

# **Biodiversity Inventory for Key Wetlands in Rwanda**

## **Final Report**

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## 1. Introduction

Wetlands in tropical countries are among the most endangered biomes. Rapid destruction of marshlands has led to remnant stands, often converted into agriculturally used landscape. Data on vascular plants are available to a certain degree, but the lack of data for amphibians, reptiles, birds and mammals is a major problem also for conservation planning and for assessment of biodiversity value.

The Convention on Biological Diversity (CBD) of 1992 has emphasized the high priority of wetlands. Rwanda with its highly diversified landscape has several important swamp areas. The first study dealing with the vegetation and ecology of swamps in Rwanda was made by DEUSE (1966) who presented a first inventory of Kamiranzovu-, Rugezi-, Akagera- and the Rweru-Mugesera-Complexes. However, his species lists were far from complete and only the most dominant species were annotated. TROUPIN (1966) made a phytosociological inventory of the Akagera National Park and Eastern Rwanda where swamps, however, were only briefly mentioned. A more detailed inventory of Kamiranzovu Swamp was published by BOUXIN (1974). The only other publications available dealing with the vegetation of swamps in Rwanda are FISCHER & HINKEL (1992) and HINKEL & FISCHER (1995). The adjacent Kahuzi-Biéga National Park in Eastern Congo and its swamps were studied by FISCHER (1996). For all other important swamp areas only unpublished reports are available, e.g. HATEGEKIMANA & TWARABAMENYE (2005) for Rugezi Swamp and EXPERCO DES GRANDS LACS (2003) for a short overview of all swamps.

The present study is the first detailed inventory of the four most important swamp areas in Rwanda, i.e. Kamiranzovu Complex, Rugezi Complex, Rweru-Mugesera Complex and Akagera Complex (Fig. 1-4) . Beside vascular plants and vegetation, the important indicator groups of birds, reptiles and amphibians were investigated in detail. For mammals, random observations and literature survey are the base for the preliminary lists.

The aims of the present study are

1. to evaluate the diversity of vascular plants, amphibians, reptiles, birds and small mammals in the four key marshlands of Kamiranzovu, Rugezi, Rweru-Mugesera and Akagera
2. to collect biodiversity data to assist in guiding conservation activities and management of Rwanda's key wetlands
3. to enhance scientific information and capacity of Rwanda by incorporating the collected data in the national biodiversity information system
4. through consultation and support from local experts and local people, to collect information on major socio-economic conditions, human disturbance, and anthropogenic threats to the ecosystem and species.

## 2. Materials and Methods

The  $\alpha$ - and  $\beta$ -diversity of vascular plants, amphibians, reptiles and birds will be monitored along transects in four key marshlands: Kamiranzovu Complex, Rugezi Complex, Rweru-Mugesera Complex and Akagera Complex.

The inventory of these organisms as model groups are based on geo-coded GPS-data for each species. An exhaustive iconography with photographs of as many species as possible is included. The informations collected for each species are:

- Status: Local endemic, Albertine Rift endemic or widespread
- Possible threats or, if available, IUCN Conservation Status
- Possible use, especially for plants (e.g. medicinal plants, construction material, food etc.).

All data are recorded along selected transects. These transects are chosen randomly but in some cases (e.g. Kamiranzovu, Rugezi) the choice depends on availability. For a survey of the flora and vegetation transects are established in the most representative sites within the four complexes mentioned above. The transects are marked and recorded to enable future monitoring in the same sites. Plants are usually identified directly in the field. In case of doubt, voucher specimens were sampled and identified in the laboratory later. The main source for identification is the 'Flore du Rwanda' in 4 volumes (TROUPIN 1978, 1983, 1985, 1988). The circumscription of plant families follows APG (2009). The nomenclature of plant communities is used according SCHMITZ (1988). Field methods for recording amphibian diversity follow standard methods for amphibian inventories (HEYER et al. 1994, RÖDEL & ERNST 2004, VEITH et al. 2004). The main field method is a combination of visual and acoustic transect sampling and visual (VES) and acoustic (AES) encounter surveys (cf. RÖDEL & ERNST 2004). The combination of visual and acoustic sampling techniques is especially efficient because not only species that are easily detected by sight can be found but also those that call from hideouts. In each of the investigated areas we have established between 3 and 5 linear transects (length 300-500 m) in which we sampled on 22 non-consecutive days in the afternoon and during the night. Taking voucher specimens is still a fundamental technique of taxonomic research and will be so even with the advent of genetic

barcoding techniques. In some case we found a species that we were not able to identify in the field, therefore we took a limited number of vouchers. Animals were killed according to international guidelines of humane killing of animals, immersing them in chlorobutanol solution. Tissue samples were taken under field conditions and stored in ethanol. Frogs were fixed and stored in ethanol and deposited in a major museum collection (Zoological Museums Bonn and Berlin). Reptiles were recorded along the transects on sight. For birds and mammals a similar combination of visual and acoustic methods was applied. The nomenclature of amphibians follows CHANNING & HOWELL (2006), that of reptiles except chameleons SPAWLS et al. (2002), that of chameleons TILBURY (2010), that of birds STEVENSON & FANSHAWE (2002) and that of mammals KINGDON (1997).

The IUCN red list status is only marked if the taxon is at least considered to be near threatened (NT). Species listed as least concern (LC) are not marked. The status of the different taxa as Albertine Rift Endemics was assessed for the plants after FISCHER (unpublished) and for the animals after PLUMPTRE et al. (2007).

The hierarchical cluster analysis of the plants and animals from the four study sites based on squared Euclidean distance (Ward's minimum variance method) was implemented with PC-ORD version 5.33 (McCUNE & MEFFORD 2006).

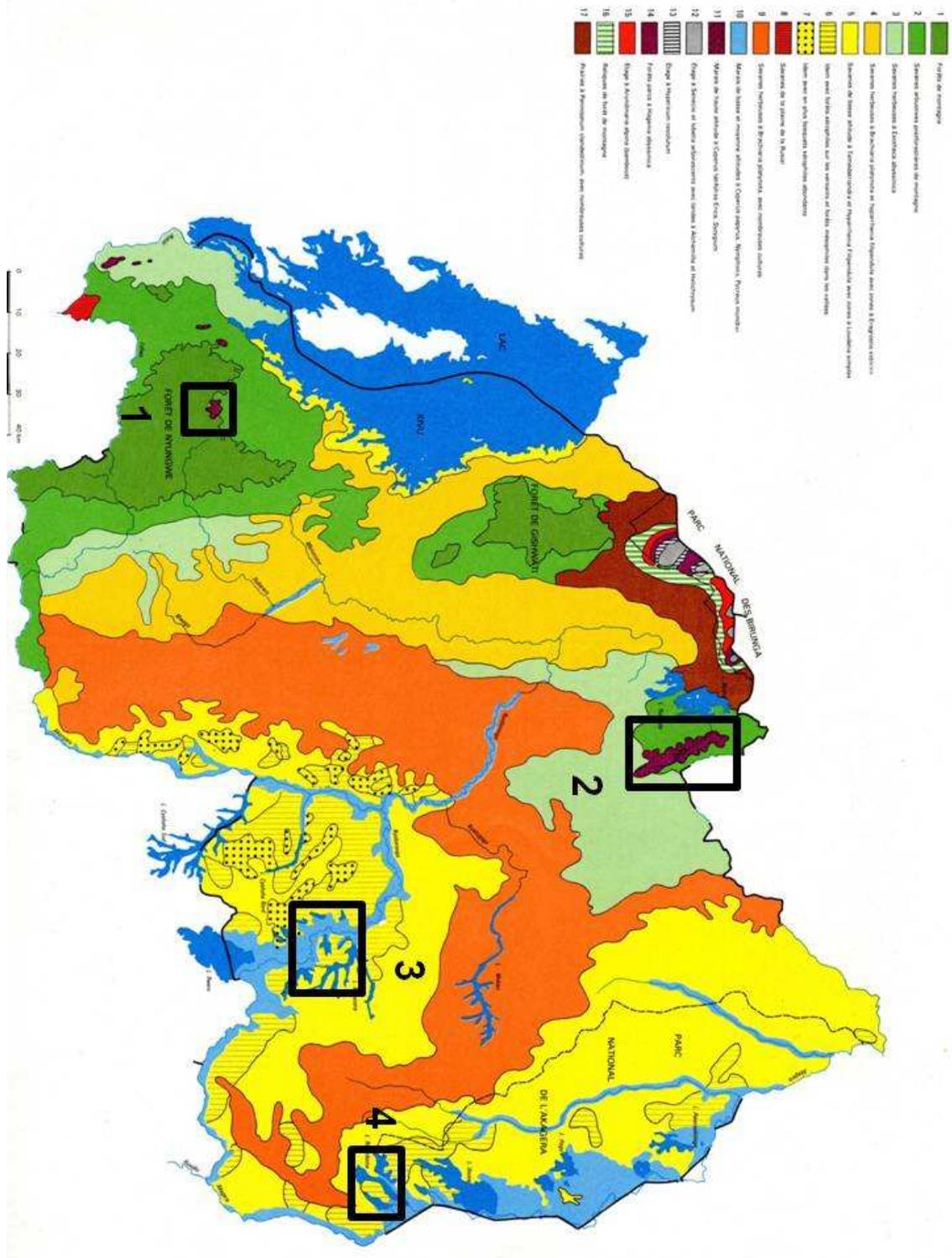


Fig. 1. Vegetation map of Rwanda showing study sites: 1 Kamiranzovu complex, 2 Rugezi complex, 3 Rweru-Mugesera complex, 4 Akagera complex (PRIOUL & SIRVEN 1981)

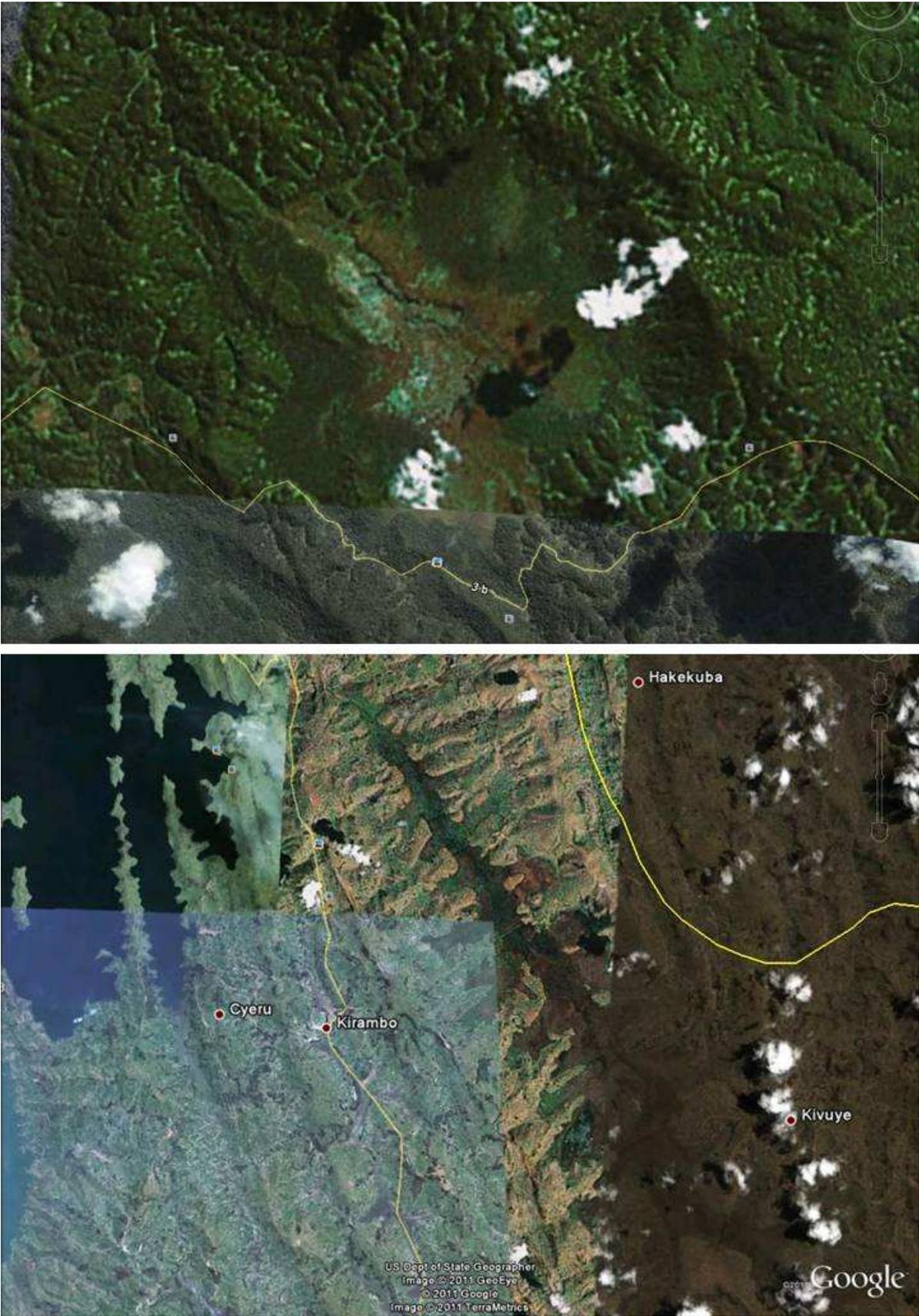


Fig. 2: Kamiranzovu Complex (above), Rugezi Complex (below) (Source: Google Earth).



