* in all continental Europe.

Syntaxonomical conspectus (bryo-pteridophytic syntaxa cited in the text)

PLATYHYPNIDIO-FONTINALIETEA Philippi 1956
Brachythecietalia plumoso-rivularis Drehwald & Preising 1991
Brachythecion plumosi Drehwald & Preising 1991
Homalio lusitanicae-Trichomanietum speciosi Pérez Latorre, M. J. Cano, Cabezudo and J. Guerra **ass. nova hoc loco** [Bryo-pteridophytic hygro-rheophilous south-Iberian vegetation]

CLADONIO-LEPIDOZIETEA REPTANTIS Jézěk and Vondráček 1962
Lophocoletalia heterophyllae Barkman 1958 (= *Lepidozietalia reptantis* Philippi 1965)
Alliance (?)
Trichomanietum speciosi Huck 1997 [Gameto-pteridophytic ultra-shaded vegetation]

ANOMODONTO-POLYPODIETEA Rivas Martínez 1975
Anomodonto-Polypodietalia O. Bolós & Vives *in* O. Bolós 1957
Bartramio-Polypodion serrati O. Bolós & Vives *in* O. Bolós 1957
Pterogonio gracilis-Davallietum canariensis Pérez Latorre, Cabezudo & J. Guerra 2000 [Bryo-pteridophytic epiphytic south Iberian vegetation]
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