

## **Checklist of Lycopodiopsida (clubmosses and quillworts) and Polypodiopsida (ferns) of Rwanda**

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## Checklist of *Lycopodiopsida* (clubmosses and quillworts) and *Polypodiopsida* (ferns) of Rwanda

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**Abstract:** The checklist comprises 208 species and two varieties of *Lycopodiopsida* and *Polypodiopsida*. All historic literature records, mainly from Brause & Hieronymus (1910) and Pichi Sermolli (1983, 1985) have been revised. The pteridological results of 39 years of botanical exploration of the flora of Rwanda by Eberhard Fischer, have been added. Two new varieties (*Pleopeltis macrocarpa* var. *dichotoma* and *P. macrocarpa* var. *pinnatiloba*) are validated.

**Keywords:** Central Africa, checklist, clubmosses, diversity, endemism, ferns, *Lycopodiopsida*, *Pleopeltis*, *Polypodiopsida*, pteridological history, quillworts, Rwanda

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### Introduction

The ferns and fern allies of Rwanda have received little attention. The only more detailed list providing localities was that by Pichi Sermolli (1983, 1985). Since then, only Roux (2009) published an updated list for all countries of Africa including Madagascar, albeit without reference to the single records.

During the preparation of an illustrated field guide of ferns and fern allies for Rwanda, including descriptions and keys for all taxa, the authors recorded numerous species as new country records and six species new to science, as well as two varieties previously not validly published. Two new species are already described, one in a paper on *Isoetes* in Central Africa (Fischer & Lobin 2022) and one *Dryopteris* species in a treatment of the exindusiate *Dryopteris* species from Central Africa (Fischer & Lobin 2023a). A further three new *Asplenium* species and a synoptic revision of the genus in Rwanda, as well as an overview of *Diplazium* with the description of a new species, have recently been published (Fischer & Lobin 2023b, 2023c).

The aim of the present publication is to provide the first checklist of all fern and clubmosses species recorded for Rwanda and the formal description of *Pleopeltis macrocarpa* var. *dichotoma* Eb. Fischer & Lobin and *P. macrocarpa* var. *pinnatiloba* Eb. Fischer & Lobin.

### Material and methods

The present checklist is based on an evaluation of the existing literature, herbarium studies in the following herbaria: B, BR, FI, K (abbreviations after Thiers 2022+), and fieldwork between 1984 and 2022. The authors have tried to verify all historic records, mainly from Brause (1910), Brause & Hieronymus (1910) and Pichi Sermolli (1983, 1985).

### Results and Discussion

#### History of pteridological exploration of Rwanda

Until 1907, the flora and fauna of Rwanda were almost unknown to science. During the expedition of Graf von Götzen in 1894 (Götzen 1895) no ferns appear to have been collected in Rwanda, although he listed a few fern collections from the ascent of Mt Nyiragongo, part of the Virunga massif in eastern Democratic Republic of Congo (D. R. Congo). Richard Kandt (see Bindseil 2008), who lived in Rwanda as a private naturalist from 1898–1902, 1905–1907, and later as the Imperial Resident for Rwanda until 1913, made some botanical collections, but only of flowering plants. In 1907 Adolf-Friedrich Her-

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zog zu Mecklenburg embarked on an expedition with the intention of exploring Rwanda and the eastern Belgian Congo. He was accompanied by the geologist Egon von Kirschstein, botanist Johannes Mildbraed, zoologist Hermann Schubotz, anthropologist Jan Czekanowski, Lieutenant and cartographer Max Weiss, physician and bacteriologist W. von Raven, as well as Lieutenant Walter von Wiese und Kaiserwaldau, Friedrich Weidemann, Sergeant Czczatka and 25 Askari (Herzog zu Mecklenburg 1909). They travelled by train to Lake Victoria and trekked to northeastern Rwanda, where they collected at Lake Mohasi (see Bamps 1975). Having visited the court of King Yuhi V. Musinga at Niansa, Mildbraed and Schubotz left the expedition for about two weeks in order to collect plants and animals in the Nyungwe forest (= Rugege Wald). By March 1908, Mildbraed had visited Lake Kivu and the Virunga Volcanoes, followed by the eastern Congo (Ituri, Aruwimi) and the Ruwenzori mountains. In May 1908 the expedition party travelled down the river Congo by steamboat until they reached the western coast of Africa. They arrived in Hamburg on 30<sup>th</sup> June 1908. The scientific results, including zoology, were not published until 1925. The botanical volume, edited by Mildbraed (1910) covered 718 pages. The ferns and fern allies were studied by Brause (1910), Brause & Hieronymus (1910) and Hieronymus (1910). The lycophytes were identified by Herter. The authors recognized 116 species collected during the expedition, among them 12 new species and one new variety. They recorded 47 species for Rwanda, five of them described as new (see Table 3). Their treatment would remain a classic work and, for almost 70 years, the only account for Rwanda and D. R. Congo (former Zaïre).

The next comprehensive work on the ferns was compiled by Pichi Sermolli (1983, 1985). He published an overview of the ferns of eastern D. R. Congo, Rwanda and Burundi. In these papers, he listed all available collections from the region, except those of Mildbraed, and the account is based on his own collections from 1956 and on those from researchers who mostly worked in the area between 1956 and 1982. Pichi Sermolli himself collected only for a few weeks in Rwanda, mainly in the Nyungwe Forest. But he included in his work many collections from various collectors. He described 15 new species, nine of them from Rwanda (see Table 3). In total, Pichi Sermolli recorded 112 species from Rwanda. He was aware of the outstanding botanical and zoological diversity of the region and stated that the Albertine Rift was poorly studied.

While a Flora for the seed plants of the Albert National Park (today Parc National des Virunga in D. R. Congo and Volcano National Park in Rwanda) was published by Robyns (1947, 1948) and Robyns & Tournay (1955), nothing was available for the ferns. In 1945 Taton produced a handwritten manuscript for the ferns of this national park, but it was never published (Bamps 1990). The French botanist H. Humbert was the first to collect

on Mt Kahuzi and Mt Biéga in 1929, and also visited the Virunga volcanoes. A. R. Christiaensen, a private researcher associated with the Institut de Recherche Scientifique en Afrique Centrale (IRSAC), collected ferns in Rwanda between 1955 and 1957.

After the independence of Rwanda and D. R. Congo (then Zaïre), several botanists continued to work in this phytogeographically interesting region. From December 1971 to March 1972 and in 1974, the members of the “Mission des Volcans”, P. H. Auquier, P. Bamps, J. E. J. Lambinon, and P. Van der Veken collected in the Nyungwe (= Rugege) Forest and on the volcanoes in Rwanda. They also made extensive collections on Mt Kahuzi, Mt Biéga and around the Irangi Station in D. R. Congo. G. Bouxin and M. Radoux collected in Akagera National Park between 1969 and 1970, and G. Bouxin made collections of ferns between 1970 and 1972 in Nyungwe Forest. During botanical explorations for the “Flore du Rwanda, Spermatophytes” (Troupin 1978, 1983, 1985, 1988), G. Troupin also collected ferns, mainly between 1956 and 1982. Since 1969, single volumes on ferns of the Flore d’Afrique Centrale (previously Flore du Congo du Rwanda et du Burundi) have appeared. Until now only volumes of ferns dealing with smaller families have been published (*Actiniopteridaceae*: Lawalrée 1969a, *Azollaceae*: Lawalrée 1976, *Blechnaceae*: Lawalrée 1971, *Davalliaceae*: Lawalrée 1993, *Equisetaceae*: Lawalrée 1969b, *Lindsaeaceae*: Kramer 1971, *Lycopodiaceae*: Lawalrée 1989, *Marsileaceae*: Launert 1975, *Nephrolepidaceae*: Lawalrée 2000, *Osmundaceae*: Lewalle 1973, *Parkeriaceae*: Lawalrée 1969c, *Psilotaceae*: Lawalrée 1969d, *Schizaeaceae*: Lawalrée 1970). Only in the treatment of *Selaginellaceae* (Bizzari 1985) was a larger number of 23 taxa included. Therefore, until now a total of 74 fern species from Central Africa (D. R. Congo, Rwanda, Burundi) have been subject to taxonomic treatment.

Kornaś & al. (1993) provided a distribution atlas of the ferns and fern allies of Rwanda based on the collections published by Pichi Sermolli (1983, 1985) and those of K. A. Nowak. The latter, a priest, lived in Rwanda from 1978 to 1984 and collected ferns in his spare time over almost all Rwanda (Kornaś & Nowak 1991). Seven species were mentioned for the first time for Rwanda. The majority of his specimens are deposited in Krakow (KRA) with duplicates in Meise (BR). Dzwonko & Kornaś (1994) analysed the distribution patterns and diversity of Rwandan ferns.

From 1984 to 2022 the first author (EF) studied the flora and vegetation of Rwanda and eastern D. R. Congo. He was among the first to collect in remote sites and botanically undercollected regions (e.g. Cyamudongo Forest, Busaga Forest, Kagitumba, Ibanda Makera etc.). He found 39 taxa for the first time in Rwanda, among them six species (see Table 3). 24 species are recorded for the first time in this checklist. The other 10 new records and the six new species have been published elsewhere.



Fig. 1. *Cystopteris diaphana*, E. Fischer s.n. – A, B: habit; C: frond, adaxial view; D: frond, abaxial view. – A–D: Rwanda, foot of Mt Bisoke, 22 Sep 2022, photographs by and © Eberhard Fischer. – Scale bars: A = 5 cm; B–D = 1 cm.

Table 1. Species number, species/area ratio and endemics of clubmosses, quillworts and ferns of continental African countries (including Cape Verde and islands of Gulf of Guinea).