Fig. 3. Rweru-Mugesera Complex (Source: Google Earth).



Fig. 4. Akagera-Complex, Ibanda-Makera (below) (Source: Google Earth).

### 3. Results

The present inventory was carried out in spring 2011 during the rainy season. A total of 457 vascular plants, among them 57 Albertine Rift endemics, were recorded in the four study sites (tab. 1, 2). Altogether 33 species of amphibians have been found comprising 9 Albertine Rift endemics (tab. 1,3). 27 species of reptiles were observed including 5 Albertine Rift endemics (tab. 1,4). 118 birds with 5 Albertine Rift endemics were observed (tab. 1, 5). 32 mammals (6 Albertine Rift endemics) are known from the four swamps in Rwanda (tab. 1, 6).

	Kamiranzovu	Rugezi	Rweru-Mugesera	Akagera	Total
Vascular Plants	326	94	53	77	457
Amphibians	12	6	13	16	33
Reptiles	12	3	6	13	27
Birds	26	37	40	54	118
Mammals	18	2	16	11	33

Tab. 1: Species numbers of plants and animals of the four different study sites.

#### 3.1 Kamiranzovu Complex

##### 3.1.1 Geography and geology

Kamiranzovu is a large swamp situated on the eastern slope of the Congo-Nile watershed at about 1950 m. It is part of Nyungwe National Park and forms the largest peat bog in Continental Africa. It represents a large flat basin of about 850 hectares surface surrounded by hills covered with montane forest. The swamp is the source of the Kamiranzovu River which flows into Lake Kivu and the Congo basin. The swamp lies within a depression of Burundian schist and is surrounded by a quartzitic crest.

##### 3.1.2 Previous studies

The vegetation of Kamiranzovu Swamp has first been studied by DEUSE (1966). A more detailed phytosociological inventory was published by BOUXIN (1974). Data on amphibians and reptiles were published by FISCHER & HINKEL (1992) and HINKEL (1996). For previous studies on birds and mammals see DOWSETT-LEMAIRE (1990) and DOWSETT (1990).



Fig. 5. View of Kamiranzovu Swamp.



Fig. 6. Open Swamp with *Eulophia horsfallii* (above), shrubs covered with epiphytes (below).



Fig. 7. Swamp Forest, Kamiranzovu.

### 3.1.3 Anthropogenic impact and use

As Nyungwe Forest has been gazetted as National Park in 2004, the anthropogenic impact is restricted to tourist visits along the official trails. A part of Kamiranzovu trail traversing the swamp is constructed as a log paved path to minimize destruction of the sensitive vegetation. Immediately after the genocide, poaching was abundant which led to the extinction of the last forest elephants. Since 1999, however, the area is regularly controlled and poaching and other illegal activities have been nearly totally reduced.

### 3.1.4 Flora and vegetation

#### 3.1.4.1 Plant communities

The Kamiranzovu Swamp is surrounded by a swamp forest dominated by *Carapa grandiflora*, *Syzygium guineense* ssp. *parvifolium*, *Anthocleista grandiflora*, and *Podocarpus latifolius* (Fig. 7). This forest is characterized by the high abundance of epiphytes including large moss balls composed of *Dicranoloma billardieri* and *Plicanthus hirtellus*. The open swamp is dominated by *Cyperus latifolius*, *Cyperus denudatus*, *Cyperus nigricans*, and *Thelypteris confluens* (Fig. 6). Some areas are inhabited by a community with *Lobelia mildbraedii* and *Cyperus denudatus*. Towards the swamp forest, numerous small shrubs (e.g. *Hymenodictyon floribundum*, *Syzygium rowlandii*, *Vaccinium stanleyi*) are occurring which carry numerous vascular epiphytes, among them a high diversity of orchids (Fig. 6). In the interior of the swamp open water surfaces are observable which, however, are inaccessible.

#### 3.1.4.2 Flora of vascular plants

Kamiranzovu Swamp is highly diverse due to the habitat diversity with open swamps and swamp forest. Thus 326 species of vascular plants could be recorded (see tab. 2). Another explanation for this high diversity is the fact that Kamiranzovu has been part of a protected area since 1933 when Nyungwe was gazetted as Forest Reserve. So all important habitats remained intact and in an almost primary condition.

#### 3.1.4.3 Endemic and/or remarkable species

Along the three transects in Kamiranzovu Swamp, 56 species of Albertine Rift Endemics were recorded. Among them, one species, *Aframomum wuerthii*, is only known from this area (i.e. a local endemic), and a second species, *Disperis*

*reklieberae*, is elsewhere only known from Cyamudongo Forest. The recorded endemics are listed and briefly described below.

*Aframomum wuerthii* (Fig. 8)

Description: Perennial herb with leafy shoots well separated, 90 to 200 cm tall. Leaves ovate-lanceolate, up to 20 cm long. Inflorescence with up to 7 flowers, arising at base of leafy shoots. Bracts carmesine red. Flowers white, with labellum up to 6 cm long, petals 4 cm long. Fruits light red, broadly ovate, 6 x 4 cm. Habitat and distribution: The species grows at the edge of a swamp forest with *Anthocleista grandiflora*, *Syzygium guineense* ssp. *parvifolium* and *Carapa grandiflora*. It is only known from a small population in Kamiranzovu swamp. Notes: Local endemic of Rwanda which was only recently discovered and described in 2006. The fruits are usually eaten by monkeys.

*Ancistrohynchus tenuicaulis*

Description: Epiphytic orchid up to 2-16 cm tall. Leaves linear, unequally bilobed at apex, 2-7.2 x 0.4-0.5 cm. Inflorescence capitate, up to 0.4-0.5 cm long. Flowers white, dorsal sepal elliptic-oblong, obtuse, 0.15-0.35 x 0.1 cm, lateral sepals similar, 0.2-0.35 x 0.1 cm, petals elliptic, rounded, 0.17-0.3 x 0.07-0.14 cm, lip concave, ovate, obtuse, 0.14-0.25 x 0.14-0.24 cm, spur globose, 0.1-0.2 cm long. Flowering season: March to June, September to November. Habitat and distribution in Rwanda: Montane rainforest, 1800-2000 m. In Nyungwe National Park at Gisakura, Kamiranzovu, and between Pindura and Bweyeye. Distribution in Africa: Cameroon, Congo-Kinshasa, Burundi, Uganda, Tanzania, Malawi.

*Angraecopsis pusilla*

Description: Epiphytic orchid not exceeding 10 cm. Leaves longitudinally plicate, linear-oblong, 1.5-5 x 0.15-0.5 cm. Inflorescence with 4-7 flowers, up to 2-3 cm long. Flowers white, sepals 0.15-0.3 cm long, dorsal sepal ovate and subcircular, lateral sepals incurved, obovate, petals ovate to elliptic, rounded, up to 0.2 cm long, lip 0.25 x 0.2 cm, concave, subcordate at base, acute at apex, spur rounded at apex, up to 0.3 cm long. Flowering season: January to March. Habitat and distribution in Rwanda: Montane forest, on small twigs in the canopy, 1800-2000 m. In Nyungwe National Park at Gisakura, Karamba, Kamiranzovu and between Pindura and



Fig. 8. *Aframomum wuerthii* (above), *Adenia bequaertii* (below).



Fig. 9. *Begonia pulcherrima*.

Bweyeye. Distribution in Africa: Eastern Congo (Virunga Volcanoes, Nyamagira, Kahuzi Biega). Notes: Albertine Rift endemic, only known from the Virunga Volcanoes, Kahuzi Biega and Nyungwe.

*Ardisia kivuensis*

Description: Tree or shrub up to 1.5-15 m tall, branches with ferruginous hairs at apex. Leaves alternate, petiole 5-15 cm long, lamina elliptic to oblong, acute to acuminate at apex, cuneate to obtuse at base, dentate or crenulate at margin, coriaceous, 4-20 cm long and 2-9.5 cm wide. Inflorescence a short axillary raceme up to 0.3-2 cm long, with 3-14 flowers, glabrous to densely ferruginous-pubescent. Flower white to pinkish with red spots, up to 0.5 cm long. Fruit a globose berry, 0.6-0.8 cm in diameter. Habitat and distribution: Montane rainforest, 2000-2500 m. In Nyungwe at Kamiranzovu, Uwinka, Nshili. Cameroon, Eastern Congo (Kahuzi-Biega), Burundi, Western Uganda. Notes: Albertine Rift near-endemic with disjunct occurrence in Cameroon.

*Begonia pulcherrima* (Fig. 9)

Description: Perennial terrestrial herb up to 30 cm tall, glabrous to sparsely hairy. Leaves alternate, rosulate, asymmetrical, dark green, shining, papery with distinct dentate margin towards apex, petiolate, up to 8-25 cm long. Inflorescence with 1-2 flowers. Flowers yellow, male flowers with 20-26 stamens, female flowers with slightly 4-winged ovary and 3-4 styles. Habitat and distribution: Understorey of primary montane rainforest, usually near streams and waterfalls, 1900-2000. Only known from Western Nyungwe: between Pindura and Bweyeye, Kamiranzovu, Karamba, Gisakura. Notes: Local endemic of Rwanda. This conspicuous species has been misidentified as *Begonia scapigera* Hook. from Cameroon and has been described only in 1988.

*Beilschmiedia rwandensis* (Fig. 10)

Description: Tree up to 20 m tall, crown spreading, bark greyish, rugose, young branches pubescent. Leaves alternate, petiole 0.5-1 cm long, lamina elliptic to lanceolate, acuminate at apex, acute to rounded at base, glabrous, 10-20 cm long and 2-4 cm wide. Flowers in terminal panicles up to 10-13 cm long, pubescent, with numerous flowers, flowers with greenish to yellowish perianth up to 0.15-0.22 cm



Fig. 10. *Beilschmiedia rwandensis* (above), *Dorstenia nyungwensis* (below).

long, anthers 2-celled opening by 2 valves. Fruit a elliptic drupe without basal cupula, up to 4-6 cm long. Habitat and distribution: Montane Forest, 1900-2500 m. In Nyungwe at Gisakura, Kamiranzovu, Uwinka. Notes: Local endemic of Rwanda.

*Blotiella bouxiniana*

Description: Terrestrial fern, rhizome ascending, with tufted leaves. Leaves up to 2 m long, lamina bipinnate to tripinnate, pinna rachis wingless, densely hairy, veins reticulate, sori marginal between lobes. Habitat and distribution: Montane rainforest, 1900-2200 m. In Nyungwe at Gisakura, Karamba, Kamiranzovu. Notes: Albertine Rift endemic, only known from Rwanda. The type was collected at Kamiranzovu swamp.

*Bulbophyllum vulcanicum* (Fig. 11)

Description: Epiphytic orchid with narrowly-cylindrical pseudobulbs, up to 5-11 cm long, each bearing 2 leaves. Leaves coriaceous, oblong-elliptic, 12-15 cm long. Inflorescence erect, up to 33 cm long, with numerous dense flowers. Flowers greenish tinged with purple or entirely purple, all turned to one side, up to 1.5 cm long, dorsal sepal oblong to ovate, lateral sepals triangular, petals triangular, lip long-ciliate. Flowering season: January to March, June, October to December. Habitat and distribution in Rwanda: Epiphyte in montane rainforest, 2000-2400 m. In Nyungwe National Park at Gisakura, Kamiranzovu, Uwinka, between Pindura and Bweyeye, also known from Gishwati Forest. Distribution in Africa: Eastern Congo, Western Uganda (Ruwenzori), Burundi. Notes: Albertine Rift endemic only known from few localities in montane forests around the Albertine Rift valley.

*Chassalia subochreatea*

Description: Shrub or small tree up to 1.8-9 m tall, glabrous. Leaves opposite, thin, petiole 0.2-3.5 cm long, glabrous, stipules joined to form a sheath, 0.3-0.4 cm long, lamina oblanceolate to narrow elliptic, acuminate at apex, narrowly cuneate at base, 3.5-18 cm long and 1.2-5.5 cm wide, glabrous. Inflorescence with numerous flowers in dense panicle-like terminal cyme, peduncles white. Flowers white, greenish or yellow, corolla with narrowly infundibuliform tube up to 0.5-0.6 cm long and 5 elliptic-oblong lobes 0.4-0.5 cm long, ovary inferior. Fruit a black ellipsoid drupe, 0.45-0.65 cm long. Habitat and distribution: Montane forest, 1700-2700 m. In Nyungwe widespread on the Western slope. In Rwanda also in Gishwati Forest. Eastern Congo



Fig. 11. *Bulbophyllum vulcanicum*.

