

Species new to science described from Marojejy since 1988: An extraordinary area of discovery at one of Madagascar's most biodiversity rich protected areas

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Abstract

The Marojejy Massif, including the Marojejy National Park, has been the subject of biological surveys over the past decades, particularly the period after 1988. During these investigations, specimens of a range of different organisms have been obtained and deposited in museum and herbarium collections. This material has been used in scientific investigations and a considerable number of new species to science have been described. Herein, we tabulate the new taxa named from on and around the massif since 1988 and separate material cited in these descriptions based on specimens collected before 1988 and after 1988: numbers presented as total for each group, followed by in parentheses pre-1988 collections (in standard font) and post-1988 collections (in bold font): Bryophytes = 4 (1 and 3), Pteridophytes = 14 (0 and 14), Angiosperms = 97 (18 and 79), Gastropoda = 41 (0 and 41), non-insect Arthropoda = 71 (1 and 70), insects = 181 (43 and 138), Vertebrata = 42 (2 and 40), total number new to science = 450 (65 and 385). This information highlights the unique biological richness of the Marojejy Massif and the importance of

continued biological exploration of the site, as well as different forested areas of Madagascar, including the collection of voucher specimens. The associated data are important to document the island's biodiversity, address different questions in evolutionary biology, and advance different conservation programs.

Key words: species new to science, Marojejy area, since 1988, flora, fauna

Résumé détaillé

Le massif de Marojejy, y compris le Parc National de Marojejy, a fait l'objet d'études biologiques au cours des dernières décennies, en particulier après 1988. Au cours de ces études, les chercheurs ont collecté des spécimens d'organismes différents et ceux-ci ont été déposés dans des musées et herbiers. Ce matériel a été utilisé pour une large échelle d'investigations scientifiques et un nombre considérable d'espèces nouvelles pour la science ont été décrites. Ici, nous classifions les nouveaux taxons nommés du et autour du massif depuis 1988 et séparons ce matériel cité dans ces descriptions sur la base des spécimens collectés avant et après 1988 [nombres présentés sous forme de total pour chaque groupe, suivis entre parenthèses des collections antérieures à 1988 (en police d'écriture standard) et collections post-1988 (en gras)] : Bryophytes = 4 (1 et 3), Pteridophytes = 14 (0 et 14), Angiospermes = 97 (18 et 79), Gastropodes = 41 (0 et 41), Arthropodes non-insectes = 71 (1 et 70), insectes = 181 (43 et 138), Vertébrés = 42 (2 et 40), nombre total de nouvelles espèces pour la science = 450 (65 et 385). Ces informations mettent en évidence la richesse biologique unique du massif de Marojejy, un site qui compte par exemple le plus grand nombre d'espèces de vertébrés de toutes les aires protégées de l'île, l'importance d'une exploration biologique continue, ainsi que celle des différentes zones forestières de Madagascar, y compris la collection de spécimens de référence. Les données associées résultant des études de ces spécimens sont importantes pour documenter la biodiversité de l'île, répondre à différentes questions de biologie évolutive et faire progresser les programmes de conservation.

Mots clés : espèces nouvelles pour la science, zone de Marojejy, depuis 1988, flore, faune

Introduction

The fauna and flora of Madagascar are unique to our planet and with one of the highest levels of endemism at different taxonomic levels of any country (Antonelli *et al.*, 2022; Goodman, 2022), and at the same time threatened based on a range of different factors founded in social, economic, biological aspects (Jones *et al.*, 2022; Ralimanana *et al.*, 2022). Rates of deforestation and other anthropogenic pressures remain serious impediments to improve the advancement of conservation programs on the island, as is also the case elsewhere in the world (e.g., Harper *et al.*, 2007; Jones *et al.*, 2018; Vielledent *et al.*, 2018; Grinand & Nourtier, 2022). From the side of biodiversity, which we consider here to include habitats, species distributions, biological richness, and biotic importance, and in light of the actions needed to protect the remaining natural ecosystems of Madagascar, prioritization assessments have historically been based on measures of species diversity and patterns of local endemism (e.g. Kremen *et al.*, 2008; Allnutt *et al.*, 2012).

One aspect that is rather remarkable about the biota of Madagascar is the number of species described as new to science each year. Hence, measures of the biodiversity importance of a given site often increase through time and are directly linked to levels of local endemism and research activities associated with biological surveys. Elsewhere in the world, the insight these measures provide to maximize biotic representation have been underlined in the literature, as well as the persistence of key endemic species in generating rankings of protected areas, and the steps needed to advance in their protection (Lehtomäki *et al.*, 2019; Morales-Barbero & Ferrer-Castán, 2019).

Marojejy in northeastern Madagascar is well known for its high levels of species diversity and local endemism (Goodman *et al.*, 2018a). The reason for this extraordinary biodiversity remains to be elucidated, but certainly is related to the size of the protected area of more than 60,000 ha, the elevational gradient ranging from lowland forest to the summit at 2130 m, and important levels of rainfall with little in the way of a pronounced dry season. For terrestrial vertebrates this site has the highest number of known species ($n=338$ as tabulated in mid-2017) of any protected area on Madagascar (Goodman *et al.*, 2018b). This site first received official protection in 1952 as Réserve Naturelle Intégrale (N° 12) and in 1998 the status was changed to a Parc National (IUCN category II). To further underline the

importance of the site, the Marojejy National Park was named in 2007 as part of a UNESCO World Patrimony site, composed of six widely separated national parks, and known as Forêts humides de l'Atsinanana or Rainforests of Atsinanana.

The known flora of the Marojejy protected area was tabulated in mid-2017, based on 3125 herbarium specimens, to contain over 1300 species (Phillipson *et al.*, 2018). Marojejy has been a major source of previously undescribed taxa to science. At least a portion of this taxonomic research has been based on specimens collected during biological inventories on and around the massif. Further, for more recently obtained material, tissue samples associated with specimens have been used in molecular studies and further advancing the diagnoses and delimitations of recently named taxa. Herein, on the basis of the published literature and using some different databases, we document the level of new species described from Marojejy since 1988. Our intentions include to provide a better understanding of the spectacular biological diversity of the massif, the level of discovery of previously undescribed species, and the importance of continued inventories to document the richness of this protected area, as well as other sites on Madagascar for the benefit of science and conservation alike.

Methods

After an extensive literature search, which should be considered exhaustive, we were able to tabulate species described from the Marojejy Massif during the period from early 1988 until early October 2022. For plants we have extensively used the Missouri Botanical Garden's Tropicos database (MBG, no date). The short accounts presented below of taxa named from specimens collected at Marojejy either as holotypes, paratypes, type series, and referred material are based on named localities on the mountain and surrounding foothills in the original descriptions and not on subsequent field surveys, research, and publications. Hence, for example, a description published in 1990 for a new taxon from Analamazaotra thought to be a local endemic and subsequently found or identified at Marojejy in a publication outside of the original description does not appear herein.

To further emphasize in the succinct accounts presented in the results section on the importance of modern biological inventories and the collection of specimens in and around the massif into measures of the local biodiversity, for holotypes, paratypes or

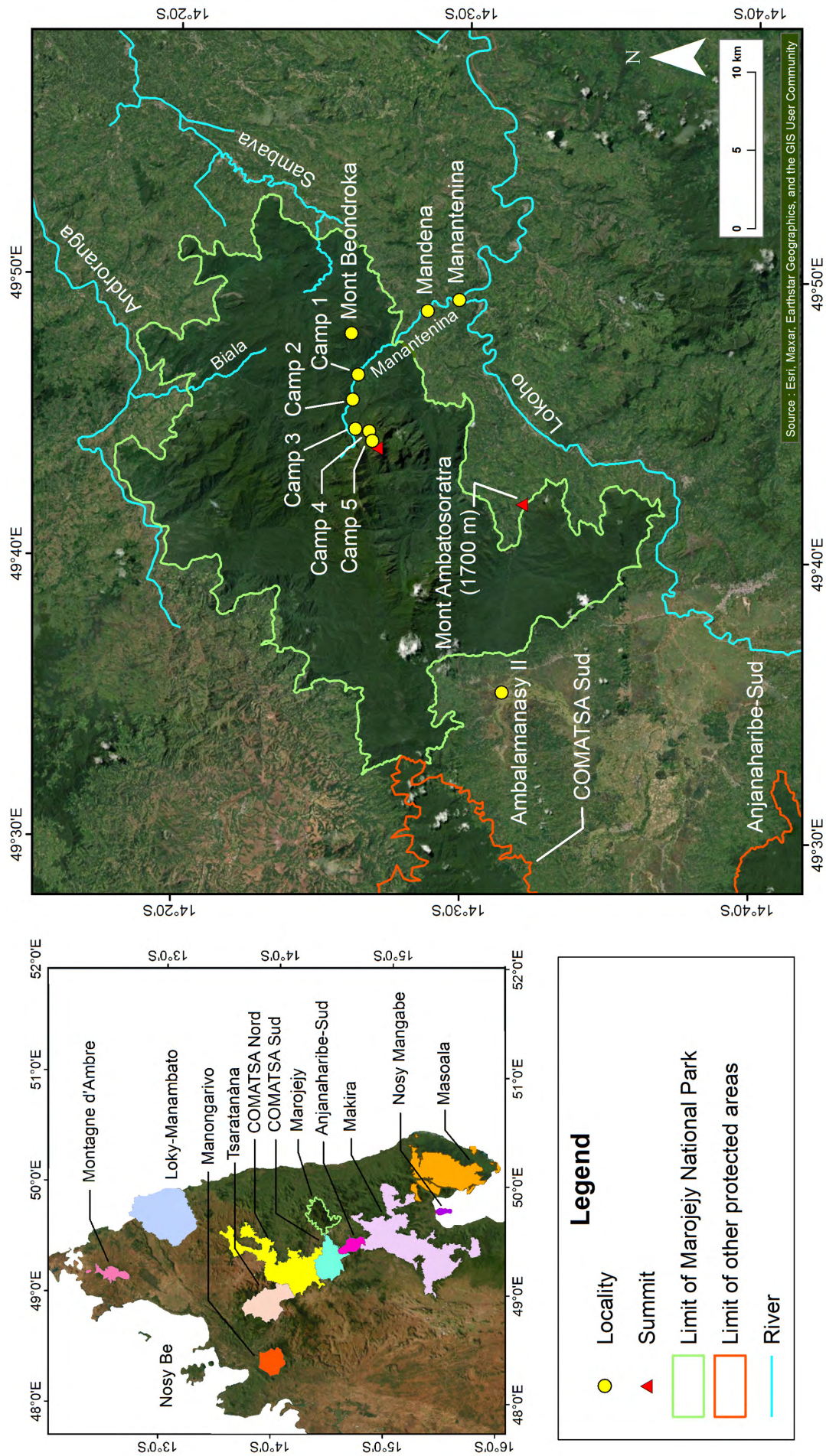


Figure 1. Localities in and around the Marojejy Massif that have been the principal localities from which new species to science have been described since 1988. The inset to the left illustrates the different protected areas from northern Madagascar where a range of new taxa have been described and the interconnectivity of these sites.

referred material published since 1988 based on pre-1988 specimens, the scientific names are given in *italic* type, and those using post-1988 collections are presented in mixed **bold** and *italic* type. We have not included in these accounts new varieties, subspecies, or geographic forms named from Marojejy. Within a family, we generally present genera and associated species in alphabetical order.