Country	No. of species	Area (km <sup>2</sup> )	Species/area ratio	No. of endemics	% of endemics
Tanzania	423	945,087	0.00045	33	7.80%
D. R. Congo	314	2,345,409	0.00013	31	9.87%
South Africa	297	1,221,037	0.00024	50	16.84%
Cameroon	292	475,442	0.00061	18	6.16%
Kenya	290	580,367	0.00050	12	4.14%
Zimbabwe	289	390,757	0.00074	6	2.08%
Uganda	266	241,037	0.00110	10	3.76%
Mozambique	257	801,590	0.00032	4	1.56%
Malawi	236	118,484	0.00199	0	0%
Bioko	214	2017	0.10610	11	5.14%
Angola	212	1,246,700	0.00017	3	1.42%
<b>Rwanda</b>	<b>208</b>	<b>26,338</b>	<b>0.00790</b>	<b>28</b>	<b>13.46%</b>
Liberia	198	111,369	0.00178	3	1.52%
Burundi	182	27,834	0.00654	16	8.79%
Zambia	177	752,617	0.00024	4	2.26%
Nigeria	177	928,766	0.00019	1	0.56%
Ethiopia	175	1,104,300	0.00016	5	2.86%
Sudan (incl. South Sudan)	171	2,505,813	0.00007	1	0.58%
Guinea	155	245,857	0.00063	1	0.65%
Ghana	151	238,537	0.00063	2	1.32%
Côte d'Ivoire	143	322,463	0.00044	0	0%
Gabon	139	267,667	0.00052	3	2.16%
Congo	139	342,000	0.00041	1	0.72%
Equatorial Guinea	133	28,051	0.00474	1	0.75%
Sierra Leone	129	71,740	0.00180	1	0.78%
São Tomé	128	17	7.52941	13	10.16%
Swaziland	118	17,363	0.00680	5	4.24%
Central African Republic	93	622,984	0.00015	1	1.08%
Príncipe	64	136	0.47059	6	9.38%
Namibia	59	824,116	0.00007	8	13.56%
Benin	59	112,622	0.00052	0	0%
Togo	56	56,785	0.00099	0	0%
Botswana	42	581,730	0.00007	6	14.29%
Annobón	40	17	2.35294	4	10.00%
Somalia	40	637,657	0.00006	0	0%
Mali	39	1,240,192	0.00003	0	0%
Chad	37	1,284,000	0.00003	0	0%
Cape Verde	36	4033	0.00893	1	2.78%
Senegal	35	196,722	0.00018	0	0%
Burkina Faso	28	274,200	0.00010	1	3.57%
Eritrea	24	117,600	0.00020	1	4.17%
Guinea Bissau	24	36,125	0.00066	0	0%
Gambia	9	10,689	0.00084	0	0%
Niger	4	1,267,000	0.000003	0	0%

## Diversity and endemism

Roux (2009: 2) listed 166 species of ferns and fern allies for Rwanda. Of these two records (*Asplenium goetzei* and *Trichomanes crispiforme*) are erroneous and therefore excluded here. As a result of intensive field work, we were able to add 38 species, either as new country records or as species new to science. Roux (2012) provided three further species records in his monograph of *Dryopteris*. Three species (*Pseudolycopodiella affinis*, *Cystopteris diaphana*, *Polystichum wilsonii*) have been overlooked by Roux (2009). Therefore, 208 species are actually known.

Rwanda is placed twelfth among the top countries with a species-rich fern flora. The following numbers are mainly adopted from Roux (2009) with additional records from recent literature and own research. Tanzania is number one, harbouring 423 species, followed by the D. R. Congo with 314 species, South Africa with 297 species, Cameroon with 292 species, Kenya 290 species, Zimbabwe 289 species, Uganda 266 species, Mozambique 257 species (Odorico & al. 2022), Malawi 236 species, Bioko 214 species, Angola 212 species, Rwanda 208 species, and Liberia 198 species. For the adjacent country Burundi only 182 species are recorded, followed by Zambia and Nigeria, each with 177 species, Ethiopia with 175 species, Sudan (including South Sudan) with 171 species and Guinea with 155 species (Roux 2009; Ballings 2022) (Table 1).

The picture is quite different if we look at the species/area ratio. From this perspective, top of the list are the small islands of São Tomé with 128 species in 17 km<sup>2</sup> and a species/area ratio of 7.52941. Then come Annobón with 40 species in 17 km<sup>2</sup> and a species/area ratio of 2.35294, Príncipe with 64 species in 136 km<sup>2</sup> and a ratio of 0.47059, Bioko with 214 species in 2017 km<sup>2</sup> and a ratio of 0.10610, and the Cape Verde islands with 36 species in 4033 km<sup>2</sup> and a ratio of 0.00893. Rwanda with 208 species and a surface area of 26,338 km<sup>2</sup> is ranked at place six with a ratio of 0.00790 (Table 1). The large and diverse countries like Tanzania with 423 species and an area of 945,087 km<sup>2</sup> and the D. R. Congo with 314 species and a surface of 2,345,409 km<sup>2</sup> have only a ratio of 0.00045 and 0.00013, respectively. However, the high species number recognized for Rwanda is certainly the result of intensive collecting during the last three years, and Burundi and the eastern D. R. Congo probably harbour many species not yet recorded.

The complete absence of neophytic fern species is remarkable. The taxa known as neophytes in other parts of the World are the following: *Azolla filiculoides* Lam. is known from Morocco and southern Africa and has no natural occurrence on the African continent. The species has not yet been recorded for Rwanda. *Nephrolepis biserrata* Schott is frequently cultivated in Rwanda but there is no occurrence outside gardens. However, it has its natural distribution in all neighbouring countries. Other potential neophytes like *Selaginella kraussiana* (Kunze)

A. Br., *Christella dentata* (Forssk.) Brownsey & Jermy and *Pteris vittata* L have already been collected by Mildbraed in 1907 and occur in their natural distribution area. *Pteridium aquilinum* (L.) Kuhn is represented by the African subsp. *capense*, and its huge stands are already described by Mildbraed (1910) as “*Pteridium*-Formation”.

The number of Albertine Rift endemics and local endemics is considerably high in Rwanda. The Albertine Rift, as defined by Plumptre & al. (2007), includes much of the western Rift valley down to southern Tanzania and northern Zambia. We define it as the region from Lake Albert to the southern tip of Lake Tanganyika. Examples of important forest areas are Budongo Forest, Kibale NP, Ruwenzori, the Virunga Massif, Nyungwe and Kibira NP, Bururi Forest, Kahuzi-Biéga NP, Itombwe Massif, Mt Kabobo, Mahale Mts. NP, and the Marungu Plateau (Plumptre & al. 2007).

From the 208 species of ferns and fern allies recorded from Rwanda, 20 species are Albertine Rift endemics, present at least in Rwanda and eastern D. R. Congo or Burundi (Table 2), and eight species are local endemics, currently only known from Rwanda (Table 2). Therefore, 28 endemic species are recorded that represent 13.46% of the total fern flora.

If we compare the number of endemic species, Rwanda is ranked at number four after South Africa, which has 50 endemic species (mainly in *Isoetes* and *Cheilanthes*), Tanzania with 33 species and D. R. Congo with 31. Concerning the percentage of endemics for the whole fern flora, Rwanda with 13.46% ranks third after South Africa with 16.8% and Namibia with 13.5 %, and is followed by São Tomé and Annobón, each with 10%, and D. R. Congo with 9.8% (Table 1, 2). A list of all range-restricted ferns and fern-allies from continental Africa is provided in Supplementary table S1 (see Supplemental content online).

## Checklist

The taxa are arranged in systematic order after PPG (2016), and Wei & Zhang (2022). For the first records, we cite the name under which the relevant author published it. Misidentifications are recognizable by “auct. non”, synonyms bear full authors citations. New records for Rwanda are marked with “+” before the species name.

The Checklist contains 208 species and two varieties. The most species-rich fern-genus in Rwanda is *Asplenium* with 44 species (almost every fifth species is an *Asplenium*), followed by *Pteris* (11 species) and *Dryopteris* (10 species out of 26 recorded by Roux (2012) for the whole African continent).

In Rwanda the exploration of the pteridological flora had three major periods: at the beginning of the 20<sup>th</sup> century, culminating with the collections from Mildbraed (Mildbraed 1910), a second period in the 1950s with the main collector Pichi Sermolli (Pichi Sermolli 1983, 1985), and a third, from 1984 until today mainly with the collec-

tions from the first author, Eberhard Fischer. An enumeration of the number of species mentioned by the above cited collectors for the first time for Rwanda is found in Table 3.

### *Lycopodiopsida* *Isoetaceae*

*Isoetes rwandensis* Eb. Fisch. & Lobin  
First recorded — Fischer & Lobin (2022: 332).  
Endemic status — Local endemic.

### *Lycopodiaceae* *Huperziaceae*

*Phlegmariurus afromontanus* (Pic. Serm.) A. R. Field & Bostock  
First recorded — Pichi Sermolli (1983: 183) as *Huperzia afromontana* Pic. Serm.  
Endemic status — Albertine Rift endemic.

*Phlegmariurus bampsianus* (Pic. Serm.) A. R. Field & Bostock  
First recorded — Pichi Sermolli (1985: 193) as *Huperzia bampsiana* Pic. Serm.  
Endemic status — Local endemic.

*Phlegmariurus gnidioides* (L. f.) A. R. Field & Bostock  
First recorded — Pichi Sermolli (1983: 184) as *Huperzia gnidioides* L. f.

*Phlegmariurus mildbraedii* (Herter) A. R. Field & Bostock  
First recorded — Brause (1910: 38) (determination W. Herter) as *Lycopodium mildbraedii* Herter.

*Phlegmariurus saururus* (Lam.) B. Øllg.  
First recorded — Brause (1910: 38) (determination W. Herter) as *Lycopodium saururus* Lam.

*Phlegmariurus verticillatus* (L. f.) A. R. Field & Testo  
First recorded — Pichi Sermolli (1983: 185) as *Huperzia verticillata* (L. f.) Trevis.

### *Lycopodielloideae*

*Palhinaea cernua* (L.) Carv. Vasc. & Franco  
First recorded — Brause (1910: 39) (determination W. Herter) as *Lycopodium capillaceum* (Willd. ex Spring) Willd. ex Spring.

*Pseudolycopodiella affinis* (Bory ex Willd.) Holub  
First recorded — Brause (1910: 39) (determination W. Herter) as *Lycopodium carolinianum* auct. non L.  
Note — Although already mentioned by Brause (1910) (*J. Mildbraed* 968, B 20 0109407 [https://herbarium.bgbm.org/object/B200109407]), this species has been overlooked by recent researchers (e.g. Roux 2009).

### *Lycopodioideae*

*Lycopodium clavatum* L.  
First recorded — Brause (1910: 39) (determination W. Herter) as *Lycopodium trichophyllum* auct. non Desv.

### *Selaginellaceae*

+*Selaginella caffrorum* (Milde) Hieron.  
New record — RWANDA: EASTERN PROVINCE: Nyarubuye, Rugarama, quartzitic rocks on sun-exposed rock faces, 02°09'16.12"S, 30°42'56.19"E, 1743 m, 10 Apr 2005, *E. Fischer s.n.* (KOBL); Nyarubuye, 02°08'54.74"S, 30°45'00.37"E, 1749 m, 30 Mar 2014, *E. Fischer s.n.* (KOBL).

*Selaginella goudotana* Spring  
First recorded — Bizzarri in Pichi Sermolli (1983: 188) as *Selaginella goudotana* var. *abyssinica* (Spring) Bizzarri.