(Kivu), Burundi, Western Uganda (Kigezi), Western Kenya (Mau), Western Tanzania (Kigoma). Notes: Albertine Rift endemic with a disjunct occurrence in Kenya.

*Cynorkis symoensii*

Description: Terrestrial orchid up to 15 cm tall, stem glabrous, with 2 leaves near base. Leaves elliptic, up to 11 cm long. Inflorescence secund, dense, with 3-12 flowers. Flowers bright magenta-pink, with green sepals, up to 1.3 cm long, sepals 0.3-0.4 x 0.2 cm, petals ovate, 0.3 x 0.2 cm, lip 3-lobed, with large side-lobes, up to 1 cm long and 0.8-1 cm wide, spur distinctly swollen at apex, 0.8 cm long. Flowering season: January to March, November to December. Habitat and distribution in Rwanda: Open soil on roadcuts and in ericaceous shrub, 2000-2400 m. In Nyungwe National Park at Gisakura, Kamiranovu, Uwinka, also known from Gishwati Forest. Distribution in Africa: Eastern Congo (Mt. Kabogo, B. KIRUNDA 2007 pers. comm.), Burundi, Malawi. Notes: Albertine Rift endemic only known from Rwanda, Eastern Congo and Malawi.

*Disa eminii*

Description: Robust terrestrial orchid up to 30-60 cm tall. Leaves usually 7-10, narrowly linear-lanceolate, 10-45 cm long. Inflorescence lax, with 7 to numerous flowers. Flowers cherry- or coral-red, about 1.5 cm in diameter, dorsal sepal erect, very convex and nearly hooded, broadly elliptical, apex rounded, spurred near base, 0.9 x 0.7-0.8 cm when flattened, with a cylindrical spur up to 2-2.5 cm long, lateral sepals spreading, oblong-elliptical, 1 x 0.4-0.6 cm, petals erect, covered by hood of dorsal sepal, oblong, 0.7 x 0.2-0.4 cm, lip oblanceolate, 1 x 0.4 cm. Flowering season: Flowers recorded in all months. Habitat and distribution in Rwanda: Open soil on roadcuts and in swamps, 2000-2400 m. In Nyungwe National Park abundant between Kamiranzovu and Uwinka, also known from Volcano National Park. Distribution in Africa: Burundi, Southwestern Uganda (Kigezi), Western Tanzania (Bukoba), Zambia (Mwinilunga).

*Disperis reklieberae*

Description: Terrestrial orchid up to 13-14 cm tall. Leaves 2, opposite, cuneate to truncate at base, unequal, one leaf larger, 5.5-6.5 cm long and 3 cm wide, the other 4.5 cm long and 1.8 cm wide. Inflorescence erect, with 3-6 flowers. Flower white,

sometimes tinged with purple, up to 1.5 cm long, dorsal sepal joined with petals, forming a slender, horizontal spur, slightly emarginate at apex, up to 1 cm long. Flowering season: November to December. Habitat and distribution in Rwanda: Understorey of rainforest in leaf-litter, 1900-2000 m. In Nyungwe National Park only in Cyamudongo Forest, at Kamiranzovu swamp and at km 107 on road Huye-Rusizi. Notes: This local endemic species had provisionally been identified as *D. bifida* P.J.Cribb (Delepierre & Lebel 2004) which is an endemic of Malawi. It differs, however, in the following characters: flower colour and shape of lip and spur.

*Dorstenia nyungwensis* (Fig. 10)

Description: Herb up to 80 cm tall, stems ascending, woody at base, densely pubescent. Leaves alternate, lamina elliptic to obovate, up to 5-11 cm long, apex acute, base cordate. Inflorescence solitary, receptacle discoid, with terminal primary appendages, flowering face elliptic, 1.5-2.2 cm long and 0.3-0.7 cm wide.

Habitat and distribution: Understorey of montane rainforest, 2000-2100 m. In Nyungwe around Kamiranzovu swamp and near Karamba. Not known elsewhere.

Notes: Local endemic of Rwanda, only known from few localities in Nyungwe National Park.

*Eggelingia ligulifolia* (Fig. 12)

Description: Epiphytic orchid, up to 7-45 cm tall. Leaves distichous, succulent, narrowly oblong lanceolate, unequally bilobed at apex, up to 1.7-7 cm long and 0.4-0.8 cm wide, with articulated leaf-bases. Inflorescence a short raceme in the axils of leaves, with 2-3 flowers. Flowers white, 1-1.3 cm in diameter, sepals and petals 0.5-0.8 x 0.2-0.3 cm, lip entire, auriculate at base, 0.4-0.6 x 0.17-0.35 cm, spur straight, cylindrical, 0.4-0.5 cm long, only slightly inflated at apex. Flowering season: January to March, November to December. Habitat and distribution in Rwanda: Epiphyte in montane forest, 1900-2000 m. In Nyungwe National Park at Gisakura, Kamiranzovu and Bweyeye. Distribution in Africa: Eastern Congo, Burundi and Western Uganda (Kigezi Impenetrable Forest). Notes: Albertine Rift endemic, only known from Kahuzi, Nyungwe, Kibira and Kigezi.



Fig. 12. *Eggelingia ligulifolia*.

*Harungana montana*

Description: Shrub or tree up to 15-20 m tall, much branched, young stems densely covered with rusty stellate or dendrod hairs. Leaves opposite, petiole up to 1-2 cm long, lamina elliptic to ovate, 6.5-8.5 (20) cm long and 4.5-10 cm wide, obtuse and rounded at apex, obtuse and rounded at base, glabrous at upper surface, lower surface with heterogeneous hairs, tomentose hairs surmounted by red stellate hairs. Inflorescence cymose, many-flowered, Flowers white, calyx about 0.2 cm long, corolla up to 0.3 cm long, stamens 3-4 per bundle. Fruit a spherical drupe, 0.4 cm in diameter. Habitat and distribution: Montane rainforest, 2000 - 2400 m. In Nyungwe at Gisakura, Karamba, Kamiranzovu, Uwinka and between Pindura and Bweyeyeye. Eastern Congo. Notes: Albertine Rift endemic known only from Eastern Congo (Kasindi, Kahuzi) and Western Rwanda. The species is sometimes considered to represent a mere ecological variety of *H. madagascariensis*.

*Impatiens bequaertii* (Fig. 13)

Description: Perennial herb, glabrous or with few scattered hairs on upper leaf-surface, stems procumbent to ascending, up to 20 cm tall. Leaves alternate, petiole (0.3= 0.9-4 cm long, lamina ovate-rhomboidal, acuminate at apex, truncate at base, margin crenate-serrate, 1.8-4.5 cm long and 1-2.4 cm wide. Inflorescence a 3-4-flowered dense raceme. Flowers white or pale pink, up to 1 cm long, spur filiform, 0.7-0.9 cm long. Capsule 0.7-0.8 cm long. Habitat and distribution: Understorey of montane forest, often near streams or on mossy rocks, 1800-2300 m. In Nyungwe from Gisakura, Karamba, Kamiranzovu to Uwinka and Bweyeye. Eastern Congo, Burundi, Southwestern Uganda. Notes: Albertine Rift endemic.

*Impatiens purpureo-violacea* (Fig. 13)

Description: Perennial herb, glabrous to pubescent, stems ascending to erect, becoming woody and leafless below, up to 10-50 cm tall. Leaves alternate, petiole 0.5-2.8 cm long, lamina dark green above, paler below, ovate to elliptic, acuminate at apex, rounded at base, margin crenulate or denticulate, 2.4-9.4 cm long and 1.7-4.1 cm wide. Inflorescence a 1-3-flowered axillary raceme. Flowers pink or violet-pink to purplish, up to 3 cm long, spur filiform, curved, up to 2.5 cm long. Capsule 1 cm long. Habitat and distribution: Understorey herb in montane rainforest from 2000 to 2600 m. In Nyungwe mainly in the western part: Karamba, Pindura, Uwinka, Mt. Bigugu,



Fig. 13. *Impatiens purpureo-violacea* (above left), *Impatiens bequaertii* (above right, below left), *Impatiens mildbraedii* (below right).

Mt. Muzimu, Source of the Nile. Eastern Congo, Burundi. Notes: Albertine Rift endemic. The plant was first collected in 1907 at the source of the Nile in Nyungwe by the German Botanist Johannes Mildraed during the first German Expedition to Central Africa 1907/1908 and described in 1914.

*Impatiens keilii* (Fig. 14)

Description: Epiphytic perennial succulent herb, glabrous, stems ascending to erect, up to 50 cm long, rooting at the lower nodes. Leaves alternate, petiole 0.17-5 cm long, lamina elliptic to ovate, slightly coriaceous, 3.5-5 cm long and 1.7-3 cm wide. Inflorescence an axillary 1-2-flowered cluster. Flowers red with yellow, petals green to yellowish-green, 2-2.5 cm long, spur red, spirally curved, 0.8-1.2 cm long. Capsule 1 cm long. Habitat and distribution: Obligate epiphyte, usually in moss-cushions, 1800-2200 m. In Nyungwe between Gisakura, Karamba and Kamiranzovu. Eastern Congo (Kahuzi-Biega), Burundi (Kibira). Notes: Albertine Rift endemic only known from the Western and Eastern Crest of the Central African Rift around Lake Kivu. The related *Impatiens epiphytica* G.M.Schulze is endemic to the Uluguru Mountains in Tanzania.

*Impatiens mildbraedii* (Fig. 13)

Description: Perennial herb, glabrous, stems procumbent to ascending, up to 40-50 cm long. Leaves alternate, petiole 0.4-2.1 cm long, lamina elliptic to ovate-lanceolate, acuminate at apex, rounded to attenuate at base, margin crenulate or denticulate, 1.5-6.2 cm long and 0.8-2.7 cm wide. Inflorescence a 2-4-flowered axillary raceme. Flowers pale pink or violet-pink, up to 1 cm long, spur filiform, 0.6-1.3 cm long. Capsule 0.8 cm long. Habitat and distribution: Open swamps in montane rainforest, usually in full sun, 2000-3000 m. In Nyungwe at Kamiranzovu. In Rwanda in Gishwati Forest and on the Virunga Volcanoes. Eastern Congo, Burundi, Western Uganda. Notes: Albertine Rift endemic. The plant was first collected in 1907 at Lake Karago near Ruhengeri by the German Botanist Johannes Mildraed during the first German Expedition to Central Africa 1907/1908 and described in 1914.

*Memecylon walikalense*

Description: Shrub to small tree, up to 4-8 m tall, glabrous, branches slightly 4-angled. Leaves opposite, coriaceous, petiole 0.2-0.4 cm long, lamina elliptic, apex



Fig. 14. *Impatiens niamniamensis* (above), *Impatiens keilii* (below).

acute to subacute, base rounded to slightly cordate, 6-12 cm long and 2-5.5 cm wide, with 3 palmate veins. Inflorescence thyrse, solitary or in pairs, with few flowers, up to 5 cm long. Flowers with cupular calyx up to 0.3 cm long, corolla pink to violet, with 4 oblong-obovate petals, up to 0.3-0.5 cm long. Fruit a pink berry up to 1.5 cm in diameter. Habitat and distribution: Montane forest, 1900-2100 m. In Nyungwe in Cyamudongo Forest and at Gisakura, Karamba, Kamiranzovu, Uwinka, between Pindura and Bweyeye. Eastern Congo. Notes: Albertine Rift endemic.

*Monanthonoxia orophila* (Fig. 15)

Description: Woody liana up to 12 m long, apical branches zigzag-like, glabrous. Leaves alternate, petiole 0.4-0.7 cm long, lamina elliptic to oblong or lanceolate, acute at apex, subcordate at base, 4-11 cm long and 1.2-4 cm wide, usually bluish green on upper surface. Flowers solitary, calyx 0.4-0.5 cm in diameter, divided into 3 triangular lobes. Petals greenish, tomentose inside and woolly ferruginose outside, up to 0.8 cm long and 0.7 cm wide. Fruit with 7-10 ovate to oblong carpels, 1-1.4 cm long and 0.6-0.8 cm wide, green, becoming orange-red when mature. Habitat and distribution: Montane rainforest, 1900-2300 m. In Nyungwe at Kamiranzovu and Uwinka. Eastern Congo, Western Uganda. Notes: Albertine Rift Endemic, only known from Eastern Congo (Kahuzi-Biega), Rwanda (Nyungwe) and Western Uganda (Kigezi).