Given the complexity of Malagasy place names, we have in some cases had to interpret certain cited localities presented in papers describing new taxa. To help the reader locate a variety of cited toponyms within and outside the Marojejy National Park and in northeastern Madagascar, we have included numerous localities in Figure 1. Some points need to be mentioned. When reference is made to the “summital trail” this is the path starting in Manantenina, entering the park, passing the classically used camp sites, and terminating at the summit. The use of “Camp” is in reference to the five camp sites that were used in the 1996 survey (Goodman, 2000) and numerous field studies on the massif, discussed in detail in the introduction to this monograph. All cited elevations are in meters and in reference to above sea-level.

There are some problematic published localities with geographic details partially confused. For example, “Madagascar Est, Marojejy, rés. nat. int. XII, Anjanaharibe S., 1600 m” (e.g., Lacroix, 1991). To our knowledge since their formal designation as protected areas, Marojejy and Anjanaharibe-Sud have been separate entities. Hence, for the locality mentioned above it is difficult to discern in which of these two protected areas a specimen bearing such data was collected. Another locality that has on occasion been confused in the literature is « Anjanaharibe Nord ». This site is not part of the Marojejy complex, but an isolated massif to the north of Maroansetra and in vicinity to Ambinantelo.

For terms associated with vegetation types we generally employ those of Gautier *et al.* (2018). For flowering plants, we follow the classification of The Angiosperm Phylogeny Group (2016) and for insects, we follow Misof *et al.* (2014). Otherwise, we employ the classifications used in a recent synthetic book on the natural history of Madagascar (Goodman, 2022).

Results

Non-vascular Plants

Bryophytes

Lejeuneaceae

Cololejeunea deroinii – holotype was collected on the Marojejy Massif and along the Manantenina River at 350 m (Tixier, 1993; Dorr, 1997).

Radula marojezica – described from the Marojejy National Park and is only known from that massif (Jones, 1992).

Dicranaceae

Leucoloma marojeziense – described from and only known from the southeastern slopes of Marojejy (La Farge, 2002).

Orthotrichaceae

Schlotheimia fornicata var. *apiculata* – type collected on the eastern slopes of the Marojejy Massif at around 1400 m (Crosby *et al.*, 1983).

Pteridophytes

Cyatheaceae

Cyathea basirobundata – type obtained in the northwestern portion of the Marojejy National Park (Janssen & Rakotondrainibe, 2008).

Lomariopsidaceae

Lomariopsis christensenii – holotype and several paratypes were collected in the Réserve Naturelle Intégrale de Betampona and other paratypes from sites in the northeast, including Marojejy (Rakotondrainibe & Jouy, 2017).

Lomariopsis holttumii – holotype collected in the Andranomay Forest (Anjozorobe) and the paratypes from a broad geographical range of sites, including Marojejy (Rakotondrainibe & Jouy, 2017).

Polypodiaceae

Enterosora sinuata – described based on material collected on the Manongarivo Massif; it is also known from Marojejy and other mountains in northern Madagascar (Rakotondrainibe *et al.*, 2018).

Grammitis coriaceifolia – named from specimens collected on the Marojejy Massif (Rakotondrainibe *et al.*, 2018).

Moranopteris madagascariica – holotype from Marojejy (Rakotondrainibe *et al.*, 2018).

Selaginellaceae

Selaginella rasoloheryi – type collected in the northwestern portion of the Marojejy Massif (Rakotondrainibe & Jouy, 2016a).

Thelypteridaceae

Pronephrium marojejyensis – described from the northwestern slopes of the Marojejy Massif (Rakotondrainibe & Jouy, 2012).

Dryopteridaceae

Elaphoglossum longiacuminatum – described from Mont Beondroka within the Marojejy National Park (Rouhan, 2020).

Elaphoglossum rakotondrainibeae – named from the southeastern slopes of Marojejy (Rouhan, 2020).

Lastreopsis coriaceosquamata – type was collected in the northwestern portion of the national park (Rakotondrainibe & Tronchet, 2009).

Athyriaceae

Deparia florensiiae – described from northern Madagascar, including material from the Marojejy Massif (Rakotondrainibe & Jouy, 2016b).

Deparia longipilosa – recently named from northern Madagascar, including specimens from the Marojejy Massif (Rakotondrainibe & Jouy, 2016b).

Deparia septentrionalis – type specimen from Marojejy and the species is also known elsewhere in northern Madagascar (Rakotondrainibe & Jouy, 2016b).

Angiosperms

Piperales

Piperaceae

Peperomia erythrocaulis – collected in the Marojejy National Park along the summit trail (Mathieu, 2006).

Peperomia humberitii – type was obtained on the Marojejy Massif (Mathieu, 2003).

Magnoliales

Annonaceae

Xylopiya marojejyana – holotype from the western slopes of the Marojejy Massif (Johnson & Murray, 2020).

Xylopiya ravelonarivoi – holotype was collected in the region of Brickaville (Ampasimanolotra) and the paratypes from a range of localities on the island, including the Marojejy Massif (Johnson & Murray, 2020).

Laurales

Monimiaceae

Tambourissa rakotozafyi – described from material collected in the Lokoho River valley and near Mont Ambatosoratra (Jérémie & Lorence, 1991).

Pandanales

Triuridaceae

Seychellaria barbata – named from material collected at Marojejy (Nuraliev *et al.*, 2016).

Pandanaceae

Pandanus alveolatus – type from the western slopes and summit of Mont Beondroka (Huynh, 1999).

Pandanus humberitii – type from near Camp 2 (Laivao *et al.*, 2007).

Pandanus marojejicus – known only from two sites at Marojejy (Callmander *et al.*, 2003).

Pandanus tabellarius – type from main summital trail and between 700 and 1150 m (Huynh, 1999).

Asparagales

Orchidaceae

Bulbophyllum lemurense – type specimen from the Lokoho River valley, specifically near Mont Beondroka (Bossier, 2000).

Bulbophyllum perreflexum – type collected from upper portion of medium altitude moist evergreen forest (Bossier & Cribb, 2001).

Cynorkis uliginosa – type obtained near the summit at 2050 m (Bossier, 2015).

Arecales

Arecaceae

Dypsis cookei – type from Marojejy, where it is endemic (Dransfield & Beentje, 1995).

Dypsis coursii – described from Marojejy and also known from other areas of northeastern Madagascar (Dransfield & Beentje, 1995).

Dypsis pumila – an endemic to Marojejy and described based on specimens collected near the summital zone (Dransfield & Beentje, 1995).

Dypsis lokohoensis – named based on specimens from Marojejy and also known from other areas of northeastern Madagascar (Dransfield & Beentje, 1995).

Dypsis marojejyi – described from material collected at Marojejy and also known from other portions of northeastern Madagascar (Dransfield & Beentje, 1995).

Dypsis mirabilis – a species distributed in the northeastern portion of Madagascar and the holotype is from Marojejy (Dransfield & Beentje, 1995).

Dypsis spicata – described based on specimens collected at Marojejy and it is known from other areas of northern Madagascar (Dransfield & Beentje, 1995).

Zingiberales

Strelitziaceae

Ravenala menahirana – a species recently described from numerous sites in the central east and northeast, and based on observations may occur at Marojejy (Haevermans *et al.*, 2021).

Poales

Xyridaceae

Xyris marojejyensis – type specimen was collected in the upper portion of the Marojejy Massif and this species is known on several neighboring mountains (Rakotonirina *et al.*, 2014).

Poaceae

Stypeiochloa marojejyensis – type was collected near the Marojejy summit and the species is known from a few other specimens obtained in the upper reaches of the massif (Teisher *et al.*, 2022).

Fabales

Fabaceae

Dalbergia andapensis – named from older specimens collected in the Lokoho River basin (Bossler & Rabevohitra, 1996).

Oxalidales

Cunoniaceae

Weinmannia integrifolia – known from different sites on and around the Marojejy Massif, as well as on the Masoala Peninsula (Bradford & Miller, 2001).

Weinmannia lowryana – this species was recently described based on herbarium collections and only known from the type obtained in the northwestern portion of the Marojejy Massif (Bradford & Miller, 2001).

Weinmannia marojejyensis – an endemic to the Marojejy Massif and has been collected at several localities between 990 and 1300 m (Bradford & Miller, 2001).

Weinmannia pauciflora – restricted to the upper reaches of Marojejy and collected between 1690 and about 2000 m (Bradford & Miller, 2001).

Weinmannia rakotomalazana – only known from the type collection made in close proximity to Camp 3 (Bradford & Miller, 2001).

Weinmannia venosa – type material coming from Marojejy and also known from Anjanaharibe-Sud and Andohahela (Bradford & Miller, 2001).

Malpighiales

Euphorbiaceae

Acalypha magistri – described from a single site on Marojejy in medium altitude evergreen moist forest (Montero-Muñoz *et al.*, 2022).

Croton alchorneifolius – this dubiously described species is based on a type collected between 1900 and 2130 m along the trail leading to the Marojejy summit (Radcliffe-Smith, 2016).

Myrtales

Myrtaceae

Eugenia andapae – type was collected at Anjanaharibe-Sud and with referred material coming from Marojejy and other localities in northern Madagascar (Snow *et al.*, 2015).

Eugenia gandhii – type was obtained on Nosy Mangabe and with referred material coming from Marojejy and other localities in northern Madagascar (Snow *et al.*, 2015).