*Selaginella kraussiana* (Kunze) A. Br.  
First recorded — Hieronymus (1910: 40).

*Selaginella lewalleana* Bizzarri  
First recorded — Bizzarri (1981: 222).  
Endemic status — Albertine Rift endemic.

+*Selaginella mittenii* Baker  
New record — RWANDA: WESTERN PROVINCE: Nyungwe NP, Cyamudongo Forest, wet rocks in montane forest, 02°33'04.03"S, 28°59'48.58"E, 1732 m, 6 Sep 2017, *E. Fischer s.n.* (KOBL).

*Selaginella soyauxii* Hieron.  
First recorded — Bizzarri in Pichi Sermolli (1983: 189).

+*Selaginella tenerrima* A. Br. ex Kuhn  
New record — RWANDA: WESTERN PROVINCE: Nyungwe NP, Cyamudongo Forest, Forest floor or on wet rocks near streams and waterfalls in montane forest, 1732 m, 02°33'04.03"S, 28°59'48.58"E, 4 Apr 2021, *E. Fischer s.n.* (KOBL).  
Note — Roux (2009: 28) listed Rwanda under *Selaginella tenerrima*, albeit without mentioning a published record. Bizzarri (1985) has recorded the species only in D. R. Congo and Burundi. Therefore, our collections from Rwanda represent the first definite record of the species.

### *Polypodiopsida* *Ophioglossidae* *Ophioglossaceae*

*Ophioglossum costatum* R. Br.  
First recorded — Brause (1910: 38) as *Ophioglossum fibrosum* Schumach.

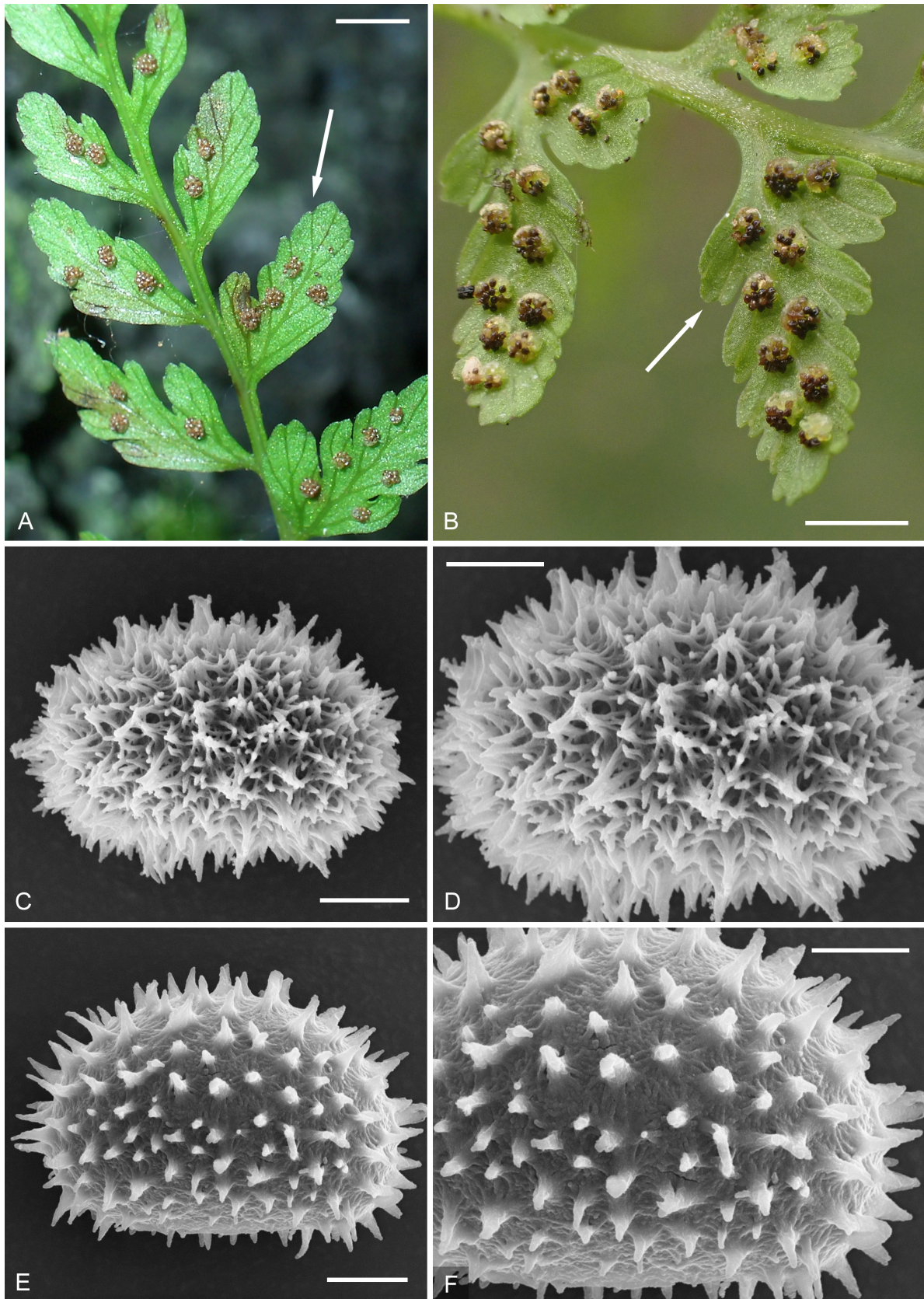


Fig. 2. *Cystopteris diaphana*, E. Fischer s.n. – A, B: pinnules, showing veins ending in sinuses between teeth (arrows); C, D: SEM micrographs of spores. – *Cystopteris fragilis*, E. Fischer s.n. – E, F: SEM micrographs of spores. – A–D: Rwanda, foot of Mt Bisoke, 22 Sep 2021, photographs by and © Eberhard Fischer (A, B) and by Eberhard Fischer, Wolfram Lobin and Yaron Malkowsky (C, D). – E, F: Germany, Koblenz, photographs by Eberhard Fischer, Wolfram Lobin and Yaron Malkowsky. – Scale bars: A, B = 5 mm; C, E = 10  $\mu$ m; D, F = 8  $\mu$ m.



**+*Ophioglossum thomasi*** R. T. Clausen

*New record* — RWANDA: NORTHERN PROVINCE: W Mukamira S of Bigogwe, granitic outcrops, 01°38'45.56"S, 29°23'37.08"E, 2425 m, Oct 1989, E. Fischer s.n. (KOB).

***Ophioglossum vulgatum*** subsp. ***africanum*** Pocock ex J. E. Burrows

*First recorded* — Pichi Sermolli (1983: 193) as *Ophioglossum vulgatum* L.

**Marattiidae****Marattiaceae*****Ptisana africana*** Christenh.

*First recorded* — Brause (1910: 37) as *Marattia fraxinea* auct. non Sm.

**Polypodiidae****Anemiaceae*****Anemia lepigera*** (Baker) Christenh.

*First recorded* — Pichi Sermolli (1983: 209) as *Mohria lepigera* (Baker) Baker.

**Aspleniaceae*****Asplenium abyssinicum*** Fée

*First recorded* — Pichi Sermolli (1985: 125).

***Asplenium adiantum-nigrum*** L.

*First recorded* — Fischer & Lobin (2023c: 9).

***Asplenium aethiopicum*** (N. L. Burm.) Becherer subsp. ***aethiopicum***

*First recorded* — Brause & Hieronymus (1910: 19) as *Asplenium furcatum* Thunb.

***Asplenium africanum*** Desv.

*First recorded* — Fischer & Lobin (2023c: 9).

***Asplenium boltonii*** Hook. ex Schelpe

*First recorded* — Fischer & Lobin (2023c: 9).

***Asplenium bugoiense*** Hieron.

*First recorded* — Hieronymus in Brause & Hieronymus (1910: 10).

***Asplenium burundense*** Pic. Serm.

*First recorded* — Fischer & Lobin (2023c: 10).

*Endemic status* — Albertine Rift endemic.

***Asplenium cancellatum*** Alston

*First recorded* — Fischer & Lobin (2023c: 10).

***Asplenium ceii*** Pic. Serm.

*First recorded* — Brause & Hieronymus (1910: 12) as *Asplenium loxoscaphoides* auct. non Baker.

***Asplenium centrafricanum*** Pic. Serm.

*First recorded* — Brause & Hieronymus (1910: 12) as *A. sertularioides* auct. non Baker.

*Endemic status* — Albertine Rift endemic.

***Asplenium christii*** Hieron.

*First recorded* — Fischer & Lobin (2023c: 14).

***Asplenium dregeanum*** Kunze

*First recorded* — Pichi Sermolli (1985: 131) as *Asplenium dregeanum* subsp. *brachypterum* (Kunze ex Houlist. & T. Moore) Pic. Ser.

***Asplenium elliotii*** C. H. Wright

*First recorded* — Brause & Hieronymus (1910: 8) as *Asplenium chlaenopteron* auct. non Fée.

***Asplenium erectum*** Bory ex Willd.

*First recorded* — Pichi Sermolli (1985: 133) as *Asplenium erectum* var. *usambarense* (Hieron.) Schelpe.

***Asplenium friesiorum*** C. Chr.

*First recorded* — Brause & Hieronymus (1910: 16) as *Asplenium decrescens* auct. non Kunze.

***Asplenium gemmascens*** Alston

*First recorded* — Pichi Sermolli (1985: 135).

***Asplenium hypomelas*** Kuhn

*First recorded* — Pichi Sermolli (1985: 123) as *Loxoscapha nigrescens* T. Moore.

***Asplenium inaequilaterale*** Willd.

*First recorded* — Fischer & Lobin (2023c: 19).

***Asplenium linckii*** Kuhn

*First recorded* — Pichi Sermolli (1985: 143).

***Asplenium lividum*** Mett.

*First recorded* — Fischer & Lobin (2023c: 19).

***Asplenium loxoscaphoides*** Baker

*First recorded* — Brause & Hieronymus (1910: 12).

***Asplenium majus*** (Hieron.) Pic. Serm.

*First recorded* — Brause & Hieronymus (1910: 19) as *Asplenium goetzei* var. *majus* Hieron. in Brause & Hieronymus (1910: 8).

***Asplenium mannii*** Hook.

*First recorded* — Pichi Sermolli (1985: 144).

***Asplenium markusbeckeri*** Eb. Fisch. & Lobin

*First recorded* — Fischer & Lobin (2023c: 24).

*Endemic status* — Albertine Rift endemic.



Fig. 3. Habit of *Pleopeltis macrocarpa* var. *dichotoma*, E. Fischer s.n. – A: Rwanda, Mt Gahinga, 20 Mar 2022, photograph by and © Eberhard Fischer; B–D: Germany, in cultivation in Botanical Gardens Bonn, photographs by and © Eberhard Fischer and Wolfram Lobin. – Scale bars: A, B = 1 cm.