*Octomeron montanum*

Description: Prostrate creeping herb up to 30-40 cm long, pubescent. Leaves opposite, petiole up to 0.5 cm long, lamina elliptic to broadly ovate, acute at apex, attenuate at base, margin dentate, up to 3 cm long and 1.6 cm wide. Inflorescence terminal, thyrse, dense, resembling a spike, up to 1.5-2 cm long. Flowers white, up to 0.25-0.3 cm long. Fruit with four 1-seeded nuts. Habitat and distribution: Montane forest, often in clearings and at road-cuts, 2000-2400 m. In Nyungwe widespread on the Western slope. In Rwanda also in Gishwati Forest. Eastern Congo. Notes: Albertine Rift endemic, only known from Rwanda and Eastern Congo.

*Oricia renieri* (Fig. 15)

Description: Tree or shrub up to 4-10 m tall. Leaves alternate, sometimes opposite, up to 30 x 10 cm, pinnate with 3 pinnae. Flowers in axillary or terminal panicles,



Fig. 15. *Monanthotaxis orophila* (above), *Oricia renieri* (below).

flowers 0,4 - 0,5 cm long, male and female flowers present. Fruits ovate, 1 - 0,7 cm. Habitat and distribution: Understorey of rainforests, 1600 - 2300 m. In Nyungwe rare in the western part. In Rwanda also in gallery forests of the Akagera. Widespread in East and Southeast Africa. Notes: Local endemic of Rwanda, not known elsewhere.

*Oxyanthus troupinii*

Description: Shrub or small tree up to 1-12 m tall. Leaves opposite, subcoriaceous, petiole 0.4-0.5 cm long, glabrous, stipules ovate to lanceolate, 1-2 cm long, 0.4-0.7 cm wide, acute, often bifid, lamina elliptic to oblanceolate, acute to acuminate at apex, cuneate at base, 6.2-14 cm long and 2-6.1 cm wide, glabrous. Inflorescence with numerous flowers in a cymose panicle. Flowers fragrant, white, corolla with funnel-shaped tube up to 2.2 cm long and 0.1-0.15 cm wide, 5 triangular lobes 0.7-0.9 cm long, ovary inferior. Fruit an elliptic to rounded berry, up to 3 cm long. Habitat and distribution: Montane forest, 1800-2400 m. In Nyungwe at Gisakura, Kamiranzovu, Uwinka, between Pindura and Bweyeye. Burundi (Kibira), Western Uganda (Kigezi). Notes: Albertine Rift endemic, only known from Kigezi, Nyungwe and Kibira on the Eastern crest of the Rift.

*Peddiea rapaneoides*

Description: Shrub or small tree up to 1.5-10 m tall. Leaves alternate, petiolate, petiole 0.2-0.6 cm long, lamina narrowly to broadly elliptic or lanceolate, 5-9 (-11) cm long and 2.3-3.7 (-4.6) cm wide. Inflorescence subumbellate, with 7-28 flowers. Inflorescence umbellate, with 8-26 flowers. Flowers greenish-yellow, with 4-5 lobes, 0.6-0.9 cm long. Habitat and distribution: Montane forest and bamboo forest, 2000-2800 m. In Nyungwe at Gisakura, Mt. Bigugu and Mt. Muzimu. In Rwanda also in the Virunga Volcanoes. Eastern Congo, Western Uganda, Burundi. Notes: Albertine Rift endemic, only known from Kahuzi-Biéga, Nyungwe, Kibira and the Virunga Volcanoes.

*Polystachya aconitiflora* (Fig. 16)

Description: Epiphytic or lithophytic orchid up to 3.7- 5 (-10) cm tall, pseudobulbs tightly clustered on rhizome, narrowly cylindrical, less than 5 cm long, with 1 leaf. Leaf linear, flat, less than 2.5-5 cm long and 0.2-0.3 cm wide. Inflorescence shorter than leaf, simple, racemose, 2-4 cm long, with up to 5 flowers. Flowers pinkish-purple with



Fig. 16. *Polystachya aconitiflora*.

rose, up to 0.6-0.7 cm long, dorsal sepal less than 0.6 cm long, petals less than 0.45 cm long, lip 3-lobed, up to 0.4 cm long. Flowering season: January to April, August to December. Habitat and distribution in Rwanda: On mossy branches and rocks in montane rainforest, 1900-2800 m. In Nyungwe National Park at Gisakura, Kamiranzovu, Uwinka, between Pindura and Bweyeye, on Mt. Bigugu.

*Polystachya dewanckeliana* (Fig. 17)

Description: Epiphytic orchid up to 20 cm tall, stems filiform, 2-6 cm long and less than 0.1 cm in diameter, with 1 leaf. Leaf oblong, obtuse, 6-7 x 0.2-0.4 cm. Inflorescence longer than leaf, simple, racemose, 8-12 cm long, with up to 5-15 flowers. Flowers greenish-yellow with purple lip, 0.3 cm in diameter, dorsal sepal elliptic, 0.25 x 0.15 cm, lateral sepals triangular, obtuse, 0.35 x 0.3 cm, petals obovate, apiculate, 0.3 x 0.08-0.1 cm, lip 0.35 x 0.2 cm, slightly 3-lobed, with globular callus. Flowering season: March to June, September to December. Habitat and distribution in Rwanda: Epiphyte in montane rainforest, 1900-2500 m. In Nyungwe National Park at Gisakura, Kamiranzovu swamp, Uwinka, Rangiro and between Pindura and Bweyeye. Distribution in Africa: Eastern Congo (Masisi, Walikale). Notes: Albertine Rift endemic, only known from Nyungwe and Eastern Congo. As the forests around Masisi are mostly destroyed today, the species may be already extinct in this area.

*Polystachya fallax*

Description: Epiphytic or rarely lithophytic orchid up to 20 cm tall, pseudobulbs conical, 2.5-5 cm long, with 1 leaf. Leaf oblong, acute or obtuse, 9-12 cm long. Inflorescence shorter than leaf, simple, 4-5 cm long, with 3-5 flowers. Flowers white with yellow, up to 0.7-1.2 cm long, sepals and petals acuminate, dorsal sepal ovate-lanceolate, 0.75-1.1 x 0.3 cm, lateral sepals narrowly triangular, petals linear-lanceolate, 0.65-0.8 x 0.1-0.2 cm, lip 3-lobed, strongly recurved, up to 1.2 x 0.6 cm, with a longitudinal central fleshy callus on mid-lobe. Flowering season: January to April, October to December. Habitat and distribution in Rwanda: Epiphyte in moss cushions or lithophyte in montane rainforest, 1900-2950 m. In Nyungwe National Park at Gisakura, Kamiranzovu, Uwinka, between Pindura and Bweyeye and on rocks at summit of Mt. Bigugu. Distribution in Africa: Eastern Congo, Burundi,



Fig. 17. *Polystachya dewanckeliana* (above), *Polystachya pachychila* (below).

Western Uganda (Kibale, Kigezi). Notes: Albertine Rift endemic only known from few montane forests around Lake Kivu.

*Polystachya hastata*

Description: Pendulous epiphytic orchid up to 20 cm tall. Pseudobulbs caespitose or superposed, narrowly cylindrical, up to 10 x 0.2-0.5 cm, with 2 leaves at apex. Leaves grass-like, erect, linear, minutely bilobed, 3-18 x 0.3-0.5 cm. Inflorescence erect, racemose, 4-5.5 cm long, dense, with numerous flowers, with a compressed acute sheath at base. Flowers white or pink-white, dorsal sepal ovate, 0.2-0.3 x 0.1-0.2 cm, lateral sepals ovate, 0.2-0.3 x 0.17-0.2 cm, petals elliptic-ovate, 0.15-0.2 x 0.12-0.17 cm, lip with long claw, hastate, 0.26-0.36 cm, claw 0.15 cm long, lamina triangular, acute, 0.15-0.2 x 0.15-0.2 cm, with a lunate callus. Flowering season: February to March, October to December. Habitat and distribution in Rwanda: Montane rainforest, 1900-2400 m. Only in Nyungwe National Park at Gisakura, Kamiranzovu, Uwinka, and between Pindura and Bweyeye. Distribution in Africa: Eastern Congo (Virunga Volcanoes, Kahuzi), Burundi (Kibira), Uganda (Ankole, Kalinzu Forest). Notes: Albertine Rift endemic.

*Polystachya leucorhoda* (Fig. 18)

Description: Epiphytic orchid up to 30 cm tall, pseudobulbs narrowly cylindrical, with 1 leaf. Leaf oblong, acute, 12-22 x 0.7-1.5 cm. Inflorescence paniculate, shorter than leaf, 8-20 cm long, with up to 20-50 flowers. Flowers 0.6-1 cm in diameter, pale green or cream, with reddish-purple lines or spotted or flushed purple, lip reddish-purple, dorsal sepal triangular-ovate, 0.6-0.85 x 0.2-0.35 cm, lateral sepals spreading, rounded-triangular, 0.6-0.85 x 0.37-0.52 cm, petals oblanceolate, 0.45-0.8 x 0.15-0.25 cm, lip 0.5-0.7 x 0.3-0.5, sessile, 3-lobed in upper third, mid-lobe ovate, without longitudinal furrow. Flowering season: March to April, October to December. Habitat and distribution in Rwanda: Montane Forest, ericaceous shrub, 1800-2800 m. In Nyungwe National Park at Uwinka, Mt. Bigugu and Gisovu trail, also on the Virunga Volcanoes (Karisimbi).

*Polystachya pachychila* (Fig. 17)

Description: Epiphytic orchid up to 28 cm tall, pseudobulbs 1.5-15 cm long, with 1 leaf. Leaf elliptic-ovate, coriaceous, auriculate at base, tinged with purple, 3-13 cm



Fig. 18. *Polystachya leucorhoda*.

long and 1-3.3 cm wide. Inflorescence longer than leaf, a richly branched panicle 6-18 cm long, with up to 60 flowers. Flowers yellow with magenta spots, up to 1.3 cm long, dorsal sepal oblong-lanceolate, 0.4-0.54 x 0.2-0.25 cm, lateral sepals triangular, 0.4-0.7 x 0.35-0.6 cm, petals linear to spatulate, obtuse, 0.35-0.6 x 0.12-0.15 cm, lip 3-lobed, up to 0.4-0.7 x 0.2-0.65 cm, sessile, fleshy. Flowering season: Flowers recorded over most of the year. Habitat and distribution in Rwanda: Epiphyte in montane rainforest, 1900-2300 m. In Nyungwe National Park at Gisakura, in Kamiranzovu swamp, Uwinka, between Pindura and Bweyeye, also known from Gishwati Forest. Distribution in Africa: Eastern Congo, with a doubtful record from Kenya (possibly a different species). Notes: Albertine Rift endemic, mainly in Eastern Congo and Rwanda.

*Polystachya poikilantha* (Fig. 19)

Description: Epiphytic orchid up to 30 cm tall, pseudobulbs narrowly cylindrical, with 1 leaf. Leaf oblong, acute, 12-22 x 0.7-1.5 cm. Inflorescence paniculate, shorter than leaf, 8-20 cm long, with up to 20-50 flowers. Flowers 0.6-1 cm in diameter, yellowish or yellow, with purple or maroon spots, lip white, dorsal sepal triangular-ovate, 0.6-0.85 x 0.2-0.35 cm, lateral sepals spreading, triangular, 0.6-0.85 x 0.37-0.52 cm, petals obovate, 0.45-0.8 x 0.15-0.25 cm, lip 0.5-0.7 x 0.3-0.5, subsessile, entire, without longitudinal furrow. Flowering season: March to April, August to December. Habitat and distribution in Rwanda: Montane Forest, ericaceous shrub, 1800-2800 m. In Nyungwe National Park at Gisakura, Kamiranzovu, Uwinka and Pindura, also in Gishwati Forest and on the Virunga Volcanoes (Karisimbi, Karisoke). Distribution in Africa: Eastern Congo (Kahuzi-Biega, Virunga Volcanoes), Uganda (Kigezi, Impenetrable Forest). Notes: Albertine Rift endemic.

*Polystachya tridentata*

Description: Small epiphytic or lithophytic orchid with rounded pseudobulbs, each with 2 leaves, stems up to 30 cm long. Leaves ovate, acuminate at apex, up to 3.3 - 10 x 0.5-1.1 cm. Inflorescence with 3-9 flowers. Flowers brownish with white lip bearing a yellow dot, densely hairy outside, up to 1.8-2 cm in diameter, dorsal sepal broadly lanceolate, 0.6 x 0.3 cm, lateral sepals lanceolate-triangular, 0.9 x 0.62 cm, petals oblanceolate, 0.5 x 0.15 cm, lip up to 0.7-0.9 x 0.45 cm, with a long claw,

callus fleshy, with 3 teeth. Flowering season: November to December. Habitat and



Fig. 19. *Polystachya poikilantha*.

distribution in Rwanda: On old rocks, also epiphytic, 2400 m. In Nyungwe National Park at Gisakura, Kamiranzovu, ca. 1-2 km S of Pindura, Uwinka and at Gisovu. Distribution in Africa: Eastern Congo, Burundi. Notes: Albertine Rift endemic, only known from Eastern Congo and Uganda (Ruwenzori), Rwanda and Burundi. The species was reduced to a variety of *P. ruwenzoriensis* by Geerinck (1992) but is considered here to be specifically distinct.