Eugenia randrianasoloi – a species only known from the lowland forests of Marojejy (Miller, 2000).

Eugenia schatzii – this species appears restricted to the area close to Manantenina, specifically between Camp 1 and the park entrance (Miller, 2000).

Melastomataceae

Gravesia serratifolia – type series from the summital zone of Marojejy and this species is also known from a few sites on the massif at lower elevation (Almeda & Ranarivelo, 2019).

Sapindales

Burseraceae

Canarium findens – type from Marojejy National Park, specifically along the summital trail between 850 and 1000 m (Daly *et al.*, 2015).

Anacardiaceae

Camposperma parvifolium – described from Marojejy and also known from Anjanaharibe-Sud (Miller & Randrianasolo, 1998).

Rutaceae

Ivodea ravelonarivoi – type was collected in lowland moist evergreen forest of Marojejy along the Biala (=Beala) River (Rabarimanarivo *et al.*, 2015).

Malvales

Sarcocaulaceae

Rhodolaena coriacea – named from Anosibe An'Ala and a paratype was collected at Marojejy (Schatz *et al.*, 2000).

Brassicales

Capparaceae

Crateva simplicifolia – a species only known from the lowland forest of Marojejy (Miller, 1998).

Ericales

Balsaminaceae

Impatiens andapensis – named from lowland forest on the western side of the Marojejy Massif (Fischer & Rahelivololona, 2007).

Impatiens betsomangae – only known from the type obtained in the northwestern portion of the massif (Fischer & Rahelivololona, 2007).

Impatiens galactica – described from the Marojejy National Park, where it is a local endemic (Fischer *et al.*, 2017).

Impatiens gautieri – type specimen was from Manongarivo and the species is also known from Marojejy (Fischer & Rahelivololona, 2002).

Impatiens haingosonii – only known from a single site on the massif, which is the type locality (Fischer & Rahelivololona, 2007).

Impatiens hendrikii – this species is only known from Marojejy (Fischer & Rahelivololona, 2015).

Impatiens mananteninae – type specimen was collected in the summital zone of Marojejy (Fischer & Rahelivololona, 2002).

Impatiens max-huberi – only known from the Marojejy and Anjanaharibe-Sud Massifs (Fischer & Rahelivololona, 2016).

Impatiens messmerae – named from a single locality in the lowland forest of Marojejy (Fischer & Rahelivololona, 2007).

Impatiens navicula – type specimen from below Camp 3 (Fischer & Rahelivololona, 2002).

Impatiens nomenyae – endemic to the lowland forest of Marojejy and only known from a single site (Fischer & Rahelivololona, 2007).

Impatiens paranyi – only known from two different areas on the Marojejy Massif (Fischer & Rahelivololona, 2007).

Impatiens renae – documented from several localities on and around the Marojejy Massif (Fischer & Rahelivololona, 2004).

Impatiens serusiauxii – only known from Marojejy, but has been recorded at several different sites on the massif (Fischer *et al.*, 2020).

Impatiens sidaeformis – only recorded from northern and western portions of the Marojejy Massif (Fischer & Rahelivololona, 2004).

Impatiens susan-nathansoniae – only known from the Marojejy Massif (Fischer & Rahelivololona, 2015).

Primulaceae

Ardisia marojejyensis – described from Marojejy, where it is known from two lowland forest sites (Miller & Pipoly, 1993).

Ericaceae

Erica marojejyensis – named from material collected in the summital zone of the Marojejy Massif (Dorr & Oliver, 1999).

Gentianales

Rubiaceae

Astiella homolleae – type specimen was collected in the western portion of the Marojejy Massif (Groeninckx *et al.*, 2017).

Chapelieria septentrionalis – type from near Camp 3 (Davies & Davies, 2014).

Coffea pustulata – known from several localities in northern Madagascar, including Marojejy (Davis & Rakotonasolo, 2021).

Gaertnera bambusifolia – type specimen was obtained in the Marojejy protected area, on the trail leading towards the summit and between 850 and 1000 m (Malcomber & Davis, 2005).

Gaertnera ianthina – type is from along summit trail and near Camp 2 (Malcomber & Taylor, 2009).

Gaertnera pauciflora – only known from above Camp 3 (Malcomber & Davis, 2005).

Ixora pedalis – holotype is from the Marojejy National Park, specifically the western slopes of Mont Beondroka (De Block, 2014).

Lemyrea marojejyensis – recorded from two sites in the southeastern portion of the park and between 700 and 1220 m (Stone & Davis, 2004).

Payera marojejyensis – named based on material obtained on the Marojejy Massif in the upper Manantenina River valley (Buchner & Puff, 1993).

Peponidium crassifolium – described based on a type specimen collected on Marojejy and this species is also known from elsewhere on the island (Lantz *et al.*, 2007).

Pyrostria pendula – this taxon is only known from the upper reaches of the Marojejy Massif (Lantz *et al.*, 2007).

Robbrechtia milleri – type specimen was collected on Marojejy (De Block, 2003).

Sabicea marojejyensis – a taxon only known from Marojejy and between 770 and 1300 m (Razafimandimbison & Miller, 1999).

Schismatoclada spathulata – this species is only documented on the Marojejy Massif and recorded between 1200 and 2132 m (Strid *et al.*, 2019).

Apocynaceae

Cynanchum bosseri – described from material collected on the Marojejy Massif between 1000 and 1700 m (Liede, 1992).

Baroniella longicornis – named from a specimen obtained in the northwestern portion of the massif (Klackenberg, 1997).

Secamone laxa – named based on material collected on the Marojejy Massif (Klackenberg, 1992).

Solanales

Solanaceae

Solanum marojejy – type specimen was obtained on a slope of the Manantenina River valley and north of Mandena (D’Arcy & Rakotozafy, 1994).

Solanum myrsinoides – named based on material collected from the western slopes of Marojejy (D’Arcy & Rakotozafy, 1994).

Solanum trichopetiolatum – named based on specimens collected from the eastern side of the Marojejy Massif and to the west of the Manantenina River (D’Arcy & Rakotozafy, 1994).

Lamiales

Oleaceae

Noronhia marojejyensis – type specimen was obtained in the southern portion of the Marojejy Massif at the base of Mont Beondroka (Hong-Wa, 2016).

Acanthaceae

Brachystephanus densiflorus – described based on material collected at Anjanaharibe-Sud and this species is also known from sites in northern Madagascar, including Marojejy (Figueiredo & Jury, 1996).

Mendoncia kely – type obtained in the western portion of the Marojejy Massif (Magnaghi & Daniel, 2014).

Bignoniaceae

Rhodocolea humbertii – type specimen collected in the northern zone of the Marojejy Massif (Callmänder & Phillipson, 2011).

Rhodocolea magnifica – named based on a specimen collected along the western portion of the Marojejy Massif (Callmänder & Phillipson, 2011).

Lamiaceae

Clerodendrum kamhyoae – known from several localities in northern Madagascar, including the Marojejy Massif (Phillipson & Allorge, 2016).

Platostoma laxiflorum – named from material collected on Marojejy (Hedge *et al.*, 1998).

Plectranthus humbertii – named based on material collected on the western side of the Marojejy Massif (Hedge *et al.*, 1998).

Plectranthus laurifolius – described from specimens collected in the Lokoho River valley and elsewhere on the Marojejy Massif, as well as other sites in northeastern Madagascar (Hedge *et al.*, 1998).

Plectranthus linearis – described from material obtained on the western side of the massif, to the east of Ambalamanasy II (Hedge *et al.*, 1998).

Plectranthus oblanceolatus – named from specimen collected on the western side of Marojejy (Hedge *et al.*, 1998).

Plectranthus pichompae – described from material collected on the western side of Marojejy (Hedge *et al.*, 1998).

Plectranthus rubroviolaceus – type specimen was obtained in the western foothills of the Marojejy Massif (Hedge *et al.*, 1998).

Plectranthus scaposus – collected in the Marojejy protected area on the north slopes of Ambatosoratra (Hedge *et al.*, 1998).

Plectranthus vinaceus – type specimen was obtained on the eastern side of the Marojejy Massif, to the west of the upper Manantenina River (Hedge *et al.*, 1998).

Orobanchaceae

Alectra fruticosa – type coming from the western slopes and summit of Mont Beondroka (Fischer, 1996).

Asterales

Asteraceae

Humbertacalia madagascarensis – type was collected on Marojejy near Camp 4 (Peng & Zhang, 2016).

Invertebrates

Order Gastropoda

Acavidae

Ampelita akoratsara – holotype from Mont Ambatosorotra and collected at 800 m, and other material coming from other sites on and around Marojejy (Emberton, 1999).

Cyclophoridae

Boucardicus bevavus – holotype collected at Marojejy and the species is known from other sites on the massif (Emberton, 2002a).

Boucardicus lavekelius – holotype obtained from the Marojejy Massif (Emberton, 2002a).

Boucardicus lelus – holotype from the Marojejy and the species is known from a few other sites on the massif (Emberton, 2002a).

Boucardicus malemius – holotype collected from the eastern portion of Marojejy and the species is known from a few other sites on the massif (Emberton, 2002a).

Boucardicus manantenus – holotype from the eastern Marojejy (Emberton, 2002a).

Boucardicus mandenae – holotype obtained in the eastern Marojejy and the species is known elsewhere on the massif (Emberton, 2002a).

Boucardicus marojejiae – holotype from Marojejy and the species is known elsewhere on the mountain (Emberton, 2002a).

Boucardicus minicompectus – type series known from a single site on the eastern side of the Marojejy Massif (Emberton, 2002a).

Boucardicus mitovytovalavalavus – holotype from the western portion of Marojejy and the species is known elsewhere on the massif (Emberton, 2002a).

Boucardicus nifius – holotype from the eastern portion of Marojejy and the species has been collected at other sites on the massif (Emberton, 2002a).

Boucardicus pendulus – holotype from the eastern portion of Marojejy and the species is known from one other site on the massif (Emberton, 2002a).

Boucardicus regularis – holotype from the western portion of Marojejy and the species is known from one other site on the massif (Emberton, 2002a).

Boucardicus reservei – holotype from the western portion of Marojejy Massif, the only site the species is known from (Emberton, 2002a).

Boucardicus roamolotrus – holotype from the western portion of Marojejy and the species is known from a few other sites on the massif (Emberton, 2002a).

Boucardicus ruthae – holotype from the Marojejy Massif and the species is only known from a single site (Emberton, 2002a).