***Asplenium megalura*** Hieron.

*First recorded* — Pichi Sermolli (1985: 144).

***Asplenium mildbraedii*** Hieron.

*First recorded* — Hieronymus in Brause & Hieronymus (1910: 21).

***Asplenium monanthes*** L.

*First recorded* — Brause & Hieronymus (1910: 15).

***Asplenium musiraense*** Viane

*First recorded* — Pichi Sermolli (1985: 127) as *Asplenium buettneri* auct. non Hieron.

*Endemic status* — Albertine Rift endemic.

***Asplenium normale*** D. Don

*First recorded* — Pichi Sermolli (1985: 146).

***Asplenium preussii*** Hieron.

*First recorded* — Pichi Sermolli (1985: 147) as *Asplenium pseudoauriculatum* Schelpe.

***Asplenium protensum*** Schrad.

*First recorded* — Brause & Hieronymus (1910: 16).

***Asplenium ramicola*** Eb. Fisch. & Lobin

*First recorded* — Fischer & Lobin (2023c: 35).

*Endemic status* — Local endemic.

***Asplenium rukaraense*** Hieron.

*First recorded* — Hieronymus in Brause & Hieronymus (1910: 12).

*Endemic status* — Albertine Rift endemic.

***Asplenium rutifolium*** (P. J. Bergius) Kunze

*First recorded* — Pichi Sermolli (1985: 152) as *Asplenium strangeanum* Pic. Serm.

***Asplenium sandersonii*** Hook.

*First recorded* — Brause & Hieronymus (1910: 15).

***Asplenium sertularioides*** Baker

*First recorded* — Brause & Hieronymus (1910: 12).

***Asplenium smedsii*** Pic. Serm.

*First recorded* — Pichi Sermolli (1985: 152).

***Asplenium stuhlmannii*** Hieron.

*First recorded* — Pichi Sermolli (1985: 152).

***Asplenium tenuicaudatum*** Pic. Serm.

*First recorded* — Pichi Sermolli (1985: 153).

*Endemic status* — Albertine Rift endemic.

***Asplenium theciferum*** var. *concinnum* (Schrad.) Schelpe

*First recorded* — Pichi Sermolli (1985: 124) as *Loxoscapha thecifera* var. *concinna* (Schrad.) Kuhn.

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

*First recorded* — Fischer & Lobin (2023c: 46).

***Asplenium uhligii*** Hieron.

*First recorded* — Pichi Sermolli (1985: 136) as *Asplenium kassneri* auct. non Hieron.

***Asplenium uschiaae*** Eb. Fisch. & Lobin

*First recorded* — Fischer & Lobin (2023c: 50).

*Endemic status* — Albertine Rift endemic.

***Asplenium volkensisii*** Hieron.

*First recorded* — Pichi Sermolli (1985: 153).

***Hymenasplenium kenyense*** Li Bing Zhang, K. W. Xu & Kamau

*First recorded* — Fischer & Lobin (2023c: 57).

### Athyriaceae

***Athyrium newtonii*** Baker

*First recorded* — Pichi Sermolli (1985: 154) as *Athyrium scandicinum* auct. non (Willd.) C. Presl.

***Athyrium schimperii*** Moug. ex Fée

*First recorded* — Pichi Sermolli (1985: 155).

***Deparia boryana*** (Willd.) M. Kato

*First recorded* — Pichi Sermolli (1985: 155) as *Dryoathyrium boryanum* (Willd.) Ching.

***Diplazium cyamudongense*** Eb. Fisch. & Lobin

*First recorded* — Fischer & Lobin (2023b: 170).

*Endemic status* — Local endemic.

***Diplazium humbertii*** (C. Chr.) Pic. Serm.

*First recorded* — Pichi Sermolli (1985: 155).

*Endemic status* — Albertine Rift endemic.

***Diplazium zanzibaricum*** (Baker) C. Chr.

*First recorded* — Kornaś & Nowak (1991: 12).

### Blechnaceae

***Lomaridium attenuatum*** (Sw.) Gasper & V. A. O. Dittrich

*First recorded* — Pichi Sermolli (1985: 191) as *Blechnum giganteum* (Kaulf.) Schldl.

***Lomariocycas tabularis*** (Thunb.) Gasper & A. R. Sm.

*First recorded* — Brause & Hieronymus (1910: 27) as *Blechnum tabulare* (Thunb.) Kuhn.

### Cyatheaceae

***Alsophila dregei*** (Kunze) R. M. Tryon

*First recorded* — Pichi Sermolli (1983: 254).



Fig. 4. *Pleopeltis macrocarpa* var. *pinnatiloba*, E. Fischer s.n. – A, B, D: habit; C: frond. – A–C: Rwanda, Mt Gahinga, 20 Mar 2022 (A), 5 Oct 2006 (B, C), photographs by and © Eberhard Fischer; D: Germany, in cultivation in Botanical Gardens Bonn, photograph by and © Wolfram Lobin. – Scale bars: A = 5 cm; B–D = 1 cm.

*Alsophila manniana* (Hook.) R. M. Tryon  
*First recorded* — Brause (1910: 1) as *Cyathea engleri* Hieron.

### Cystopteridaceae

*Cystopteris diaphana* (Bory) Blasdell.

*First recorded* — Brause & Hieronymus (1910: 2) mentioned *Cystopteris fragilis* auct. non (L.) Bernh., but this was overlooked by recent researchers (e.g. Roux 2009).

*Note* — *Cystopteris diaphana* [= *C. viridula* (Desv.) Desv.] according to Lobin (1986), is distinguished by the veins ending in sinuses between the teeth (vs ending in apices of teeth in *C. fragilis*) and the spiny-lacunar spores, so densely covered with spines that they obscure the surface (vs echinate spores loosely covered with spines in *C. fragilis*) (Fig. 1, 2). He recorded the species for the Canary Islands.

Fraser-Jenkins (1986) made the first record for the African mainland (Cameroon). A description of *C. viridula* with comparison to *C. fragilis* is also provided by Murphy & Rumsey (2005). Verdcourt (2003: 5) distinguished two subspecies of *C. fragilis*. His “subspecies B” exactly matches the key characters of *C. diaphana*. Roux (2009) followed Verdcourt’s taxonomic view (2003) and listed “subspecies B” from Algeria, Morocco, Cameroon, Sudan, Ethiopia, Uganda, Kenya, Lesotho and South Africa. All records probably belong to *C. diaphana* but need verification by spore characters. According to Roux (2009), this species is known only from the Comoro Islands and Réunion. The author also erroneously placed *C. viridula* as a synonym of *C. fragilis*. Here we provide the first definite record of *C. diaphana* for Central Africa.

### Davalliaceae

+*Davallia chaerophylloides* (Poir.) Steud.

*New record* — RWANDA: WESTERN PROVINCE: Rubavu (= Gisenyi), epiphyte on oil palm, 01°42'11.62"S, 29°15'32.15"E, 1472 m, 4 Oct 2022, *E. Fischer s.n.* (KOB). (KOB).

### Dennstaedtiaceae

*Blotiella bouxiniana* Pic. Serm.

*First recorded* — Pichi Sermolli (1983: 262).

*Endemic status* — Albertine Rift endemic.

*Blotiella glabra* (Bory) R. M. Tryon

*First recorded* — Brause & Hieronymus (1910: 31) as *Lonchitis pubescens* Willd.

*Histiopteris incisa* (Thunb.) J. Sm.

*First recorded* — Pichi Sermolli (1983: 261).

*Hypolepis rugosula* subsp. *pichi-sermolliana* Schwartsb. & J. Prado

*First recorded* — Pichi Sermolli (1983: 258) as *Hypolepis rugosula* var. *africana* C. Chr.

*Note* — Schwartsburd & Prado (2014) revised the difficult species complex *Hypolepis rugosula* and separated 15 geographically distinct subspecies.

*Hypolepis sparsisora* (Schrad.) Kuhn

*First recorded* — Pichi Sermolli (1983: 260).

*Microlepia speluncae* (L.) T. Moore

*First recorded* — Brause & Hieronymus (1910: 6).

*Note* — Kornaś & Nowak (1991) claim this species as a new record for the Flora of Rwanda, overlooked the above citation.

*Pteridium aquilinum* subsp. *capense* (Thunb.) C. Chr.

*First recorded* — Pichi Sermolli (1983: 260) as *Pteridium aquilinum* (L.) Kuhn subsp. *aquilinum*.

+*Pteridium centrali-africanum* (Hieron.) Alston

*New record* — RWANDA: EASTERN PROVINCE: rocky savanna N of Karemba, 02°05'58.82"S, 30°26'45.86"E, 1389 m, 8 Dec 2021, *E. Fischer s.n.* (KOB).

*Note* — Thomson & al. (2005) and Roux (2009: 112) cited Rwanda among the distribution records. However, we could not find any earlier record for the country, and neither Thomson & al. (2005) nor Roux (2009) cited any sources. Our collection is apparently the first record.

All *Pteridium* specimens from Meise (BR) collected in Rwanda, three of which were misidentified as *Pteridium aquilinum* var. *africanum* (Bonap.) R. M. Tryon (= *P. centrali-africanum*), are *P. aquilinum* subsp. *capense*. The latter taxon is found in montane forests on open ground and clearings, while *P. centrali-africanum* is restricted to grassland and dry forests.

### Didymochlaenaceae

*Didymochlaena spinulosa* (Brause) Li Bing Zhang & H. Shang

*First recorded* — Pichi Sermolli (1985: 176) as *Didymochlaena truncatula* auct. non (Sw.) J. Sm.

*Note* — Shang & Zhang (2023) published a revision of the formerly monotypic genus *Didymochlaena* and recognized 22 species.

### Dryopteridaceae

#### Dryopteridoideae

*Arachniodes webbiana* subsp. *foliosa* (C. Chr.) Gibby & al.

*First recorded* — Pichi Sermolli (1985: 175) as *Arachniodes foliosa* (C. Chr.) Schelpe.

***Dryopteris antarctica*** (Baker) C. Chr.

*First recorded* — Pichi Sermolli (1985: 157) as *Dryopteris callolepis* C. Chr.

***Dryopteris athamantica*** (Kunze) Kuntze

*First recorded* — Pichi Sermolli (1985: 157).

***Dryopteris fadenii*** Pic. Serm.

*First recorded* — Roux (2012: 48).

***Dryopteris kilemensis*** (Kuhn) Kuntze

*First recorded* — Pichi Sermolli (1985: 157).