*Polystachya troupiniana*

Description: Epiphytic orchid up to 50 cm tall, partially papillose. Stems clustered, filiform, 8-20 x 0.1-0.15 cm, 1 leaf at apex. Leaf oblong, obtuse to rounded, 10-20 x 0.4-1 cm. Inflorescence paniculate, 10-20 cm long, with 10-20 flowers, as long or slightly longer than leaf. Flowers yellowish marked with purple, 0.4-0.6 cm in diameter, dorsal sepal elliptic, acute, 0.5-0.6 x 0.2 cm, lateral sepals ovate, 0.5-0.6 x 0.2-0.3 cm, petals ovate, rounded, 0.35 x 0.1 cm, lip 0.5 x 0.25 cm, with short claw, deeply 3-lobed at apex, without callus, lateral lobes larger than mid-lobe. Flowering season: August to October. Habitat and distribution in Rwanda: Montane forest and bamboo forest, 1900-2400 m. In Nyungwe National Park at Gisakura, Kamiranzovu, Uwinka, Mt. Muzimu, also in Gishwati Forest at Gikungu. Distribution in Africa: Eastern Congo (Mt. Bukulumiza). Notes: Albertine Rift endemic.

*Polystachya virginea* (Fig. 20)

Description: Epiphytic orchid up to 16-37 cm tall, pseudobulbs loosely clustered on rhizome, cylindrical, 5-11 cm long, with 1 leaf. Leaf lanceolate, obtuse, cuneate at base, up to 8-25 cm long. Inflorescence shorter than leaf, simple, racemose, 4-9 cm long, with up to 10 flowers. Flowers white, up to 1.4-2.4 cm long, dorsal sepal ovate-triangular, 0.87-1.2 x 0.45-0.75 cm, lateral sepals similar, 0.85-1.2 x 0.45-0.95 cm, petals elliptic to ovate, 0.8-1.3 x 0.3-0.45 cm, lip 3-lobed, strongly recurved, up to 1.1-1.5 x 0.85-1.1 cm, mid-lobe with central fleshy callus. Flowering season: Flowers recorded over most of the year. Habitat and distribution in Rwanda: Epiphyte in montane rainforest, 2000-2800 m. In Nyungwe National Park at Gisakura, Kamiranzovu, Uwinka, between Pindura and Bweyeye, near summit of Mt. Bigugu, also known from Gishwati Forest.



Fig. 20. *Polystachya virginea*.



Fig. 21. *Polystachya vulcanica*.

*Polystachya vulcanica* (Fig. 21)

Description: Epiphytic or lithophytic orchid up to (8) 10-20 cm tall, pseudobulbs narrowly cylindrical, more than 4.5 cm and up to 9 cm long, with 1 leaf. Leaf linear, semiterete, over 5.3 cm and up to 11 cm long, less than 0.3-0.4 cm wide. Inflorescence shorter than leaf, simple, racemose, 2-8.5 cm long, with up to 5 flowers. Flowers up to 1.5 cm long, sepals and petals creamy-white with rose, lip dark pinkish-purple, dorsal sepal up to 0.8 cm long, petals 0.45-0.62 cm long, lip 3-lobed, up to 0.9 cm long. Flowering season: January to April, August to December. Habitat and distribution in Rwanda: On mossy branches and rocks in montane rainforest, 1900-2400 m. In Nyungwe National Park at Gisakura, Karamba, Kamiranzovu, Rangiro, Uwinka, between Pindura and Bweyeye. Distribution in Africa: Eastern Congo, Western Uganda, Burundi. Notes: Albertine Rift endemic, only known from Kahuzi-Biega, Nyungwe-Kibira, the western Virunga Volcanoes, Kigezi and Ruwenzori.

*Polystachya woosnamii*

Description: Epiphytic orchid up to 30 cm tall, glabrous, stems simple, with 2-3 leaves. Leaves oblong, rounded, 3-18 cm long. Inflorescence longer than leaves, simple, densely racemose, up to 6-12 cm long, bracts filiform, with up to 10-25 flowers. Flowers whitish-yellowish to greenish, up to 0.8-1 cm in diameter, dorsal sepal lanceolate to ovate, acuminate to acute, 0.4 x 0.2 cm, lateral sepals ovate, 0.9-1.1 x 0.4 cm, petals linear-oblong, 0.2 x 0.1 cm, lip slightly 3-lobed, with a long claw, up to 0.4-0.75 x 0.45 cm. Flowering season: January to April, October to December. Habitat and distribution in Rwanda: Epiphyte in montane rainforest, 1900-2400 m. In Nyungwe National Park at Gisakura, in Kamiranzovu swamp, Uwinka, between Pindura and Bweyeye, also Gishwati Forest. Distribution in Africa: Eastern Congo, Burundi, Western Uganda. Notes: Albertine Rift endemic.

*Rhaesteria eggelingii* (Fig. 22)

Description: Epiphytic orchid, stem up to 1-8 cm tall. Leaves distichous, coriaceous, succulent, ovate-elliptic, unequally bilobed at apex, up to 1-1.6 cm long and 0.5-0.9 cm wide. Inflorescence a short raceme in the axils of leaves, with 2-3 flowers. Flowers yellowish-greenish, 0.2-0.3 cm long, sepals fused to the petals in their basal half, sepals oblong to elliptic, obtuse, 0.15-0.2 x 0.08-0.1 cm, petals oblong to elliptic,



Fig. 22. *Rhaesteria eggelingii*.

obtuse, 0.1-0.2 x 0.08 cm, lip concave, ovate to elliptic, subacute, 0.25 x 0.3 cm, spur incurved, conical, 0.25 cm long. Flowering season: January to April, December. Habitat and distribution in Rwanda: Epiphyte in montane rainforest, 1800-2000 m. In Nyungwe National Park at Kamiranzovu and between Pindura and Bweyeye. Distribution in Africa: Western Uganda.

*Rhipidoglossum bilobatum*

Description: Epiphytic orchid with elongated pendent stem up to 50 cm long. Leaves twisted along stem to lie in one plane, elliptic or elliptic-oblong, unequally bilobed at apex, 3-10 cm long. Inflorescences several, with 15-30 flowers. Flowers greenish, up to 1.4 cm in diameter, dorsal sepal oblong, apiculate, 0.4-0.7 x 0.25-0.35 cm, lateral sepals ovate, acute, 0.5-0.7 x 0.2-0.3 cm, petals oblong, rounded, 0.35-0.5 x 0.2-0.3 cm, lip obscurely 3-lobed, 0.5-0.7 x 0.35-0.5 cm, side lobes rounded, recurved, midlobe deeply bilobed, spur slightly incurved, up to 0.5-0.9 cm long. Flowering season: January to March, June. Habitat and distribution in Rwanda: Epiphyte in montane rainforest, 1900-2500 m. In Nyungwe National Park at Kamiranzovu swamp, Rangiro, between Pindura and Bweyeye, at Rwasenkoko, Gisovu and Cyamudongo Forest, also in Gishwati Forest. Distribution in Africa: Uganda, Kenya (Isuria escarpment), Eastern Congo and Burundi.

*Stolzia cupuligera* (Fig. 23)

Description: Creeping epiphytic orchid forming dense mats of prostrate stems, not exceeding 1-2 cm of height. Pseudobulbs elongated, not or only swollen towards apex, with 1 leaf. Leaf succulent, elliptic-lanceolate, rounded, up to 2 cm long, 0.3-0.8 cm wide. Inflorescence terminal, with 1 flower on short peduncle. Flower red, 0.7-0.9 cm long, dorsal sepal erect, lateral sepals falcate, 0.6-0.7 x 0.25 cm, lateral sepals united for about 1/3, petals similar to sepals, up to 0.2 cm wide, lip 0.35 x 0.1 cm. Flowering season: January to March, November to December Habitat and distribution in Rwanda: Montane rainforest, 1900-2400 m. In Nyungwe National Park at Kamiranzovu, Rangiro trail, between Pindura and Bweyeye and Uwinka. Distribution in Africa: Eastern Congo (Kahuzi-Biega, Ruwenzori)



Fig. 23. *Stolzia cupuligera*.

*Pteris auquieri*

Description: Rhizome erect or shortly creeping. Leaves erect, up to 45-220 cm long, with bulbils, petiole straw-colored, chest-nut towards base, 27-125 cm long, lamina subcoriaceous, ovate to ovate-lanceolate, 2-pinnatipartite, pinnules at apex with long caudate pinna up to 11 cm long, ultimate lobes 1-8 cm long and 0.25-1.1 cm wide, with numerous teeth, veins free. Habitat and distribution: Understorey of montane rainforest, 1900-2000 m. In Nyungwe only at Gisakura, Kamiranzovu, between Pindura and Bweyeye. Eastern Congo (Ituri, Kahuzi-Biega), Burundi. Western Uganda, Tanzania (Uluguru, Iringa).

*Ranunculus rugegensis*

Description: Perennial erect herb, 1-12 cm tall, pilose. Leaves up to 12 cm long, with 3 pinnatisect leaflets, leaflets 7-8 cm long and 6-6.5 cm wide, coarsely or irregularly dentate, hirsute. Flowers pale yellow, up to 1 cm in diameter, sepals not reflexed. Fruit with numerous nuts bearing a persistent beak. Habitat and distribution: Wet places near rivers or streams in montane forests, 1900-2400 m. In Nyungwe and Western Rwanda widespread. Eastern Congo, Burundi, Western Uganda. Notes: Albertine Rift endemic, only known from Kahuzi-Biega, Nyungwe, the Virunga Volcanoes and the Ruwenzori. The plant was described from a specimen collected by Mildbraed at the source of the Nile.

*Rytygynia bugoyensis*

Description: Shrub or small tree up to 100-600 cm tall, densely pubescent on young stems, glabrescent, older branches with supra-axillary opposite paired spines up to 0.6-2.5 cm long. Leaves opposite, very thin, petiole 0.3-1 cm long, glabrous, stipules connate at base, 0.4 cm long, with triangular apex, lamina ovate to elliptic, acuminate at apex, cuneate to rounded at base, 3-10.5 cm long and 1.2-7 cm wide, with appressed hairs on both sides. Inflorescence with (1-) 2-3 flowers in axillary cymes. Flowers greenish to yellowish-cream, corolla glabrous to pilose outside, with tube up to 0.3-0.6 cm long and 5 elliptic-oblong lobes 0.1-0.35 cm long, ovary inferior. Fruit a greenish to black drupe, up to 1.2 cm in diameter. Habitat and distribution: Montane rainforest, bamboo, 2000-3000 m. In Nyungwe at Rwasekoko and at Mt. Muzimu. In

Rwanda also in Gishwati Forest. Eastern Congo, Burundi, Sudan, Uganda, Kenya, Tanzania, Malawi. Notes: The plant was first described as *Plectronia bugoyensis* after a plant collected in 1907 in Gishwati (= Bugoie) Forest by the German Botanist Johannes Mildraed during the first German Expedition to Central Africa 1907/1908.

*Saintpauliopsis lebrunii*

Description: Herb with basal rosette and prostrate stems producing stolons, up to 5-25 cm tall, densely covered with articulate hairs. Leaves opposite, petiole up to 1-6 cm long, lamina ovate-oblong to suborbicular, rounded at apex, cordate at base, up to 1.4-4 cm long and 1-3.5 cm wide. Inflorescence a lax secund to helicoidal cyme. Flowers whitish to pale lilac, up to 0.6-0.7 cm long, stamens 4. Fruit an oblong-triangular capsule up to 0.6-0.7 cm long. Habitat and distribution: Rocks in the understorey of montane rainforest, 1900-2000 m. In Nyungwe at Gisakura, Kamiranzovu, between Pindura and Bweyeye. Eastern Congo, Burundi. Notes: Albertine Rift endemic, only known from Rwanda, Burundi and Eastern Congo.