Cyathopoma andapae – holotype and several paratypes collected from the Marojejy protected area and the species is known from other sites on the island (Emberton, 2003).

Cyathopoma lasavava – described from material obtained on the western side of the Marojejy National Park (Emberton, 2003).

Cyathopoma magnificum – named from material found on the eastern side of the Marojejy Massif (Emberton, 2003).

Cyathopoma marojejiae – described from a series collected on the eastern side of the massif (Emberton, 2003).

Cyathopoma mahafinaritrae – named from a specimen collected from the western side of the massif and around 800 m (Emberton, 2003).

Streptaxidae

Gulella hafa – holotype collected on Marojejy at 1300 m (Emberton, 2001).

Gulella mahafinaratra – holotype collected at 1500 m on the eastern side of the Marojejy Massif (Emberton, 2001).

Gulella marojejyae – type material from different sites in the Marojejy National Park (Emberton, 2001).

Gulella michellae – type collections obtained from different sites in the Marojejy protected area (Emberton, 2001).

Parvedentulina ambatosorotrae – holotype from Mont Ambatosorotra and other referable material from elsewhere on Marojejy (Emberton, 2002b).

Parvedentulina andapae – holotype from the eastern side of Marojejy and other material coming from different sites on the massif (Emberton, 2002b).

Parvedentulina balambasia – named from a holotype from the western side of Marojejy and other material coming from different sites on the massif (Emberton, 2002b).

Parvedentulina devolia – holotype from the eastern side of Marojejy and other specimens obtained elsewhere on the massif (Emberton, 2002b).

Parvedentulina hafa – holotype from the eastern side of Marojejy and other material coming from other sites on the massif (Emberton, 2002b).

Parvedentulina hatairana – holotype from Marojejy and other specimens obtained elsewhere on the massif (Emberton, 2002b).

Parvedentulina mahitsia – holotype from Marojejy and other material collected from different sites on the massif (Emberton, 2002b).

Parvedentulina mananarae – holotype from Mananara and a paratype coming from the Marojejy Massif (Emberton, 2002b).

Parvedentulina marojejyae – holotype from Marojejy and other material coming from different localities on the massif, as well other sites on the island (Emberton, 2002b).

Parvedentulina pyramida – known from a single specimen collected on the western side of the Marojejy Massif (Emberton, 2002b).

Parvedentulina rantovina – holotype from the Marojejy National Park and also known from one other site on the massif (Emberton, 2002b).

Parvedentulina ravinamatia – named from a single site in the Marojejy National Park (Emberton, 2002b).

Parvedentulina simplex – holotype from the Marojejy National Park and also known from one other site on the massif (Emberton, 2002b).

Parvedentulina tendrombohitra – holotype from the western side of the Marojejy National Park and also known from a few other sites on the massif (Emberton, 2002b).

Parvedentulina tsaravintana – holotype from the Marojejy National Park and also known from at least one other site on the massif (Emberton, 2002b).

Parvedentulina tsipika – named from specimens collected at a single site on the Marojejy Massif (Emberton, 2002b).

Order Scorpiones

Microcharmidae

Microcharmus sabineae – described based on a specimen collected at 600 m on the Marojejy Massif (Lourenço, 1996).

Order Araneae

Arachaeidae

Eriauchenius andrianampoinimerina – described from the Anjanaharibe-Sud Massif and material also known from a range of localities in the moist evergreen forests of Madagascar, including Marojejy (Wood & Scharff, 2008).

Eriauchenius borimontsina – named from Marojejy and known from elsewhere in the moist evergreen forests of Madagascar (Wood, 2008).

Eriauchenius workmani – described from Marojejy and was also collected from different localities in the moist evergreen forests of Madagascar (Wood & Scharff, 2008).

Corinnidae

Paccius angulatus – described from material collected at Marojejy (Platnick, 2000).

Paccius elevatus – holotype was collected in the upper reaches of the massif (Platnick, 2000).

Paccius griswoldi – named from several specimens collected in different areas of Marojejy (Platnick, 2000).

Paccius quinteri – described from material collected near Camp 4 (Platnick, 2000).

Paccius scharffii – collected in the lowland moist evergreen forest of Marojejy (Platnick, 2000).

Cyatholipidae

Alaranea ardua – described from lowland moist evergreen forest within the park (Griswold, 1997).

Lycosidae

Katableps pudicus – this new genus and species were described based on material collected in lowland moist evergreen forest of Marojejy and is also known from the Ranomafana National Park (Jocqué *et al.*, 2011).

Pholcidae

Paramicromerys manantenina – collected from lowland moist evergreen forest in the national park (Huber, 2003).

Paramicromerys marojejy – described from lowland moist evergreen forest within the protected area (Huber, 2003).

Paramicromerys quinteri – named from material collected at Camp 3 (Huber, 2003).

Paramicromerys rabeariveloi – collected in lowland moist evergreen habitat in the protected area (Huber, 2003).

Spermophora vyvato – described from lowland moist evergreen habitat on the Marojejy Massif (Huber, 2003).

Zatavua griswoldi – this genus and species was described from material collected in the lowland moist evergreen forests of Marojejy (Huber, 2003).

Phyxelididae

Ambohima maizina – type material from Camp 5 on the Marojejy Massif (Griswold *et al.*, 2012).

Salticidae

Padilla manjelatra – type specimen from the Marojejy Massif at 700 m, and this species is also known from other sites in northern Madagascar (Andriamalala, 2007).

Tomocyriba griswoldi – only known from the lowland moist evergreen forests of Marojejy (Szűts & Scharff, 2009).

Tomocyriba ubicki – type collected in lowland moist evergreen forest in the Marojejy National Park and also known from Andasibe (Szűts & Scharff, 2009).

Order Decapoda

Potamonautidae

Foza raimundi – this new genus and species of crab is only known from lowland moist evergreen forest in the Marojejy National Park (Reed & Cumberlidge, 2006).

Malagasya goodmani – holotype from Tampolo (central east) and material in the type series from Marojejy (Cumberlidge *et al.*, 2002, 2020).

Marojejy longimerus – this new genus and species was described from the upper portions of Marojejy (Cumberlidge *et al.*, 2002).

Diplopoda

Order Sphaerotheriida

Arthrosphaeridae

Zoosphaerium mangabe – described from Nosy Mangabe and is also known from Marojejy (Wesener & Anilkumar, 2020).

Zoosphaerium smaragdinum – named from Marojejy (Wesener 2009).

Zoosphaerium viridissimum – only known from the Marojejy Massif between 1325 and 2000 m (Wesener, 2009).

Pachybolidae

Aphistogoniulus rubrodorsalis – described from a single site in the medium altitude moist evergreen of Marojejy (Wesener *et al.*, 2011).

Spiromimus simplex – only known from the lowland moist evergreen forests of Marojejy (Wesener & Enghoff, 2009).

Spirobolellidae

Hylekobolus marojejy – named from specimens collected in medium altitude moist evergreen forest of Marojejy (Wesener *et al.*, 2009).

Insects

Order Ephemeroptera

Baetidae

Rheoptilum lokohensis – only known from the Lokoho River drainages of the Marojejy Massif (Gattolliat, 2002a).

Xyrodromeus ambiguus – holotype was collected from Montagne d'Ambre and other specimens from Marojejy (Gattolliat, 2004).

Xyrodromeus latipalpus – holotype was collected at Marojejy and the species is known from other sites in northern Madagascar (Gattolliat, 2002b).

Xyrodromeus modestus – holotype was obtained at Anjanaharibe-Sud, but the species is also documented at Marojejy (Gattolliat, 2002b).

Xyrodromeus sartori – described based on material from near Lakato and it is known from a broad range of sites, including Marojejy (Gattolliat, 2002b).

Order Phasmatodea

Anisacanthidae

Paranisacantha poulaini – this species is only known from Marojejy (Cliquennois, 2008).

Order Mantodea

Majangidae

Danuriella viettei – holotype is from the Masoala Peninsula and paratypes from a range of localities, including the Marojejy Massif (Roy, 2020).

Danuriella griveaudi – holotype collected near Ambohimahasoa in the Central Highlands and paratypes from a range of localities, including the Marojejy Massif (Roy, 2020).

Danuriella andapensis – holotype was collected in Anjanaharibe-Sud and a good portion of the paratypes come from different sites on the Marojejy Massif (Roy, 2020).

Order Hemiptera

Cicadellidae

Platyjassus fisheri – holotype was collected at Camp 1 of Marojejy and paratypes at Camp 3, as well as other sites in northern Madagascar (Dietrich *et al.*, 2020)

Cicadidae

Malagasia argentea – holotype was collected in the lower elevations of the Marojejy National Park (Sanborn, 2021).

Coreidae

Kerzhnercryptes couturieri – described from Marojejy (Brailovsky Alperowitz, 2011).

Fulgoridae

Belbina bourgoini – holotype was collected at Marojejy during the R.C.P. mission to the massif (Guillaumet *et al.*, 1975) at an unmentioned elevation. Of the two paratypes, one was obtained on Marojejy at 1300 m and the other in the Lakato Forest (Constant, 2014).

Belbina laetitiae – holotype was taken at La Mandraka and the paratypes at a range of localities, including on the Marojejy Massif between 500 and 1600 m (Constant, 2014).

Naucoridae

Tsingala angulata – holotype and some of the paratypes were collected in the Ranomafana National Park and other paratypes at sites in the eastern portion of the island, including Marojejy (Sites & Bergsten, 2022).

Tsingala spatulata – described from lowland areas of Marojejy and also known from other sites in eastern Madagascar (Sites & Bergsten, 2022).

Tsingala trilobata – holotype from near Ambohimanjaka (Fianarantsoa) and the paratypes from a broad range of localities, including Marojejy (Sites & Bergsten, 2022).

Reduviidae

Gibbosella conisimilis – described and only known from the lowland moist evergreen forest of Marojejy (Forthman *et al.*, 2016).

Gibbosella mantella – restricted to the lowland moist evergreen forests of the Marojejy Massif (Forthman *et al.*, 2016).

Gibbosella nitida – only known from the lowland moist evergreen forests of the Marojejy protected area (Forthman *et al.*, 2016).

Gibbosella notoconica – restricted to the lowland moist evergreen forests of Marojejy (Forthman *et al.*, 2016).

Gibbosella pallidacorium – described from Marojejy (Forthman *et al.*, 2016).