*Note* — Kuhn (1868: 24) called his new species *Aspidium kilmense* and cited as collection “Kilma”. Kunze (1891: 813) placed it in *Dryopteris* as *D. kilmensis* (not “*kilemensis*” as Roux [2009: 122] states). In his checklist, Roux (2009: 122) listed the species as *D. kilemensis*. However, in his monograph Roux (2012: 63) again named it *D. kilmensis*, following Kuhn (1868).

Kuhn (1868: 24) and Roux (2012: 122) gave the type locality as “Kilma”. We have checked the holotype in B (B 20 0051628!), where the collectors Von der Decken & Kersten clearly wrote “Kilema ad radices montis Kili-mandjaro”. Therefore, the species name must be *D. kilemensis*.

**+*Dryopteris lewalleana*** Pic. Serm.

*New record* — RWANDA: WESTERN PROVINCE, Nyungwe NP, Cyamudongo Forest, terrestrial in montane forests, 2003 m, 02°32'29.33"S, 28°59'06.56"E, 3 Apr 2021, *E. Fischer s.n.* (KOBL); Nyungwe NP, Cyamudongo Forest, terrestrial in montane forests, 1991 m, 02°33'32.58"S, 28°59'04.86"E, 18 Sep 2021, *E. Fischer s.n.* (KOBL).

*Note* — *Dryopteris lewalleana* was described from Burundi, where it occurred in the Kibira National Park. This NP is the continuation of Nyungwe NP in Rwanda, where it was found recently.

***Dryopteris manniana*** (Hook.) C. Chr.

*First recorded* — Pichi Sermolli (1985: 163).

***Dryopteris pentheri*** (Krasser) C. Chr.

*First recorded* — Brause & Hieronymus (1910: 3) as *Dryopteris filix-mas* var. *elongata* sensu Brause & Hieronymus non *D. elongata* auct. non (Sw.) Sim.

***Dryopteris ruwenzoriensis*** C. Chr. ex Fraser-Jenkins

*First recorded* — Roux (2012: 97).

*Endemic status* — Albertine Rift endemic.

***Dryopteris schimperiana*** (Hochst. ex A. Br.) C. Chr.

*First recorded* — Roux (2012: 101).

***Dryopteris schizopaleata*** Eb. Fisch. & Lobin

*First recorded* — Fischer & Lobin (2023a: 138).

*Endemic status* — Local endemic.

***Dryopteris squamiseta*** (Hook.) Kuntze

*First recorded* — Pichi Sermolli (1985: 156) as *Nothoperanema squamiseta* (Hook.) Ching.

***Polystichum transvaalense*** N. C. Anthony

*First recorded* — Roux (2000: 51).

***Polystichum wilsonii*** Christ

*First recorded* — Brause & Hieronymus (1910: 4) as *Polystichum aculeatum* auct. non (L.) Roth.

*Note* — Roux (2000: 56) did not list Rwanda in his “Distribution”, but in his paragraph “without exact locality”, he listed a specimen from “Karisimbi (versant sud) nr. Biuri, c. 3000 m, De Witte 1246 (BR)”, which is a locality in Rwanda.

*Elaphoglossoideae****Elaphoglossum acrostichoides*** (Hook. & Grev.) Schelpe

*First recorded* — Pichi Sermolli (1985: 180).

***Elaphoglossum aubertii*** (Desv.) T. Moore

*First recorded* — Pichi Sermolli (1985: 181).

***Elaphoglossum conforme*** (Sw.) J. Sm.

*First recorded* — Pichi Sermolli (1985: 181).

***Elaphoglossum deckenii*** (Kuhn) C. Chr.

*First recorded* — Pichi Sermolli (1985: 181).

***Elaphoglossum hybridum*** (Bory) Brack.

*First recorded* — Pichi Sermolli (1985: 181).

***Elaphoglossum kivuense*** Schelpe

*First recorded* — Pichi Sermolli (1985: 182).

*Endemic status* — Albertine Rift endemic.

***Elaphoglossum lancifolium*** (Desv.) C. V. Morton

*First recorded* — Pichi Sermolli (1985: 186) as *Elaphoglossum salicifolium* (Willd. ex Kaulf.) Alston.

***Elaphoglossum rwandense*** Pic. Serm.

*First recorded* — Pichi Sermolli (1985: 184).

*Endemic status* — Local endemic.

***Elaphoglossum tanganjicense*** Kraijna ex Pic. Serm.

*First recorded* — Pichi Sermolli (1985: 186).

**+*Lastreopsis vogelii*** (Hook.) Tindale

*New record* — RWANDA: NORTHERN PROVINCE: Kinigi, 25 Jun 1961, *S. C. Antun Gupfert 1005* (BR0000017581714!).

*Note* — This specimen was deposited in BR as *Lastreopsis* sp. It has never been determined and published, and the species is not recorded for Rwanda in the checklist of Roux (2009). We searched for the species at Kinigi without success.

**Gleicheniaceae**

***Dicranopteris linearis*** (N. L. Burm.) Underw.  
First recorded — Pichi Sermolli (1983: 196).

***Gleichenia elongata*** Baker  
First recorded — Pichi Sermolli (1983: 196) as *Gleicheniastrum elongatum* (Baker) Nakai.

***Sticherus flagellaris*** subsp. ***tomentosus*** (Reimers) Verdc.  
First recorded — Pichi Sermolli (1983: 197) as *Sticherus inflexus* Pic. Serm.

Note — Roux (2009: 50) listed both taxa for Rwanda. However, *Sticherus inflexus* is generally considered to be a synonym of *S. flagellaris* subsp. *tomentosus*.

**Hymenophyllaceae****Trichomanoideae**

***Abrodictyum rigidum*** (Sw.) Ebihara & Dubuisson  
First recorded — Pichi Sermolli (1983: 252) as *Selodesmium rigidum* (Sw.) Copel.

**+*Crepidomanes chevalieri*** (Christ.) Ebihara & Dubuisson

New record — RWANDA: NORTHERN PROVINCE: Volcano NP, Ibhanga Forest, terrestrial in submontane forest on lava rocks, 01°34'12.56"S, 29°38'08.17"E, 1625 m, 30 Mar 2009, *E. Fischer s.n.* (KOBL).

Note — Roux (2009) listed *Crepidomanes chevalieri* for Rwanda but without citing any source.

**+*Crepidomanes clarenceanum*** (F. Ballard) Pic. Serm.  
New record — RWANDA: WESTERN PROVINCE: Nyungwe NP, Cyamudongo Forest, epiphyte on mossy trees, often forming dense carpets, 02°33'04.03"S, 28°59'48.58"E, 1732 m, 6 Jan 2019, *E. Fischer s.n.* (KOBL).

***Crepidomanes frappieri*** (Cordem.) J. P. Roux  
First recorded — Pichi Sermolli (1983: 251) as *Vandenboschia ramitricha* (Faden) Pic. Serm.

***Crepidomanes inopinatum*** (Pic. Serm.) J. P. Roux  
First recorded — Pichi Sermolli (1983: 245) as *Vandenboschia inopinata* Pic. Serm.

***Crepidomanes mannii*** (Hook.) J. P. Roux  
First recorded — Pichi Sermolli (1983: 245) as *Gonocormus mannii* (Hook.) Copel.

***Crepidomanes melanotrichum*** (Schltdl.) J. P. Roux  
First recorded — Pichi Sermolli (1983: 249) as *Vandenboschia melanotricha* (Schltdl.) Pic. Serm.

***Didymoglossum erosum*** (Willd.) J. P. Roux  
First recorded — Pichi Sermolli (1983: 254) as *Microgonium erosum* (Willd.) C. Presl.

***Polyphlebium borbonicum*** (Bosch) Ebihara & Dubuisson

First recorded — Pichi Sermolli (1983: 245) as *Vandenboschia borbonica* (Bosch) G. Kunkel.

***Vandenboschia gigantea*** (Bory ex Willd.) Pic. Serm.  
First recorded — Pichi Sermolli (1983: 250) as *Vandenboschia radicans* auct. non (Sw.) Copel.

**Hymenophylloideae**

***Hymenophyllum capillare*** Desv.  
First recorded — Pichi Sermolli (1983: 243) as *Sphaerocionium capillare* (Desv.) Copel.

***Hymenophyllum kuhnii*** C. Chr.  
First recorded — Pichi Sermolli (1983: 242) as *Mecodium kuhnii* (C. Chr.) Copel.

***Hymenophyllum peltatum*** (Poir.) Desv.  
First recorded — Pichi Sermolli (1983: 244).

***Hymenophyllum splendidum*** Bosch  
First recorded — Pichi Sermolli (1983: 243) as *Sphaerocionium splendidum* (Bosch) Copel.

***Hymenophyllum triangulare*** Baker  
First recorded — Pichi Sermolli (1983: 244) as *Meringium triangulare* (Baker) Copel.

**Lindsaeaceae**

***Odontosoria africana*** F. Ballard  
First recorded — Brause & Hieronymus (1910: 6) as *Odontosoria melleri* auct. non (Hook.) C. Chr.  
Endemic status — Albertine Rift endemic.

**Lomariopsidaceae**

***Lomariopsis warneckei*** (Hieron.) Alston  
First recorded — Pichi Sermolli (1985: 180).

**Marsileaceae**

***Marsilea gibba*** A. Br.  
First recorded — Pichi Sermolli (1983: 241).

**+*Marsilea minuta*** L. var. ***minuta***  
New record — RWANDA: EASTERN PROVINCE: Bugesera, Nyamata, seasonal shallow ponds on ferricretes, 02°07'00.91"S, 30°04'07.67"E, 1415 m, 9 Jan 2012, *E. Fischer s.n.* (KOBL); Mpanga, seasonal shallow ponds on ferricretes, 02°04'56.65"S, 30°46'39.96"E, 1310 m, Oct 1985, *E. Fischer*; Akagera NP, near Lake Ihema, 1 Oct 2013, *E. Fischer s.n.* (KOBL).

Note — Pichi Sermolli (1983) cited a specimen of *Marsilea* sp. cf. *M. minuta* L. from eastern Rwanda (piste

Gabiro-Gatsibu, km 7, marais Kibondu, env. 1500 m, *Van der Veken 10691* [BR0000017596121!]). The specimen is sterile and unidentifiable. There are four additional sterile specimens at BR.

Roux (2009: 56) listed Rwanda under *Marsilea minuta*, but did not mention a published record. Therefore, our collections from Rwanda represent the first definite record of the species.

### *Nephrolepidaceae*

*Nephrolepis undulata* (Afz. ex Sw.) J. Sm.

*First recorded* — Brause & Hieronymus (1910: 6) as *Nephrolepis cordifolia* auct. non (L.) C. Presl.