*Strophanthus bequaertii* (Fig. 24)

Description: Liana up to 10-15 m long, glabrous, with white latex. Leaves opposite, petiole 0.2-0.6 cm long, lamina elliptic, shortly acuminate at apex, acute to acuminate at base, 4-12 cm long and 1.5-3.5 cm wide. Inflorescence terminal, cymose, with 2-7 flowers. Flowers yellow with mauve to purple spots, calyx with triangular lobes up to 1 cm long, corolla with tube up to 2 cm long, throat with 10 purple striate appendices, lobes up to 7 cm long. Habitat and distribution: Montane rainforest, 1700 – 1800 m. In Nyungwe only in Cyamudongo and at Rangiro. Eastern Congo, Burundi. Notes: Albertine Rift endemic, only known from a few localities around Lake Kivu. White latex present. The plant contains the alkaloid strophantine which has been used by the Twa (former inhabitants of the forest) and Pygmies from Congo to poison the arrows for hunting.

*Trifolium purseglovei*

Description: Perennial ascending to prostrate herb, rooting at the nodes, up to 100 cm long, glabrous to hairy. Leaves alternate, imparipinnate, 3-foliolate, petiole up to 1.5-2 cm long, stipules with stipular sheath, up to 0.5 cm long, free stipules subulate, 0.3-0.4 cm long, with 3 leaflets, elliptic-oblong, emarginate or truncate at apex,



Fig. 24. *Strophanthus bequaertii*.

cuneate at base, margin dentate, up to 1.7 cm long and 1.2 cm wide. Inflorescence a dense, capitate raceme with up to 30 flowers. Flowers purple, corolla up to 1 cm long. Fruit a linear-oblong pod up to 0.55 cm long, glabrous. Habitat and distribution: Swamps and wet places in montane forests, 1900-2500 m. In Nyungwe mainly between Gisakura and Pindura, on Mt. Bigugu and Mt. Muzimu. In Rwanda also in the Virunga Volcanoes. Eastern Congo and Uganda. Notes: Albertine Rift endemic, only known from Nyungwe and the Virunga Volcanoes.

*Uebelinia kivuensis*

Description: Perennial herb, stems prostrate, quadrangular, up to 50 cm long, hirsute to glabrous. Leaves opposite, sessile or narrowed into a 0.2-0.3 cm long petiole, lamina elliptic to nearly orbicular, mucronate at apex, ciliate at margins, up to 2 cm long and 1-1.5 cm wide. Inflorescence with solitary axillary flowers. Flowers white, up to 0.7 cm long, with 3 styles. Fruit a one-seeded capsule. Habitat and distribution: Montane grassland, moorland, swamps, bamboo forest, 1900-2900 m. In Nyungwe at Kamiranzovu, Pindura (Rugenge swamp), Rwasenkoko. In Rwanda also on the Virunga Volcanoes. Eastern Congo, Burundi, Western Uganda. Notes: Albertine Rift endemic. The plant was first collected in 1907 at the source of the Nile (Rukarara) in Rugege (=Nyungwe) Forest by the German Botanist Johannes Mildraed during the first German Expedition to Central Africa 1907/1908 and described in 1923.

*Vaccinium stanleyi* (Fig. 44)

Description: Shrub up to 4 m tall, young branches with long hairs, glabrescent at age. Leaves alternate, petiole up to 0.05 cm long, lamina elliptic to ovate elliptic, apex acute to acuminate, base cuneate, lamina 1-5 x 0.5-2 cm, glabrous, with serrulate margin. Inflorescence racemose, flowers white, pink or purplish, up to 0.25-0.45 cm long and 0.25-0.5 cm in diameter, calyx with 5 sepals, corolla with tube 3 times longer than the 5 lobes. Fruit a berry becoming blue to blackish at maturity. Habitat and distribution: Ericaceous shrub on rocky slopes, also in swamps, 2000-2950 m. In Nyungwe in Kamiranzovu on summit of Mt. Bigugu and at Rwasenkoko. In Rwanda also in the Virunga Volcanoes. Mountains of Eastern Congo, Burundi and Western Uganda. Notes: Albertine Rift endemic. This species is the only representative of the more temperate blueberries in tropical Africa. The fruits are edible and resemble the European blueberry in size and taste.

*Vernonia scaettae*

Description: Shrub up to 1.5-2 m tall, stems erect, finely tomentose when young. Leaves alternate or verticillate, sessile, coriaceous, linear, obtuse at apex, truncate at base, margin entire, glabrous and glandular on both sides, 2-5.5 cm long and 0.1-0.4 cm wide. Capitula few in terminal cymes, up to 1.3 cm long, involucre cylindrical, up to 0.8 cm long, tubular disc flowers numerous per capitulum, mauve, lilac or purplish, 1.2 cm long. Achenes 0.45 cm long, pappus white, 0.8-1 cm long. Habitat and distribution: Rocky slopes or ericaceous shrub in montane forest, also in secondary places, 1800-2400 m. In Nyungwe mainly at Karamba and around Kamiranzovu. Eastern Congo. Notes: Albertine Rift endemic, only known from Beni, Kahuzi-Biega and Nyungwe.

*Vittaria reekmansii*

Description: Epiphytic fern with short rhizome and tufted leaves, with lanceolate scales. Leaves usually pendulous, simple, linear to linear, apex cuspidate, base cuneate, 10-30 cm long and 0.2-0.4 cm wide, veins reticulate, sori elongate, two per leaf, along the the submarginal veins, indusium absent. Habitat and distribution: Epiphyte in montane rainforest, up to 2700 m. In Nyungwe at Gisakura, Kamiranzovu, Uwinka, Mt. Bigugu, Mt. Muzimu. In Rwanda also in Gishwati Forest. Eastern Congo (Kahuzi-Biega), Burundi. Notes: Albertine Rift endemic, only known in montane forests around Lake Kivu.



Fig. 25. *Amietophrynus kisoensis*

### 3.1.5 Amphibians

#### 3.1.5.1 Amphibian species recorded

12 species of Amphibians have been recorded, among them 7 Albertine Rift endemics (tab. 3).

#### 3.1.5.2 Endemic and/or remarkable species

##### *Amietia* spec. (Fig. 26)

We found this species in the Kamiranzovu swamp. It is similar to *A. angolensis* but differs slightly in body size and parameters of the advertisement call. We are currently comparing the two species genetically.

##### *Amietophrynus kisoensis* (Fig. 25)

A medium-sized to large toad, with males reaching a body length of 71mm, females 87 mm. It is characterized by its acuminate snout, the very long and slender parotid glands, and the extensively webbed toes. The males turn yellow during breeding season. The species is an inhabitant of the montane forest between 1600 and at least 3000 m a.s.l. in the Albertine Rift with records from eastern DRC, Uganda, and Rwanda. There are also records from much lower altitude from Eastern Uganda, Kenya, Tanzania, Northern Zambia, and Northern Malawi which require confirmation. We found the species in the Marais Rugezi and the Kamiranzovu. It is otherwise known from many localities in the higher elevations of western Rwanda. Eggs are deposited in lentic water bodies.

##### *Arixalus orophilus*

This is a small tree frog. Males and females reach a body length of up to 27 mm. *Arixalus orophilus* is endemic to the Albertine Rift with records from Uganda, Democratic Republic of the Congo, Rwanda and Burundi. In Rwanda it is known from Nyungwe National Park. We found it in the Kamiranzovu swamp. This species is somewhat similar to *A. quadrivittatus* but has only two dark stripes on the back.

##### *Arixalus* spec.

This is an undescribed species which is endemic to the Albertine Rift. Its formal description is currently underway (DEHLING et al. in prep.). We found the species

calling from leaves at the edge of a swamp forest in the Kamiranzovu. The species is also known from a small number of other areas in Rwanda and Uganda (DEHLING, unpubl. data).

*Hyperolius castaneus* (Fig. 26)

This species is a medium-sized tree frog, reaching a body length of 27 mm in males and 36 mm in females. The basic colouration of the back is yellowish brown. In most of the specimens a dark line runs along each side of the body from the tip of the snout to the groin. The pattern is very variable and consists of irregular brown or green markings. This species is only found in swamps at higher elevations (>1900 m a.s.l.). It is endemic to the Albertine Rift.

*Hyperolius discodactylus* (Fig. 27)

A medium-sized tree frog, reaching a body length of 33 mm in males and 40 mm in females. The back is green with diffuse small dark spots. The tips of the fingers and toes are characteristically enlarged into broad oval discs. The species is found only in swamps and along streams in montane forest above 2000 m a.s.l. in the Albertine Rift. In Rwanda it is restricted to the Nyungwe National Park, Volcano National Park, and the Gishwati Forest Reserve.

*Hyperolius* spec. (Fig. 27)

A very small, green species which might be new to science. If so, the species would have to be considered as endemic to the Kamiranzovu swamp.

*Phlyctimantis verrucosus* (Fig. 28)

A beautiful but poorly known tree frog. This species is known from only a handful of locations in Rwanda in montane forest above 1800 m a.s.l., including the Kamiranzovu Swamp. The species is endemic to the Albertine Rift and has been recorded from Western Uganda and Eastern Democratic Republic of the Congo. Not much is known about its biology. The tadpoles develop in small ponds.

*Phrynobatrachus versicolor* (Fig. 28)

A medium-sized species of frog. The back is dark brown with two light longitudinal stripes. This species is poorly known. It is endemic to the Albertine Rift and known



Fig. 26. *Amietia* spec. (above), *Hyperolius castaneus* (middle, below).



Fig. 27. *Hyperolius discodactylus* (above), *Hyperolius spec.* (middle, below).



Fig. 28. *Phrynobatrachus versicolor* (above), *Phlyctimantis verrucosus* (middle left), *Xenopus wittei* (middle right, below).

from Uganda, DRC, Burundi, and Rwanda. In Rwanda is known from high-altitude swamps in Nyungwe Forest and the Volcano National Park.

*Phrynobatrachus* spec. 3

A comparatively large species of puddle frog. It differs from all frog species known from Rwanda. To our knowledge, it is only known from the Kamiranzovu swamp. We are currently investigating the taxonomic status of this species.

*Xenopus wittei* (Fig. 28)

This species is slightly larger than *X. victorinus*. It is endemic to the Albertine Rift and is only found in high-altitude forests above 2000 m a.s.l. of Uganda, DRC, Rwanda and Burundi. Like all clawed frogs, it spends most of its life in the water. We have found it only in lentic bodies of water.

### 3.1.6 Reptiles

#### 3.1.6.1 Reptile species recorded

12 species of reptiles could be observed in Kamiranzovu Swamp. Among them are 5 Albertine Rift Endemics (tab. 4).

#### 3.1.6.2 Endemic and/or remarkable species

*Adolfus vauereselli* – Sparse-scaled Forest Lizard (Fig. 29)

Diagnosis: Medium-sized, slender lizard; total length to about 23.5 cm); scales of back smooth, larger than those on flanks; head and middle of the back yellow to light brown, flanks dark to reddish brown with two rows of small white spots. Distribution: Tanzania, Uganda, Democratic Republic of the Congo, Rwanda; at elevations between 1000 m and 2400 m a.s.l.

*Atheris nitschei* – Great Lakes Bush Viper (Fig. 31)

Diagnosis: Medium-sized snake; total length to about 75 cm; body stout; head triangular; tail prehensile, long; body colouration green with back spots and blotches. Distribution: Endemic to Albertine Rift. Records from Democratic Republic of the Congo, Uganda, Burundi, and Rwanda (Nyungwe Forest, Gishwati Forest, Volcano National Park); at elevations between 1000 m and 2800 m a.s.l.



Fig. 29. *Adolfus vauereselli* (above left), *Kinyongia adolfifridericici* (above right, middle left), *Trioceros johnstoni* (middle), *Rhampholeon Boulengeri* (below).

*Dendroaspis jamesoni* – Jameson's Mamba (Fig. 31)

Diagnosis: Long snake; total length to more than 250 cm; body very slender; tail long; head small and narrow; eye large; body colouration green; tail black (subspecies *kaimosae*). Distribution: West Africa (Ghana) to East Africa (Sudan to Kenya, Uganda, Rwanda, DRC, and Burundi); between 600 m and 2200 m a.s.l.

*Kinyongia adolfifriederici* – Ituri Dwarf Chameleon (Fig. 29)

Diagnosis: Small chameleon; total length 15 cm; tail prehensile, slightly longer than body; small casque; no gular or ventral crest; no rostral process; no ear flaps; body colouration dull green or brown. Distribution: Endemic to Albertine Rift. Records from Democratic Republic of the Congo, Uganda, Burundi, and Rwanda (Nyungwe Forest); at elevations between 1000 m and 2200 m a.s.l.

*Lycophidion ornatum* – Forest Wolf Snake (Fig. 30)

Diagnosis: Small snake; total length usually less than 50 cm; tail relatively short; scales smooth; head narrow and flat; ground colouration brown to reddish; broad, white band running along each side of the head. Distribution: Eastern and Southern Africa from Sudan to Angola; at elevations between 700 and 2000 m.