Gibbosella vangocris – named from the Ranomafana National Park and elsewhere on Madagascar, including Marojejy (Forthman *et al.*, 2016).

Hovacoris bicolornotum – named from a holotype collected at Camp 1 on Marojejy (Zhang & Weirauch, 2011).

Marojejycoris auranticorium – this new genus and species was described based on material collected at different sites on the island, including Marojejy (Forthman *et al.*, 2016).

Marojejycoris brevifrons – named based on material collected at a range of sites, including Marojejy (Forthman *et al.*, 2016).

Marojejycoris notadichroa – holotype of this taxon, which is the type species for the genus, was collected at several different sites on Marojejy and is also known from a few other sites on the island (Forthman *et al.*, 2016).

Tanindrazanus brunneus – this new genus was described based on material collected at different sites on the island and *T. brunneus* is restricted to a single site on Marojejy (Forthman *et al.*, 2016).

Tanindrazanus irwini – holotype and part of the type series of this species from Marojejy and is also known from other moist evergreen forests in the eastern portion of the island (Forthman *et al.*, 2016).

Tanindrazanus marginatus – holotype from Ranomafana and this species is known from Marojejy and a range of sites on the island (Forthman *et al.*, 2016).

Tanindrazanus marojejy – known from two sites on Marojejy, both within medium altitude evergreen forest (Forthman *et al.*, 2016).

Toxopus antsiranana – described from a range lowland moist evergreen forests, including Marojejy (Forthman *et al.*, 2016).

Toxopus fisheri – known from northern Madagascar in different forested areas, including Marojejy (Forthman *et al.*, 2016).

Toxopus tibialis – named from different forests in northern and western Madagascar, including Marojejy (Forthman *et al.*, 2016).

Rhyparochromidae

Stilbocoris scudderi – holotype collected in the Ranomafana National Park and the paratypes from a wide range of sites, including an older specimen from Marojejy (Kondorosy & Zámbo, 2021).

Order Neuroptera

Coniopterygidae

Coniopteryx evellana – holotype and a number of paratypes come from the Ranomafana National Park and the balance of paratypes from different sites, including the Marojejy Massif (Sziráki, 2015).

Coniopteryx geniculate – holotype and a number of paratypes collected at Montagne d'Ambre National Park and the balance of paratypes from different sites, including the Marojejy Massif (Sziráki, 2020).

Order Coleoptera

Curculionidae

Diplotrichus falcatus – described based on a specimen collected at 600 m on Marojejy (Jordal, 2021).

Hybosoridae

Goudotostes parvus – type series was collected at Camp 2 on Marojejy and other material of this species at Camp 3 (Ballerio, 2021).

Goudotostes ranaivoi – material used in the description of this species was obtained at Camp 2 on Marojejy (Ballerio, 2021).

Hydraenidae

Hydraena arta – described based on material from near Camp 1 on the Marojejy Massif (Perkins, 2017).

Hydraena jubata – type from a forest stream above Camp 2 in the Marojejy National Park (Perkins, 2017).

Hydraena marojejy – known only from type material collected at Camp 3 at Marojejy (Perkins, 2017).

Hydraena pilobova – holotype collected near the Humbert Waterfall, close to Camp 1, and this species is known from other lowland sites on the Marojejy Massif (Perkins, 2017).

Hydraena renalisa – type series from close to Camp 2 on the Marojejy Massif and the species is also known from other sites in the park, as well as the Galoko Mountains (Perkins, 2017).

Hydraena rubrifurcata – described based on type material collected in lowland moist evergreen forest habitat of Marojejy (Perkins, 2017).

Madagaster cataracta – type series was collected at 800 m on the Marojejy Massif and it is known from several widely scattered localities in the eastern moist evergreen forests of the island (Perkins, 2017).

Sicilicula sexplanata – holotype collected at 1500 m on the Tsaratanàna Massif and the paratype from close to the summit of Marojejy (Perkins, 2017).

Melolonthidae

Bisencya sogai – described from Ambinanitelo at 500 m on the Marojejy Massif and it is also known from elsewhere in the northeast of Madagascar (Lacroix, 1993).

Cherbezatina pilosa – known only from the holotype collected on the western side of Marojejy at 1850 m (Lacroix, 1993).

Empecta grossepunctata – holotype collected in the western portion of the Marojejy Massif at 1600 m (Lacroix, 1989).

Hoplochelus obliterated – only known from the holotype collected on the Marojejy Massif at Ambinanitelo at 500 m (Lacroix, 1989).

Hoplochelus peyrierasi – holotype specimen was collected at 600 m on the Marojejy Massif (Lacroix, 1989).

Pseudenaria sogai – holotype was collected on Tsaratanàna and paratypes from elsewhere on that massif, as well as Marojejy and Ambodifiakarana (Lacroix, 1993).

Pseudencya cinnabarina – holotype was collected at “Madagascar Est, Marojejy, rés. nat. int. XII, Anjanaharibe S., 1600 m” (Lacroix, 1991).

Varencyia conspersa – holotype obtained during the RCP mission (Guillaumet *et al.*, 1975) to Marojejy (Lacroix, 1993).

Varencyia intricata – holotype was collected on the Tsaratanàna Massif at about 2000 m and referred material was obtained on Marojejy at 600 m and other northern montane sites (Lacroix, 1993).

Varencyia notata – holotype was collected at “Madagascar Est, Marojejy, rés. nat. int. XII, Anjanaharibe S., 1600 m” (Lacroix, 1993).

Varencyia picea – named based on a holotype collected on Marojejy at 1300 m and also known from other sites in the central east of the island (Lacroix, 1993).

Varencyia vittata – holotype was collected on Marojejy at 1300 m and the species is known from other sites on the massif ranging from 1300 to 1700 m (Lacroix, 1993).

Scarabaeidae

Adorodocia robusta – holotype was apparently from Anjanaharibe-Sud and other specimen material from Marojejy and Masoala (Montreuil & Frolovb, 2013).

Nanos constricticollis – type series from 1100 m on the Marojejy Massif (Montreuil *et al.*, 2014).

Nanos marojejyensis – described from 500 m on Marojejy and also known from one other site on the massif (Montreuil *et al.*, 2014).

Nanos mirjae – holotype and paratypes from “Beanana”, and referred material from Marojejy and Anjanaharibe-Sud (Montreuil *et al.*, 2014).

Nanos pseudominutus – holotype was collected at 1800 m on the Marojejy Massif and other material between 1240 and 1900 m in different zones in and close to the protected area (Montreuil *et al.*, 2014).

Staphylinidae

Apimela castanea – holotype from the Ankaratra Massif and other referred material from Andasy II on the Marojejy Massif (Pace, 2006).

Astenus inermis – holotype was collected on Marojejy (Jecoq, 1996).

Atheta vittata – holotype from Ambodivoangy to the east of Maroantsetra and referred material from Marojejy (Pace, 2006).

Dysamblys athetoides – holotype collected on the Marojejy Massif (Pace, 2006).

Eustenidia sogai – described from a single specimen collected on the Marojejy Massif at Andasy II (Pace, 1994).

Geopora griveaudi – named based on a holotype collected on the Marojejy Massif at Ambinanitelo (Pace, 1994).

Hovastiba betschi – holotype from the summital area of Marojejy (Pace, 2006).

Lemuridota lemuriensis – holotype was collected at Andringitra and a referred specimen from the Marojejy Massif (Pace, 2006).

Myllaena marojejyiensis – holotype from Marojejy at 1300 m and other material from lower elevations on the massif (Pace, 1994).

Oxypodinus bispinosus – holotype collected on the Marojejy Massif at 1300 m (Pace, 2006).

Pelioptera heteroclita – described based on a holotype from near Fort Dauphin (Tolagnaro) and a specimen from Marojejy (Pace, 1994).

Pseudacrotona amica – holotype obtained at 1300 m on the Marojejy Massif (Pace, 2006).

Pseudacrotona simplex – holotype collected at 1300 m on the Marojejy Massif (Pace, 2006).

Pseudacrotona tristis – holotype from the western side of the Marojejy Massif at 1120 m (Pace, 2006).

Pseudacrotona vicina – holotype collected on the western side of the Marojejy Massif and the species is also known from other areas of northern Madagascar (Pace, 2006).

Tenebrionidae

Antennoluprops triplehorni – type series from Camp 1 at Marojejy (Schawaller & Aalbu, 2015).

Torridincolidae

Incoltorrida benesculpta – type series was principally from Ambohimanjaka in the Central Highlands, as well as material from lowland areas of Marojejy (Perkins & Bergsten, 2019).

Incoltorrida marojejy – type series from lowland moist evergreen forest sites on the Marojejy Massif (Perkins & Bergsten, 2019).

Order Hymenoptera

Dryinidae

Anteon accurrens – holotype from Analamazaotra (Périnet) and other material from a range of sites on Madagascar, including near Camp 1 on the Marojejy Massif (Olmi, 1994).

Anteon cautum – holotype from near Berenty and referred material from a range of sub-Saharan countries, as well as other sites on Madagascar, including near Camp 1 on the Marojejy Massif (Olmi, 1994).

Anteon griswoldi – holotype from the Anjozorobe Forest and referred material from other sites on the island, including Camp 1 on the Marojejy Massif (Olmi, 2004).

Anteon merinum – holotype from the Anjozorobe Forest and referred material from other sites on the island, including Camp 2 on the Marojejy Massif (Olmi, 2004).

Aphelopus vernonensis – holotype from South Africa and referred material from a range of countries, including Madagascar and specimens from near Camp 2 on the Marojejy Massif (Olma, 2009).

Deinodryinus steineri – holotype collected at Ranomafana and other referred specimens from a range of sites on Madagascar, including Camp 1 on the Marojejy Massif (Olmi, 1994).

Gonatopus bellicosus – holotype from Camp 3 on the Marojejy Massif (Olmi *et al.*, 2019).

Gonatopus marojejyanus – holotype was obtained at Camp 2 on the Marojejy Massif (Oلمي *et al.*, 2019).

Gonatopus sensitivus – holotype from Ranomafana and other referred material from Camp 3 on the Marojejy Massif (Oلمي, 1993).

Madecadryinus politus – holotype collected near Camp 4 on the Marojejy Massif and the species is also known from other sites on the island (Oلمي, 2007).

Madecadryinus silvanus – holotype obtained near Ambinanitelo to the northwest of Maroantsetra and other specimen material elsewhere on the island, including Camp 1 on the Marojejy Massif (Oلمي, 2007).