### *Oleandraceae*

*Oleandra distenta* Kunze

*First recorded* — Pichi Sermolli (1985: 189).

### *Osmundaceae*

*Osmunda hilsenbergii* Grev. & Hook.

*First recorded* — Brause (1910: 37) as *Osmunda regalis* var. *brevifolia* Desv. and *O. regalis* var. *capensis* (Presl.) Milde.

### *Polypodiaceae*

#### *Crypsinoideae*

*Drynaria volkensii* Hieron.

*First recorded* — Brause & Hieronymus (1910: 33).

*Note* — Some authors prefer the name *Aglaomorpha volkensii* (Hieron.) Hovenkamp & S. Linds. for this taxon, but we follow Wei & Zhang (2022).

#### *Grammitidoideae*

+*Cochlidium serrulatum* (Sw.) L. E. Bishop

*New record* — RWANDA: WESTERN PROVINCE: Nyungwe NP, Karamba, on moss cushions on wet rocks in montane forest, 1997 m, 02°29'10.98"S, 29°06'13.27"E, 20 Mar 2011, *E. Fischer s.n.* (KOBL).

*Lellingeria oosora* (Baker) A. R. Sm. & R. C. Moran

*First recorded* — Pichi Sermolli (1983: 199) as *Xiphopteris oosora* (Baker) Alston.

*Melpomene flabelliformis* (Poir.) A. R. Sm. & R. C. Moran

*First recorded* — Pichi Sermolli (1983: 197) as *Ctenopteris rigescens* (Bory ex Willd.) J. Sm.

*Zygophlebia villosissima* (Hook.) L. E. Bishop

*First recorded* — Pichi Sermolli (1983: 198) as *Ctenopteris villosissima* (Hook.) W. J. Harley

### *Loxogrammoideae*

*Loxogramme abyssinica* (Baker) M. G. Price

*First recorded* — Brause & Hieronymus (1910: 33) as *Polypodium loxogramma* Mett.

### *Microsoroideae*

*Lepisorus excavatus* (Bory ex Willd.) Ching

*First recorded* — Pichi Sermolli (1983: 200, 205) as *Pleopeltis bambusii* Pic. Serm., *P. mildbraedii* (Hieron.) Pic. Serm., *P. rotunda* (Bonap.) Tard.

*Lepisorus schraderi* (Mett.) Ching

*First recorded* — Pichi Sermolli (1983: 206) as *Pleopeltis schraderi* (Mett.) Tard.

+*Microsorium scolopendria* (Burm. f.) Copel.

*New record* — RWANDA: WESTERN PROVINCE: Rubavu (= Gisenyi), epiphyte on roadside trees, 01°42'11.62"S, 29°15'32.15"E, 1472 m, 21 Sep 2021, *E. Fischer s.n.* (KOBL); Karongi, lithophyte on rocks, 1489 m, 02°03'46.81"S, 29°20'27.99"E, 21 Sep 2021, *E. Fischer s.n.* (KOBL); Mashyoza, on volcanic rocks, 1179 m, 02°35'00.06"S, 29°00'59.23"E, 25 Sep 2011, *E. Fischer s.n.* (KOBL).

### *Platycteridoideae*

*Pyrrosia schimperiana* (Mett.) Alston

*First recorded* — Pichi Sermolli (1983: 206) as *Pyrrosia mechowii* (Brause & Hieron.) Alston

*Note* — Some authors prefer *Hovenkampia schimperiana* (Mett.) Li Bing Zhang & X. M. Zhou as correct name for this taxon. We follow Wei & Zhang (2022).

*Platycterium elephantotis* Schweinf.

*First recorded* — Pichi Sermolli (1983: 206).

### *Polypodoideae*

+*Pleopeltis macrocarpa* var. *dichotoma* Hieron. ex Eb. Fisch. & Lobin, var. nov. (see Taxonomic treatment)

*New record* — RWANDA: Volcano National Park, Mt Gahinga, on bamboo, 2900 m, 20 Mar 2022, *E. Fischer, P. Ballings & B. Wursten s.n.* (KOBL).

*Pleopeltis macrocarpa* (Bory ex Willd.) Kaulf. var. *macrocarpa*

*First recorded* — Brause & Hieronymus (1910: 33) as *Lepicystis lanceolata* (L.) Diels.

*Pleopeltis macrocarpa* var. *pinnatiloba* Hieron. ex Eb. Fisch. & Lobin, var. nov. (see Taxonomic treatment)

*First recorded* — Brause & Hieronymus (1910: 33) as *Lepicystis lanceolata* var. *pinnatilobata* Hieron. nom. nud.



**Pteridaceae***Cheilantheoideae****Aleuritopteris farinosa*** (Forssk.) Fée

*First recorded* — Brause & Hieronymus (1910: 29) as *Cheilanthes farinosa* (Forssk.) Kaulf.

***Cheilanthes inaequalis*** (Kunze) Mett.

*First recorded* — Brause & Hieronymus (1910: 29) as *Notholaena inaequalis* Kunze.

***Doryopteris concolor*** (Langsd. & Fisch.) Kuhn

*First recorded* — Brause & Hieronymus (1910: 28) as *Doriopteris* [sic!] *concolor*.

***Pellaea calomelanos*** (Sw.) Link

*First recorded* — Brause & Hieronymus (1910: 28) as *Pellaea hastata* (L. f.) Link.

***Pellaea doniana*** J. Sm. ex Hook.

*First recorded* — Kornaś & Nowak (1991: 12).

***Pellaea involuta*** (Sw.) Baker

*First recorded* — Pichi Sermolli (1983: 216) as *Pallea* [sic!] *involuta*.

***Pellaea pectiniformis*** Baker

*First recorded* — Kornaś & Nowak (1991: 12).

***Pellaea quadripinnata*** (Forssk.) Prantl

*First recorded* — Brause & Hieronymus (1910: 28).

***Pellaea schweinfurthii*** (Hieron.) Hieron.

*First recorded* — Kornaś & Nowak (1991: 13).

***Pellaea viridis*** (Forssk.) Prantl

*First recorded* — Brause & Hieronymus (1910: 28).

*Cryptogrammoideae****Coniogramme africana*** Hieron.

*First recorded* — Pichi Sermolli (1983: 236).

*Pteridoideae***+*Actiniopteris radiata*** (Sw.) Link

*New record* — RWANDA: EASTERN PROVINCE: Nyarubuye, quartzitic rocks, 02°08'48.69"S, 30°45'10.21"E, 1632 m, 12 Mar 2007, *E. Fischer s.n.* (KOBL).

***Actiniopteris semiflabellata*** Pic. Serm.

*First recorded* — Pichi Sermolli (1985: 199).

**+*Anogramma leptophylla*** (L.) Link

*New record* — RWANDA: NORTHERN PROVINCE: Volcano NP, foot of Mt Bisoke, 01°27'22.65"S, 29°30'21.67"E, 2717 m, 30 Sep 2009, *E. Fischer s.n.* (KOBL); Volcano

NP, Muhabura, humid volcanic rocks, 01°22'02.11"S, 29°41'36.03"E, 2893 m, 17 Mar 2010, *E. Fischer s.n.* (KOBL).

***Pityrogramma aurantiaca*** (Hieron.) C. Chr.

*First recorded* — Pichi Sermolli (1983: 236).

***Pityrogramma calomelanos*** (L.) Link

*First recorded* — Kornaś & Nowak (1991: 13).

***Pityrogramma elongata*** (C. Chr.) Pic. Serm.

*First recorded* — Pichi Sermolli (1983: 237).

*Endemic status* — Albertine Rift endemic.

***Pityrogramma rupicola*** Pic. Serm.

*First recorded* — Pichi Sermolli (1983: 238).

*Endemic status* — Albertine Rift endemic.

***Pteris auquieri*** Pic. Serm.

*First recorded* — Pichi Sermolli (1983: 219).

*Endemic status* — Albertine Rift endemic.

***Pteris catoptera*** Kunze

*First recorded* — Brause & Hieronymus (1910: 30) as *Pteris quadriaurita* auct. non Retz.

***Pteris cretica*** L.

*First recorded* — Brause & Hieronymus (1910: 30).

***Pteris dentata*** Forssk.

*First recorded* — Pichi Sermolli (1983: 226).

***Pteris intricata*** C. H. Wright

*First recorded* — Pichi Sermolli (1983: 227).

***Pteris kivuensis*** C. Chr.

*First recorded* — Pichi Sermolli (1983: 227).

*Endemic status* — Albertine Rift endemic.

***Pteris linearis*** Poir.

*First recorded* — Kornaś & Nowak (1991: 13).

***Pteris microlepis*** Pic. Serm.

*First recorded* — Pichi Sermolli (1983: 227).

***Pteris preussii*** Hieron.

*First recorded* — Pichi Sermolli (1983: 231).

***Pteris pteridioides*** (Hook.) F. Ballard

*First recorded* — Pichi Sermolli (1983: 233).

***Pteris vittata*** L.

*First recorded* — Brause & Hieronymus (1910: 30) as *Pteris longifolia* L.

Table 2. Endemic and near-endemic clubmosses, quillworts and ferns of Rwanda. – Status: ARE = Albertine Rift endemic; LE = local endemic.

	Status	Species	Distribution
1	ARE	<i>Asplenium burundense</i>	D. R. Congo, Rwanda, Burundi
2	ARE	<i>Asplenium centrafricanum</i>	D. R. Congo, Rwanda, Burundi
3	ARE	<i>Asplenium markusbeckeri</i>	D. R. Congo, Rwanda
4	ARE	<i>Asplenium musiraense</i>	Rwanda, Uganda, Tanzania
5	LE	<i>Asplenium ramicola</i>	Rwanda
6	ARE	<i>Asplenium rukararensense</i>	D. R. Congo, Rwanda, Burundi
7	ARE	<i>Asplenium tenuicaudatum</i>	D. R. Congo, Rwanda
8	ARE	<i>Asplenium uschiaae</i>	D. R. Congo, Rwanda
9	ARE	<i>Blotiella bouxiniana</i>	Rwanda, Burundi
10	ARE	<i>Christella burundensis</i>	Rwanda, Burundi
11	LE	<i>Diplazium cyamudongoense</i>	Rwanda
12	ARE	<i>Diplazium humbertii</i>	D. R. Congo, Uganda, Rwanda, Burundi, Tanzania
13	ARE	<i>Dryopteris ruwenzoriensis</i>	D. R. Congo, Uganda, Rwanda
14	LE	<i>Dryopteris schizopaleata</i>	Rwanda
15	ARE	<i>Elaphoglossum kivuense</i>	D. R. Congo, Rwanda, South Sudan
16	LE	<i>Elaphoglossum rwandense</i>	Rwanda
17	ARE	<i>Haplopteris reekmansii</i>	D. R. Congo, Rwanda, Burundi
18	LE	<i>Isoetes rwandensis</i>	Rwanda
19	LE	<i>Macrothelypteris rammelooi</i>	Rwanda
20	LE	<i>Metathelypteris vandervekenii</i>	Rwanda
21	ARE	<i>Odontosoria africana</i>	D. R. Congo, Uganda, Rwanda, Burundi
22	ARE	<i>Phlegmariurus afromontanus</i>	Uganda, Rwanda, Burundi, Tanzania
23	LE	<i>Phlegmariurus bampsianus</i>	Rwanda
24	ARE	<i>Pityrogramma elongata</i>	D. R. Congo, Uganda, Rwanda
25	ARE	<i>Pityrogramma rupicola</i>	D. R. Congo, Rwanda, Burundi
26	ARE	<i>Pteris auquieri</i>	D. R. Congo, Uganda, Rwanda, Burundi, Tanzania
27	ARE	<i>Pteris kivuensis</i>	D. R. Congo, Rwanda, Burundi
28	ARE	<i>Selaginella lewalleana</i>	Rwanda, Burundi

*Vittarioideae****Adiantum capillus-veneris* L.**

*First recorded* — Kornaś & Nowak (1991: 9).