*Philothamnus ruandae* – Rwanda Forest Green Snake

Diagnosis: Medium-sized snake; total length to about 100 cm; body very slender; tail long; head small and narrow; eye very large; dorsal scales smooth; basic colouration of back black or green, sometimes with narrow yellow transverse bands. Distribution: Endemic to the Albertine Rift with records from Uganda, Democratic Republic of the Congo, Rwanda, and Burundi; at elevations between 700 m and 2300 m a.s.l.

*Rhamnophis aethiopissa* – Large-eyed Green Tree Snake (Fig. 30)

Diagnosis: Medium-sized snake; total length to about 130 cm; body slender; head short; eye large and prominent; tail long; dorsal scales smooth; basic colouration of back green or yellowish green; dorsal scales with dark edges. Distribution: Great Lakes region in East Africa.



Fig. 30. *Typhlops angolensis* (above left), *Lycophidion ornatum* (above right, middle left), *Rhamnophis aethiopissa* (middle right), *Thrasops jacksoni* (below).



Fig. 31. *Atheris nitschei* (above, middle), *Dendroaspis jamesoni* (below).

*Rhampholeon boulengeri* – Boulenger's Dwarf Chameleon (Fig. 29)

Diagnosis: Very small chameleon; total length to 8 cm, usually 5-7 cm; tail not prehensile, much shorter than body; supraocular ridge prominent; small scaly rostral process on the snout; body colouration shades of brown and grey, resembling a dead leaf. Distribution: Albertine Rift (eastern Democratic Republic of the Congo, Rwanda, Burundi) and forests of western Kenya; at elevations between 1400 and 2300 m a.s.l. In Rwanda, known from Nyungwe and Volcano National Parks.

*Thrasops jacksoni* – Jackson's Tree Snake (Fig. 30)

Diagnosis: Large snake; total length usually around 180 cm; body stout, laterally compressed; tail long; eye big; dorsal scales keeled; colour uniformly black. Distribution: Kenya and Tanzania to Rwanda and Eastern Democratic Republic of the Congo; at elevations between 600 m and 2400 m a.s.l.

*Trioceros johnstoni* – Johnston's Three-horned Chameleon (Fig. 29)

Diagnosis: Large chameleon; total length 40 cm; males having three forwardly directed horns on the snout, one on the nose and two in front of the eyes; females hornless; casque low; no ear flaps, gular, ventral, or dorsal crest; tail prehensile, slightly longer than body. Distribution: Endemic to the Albertine Rift with records from Uganda, Democratic Republic of the Congo, Rwanda, and Burundi. In Rwanda, mainly restricted to high-altitude forests above 1800 m in Nyungwe National Park, Gishwati Forest Reserve, and Volcano National Park.

*Typhlops angolensis* – Angola Blind Snake (Fig. 30)

Diagnosis: Medium-sized, burrowing snake; one of the largest blind snakes; body cylindrical, all around covered by small scales; rostral scales enlarged; tail very short; body colour dark brown. Distribution: Widespread in Central and East Africa, from Kenya to Cameroon, southwards to Angola and Zambia. In Rwanda known from several localities, including Kamiranzovu.



Fig. 32. *Corythaeola cristata*

### 3.1.7 Birds

#### 3.1.7.1 Bird species recorded

Within Kamiranzovu Swamp, 26 species of birds have been observed (tab. 5). This seems to be rather species-poor compared to the other swamp complexes. However, due to the often dense vegetation observation of birds is quite difficult. Also the quality of this diversity differs from that of the other swamps where mainly widespread birds are represented. All five Albertine Rift Endemics recorded are present in Kamiranzovu.

#### 3.1.7.2 Endemic and/or remarkable species

##### *Apalis personata*

This is a small bird attending 11 cm of length with a broad, black, vertical stripe over sides of face, throat and down to the lower breast. It is dull green above with a greyish-olive lower body. It is a typical species of montane forests and is restricted to Eastern Congo, Southwestern Uganda, Western Rwanda and Western Burundi.

##### *Batis diops* (Fig. 33)

This is a small bird with black breast bands and white underside. It prefers the undergrowth of montane forest. It is restricted to Eastern Congo, Southwestern Uganda, Western Rwanda and Western Burundi. It has been observed in Kamiranzovu swamp at night while sleeping on a small bush along the path.

##### *Bradypterus graueri*

Grauer's Swamp Warbler is a key species of high montane swamps and is restricted to Eastern Congo, Southwestern Uganda, Western Rwanda and Western Burundi. In contrast to *Apalis personata*, it is endangered and has been the subject of an international action plan (BYARUHANGA et al. 2006). In Rwanda it is known from Gahinga Swamp, Rugezi and several swamps in Nyungwe. It is a small bird up to 17 cm long with blackish streaking across the upper breast.

##### *Parus fasciiventer*

This is a dark grey, black and white tit with white wing bars. It is endemic to Eastern Congo, Southwestern Uganda, Western Rwanda and Western Burundi (SCHOTTLER & HENNING 1993). As it prefers the canopy, the species is rarely observed.



Fig. 33. *Batis diops*.

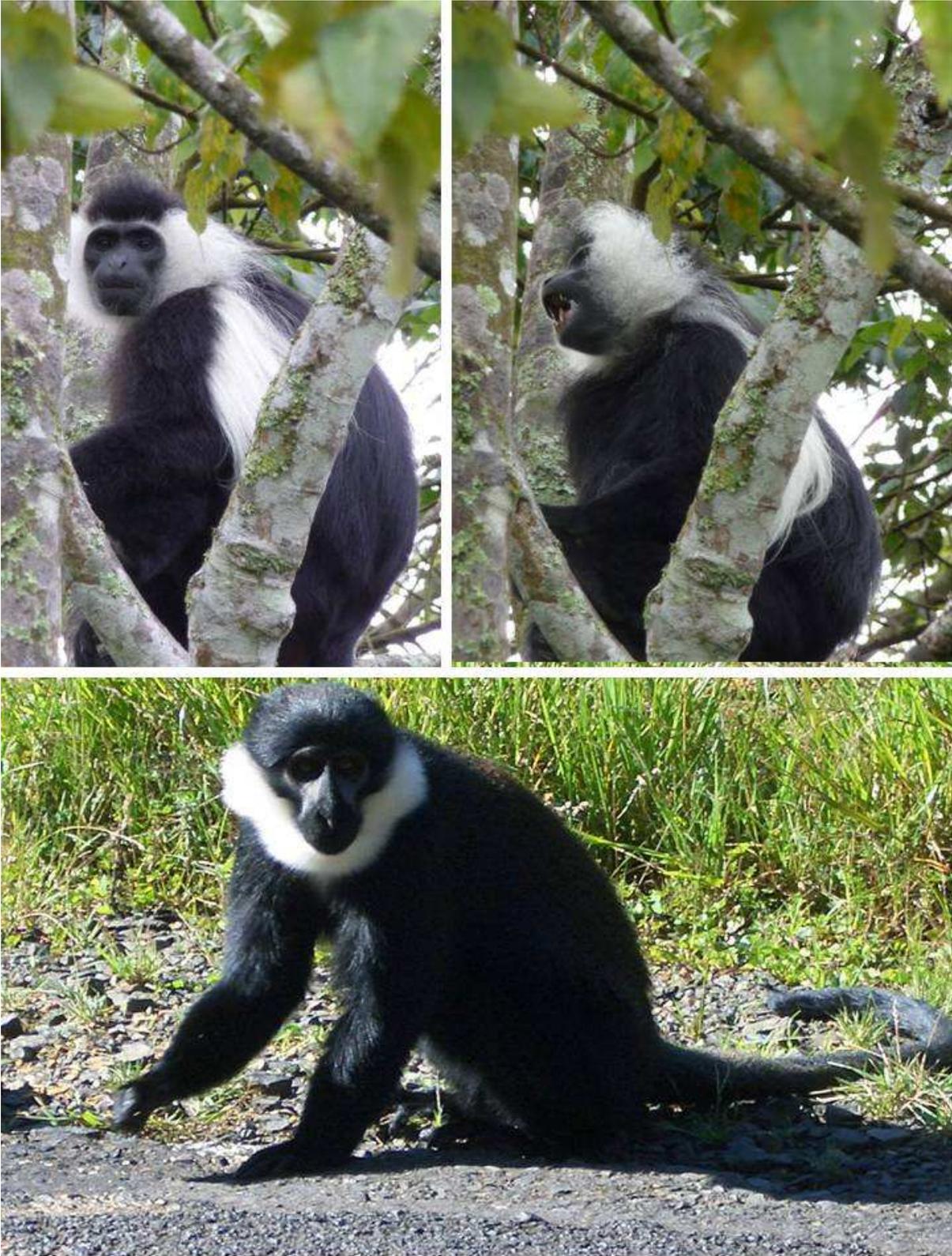


Fig. 34. *Colobus angolensis ruwenzorii* (above), *Cercopithecus l'hoestii* (below).

*Tauraco johnstoni*

Colourful turaco with a glossy green-blue crest, orange-yellow lores and eye-ring, and otherwise green-blue. It is endemic to Eastern Congo, Southwestern Uganda, Western Rwanda and Western Burundi.

**3.1.8 Mammals**

## 3.1.8.1 Mammals species recorded

In Kamiranzovu Swamp, 18 species of mammals are recorded (tab. 6). One species, the forest elephant *Loxodonta africana*, became extinct in 1999. Among the 17 species, 6 species are Albertine Rift Endemics of which 4 taxa are IUCN listed as vulnerable and endangered.

## 3.1.8.2 Endemic and/or remarkable species

*Cercopethicus l'hoesti* (Fig. 34)

This is a black-bodied monkey with white beard and a reddish back up to 80 cm long. The species is restricted to Eastern Congo, Western Uganda, Western Rwanda and Western Burundi. In Nyungwe National Park it is abundant and regularly seen also in Kamiranzovu. It is IUCN listed as vulnerable.

*Colobus angolensis ruwenzorii* (Fig. 34)

The Angola Pied Colobus is a black-bodied monkey with a white ruff. The subspecies *ruwenzorii* is restricted to the mountains along the Albertine Rift. The populations in Rwanda are considered to be the most individual rich ones.

*Delanymys brooksi*

This species is a very small, long-tailed mouse with dense reddish-brown hair. It is restricted to swamps in Eastern Congo, Southwestern Uganda, Western Rwanda and Western Burundi. It is IUCN listed as vulnerable.

*Dendromus kivu*

This is a large-headed climbing mouse with a long tail. Its typical habitats are open forests and edges of swamps. It has been recorded from Eastern Congo, Southwestern Uganda, Western Rwanda and Western Burundi.

*Lophuromys rahmi*

Rahm's Brush-furred Mouse is compact with short legs and tail. It closely resembles Woosnam's Brush-furred Mouse (see below). Its preferred habitat are primary montane forests. It has been recorded from Eastern Congo, Western Rwanda and Southwestern Uganda. In Kamiranzovu Swamp it has been observed in the Carapa-Syzygium swamp forest. It is IUCN listed as endangered.

*Lophuromys woosnami*

This mouse is similar to *L. rahmi* but usually more widespread and abundant. It is known from Eastern Congo, Western Rwanda, Southwestern Uganda and Western Burundi.

*Ruwenzorisorex suncooides*

This a small, greyish-black shrew with a rounded head, short snout and small ears. It seems to be a specialized semi-aquatic species that has been captured from small streams. It is known from Eastern Congo, Southwestern Uganda, Western Rwanda and Western Burundi.



Fig. 35. View of Rugezi Marsh.



Fig. 36. View of Rugezi Marsh.



Fig. 37. Rugezi River above Rusumo-Falls (above), view of Rugezi Marsh (below).

## 3.2 Rugezi Complex

### 3.2.1 Geography and geology

Rugezi Marsh is located southeast of the volcanoes at around 2050 m and represents a high altitude peat bog. It is a floated valley where the swamp forms a dense mat over floating peat and its deeper waters (HAGETIKIMANA & TWARABAMENYE 2005) (Fig. 35-37). The river Rugezi flows to Lake Bulera and Lake Ruhondo. The whole swamp is surrounded by quartzitic crests from the upper and middle Burundian.

### 3.2.2 Previous studies

The only published study of the vegetation of Rugezi Swamp is that of DEUSE (1966). However, several unpublished reports deal with Rugezi and its importance as a RAMSAR site (e.g. HATEGEKIMANA & TWARABAMENYE 2005, EXPERCO DES GRANDS LACS 2003).

### 3.2.3 Anthropogenic impact and use

Rugezi Marsh has been degraded by agriculture and exploitation of plants for animal feeding and construction (e.g. *Cyperus latifolius*, *Miscanthus violaceus*). Thus the northern part is actually very degraded and only the southern and southeastern part are ecologically intact (HATEGEKIMANA & TWARABAMENYE 2005). Since a few years, however, the swamp is a protected site which had consequences on the anthropogenic use. Interviews with the local population in March 2011 showed that plants are no longer cut for various uses and that the protection status is respected. The only impact actually observable was a path traversing the marsh which was used to transport cattle and goods for the market. However, there is a potential danger due to water management and hydropower production.