Formicidae

Adetomyrma clarivida – described from Camp 1 at Marojejy (Yoshimura & Fisher, 2012).

Adetomyrma goblin – named from the Vevembe Forest near Farafangana and known from a range of sites, including Marojejy (Yoshimura & Fisher, 2012).

Anochetus boltoni – holotype was obtained in the lowland forest of Marojejy and this species is also known from the Masoala Peninsula (Fisher & Smith, 2008).

Camponotus karaha – described from Camp 2 at Marojejy and also collected across an elevational range on the massif from 450 to 1325 m (Rasoamanana *et al.*, 2017).

Camponotus mifaka – named based on material from near the summital zone of the Marojejy Massif (Rakotonirina *et al.*, 2016).

Camponotus zavo – holotype from Vatovavy near Kianjavato and this species is also known from numerous sites, including Marojejy (Rakotonirina *et al.*, 2016).

Parapatrechina myops – holotype was collected at Camp 3 on Marojejy and this species is also known from other sites, including Anjanaharibe-Sud (Lapolla *et al.*, 2010).

Parapatrechina ocellatula – holotype was obtained from the Réserve Spéciale d'Ivohibe and this species is also known from numerous other sites, including Marojejy (Lapolla *et al.*, 2010).

Monomorium aureorugosum – holotype was collected on the Masoala Peninsula and this species is known from other areas of northern Madagascar, including Marojejy (Heterick, 2006).

Myrmisaraka brevis – this species, placed within a recently described genus, is only known from Marojejy (Bolton & Fisher, 2014).

Pheidole alina – holotype was collected at 1575 m at Marojejy and this species is known on the massif across the elevational range from 1325 to 2000 m, as well as other sites on the island (Salata & Fisher, 2020a).

Pheidole antranhofa – described from Camp 3 on Marojejy (Salata & Fisher, 2020a).

Pheidole clara – holotype was collected at 775 m on the Marojejy Massif and this species is also known from the Masoala Peninsula (Salata & Fisher, 2020b).

Pheidole kely – described from the Parc National de Zahamena and known from numerous other sites on the island, including Marojejy (Salata & Fisher, 2020a).

Pheidole mainty – holotype from the summital area of the Parc National de Marojejy (Salata & Fisher, 2020a).

Pheidole mamirapiratra – holotype was from Mananara-Nord and this species is known from a wide range of moist evergreen forests, including Marojejy (Salata & Fisher, 2021).

Pheidole manantenina – named based on a holotype collected at 2000 m on Marojejy and this species has been recorded on the massif down to 1575 m (Salata & Fisher, 2020a).

Pheidole maro – holotype was collected in the Analamay-Mantadia Forest and other specimens used in the description come from a range of localities, including Marojejy (Salata & Fisher, 2020b).

Pheidole mena – holotype was obtained on Montagne d'Ambre and this species is known from a number of localities in northern Madagascar, including Marojejy (Salata & Fisher, 2021).

Pheidole mikros – holotype from near Sakaramy at the foot of Montagne d'Ambre, and other material used in the description are from different sites in northern Madagascar, including Marojejy (Salata & Fisher, 2020a).

Pheidole mivory – named based on material coming from Camp 1 on Marojejy (Salata & Fisher, 2020a).

Pheidole ovalinoda – type series from the Marojejy Massif at 850 m (Salata & Fisher, 2020b).

Pheidole sava – named based on material from Camp 3 on Marojejy (Salata & Fisher, 2020a).

Pheidole tampony – described based on specimens coming from the summital area of Marojejy (Salata & Fisher, 2020a).

Pheidole trichotos – named based on a holotype collected at Ampotsidia in the Région Sofia and other material from a range of localities, including Marojejy (Salata & Fisher, 2020a).

Pheidole zirafy – named from lowland moist evergreen forest on Marojejy (Salata & Fisher, 2020b).

Prionopelta lauræ – holotype from 450 m on the Marojejy Massif and this species is known from a range of sites in the moist evergreen forests of the island (Overson & Fisher, 2015).

Prionopelta subtilis – holotype from the Anjanaharibe Massif near Ambinantelo and the species is known from a range of sites, including Marojejy (Overson & Fisher, 2015).

Stigmatomma roahady – holotype collected in the Ambatovy Forest and the taxon is known from a wide variety of sites, including Marojejy (Esteves & Fisher, 2016).

Stigmatomma tsyhady – holotype was obtained in the Ambatovy Forest and the species is known from a wide variety of sites, including Marojejy (Esteves & Fisher, 2016).

Strumigenys hilaris – described from lowland moist evergreen forest on Marojejy (Fisher, 2000).

Strumigenys ipsea – this species is only known from just below the summital zone on Marojejy (Fisher, 2000).

Tetramorium aherni – described based on type material from Marojejy and this species has a wide distribution in northeastern Madagascar (Hita Garcia & Fisher, 2012a).

Tetramorium alperti – holotype from Camp 3 at Marojejy and this species is also known from two other sites, including Anjanaharibe-Sud (Hita Garcia & Fisher, 2014).

Tetramorium elf – holotype from Marojejy and the species is known from a range of moist evergreen forest sites on the island (Hita Garcia & Fisher, 2012a).

Tetramorium enkidu – holotype collected in a forest near Antalaha and this species is also known from several different sites in northern Madagascar, including Marojejy (Hita Garcia & Fisher, 2014).

Tetramorium isoelectrum – described based on material collected in the COMATSA Sud (Betaolana Forest) forest and also known from the Marojejy and Anjanaharibe-Sud Massifs (Hita Garcia & Fisher, 2012a).

Tetramorium jedi – named from Loky-Manambato and has a wide distribution in northern Madagascar, including Marojejy (Hita Garcia & Fisher, 2012a).

Tetramorium marojejy – described based on a holotype obtained at Marojejy and this taxon is also

known from Anjanaharibe-Sud (Hita Garcia & Fisher, 2012a).

Tetramorium monticola – holotype from COMATSA Sud (Betaolana Forest) and this species is also known from a variety of sites in northern Madagascar, including Marojejy (Hita Garcia & Fisher, 2014).

Tetramorium norvigi – type specimens from the Anjanaharibe Massif near Ambinantelo and other material of this geographically widely distributed species includes Marojejy (Hita Garcia & Fisher, 2012b).

Tetramorium orc – described from the summital zone of Marojejy (Hita Garcia & Fisher, 2012b).

Tetramorium rala – holotype from Camp 1 on Marojejy and other material from a range of eastern moist evergreen forest sites (Hita Garcia & Fisher, 2014).

Tetramorium sargina – type series was collected at 1575 m on the Marojejy Massif and this species is also known from Kalambatritra (Hita Garcia & Fisher, 2012b).

Tetramorium shamshir – type series from Lokobe (Nosy Be) and a range of northern sites, including Marojejy (Hita Garcia & Fisher, 2012b).

Tetramorium silvicola – type series was collected near Camp 3 on Marojejy and this species is also known from other sites on the massif, as well as further south in the Forêt d'Ambalagoavy Nord (Ikongo) (Hita Garcia & Fisher, 2012b).

Tetramorium yammer – collected at Camp 3 at Marojejy (Hita Garcia & Fisher, 2012b).

Tetraponera merita – holotype was from Analamazaotra and this species is known from a range of moist evergreen forest sites on the island, including Marojejy (Ward, 2009).

Vitsika acclivitas – this species, placed in a recently described new genus, was named from the Loky-Manambato area and is also known from Marojejy (Bolton & Fisher, 2014).

Vitsika incisura – holotype of this taxon, which is the type species of this recently described genus, was collected at Manongarivo and it is also known from Marojejy (Bolton & Fisher, 2014).

Vitsika manifesta – holotype was collected at Marojejy and this species is also known from Anjanaharibe-Sud (Bolton & Fisher, 2014).

Vitsika suspicax – holotype was obtained at Marojejy and this species is also known from Anjanaharibe-Sud (Bolton & Fisher, 2014).

Vitsika venustas – holotype of this species was collected at Marojejy and this taxon is also known

from different sites in the north of the island (Bolton & Fisher, 2014).

Platygastridae

Trichoteleia cincta – endemic to Marojejy and known from a single site at 1250 m (Talamas *et al.*, 2011).

Trichoteleia tahotra – endemic to Marojejy and only recorded at a single site at 750 m (Talamas *et al.*, 2011).

Mymaridae

Cosmocomopsis mopsis – holotype was collected at Camp 3 on Marojejy (Huber, 2015).

Platygastridae

Trichoteleia cincta – type series was obtained at 1250 m on the Marojejy Massif (Talamas *et al.*, 2011).

Trichoteleia tahotra – holotype and paratypes were collected below Camp 2 on the Marojejy Massif (Talamas *et al.*, 2011).

Tiphiidae

Methocha nasiformis – holotype and a portion of the paratype series were obtained in the Ranomafana National Park and other paratypes on the Marojejy Massif (Kimsey, 2011).

Methocha strigosa – holotype and a portion of the paratype series were collected in the Ranomafana National Park and other paratypes at different sites on the island, including the Marojejy National Park (Kimsey, 2011).

Trigonalidae

Orthogonalys brevis – holotype from the Anjanaharibe Massif near Ambinantelo and the paratypes from different sites in the Marojejy National Park (Smith & Tripotin, 2012).

Order Trichoptera

Leptoceridae

Ceraclea sartorii – this species has a broad distribution, and one of the paratypes was collected in the Lokoho River system and in close proximity to Marojejy (Gibon & Randriamasimanana, 2013).

Oecetis goodmani – described and only known from Marojejy (Randriamasimanana & Gibon, 1998).

Oecetis marojejyensis – type series was collected on the Marojejy Massif (Randriamasimanana & Gibon, 1999).

Philopotamidae

Chimarra lehibemavo – described from specimens coming from a broad elevational swath along the southeastern slopes of Marojejy (Gibon, 2017).

Rossodes humberti – only known from the middle reaches of the Marojejy Massif (Gibon, 2013).

Rossodes manantenina – named from the southeastern slopes of the Marojejy Massif (Gibon, 2013).

Rossodes marojejyensis – only known from the Marojejy Massif (Gibon, 2013).

Wormaldia fahadimy – holotype from near Camp 5 on the Marojejy Massif (Gibon, 2014).