***Adiantum incisum* Forssk.**

*First recorded* — Pichi Sermolli (1983: 234).

***Adiantum poiretii* Wikstr.**

*First recorded* — Pichi Sermolli (1983: 236) as *Adiantum thalictroides* Willd. ex Schltdl.

***Antrophyum mannianum* Hook.**

*First recorded* — Pichi Sermolli (1983: 241).

***Haplopteris guineensis*** (Desv.) E. H. Crane  
*First recorded* — Pichi Sermolli (1983: 239) as *Vittaria guineensis* var. *orientalis* Hieron.

***Haplopteris reekmansii*** (Pic. Serm.) C. W. Chen & S. Linds.

*First recorded* — Pichi Sermolli (1983: 239) as *Vittaria reekmansii* Pic. Serm.

*Endemic status* — Albertine Rift endemic.

### Salviniaceae

**+*Azolla nilotica*** Decne ex Mett.

*New record* — RWANDA: WESTERN PROVINCE: Bugarama, in rice fields, 02°37'56.24"S, 29°01'00.88"E, 1040 m, 28 Sep 2009, *E. Fischer s.n.* (KOBL). NORTHERN PROVINCE: Lake Bulera E of Butaro, 01°23'13.48"S, 29°47'49.09"E, 1864 m, 4 Dec 2021, *E. Fischer s.n.* (KOBL). EASTERN PROVINCE: Lake Mugesera N of Karembo, Gisaya swamp, 02°03'40.44"S, 30°27'17.54"E, 1339 m, 8 Sep 2021, *E. Fischer s.n.* (KOBL); Rwinkwavu, floating on the water surface in swamps, 01°57'47.20"S, 30°55'23.33"E, 1360 m, 17 Sep 2009, *E. Fischer s.n.* (KOBL).

***Azolla pinnata*** subsp. *africana* (Desv.) R. M. K. Saunders & K. Fowler

*First recorded* — Pichi Sermolli (1985: 192) as *Azolla africana* Desv.

### Tectariaceae

***Arthropteris anniana*** Lawalrée

*First recorded* — Pichi Sermolli (1985: 188) als *Arthropteris monocarpa* auct. non (Cordem.) C. Chr.

***Arthropteris orientalis*** (Gmel.) Posth.

*First recorded* — Pichi Sermolli (1985: 189).

***Tectaria fernandensis*** (Baker) C. Chr.

*First recorded* — Pichi Sermolli (1985: 178).

***Tectaria gemmifera*** (Fée) Alston

*First recorded* — Pichi Sermolli (1985: 178).

### Thelypteridaceae

#### Phegopteridoideae

***Macrothelypteris rammelooi*** Pic. Serm.

*First recorded* — Pichi Sermolli (1983: 270).

*Endemic status* — Local endemic.

#### Thelypteridoideae

***Amauropelta bergiana*** (Schlecht.) Holttum

*First recorded* — Pichi Sermolli (1983: 275).

***Amauropelta oppositifomis*** (C. Chr.) Holttum

*First recorded* — Pichi Sermolli (1983: 276).

**+*Ampelopteris prolifera*** (Retz.) Copel.

*New record* — RWANDA: WESTERN PROVINCE: Nyungwe NP, Cyamudongo Forest, terrestrial, mostly along small streams, occasionally epiphytic in montane forest, 02°32'26.89"S, 28°59'20.46"E, 1941 m, 1 Apr 2021, *E. Fischer s.n.* (KOBL).

**+*Christopteris holttumii*** Quansah & D. S. Edwards

*New record* — RWANDA: WESTERN PROVINCE: Nyungwe NP, Pindura-Bweyeye, swamp in montane forest, 02°30'22.08"S, 29°13'59.40"E, 1960 m, 31 Mar 2021, *E. Fischer s.n.* (KOBL).

*Note* — This taxon is a generic hybrid between *Christella dentata* × *Pneumatopteris afra*. Both parents occur in Rwanda.

**+*Christella burundensis*** Pic. Serm.

*New record* — RWANDA: WESTERN PROVINCE: Nyungwe NP, Cyamudongo Forest, forest floor in montane forest, 02°33'21.65"S, 28°59'09.12"E, 1889 m, 5 Jan 2019, *E. Fischer s.n.* (KOBL).

*Endemic status* — Albertine Rift endemic.

***Christella dentata*** (Forssk.) Brownsey & Jermy

*First recorded* — Brause & Hieronymus (1910: 3) as *Dryopteris mollis* (SW.) Hieron.

***Christella gueintziana*** (Mett.) Holttum

*First recorded* — Pichi Sermolli (1983: 280).

**+*Christella hispidula*** (Decn.) Holttum

*New record* — RWANDA: WESTERN PROVINCE: Nyungwe NP, Cyamudongo Forest, terrestrial in montane rainforest, 02°32'29.33"S, 28°59'06.56"E, 2003 m, 2 Apr 2021, *E. Fischer s.n.* (KOBL).

***Christella parasitica*** (L.) Lév.

*First recorded* — Kornaś & Nowak (1991: 11).

***Cyclosorus interruptus*** (Willd.) H. Ito

*First recorded* — Brause & Hieronymus (1910: 3) as *Dryopteris (Cyclosorus) striata* (Schumach.) C. Chr.

*Note* — Verdcourt (2006) found it impossible to distinguish between three species [*Cyclosorus interruptus*, *C. striatus* (Schumach.) Ching, *C. tottus* (Thunb.) Pic. Serm.] that share the same ecology. We follow his opinion.

***Leptogramma totta*** (Schltdl.) J. Sm.

*First recorded* — Pichi Sermolli (1983: 284) as *Leptogramma pozoi* non (Lag.) K. Iwatsuki.

*Note* — We follow Kuo & al. (2019), who separated this species from *Leptogramma pozoi*.

Table 3. Collectors and authors and their contributions to clubmosses, quillworts and ferns of Rwanda (species number and new species).

Collector/author	Number of collected species	New species
Bizzarri M. P.	1	<i>Selaginella lewalleana</i> Bizzarri (1981: 222)
Fischer Eb.	39	<i>Asplenium markusbeckeri</i> Eb. Fisch. & Lobin (Fischer & Lobin 2023a), <i>A. ramicola</i> Eb. Fisch. & Lobin (Fischer & Lobin 2023a), <i>A. uschiae</i> Eb. Fisch. & Lobin (Fischer & Lobin 2023a), <i>Diplazium cyamudongense</i> Eb. Fisch. & Lobin (Fischer & Lobin 2023b), <i>Dryopteris schizopaleata</i> Eb. Fisch. & Lobin (Fischer & Lobin 2023c: 138), <i>Isoetes rwandensis</i> Eb. Fisch. & Lobin (Fischer & Lobin 2022: 322)
Mildbraed J.	47	<i>Asplenium bugoiense</i> Hieron. (Brause & Hieronymus 1910: 10), <i>A. mildbraedii</i> Hieron. (Brause & Hieronymus 1910: 21), <i>A. rukararensis</i> Hieron. (Brause & Hieronymus 1910: 12), <i>Cyathea engleri</i> Brause (Brause 1910: 1) [= <i>C. manniana</i> Hooker (1865: 21)], <i>Lycopodium mildbraedii</i> Herter (1910: 90) [= <i>Phlegmariurus mildbraedii</i> (Herter) A. R. Field & Bostock (2013: 43)]
Nowak K. A.	8	No new species, records published by Kornaś & Nowak (1991)
Pichi Sermolli R. E. G. published many records from different collectors	111	<i>Blotiella bouxiniana</i> Pic. Serm. (Pichi Sermolli 1983: 262), <i>Elaphoglossum rwandense</i> Pic. Serm. (Pichi Sermolli 1985: 184), <i>Huperzia bampsiana</i> Pic. Serm. (Pichi Sermolli 1985: 193) [= <i>Phlegmariurus bampsianus</i> (Pic. Serm.) A. R. Field & Bostock (2013: 36)], <i>Macrothelypteris rammelooi</i> Pic. Serm. (Pichi Sermolli 1983: 270), <i>Metathelypteris vandervekenii</i> Pic. Serm. (Pichi Sermolli 1983: 272), <i>Pleopeltis bampsii</i> Pic. Serm. (Pichi Sermolli 1983: 200) [= <i>Lepisorus excavatus</i> (Bory ex Willd.) Ching (1933: 68)], <i>Pteris auquieri</i> Pic. Serm. (Pichi Sermolli 1983: 219), <i>P. microlepis</i> Pic. Serm. (Pichi Sermolli 1983: 227), <i>Vandenboschia inopinata</i> Pic. Serm. (Pichi Sermolli 1983: 262) [= <i>Crepidomanes inopinatum</i> (Pic. Serm.) J. P. Roux (2001: 45)]
Roux J. P. mentioned new records in his monograph on <i>Dryopteris</i>	4	No new species for Rwanda, records published by Roux (2012)

**+*Menisorus pauciflorus* (Hook.) Alston**

*New record* — RWANDA: WESTERN PROVINCE: Nyungwe NP, Gisakura, terrestrial fern, on deeply shaded rocks along streams in rainforest, 02°27'09.67"S, 29°07'04.06"E, 1835 m, 3 Apr 2021, *E. Fischer s.n.* (KOBL); Nyungwe NP, Cyamudongo Forest, 02°33'14.63"S, 28°59'03.28"E, 1870 m, 4 Apr 2021, *E. Fischer s.n.* (KOBL).

***Metathelypteris vandervekenii* Pic. Serm.**

*First recorded* — Pichi Sermolli (1983: 272).  
*Endemic status* — Local endemic.

**+*Pneumatopteris afra* (Christ) Holttum**

*New record* — RWANDA: WESTERN PROVINCE: Nyungwe NP, Cyamudongo Forest, terrestrial in montane forest along streams, 02°33'14.63"S, 28°59'03.28"E, 1870 m, 20 Mar 2021, *E. Fischer s.n.* (KOBL).

***Pneumatopteris unita* (Kunze) Holttum**

*First recorded* — Pichi Sermolli (1983: 283).

***Pseudocyclosorus pulcher* (Bory ex Willd.) Holttum**

*First recorded* — Pichi Sermolli (1983: 277).

***Thelypteris confluens* (Thunb.) Morton**

*First recorded* — Pichi Sermolli (1983: 275).

**Records not assigned to a species*****Dryopteris (Lastrea) obtusiloba* (Desv.) C. Chr.**

*First recorded* — Brause & Hieronymus (1910: 31).

*Note* — Mildbraed collected this taxon in “Rugege-Wald” with his number 759. Unfortunately, we have not been able to trace material with this number in B. Therefore the identity remains unclear.

***Vittaria (Taeniopsis) isoetifolia* Bory**

*First recorded* — Brause & Hieronymus (1910: 31).

*Note* — Mildbraed collected this taxon in “Rugege-Wald” with his number 921. Unfortunately, the specimen is sterile, so it cannot be determined exactly. As the leaves are very small, it does not belong to *Haplopteris guineensis*, but whether it is identical with *H. reekmansii* (see above) cannot be stated with certainty. *V. isoetifolia* is known from eastern and southern Africa and therefore could occur also in Rwanda.

**Excluded species*****Asplenium goetzei* Hieron. (1900: 343)**

See discussion in Fischer & Lobin (2023c: 57) in “Excluded species”.

*Asplenium kassneri* Hieron. (1911: 376).

See discussion in Fischer & Lobin (2023c: 57) in “Excluded species”.

*Asplenium lademannianum* Rosenstock

See discussion in Fischer & Lobin (2023c: 58) in “Excluded species”.

*Trichomanes crispiforme* Alston

*Note* — This taxon was described from São Tome and represents a West African element. It is only known from Liberia, Nigeria, Cameroun, São Tome, Congo (Brazzaville), and D. R. Congo. The locality that is closest to the border of Rwanda is Irangi N of Kahuzi-Biéga National Park (Kornaś 1994). Roux (2009: 48) listed Rwanda among the recorded countries without mentioning a source. This record is considered here as erroneous.

## Taxonomic treatment

Hieronimus in Brause & Hieronymus (1910) separated Mildbraed’s plants into three different taxa: *Lepicystis lanceolata* (= *Pleopeltis macrocarpa* var. *macrocarpa*), *L. lanceolata* var. *pinnatiloba* Hieron. nom. nud., and *L. lanceolata* var. *dichotoma* Hieron. nom. nud. All material cited by him is deposited in B and has been examined by us. Unfortunately, Hieronymus in Brause & Hieronymus (1910) gave no descriptions and therefore published nomina nuda, but as he placed his name behind the varieties, he certainly regarded them as new to science. We therefore decided to validate them (see below).

In his treatment of *Polypodiaceae* for the Flora of Tropical East Africa, Verdcourt (2001: 28) assigns a “mutation” to some collections from Uganda and Kenya, citing Schelpe & Anthony (1986) who discussed these forms. In South Africa, *Pleopeltis xsimiana* (Schelpe & N. C. Anthony) N. R. Crouch & Klopper is considered to be a natural hybrid between *P. macrocarpa* and *P. polypodioides* subsp. *ecklonii* (Kunze) J. P. Roux. This hybrid looks quite similar to the East African plants and to our material from Rwanda. Verdcourt (2001) already points out that these specimens occur far from the natural range of *P. polypodioides* subsp. *ecklonii* (SE Tanzania, Mozambique, Malawi, S Africa) and the plants from Rwanda have, as do the three examined specimens in *Flora of Tropical East Africa*, normal rather than abortive spores (Verdcourt 2001). Therefore, we propose, that these specimens merit recognition as separate taxa.

Similar forms with pinnatilobed fronds have been recently described as new species from eastern D. R. Congo. *Loxogramme ntahobavakiana* Mangambu Mokoso & van Diggelen (2017: 64) differs from *L. abyssinica* mainly in the pinnatilobed leaves. *Lepisorus robbrechtianus* Mangambu Mokoso & van Diggelen (2017: 65) is separated from *L. schraderi* mainly by the presence of long and dichotomously lobed leaves. However, we

prefer to keep the material from *Pleopeltis macrocarpa* forms from eastern D. R. Congo and Rwanda in the rank of varieties.

*Pleopeltis macrocarpa* var. *dichotoma* Hieron. ex Eb. Fisch. & Lobin, **var. nov.** – Fig. 3.

Holotype: D. R. Congo, Ninagongo (= Nyiragongo), 2000–2500 m, 3 Oct 1907, *J. Mildbraed 1316a* (B 20 0025283 [https://herbarium.bgbm.org/object/B200025283]).

– *Lepicystis lanceolata* var. *dichotoma* Hieron., nom nud. in Brause & Hieronymus (1910: 33).

*Diagnosis* — The new variety differs from typical *P. macrocarpa* var. *macrocarpa* in the lamina dichotomously divided at the top, bifurcate, with each lobe also being bifurcate.

*Distribution* — Known only from the Virunga Volcanoes in D. R. Congo and Rwanda.

*Habitat* — Epiphyte in montane forest, 2000–2900 m.

*Additional specimens seen* (paratypes) — D. R. CONGO: Ninagongo (= Nyiragongo), *Acanthus*-Busch und unterer Waldgürtel, 2000–2500 m, 3 Oct 1907, *J. Mildbraed 1316*, junge Pflanze [young plant on lower right of the sheet], together with *L. lanceolata* var. *pinnatiloba* Hieron. [upper left of the sheet] (B 20 0025281); Kihawe (P. Karisimbi), 2400 m, 7 Mar 1935, *De Witte 2295* (BR0000019902777) (together with var. *pinnatiloba*). — RWANDA: Volcano National Park, Mt Gahinga, on bamboo, 2900 m, 20 Mar 2022, *E. Fischer, P. Ballings & B. Wursten s.n.* (KOB).

*Pleopeltis macrocarpa* var. *pinnatiloba* Hieron. ex Eb. Fisch. & Lobin, **var. nov.** – Fig. 4.

Holotype: Rwanda, Station Kissenye (= Gisenyi, Rubavu), Bugoie (= Gishwati forest), 2300 m, 1 Nov 1907, *J. Mildbraed 1446* (B 20 0025282 [https://herbarium.bgbm.org/object/B200025282]).

– *Lepicystis lanceolata* var. *pinnatilobata* Hieron. nom nud. in Brause & Hieronymus (1910: 33).

*Diagnosis* — The new variety differs from typical *Pleopeltis macrocarpa* (Willd.) Kaulf. var. *macrocarpa* in the pinnatilobed fronds with long and narrow pinnae. From the hybrid *P. xsimiana* (Schelpe & N. C. Anthony) N. R. Crouch & Klopper, with which it shares the pinnatilobed fronds, it is distinguished by fertile spores, while the latter only has abortive spores. Finally, one parent from the hybrid, *P. polypodioides* subsp. *ecklonii* (Kunze) J. P. Roux, does not occur in Rwanda.

*Distribution* — D. R. Congo (Virunga Volcanoes, Ruwenzori), Rwanda (Virunga Volcanoes, Gishwati) and Uganda (Muhabura); also reported from Kenya (not seen).

*Habitat* — In Rwanda, the new variety occurs in almost pure populations, not in mixed stands together with the typical variety. They have been observed in the montane forest belt up to the bamboo belt of the Virunga Volcanoes between 2500–3027 m.

*Note* — Plants of both varieties are in cultivation in the Bonn University Botanical Gardens: *Pleopeltis macrocarpa* var. *dichotoma* (BG Bonn No. 47370) and *P. macrocarpa* var. *pinnatiloba* (BG Bonn No. 47369). In cultivation both taxa kept their typical leaf form (pinnatilobed and dichotomously branched respectively) (Fig. 3, 4) even in the newly produced leaves. This is a strong argument for a genetic fixation and against an ecoform induced by the habitat conditions.

*Additional specimens seen* (paratypes) — D. R. CONGO: Ninagongo (= Nyiragongo), *Acanthus*-Busch und unterer Waldgürtel, 2000–2500 m, 3 Oct 1907, *J. Mildbraed* 1316, [upper left of the sheet, together with *P. macrocarpa* var. *dichotoma*] (B200025281); Kihawe (Karisimbi), 2400 m, 7 Mar 1935, *De Witte* 2295 (BR0000019902777) (together with *P. macrocarpa* var. *dichotoma*); Parque National Albert, volcan Karisimbi, flanc E, 2600 m, 21 Aug 1937, *J. Louis* 5441 (BR0000019902821); Nyamlagira, 2000 m, 22 Dec 1944, *R. Germain* 3138 (BR0000019902784); Ninagongo, 2200 m, *H. Humbert* 7934 (BR0000019902791); entre Kimbundo et le premier crête de Mikeno, 2175 m, Aug 1937, *J. Lebrun* 718; Kivu, Lusengi, 1500 m, May 1958, *Antun-Gupffert* 173 (BR0000019902722); Ruwenzori, Lanuri, 2000 m, 15 Apr 1914, *Bequaert* 4244 (BR0000019902739). — RWANDA: NORTHERN PROVINCE: Volcano National Park, Sabinyo, epiphyte in montane forest, 2577 m, 01°24'37.13"S, 29°36'13.51"E, 4 Jan 2017, *E. Fischer s.n.* (KOBL); Gahinga, epiphyte in montane forest, 3027 m, 01°23'23.72"S, 29°39'27.84"E, 23 Sep 2006, *E. Fischer s.n.* (KOBL); Mt Gahinga, on bamboo, 2900 m, 20 Mar 2022, *E. Fischer*, *P. Ballings* & *B. Wursten s.n.* (KOBL).

## Author contributions

Both authors contributed equally to the manuscript. Fieldwork was carried out by Eberhard Fischer.

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## Supplemental content online

See <https://doi.org/10.3372/wi.53.53302>

Supplementary table S1. Endemic and near-endemic clubmosses, quillworts and ferns of continental African countries (including Cape Verde and islands of Gulf of Guinea).

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