Wormaldia faharoa – only known from near Camp 2 on the Marojejy Massif (Gibon, 2014).

Wormaldia fahatelo – described from near Camp 3 on the Marojejy Massif (Gibon, 2014).

Wormaldia fahefatra – type series collected near Camp 4 on the Marojejy Massif (Gibon, 2014).

Wormaldia legrandi – named from material obtained near Camp 4 on the Marojejy Massif (Gibon, 2014).

Wormaldia randriamasimanana – only documented near Camp 3 on the Marojejy Massif (Gibon, 2014).

Order Lepidoptera

Pyralidae

Zitha ouvrardi – holotype was collected in the eastern portion of Marojejy at 1000 m and the paratypes at different sites in the east (Leraut, 2013).

Order Siphonoptera

Leptopsyllidae

Paractenopsyllus gemelli – obtained on an endemic rodent of the genus *Eliurus* captured on the Marojejy Massif (Duchemin, 2003).

Paractenopsyllus ratovonjatoi – collected on a shrew-tenrec of the genus *Microgale* captured on the Marojejy Massif (Duchemin, 2003).

Order Diptera

Anthribidae

Pseudobasidissus barclayi – holotype of this new genus and species was collected in Marojejy (Trýzna & Baňář, 2014).

Ephydriidae

Beckeriella fasciata – collections from Marojejy yielded the first examples of this largely New World genus on Madagascar and for the African-Malagasy region (Mathis & Grimaldi, 2000).

Beckeriella maculata – described from material obtained from near Camp 3 on Marojejy (Mathis & Grimaldi, 2000).

Muscidae

Brontaea differa – holotype was collected at Camp 1 in the Marojejy National Park and paratypes elsewhere on Madagascar (Couri *et al.*, 2006).

Cephalispa curta – holotype was obtained at Camp 3 on Marojejy, and referred material at other sites on the massif and elsewhere on the island (Couri *et al.*, 2006).

Coenosia aberrans – only known from the holotype collected in the Marojejy National Park at 1575 m (Couri *et al.*, 2006).

Dichaetomyia colorata – holotype was collected in Ranomafana and referred material from different sites on the island, including Camp 3 at Marojejy (Couri *et al.*, 2006).

Dichaetomyia copopea – holotype was obtained near Camp 3 on the Marojejy Massif (Zielke, 2020).

Dichaetomyia grinteri – type series was collected in the summital zone of the Marojejy Massif (Zielke, 2020).

Dichaetomyia nigra – described based on a holotype and some paratypes collected at Tampolo, as well as other paratypes including those from Camp 2 on the Marojejy Massif (Couri *et al.*, 2006).

Vertebrata

Order Atheriniformes

Bedotiidae

Bedotia marojejy – described based on material obtained in the Manantenina River and just outside the Marojejy National Park (Stiassny & Harrison, 2000).

Order Anura

Mantellidae

Boophis axelmeyeri – holotype and paratypes collected on Tsaratanàna and Manongarivo; material from Marojejy tentatively assigned to this species (Vences *et al.*, 2005).

Boophis englaenderi – named based on material collected on Marojejy (Glaw & Vences, 1994).

Boophis marojezensis – described based on material collected in the lowland forest of Marojejy (Glaw & Vences, 1994).

Boophis ulftunni – holotype and paratypes were collected on the Masoala Peninsula and one

specimen of the referred material from Camp 3 on Marojejy (Wollenberg *et al.*, 2008).

Boophis vittatus – described based on material collected at Marojejy (Glaw *et al.*, 2001).

Gephyromantis lomorina – holotype was collected at Camp 3 on Marojejy and it is known from other sites in northern Madagascar (Scherz *et al.*, 2018).

Gephyromantis ranjomavo – only known from Marojejy and was described from Camp 3 (Glaw & Vences, 2011).

Gephyromantis rivicola – described from material obtained near Camp 1 on the Marojejy Massif (Vences *et al.*, 1997).

Gephyromantis schilfi – type series was collected at 1250 m on Marojejy (Glaw & Vences, 2000).

Gephyromantis striatus – holotype from Marojejy and this species is known from sites spanning lowland and medium altitude moist evergreen forest on the massif, as well as other sites in northern Madagascar (Vences *et al.*, 2002).

Gephyromantis tahotra – only known from the Marojejy Massif in the vicinity of Camp 3 (Glaw *et al.*, 2011; Scherz *et al.*, 2017).

Gephyromantis tandroka – named by Glaw and Vences (2001) based on a series of specimens collected at Marojejy at about 1300 m in 1972 (holotype and most paratypes) and 1995 (two paratypes).

Guibemantis milingilingy – described based on material collected in the summital zone of Marojejy (Bletz *et al.*, 2018).

Guibemantis woosteri – a taxon restricted to Marojejy and known from between 700 and 1325 m (Lehtinen *et al.*, 2018).

Mantella manery – named based on a specimen collected below Camp 1 on Marojejy (Vences *et al.*, 1999, 2004).

Mantidactylus charlotteae – holotype was collected at Foulpointe (Mahavelona) and the paratypes from a range of localities, including different sites on Marojejy (Vences & Glaw, 2004).

Mantidactylus petakorona – only known from Marojejy (Scherz *et al.*, 2019a).

Spinomantis tavaratra – holotype collected from the Sorata Massif and paratypes from a range of localities, including Marojejy (Cramer *et al.*, 2008).

Microhylidae

Cophyla fortuna – type series was collected in the lowland forest of the Marojejy National Park (Rakotoarison *et al.*, 2019a).

Platypelis ranjomena – holotype of this species was collected near the Makira protected area and the taxon is known from different areas of lowland moist evergreen forest of the east, including Marojejy (Glaw *et al.*, 2020).

Platypelis ravus – only known on Marojejy around Camp 3 (Glaw *et al.*, 2012).

Plethodontohyla guentheri – described based on a specimen obtained above Camp 3 on the Marojejy Massif (Glaw & Vences, 2007).

Rhombophryne botabota – holotype was collected at Camp 3 on Marojejy and is also known from other sites in northeastern Madagascar (Scherz *et al.*, 2016).

Rhombophryne savaka – described from specimens obtained at about 750 m on the Marojejy Massif (Scherz *et al.*, 2016).

Rhombophryne vaventy – only known from Camp 3 on Marojejy, from where the type material was obtained (Scherz *et al.*, 2014).

Stumpffia achillei – restricted to lowland moist evergreen forest on the Marojejy Massif (Rakotoarison *et al.*, 2017, 2019b).

Stumpffia diutissima – only known from lowland moist evergreen forest of Marojejy (Rakotoarison *et al.*, 2017, 2019b)

Order Squamata

Chamaeleonidae

Brookesia tedi – described from Camp 3 on Marojejy, the only site it is known (Scherz *et al.*, 2019b).

Calumma jeji – named from the upper portion of the Marojejy Massif (Raxworthy & Nussbaum, 2006).

Calumma uetzi – type material from the Sorata Massif and a specimen from Camp 3 at Marojejy has been identified as this taxon (Prötzel *et al.*, 2018).

Furcifer timoni – described from Montagne d'Ambre, but also recorded from Marojejy as *F. cf. timoni* based on photographs (Glaw *et al.*, 2009).

Gekkonidae

Lygodactylus ulli – described from Camp 1 on Marojejy, the only site it is known (Vences *et al.*, 2022).

Uroplatus fangorn – holotype was obtained at Camp 3 on Marojejy and the species is also known from elsewhere in northern Madagascar (Ratsoavina *et al.*, 2020).

Uroplatus finaritra – holotype is from Marojejy at about 800 m and this taxon is only known from a few sites on the massif (Ratsoavina *et al.*, 2019).

Uroplatus fivehy – holotype was collected on the Sorata Massif and paratypes from different localities; DNA sequences revealed its occurrence in Marojejy (Ratsoavina *et al.*, 2020).

Uroplatus giganteus – described from Montagne d'Ambre, but a genetically distinct specimen was also recorded from Marojejy (Glaw *et al.*, 2006).

Scincidae

Madascincus nanus – holotype from the nearby Anjanaharibe-Sud Massif and paratypes from this same site and other zones of northern Madagascar (Andreone & Greer, 2002). These authors suggest that previous records of *M. minutus* from Marojejy (Raselimanana *et al.*, 2000) are possibly referable to *M. nanus*.

Pseudoacantias angelorum – known from a single specimen collected within the national park at 650 m (Nussbaum & Raxworthy, 1995).

Pseudoxyrhophiidae

Ithyocyphus blanci – named based on a single holotype collected on Marojejy at about 300 m in 1972 (Domergue, 1988).

Liopholidophis oligolepis – named based on a single specimen collected near Camp 1 at Marojejy (Glaw *et al.*, 2014) and more recently has been found in COMATSA Sud (Glaw *et al.*, 2022).

Class Mammalia

Order Chiroptera

Miniopteridae

Miniopterus ambohitrensis – type locality is Montagne d'Ambre National Park and it is known from other highland localities, including Marojejy (Goodman *et al.*, 2015).

Discussion

Remarkable levels of new species descriptions

During the period from early 1988 to late 2022, a total of 450 species across a wide range of plant and animal groups were described as new to science on the basis of specimens collected in and around the Marojejy Massif (Table 1). The inclusion of a given taxon in this tabulation is only when the type material or cited specimens (including photographs and DNA sequences) were collected at the site and the material explicitly cited in the original description. In numerous cases, subsequent field surveys and associated collections were made after a given species description was published, which extend

the known distribution of many of these taxa; these records are not incorporated into the data we have tabulated here, as our focus is on initial discovery and description.

The material used for these different descriptions published since 1988 can be divided into two separate groups: 1) older specimens, having been collected before 1988, and employed in the diagnosis of the new taxon and 2) specimens obtained after 1988 and used in the descriptions. Below we present some overview details for different taxonomic groups on the role of specimens in the unfurling of knowledge on the biodiversity of Marojejy.

Pre-1988 and post-1988 collections

Plants

The French botanist Jean-Henri Humbert based at the Muséum national d'Histoire naturelle (Paris) was instrumental in the original delineation and designation of the Marojejy protected area (Humbert, 1955). During his exploration of the area starting in 1948, often together with other eminent botanists of the period including René Capuron and Gilbert Cours-Darne, he made approximately 2500 numbered collections (Leroy, 1956; Dorr, 1997). These specimens are an invaluable resource that continues to be studied by systematic botanists around the world. Of the 97 angiosperms listed herein having been described from Marojejy since 1988, less than one-quarter are based on older collections, but many of these were made by Humbert and his collaborators.

The next phase of botanical exploration of Marojejy commenced in May 1987 with a project under the direction of Missouri Botanical Gardens (MBG) and first orchestrated by Marion Nicoll to document the flora of the massif (Dorr, 1997). Early in 1988, the year we use to separate the two collection periods, the large-scale effort of teams of field botanists to collect herbarium material on the massif was under the direction of James S. Miller and his colleagues at MBG, as well as other European and North American botanists and those from Malagasy institutions such as Parc Botanique et Zoologique de Tsimbazaza (TAN) and Centre National de la Recherche Appliquée au Développement Rural Herbier (TEF). It was at this time that regular collection of material for molecular analysis became routine practice and has provided valuable new insights into patterns of plant species diversification and evolution.

Since 1987, approximately 4500 plant collections have been made by over 60 botanists in and around Marojejy, mostly with duplicate specimens to ensure

representative material is available in herbarium collections in Madagascar and key institutions overseas. Of these, more than half have been collected by five botanists: James (Jim) Miller (1988-1989), Pierre (Coca) Rakotomalaza (1996), Richard Randrianaivo (2014-2015), Fanja Rasoavimbahoaka (1994-1996), and Désiré Ravelonarivo (1994-2010). Since 1994 this work was carried out in the context of a plant parataxonomist training program initiated by MBG, and led by Miller, which succeeded not only to develop botanical skills among the trainees, but also to ensure representative coverage of all parts of the protected area and to undertake plot-based studies to provide information on phenology and plant communities.

Non-insect arthropods

Of the 71 species of non-insect arthropods and gastropods (scorpions, spiders, crabs, millepedes, and snails) described from Marojejy, all but one is based on post-1988 specimen collections (Table 1). This can be explained by two aspects: 1) pre-1988 collections did not include material of these two groups and/or 2) earlier collections have not been located and examined by the specialists working on these organisms. In any case, it is clear that recent inventories and associated specimens have provided important insights into the non-insect arthropod diversity of the massif and we suggest that even with these advances, much remains to be discovered. For example, no new species of mites (Acari) have been named from small mammals of Marojejy, although important collections of mites are known (O'Connor, 2000) and these certainly represented numerous new taxa to science.

Insects

The Marojejy Massif has been the subject of entomological exploration for many decades (e.g., Griveaud, 1960; Guillaumet *et al.*, 1975, 2008; Fisher, 2022). Renaud Paulian, one of the fathers of modern entomological research on Madagascar, directed a French Centre National de la Recherche Scientifique (CNRS) program under the title "Etude des écosystèmes montagnards dans la région Malgache" (RCP 225) between 1970 and 1973 on the ecology of several high mountain areas of the island. In the context of the RCP project, fieldwork on Marojejy took place in 1972 and included a strong insect component and several different entomologists took part, including Jean-Marie Betsch, André

Table 1. Tabulations of new species of plants and animals described from on and around the Marojejy Massif since 1988 and segregated based on type material being collected before 1988 and after 1988.

Taxonomic group	Type material collected before 1988	Type material collected after 1988	Total number of new species since 1988
Bryophytes (mosses)	1	3	4
Pteridophytes (ferns)	0	14	14
Angiosperms (flowering plants)			
Piperaceae	0	2	2
Annonaceae	0	2	2
Monimiaceae	1	0	1
Triuridaceae	0	1	1
Pandanaceae	0	4	4
Orchidaceae	1	2	3
Arecaceae	2	5	7
Strelitziaceae	0	1	1
Xyridaceae	0	1	1
Poaceae	1	0	1
Fabaceae	1	0	1
Cunoniaceae	1	5	6
Euphorbiaceae	0	2	2
Myrtaceae	0	4	4
Melastomataceae	0	1	1
Burseraceae	0	1	1
Anacardiaceae	0	1	1
Rutaceae	0	1	1
Sarcolaenaceae	0	1	1
Capparaceae	0	1	1
Balsaminaceae	2	14	16
Primulaceae	0	1	1
Ericaceae	1	0	1
Rubiaceae	1	13	14
Apocynaceae	2	1	3
Solanaceae	0	3	3
Oleaceae	0	1	1
Acanthaceae	1	1	2
Bignoniaceae	1	1	2
Lamiaceae	3	7	10
Orobanchaceae	0	1	1
Asteraceae	0	1	1
Total number for Angiosperms	18	79	97
Gastropoda (terrestrial snails)	0	41	41
Arthropoda			
Scorpiones (scorpions)	1	0	1
Araneae (spiders)	0	20	20
Potamonautidae (crabs)	0	3	3
Diplopoda (millipedes)	0	6	6
Non-insect arthropods	1	70	71
Insects			
Ephemeroptera (mayflies)	0	5	5
Phasmatodea (stick insects)	1	0	1
Mantodea (praying mantises)	3	0	3
Hemiptera (true bugs)	3	23	26
Neuroptera (net-winged insects)	0	2	2
Coleoptera (beetles)	30	16	46
Hymenoptera (sawflies, wasps, bees, and ants)	4	68	72
Trichoptera (caddisflies)	0	13	13
Lepidoptera (moths and butterflies)	1	0	1
Siphonoptera (fleas)	0	2	2
Diptera (flies)	1	9	10
Total number insects	43	138	181
Vertebrata			
Fishes	0	1	1
Amphibia (frogs)	1	26	27
Reptiles (lizards and snakes)	1	12	13
Mammals (rodents, tenrecs, and bats)	0	1	1
Total number of Vertebrata	2	40	42
Total number across all taxa	65	385	450

Peyrieras, and Pierre Soga (Guillaumet *et al.*, 1975). Additionally, before and after these studies, the massif was the subject of considerable entomological prospection by field scientists associated with the Institut de Recherche Scientifique de Madagascar (IRSM) and Office de la Recherche Scientifique et Technique Outre-Mer (ORSTOM), which is today the Institut de Recherche pour le Développement (IRD), and these included insect field collectors such as Paul Griveaud, André Peyrieras, and Pierre Soga. These extensive insect collections are for the most part deposited in the Muséum national d'Histoire naturelle (Paris) and continue to be studied by entomologists as exemplified by groups such as Melolonthidae (12 recently described species) and Staphylinidae (15 recently described species) beetles for which all of the taxa described after 1988 are based on earlier collections. In contrast, for groups such as Formicidae ants, only 1 of the 53 species described since 1988 was based on type material collected before 1988.

Starting in the early 1990s, a new phase of entomological research on Marojejy commenced and included research groups such in 1993 of Gary Alpert associated with the Museum of Comparative Zoology (Harvard); in 1996 with Tam Nguyen and Eric Quinter from the American Museum of Natural History (New York) and Steve Goodman of the Field Museum of Natural History (Chicago); and in 2003 Brian Fisher and colleagues from the Madagascar Biodiversity Center associated with the California Academy of Sciences (San Francisco). Invertebrate collections deposited in the latter institution are dispersed to about 180 taxonomic specialists around the world and have resulted in a continuous stream of scientific papers describing new taxa to science. Those associated with collections from Marojejy are cited in the above section. Of new insect species to science named since 1988, 138 of 181 are based on the post-1988 collections (Table 1).

The absence of specific surveys for certain groups or lack of detailed studies of previously collected material for taxonomic work indicates that much still needs to be learned about the species diversity of insects on Marojejy. For example, over the past few decades a remarkable number of new species of tiger beetles (Cicindelidae) have been described from Madagascar (Moravec, 2022), but not a single species from Marojejy, which is directly related to the lack of a dedicated field mission to the site for this beetle family (J. Moravec, in litt.).

Vertebrates

Since 1988, 42 species of vertebrates occurring on the Marojejy Massif have been described as new to science and all but two are entirely based on material collected after 1988. The researchers describing these new species are referencing older collections in their taxonomic studies, but given that almost all of the recently named taxa are based on post-1988 collected material underlines the importance of new inventories, specifically specimens and associated tissues for molecular studies.

Scientific investigations continue to advance. For example, the descriptions of three additional *Mantidactylus* frog species from Marojejy were published in December 2022 (Scherz *et al.*, 2022) just a few weeks after the early October 2022 deadline used herein for the inclusion of recently described species. Two additional new species of *Guibemantis* from the massif have been published recently (Koppetsch *et al.*, 2023) and several other amphibians and reptiles from Marojejy have already been identified as new species or new candidate species, but are still awaiting taxonomic revisions. The number of new species of frogs, and to a lesser extent reptiles, named from the massif is rather extraordinary and underlines that the level of previous scientific research on these groups was insufficient to provide a good measure of species diversity. However, an important series of amphibian and reptile specimens were collected during the ORSTOM/RCP exploration of Marojejy in the 1970s and numerous new species described based on this material before the more modern wave (e.g., Brygoo *et al.*, 1973, 1974; Guibé, 1974, 1975).

Only one species of fish and no species of bird or terrestrial mammal from Marojejy have been described as new to science since 1988. For mammals, many of the regional endemics of the families Tenrecidae and Nesomyidae are shared with the nearby Anjanaharibe-Sud Massif (Goodman, 1998), which was inventoried and the results published before the 1996 inventory of Marojejy; hence, the descriptions of these taxa are not figured in the tabulations presented here. A species of mouse lemur, *Microcebus mittermeieri*, described from the Anjanaharibe-Sud protected area (Louis *et al.*, 2006) was subsequently found in Marojejy (Rasoloarison *et al.*, 2013). Detailed systematic work on the species level delimitations is advancing in part with molecular tools and numerous species in the genera *Microgale* and *Oryzorictes* remain to be described, including

those from Marojejy (Goodman *et al.*, 2018c; Everson *et al.*, 2022; Jenkins *et al.*, 2022).

Conclusion

Since 1988 at least 450 species of plants and animals have been named as new to science and for which at least one specimen per species cited in the description was collected on the Marojejy Massif. Approximately 85% of these species have been described using material collected after 1988, which clearly underlines the need to continue inventories and associated voucher collections being archived in the form of museum specimens. On the basis of the experience of the different authors of this paper, with considerable knowledge of the plant and animal taxonomic literature concerning Madagascar, no other protected area on the island has produced higher rates of new species descriptions when compared with Marojejy. This underlines the important level of biodiversity of the massif and the importance of conserving the remaining ecosystems in and around the protected area and the constituent species.

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