### 3.2.4 Flora and vegetation

#### 3.2.4.1 Plant communities

The main part of the swamp is covered by a floating mat of *Miscanthus violaceus* (Fig. 38-40). This community has been described as *Miscanthidio-Dissotetum incanae*. In the northern degraded part small islands of *Cyperus papyrus* occur. The southern area bears a community with *Erica rugegensis*, *Xyris valida*, *Drosera madagascariensis* and the peat moss *Sphagnum planifolium*. The ditches and rivers

are inhabited by *Potamogeton thunbergii*, *Utricularia gibba* and *Nymphaea heudelotii*



Fig. 38. Floating mats of *Miscanthus violaceus*.



Fig. 39. Floating mats with *Miscanthidium violaceum* and open streams.

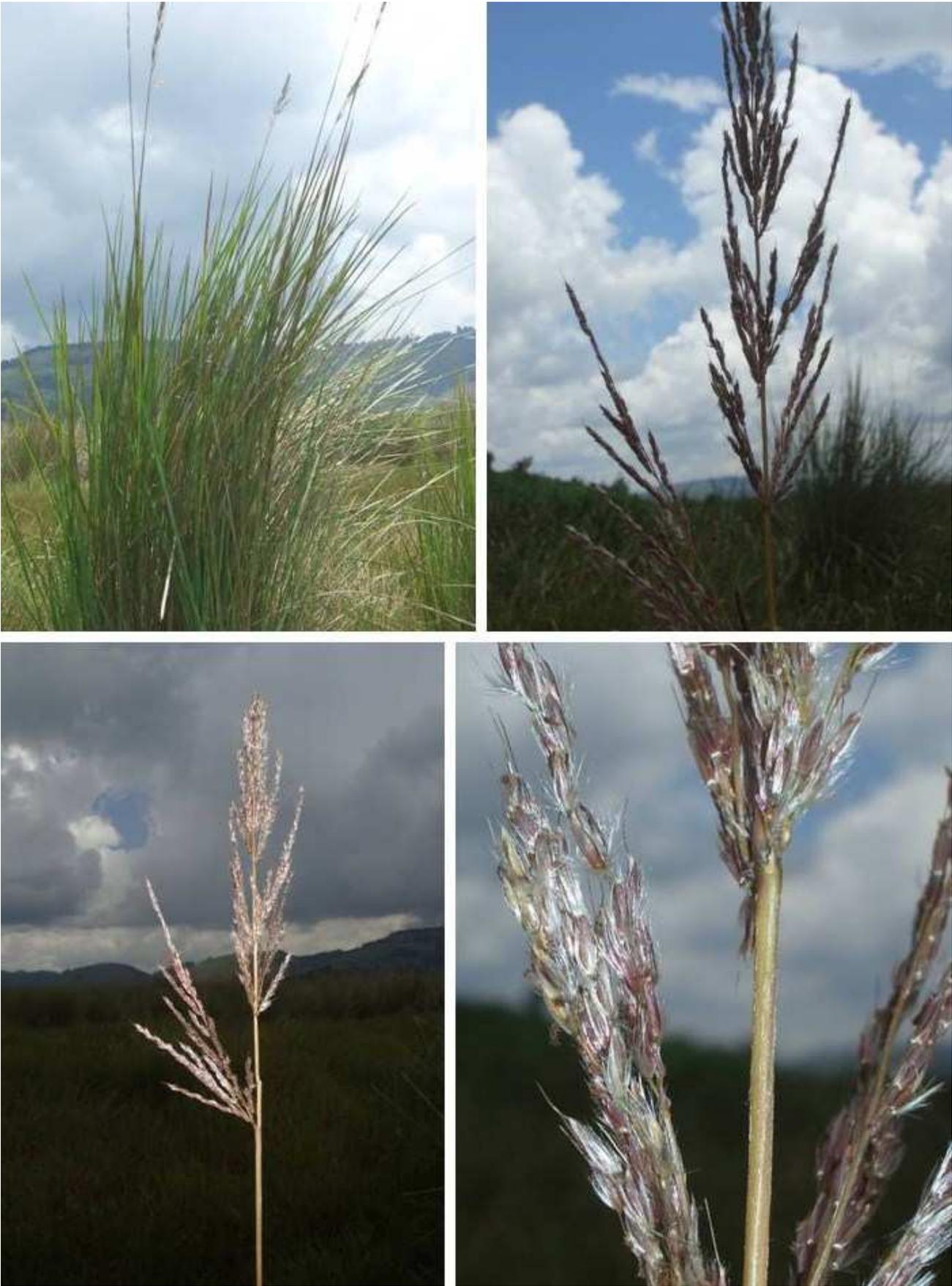


Fig. 40. *Miscanthus violaceus*.



Fig. 41. *Utricularia gibba*.

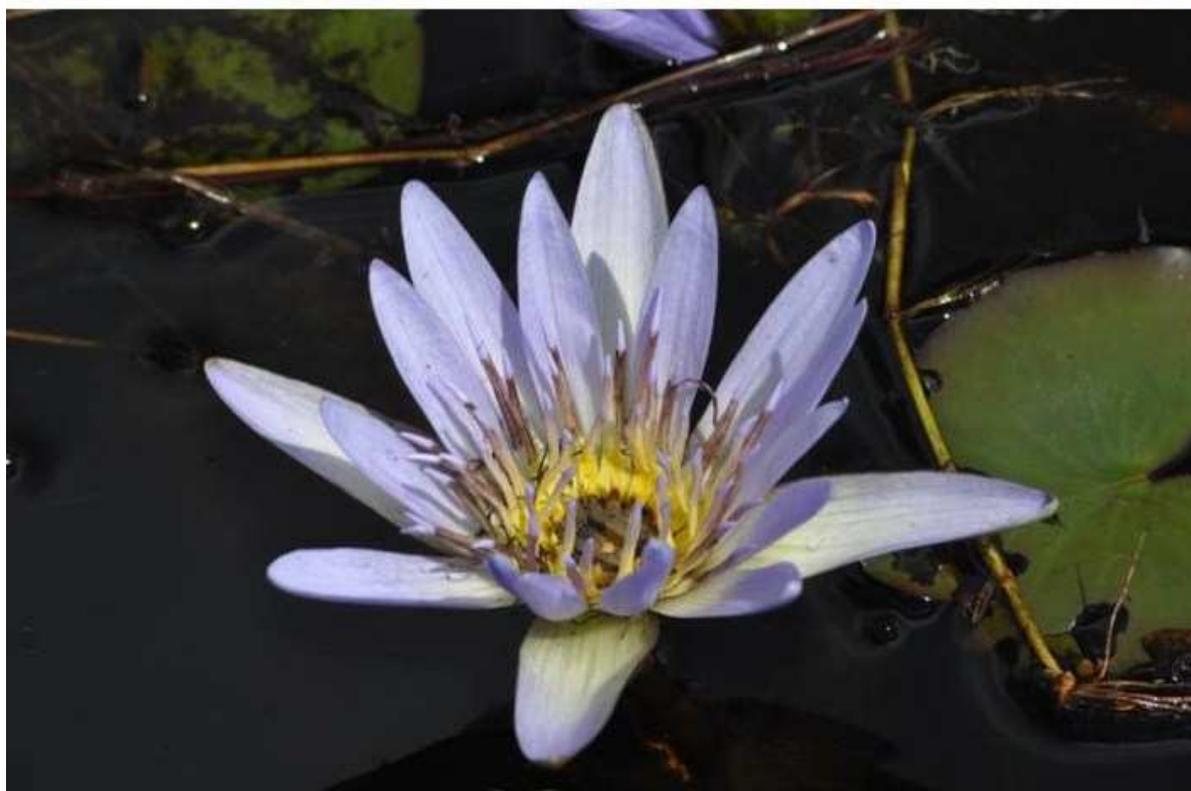
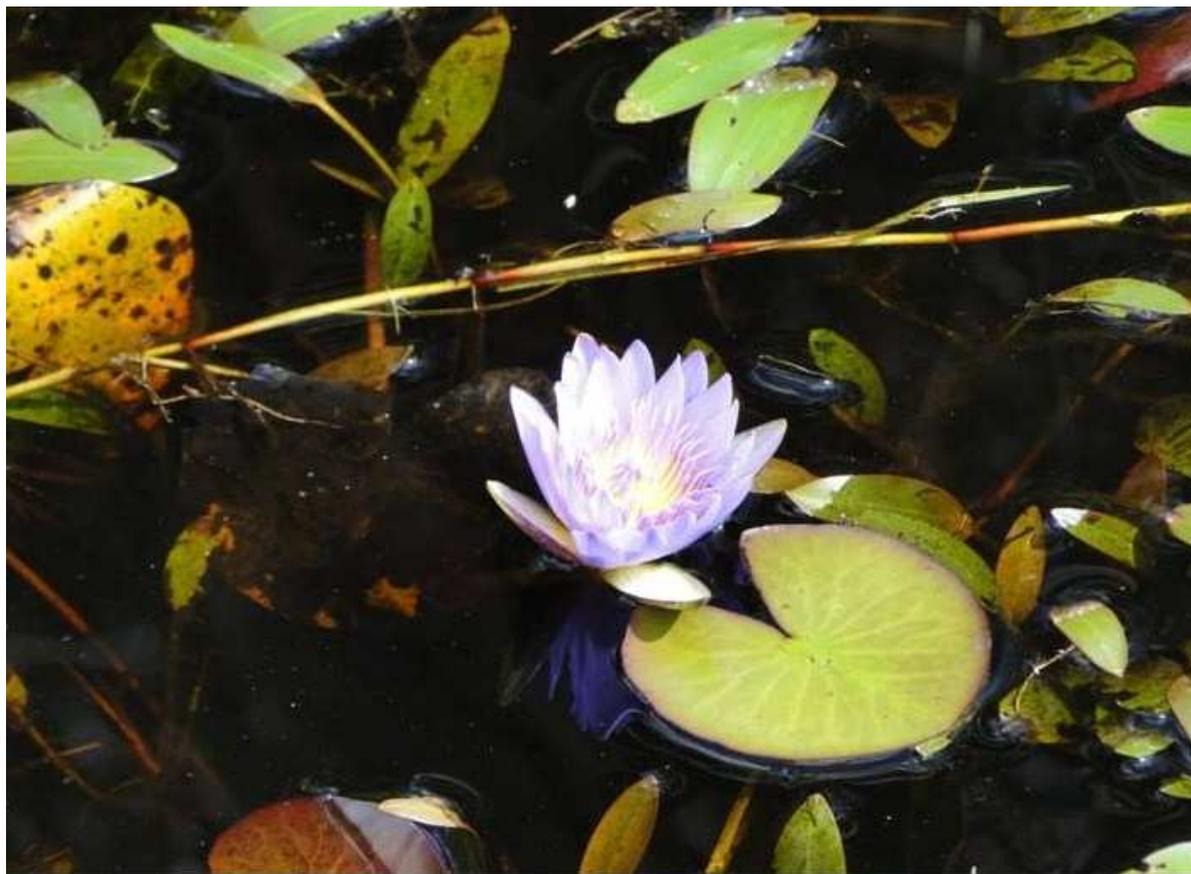


Fig. 42. *Nymphaea heudelotii*.

are covered with aquatic vegetation of *Potamogeton thunbergii*, *Utricularia gibba* (Fig. 41) and *Nymphaea heudelotii* (Fig. 42).



Fig. 43. *Xyris valida*.



Fig. 44. *Hypericum humbertii* (above), *Vaccinium stanleyi* (below).

#### 3.2.4.2 Flora of vascular plants

In Rugezi Marsh 94 species of vascular plants have been recorded (tab. 2). A characteristic feature of the swamp is the high number of afro-montane taxa also occurring in Nyungwe and Volcano National Park. However, Albertine Rift Endemics are scarce. Due to the floating islands and mats several parts of the swamp are inaccessible and may reveal plant species hitherto not recorded.

#### 3.2.4.3 Endemic and/or remarkable species

Only two species are Albertine Rift Endemics. *Vaccinium stanleyi* (Fig. 44) has already been described in the Kamiranzovu chapter.

#### *Hypericum humbertii* (Fig. 44)

Description: Perennial prostrate herb, stems up to 30 cm long. Leaves opposite, elliptic or ovate, 0.7-1.9 x 0.4-1.1 cm, obtuse at apex, cordate and amplexicaulous at base, with minute translucent glandular dots. Flowers single, axillary, up to 1.6 cm in diameter, petals yellow, stamens in 3 groups of 12-15. Habitat and distribution: Swamps and grassland, 1700-2600 m. In Nyungwe at Rwasekoko. In Rwanda at the Virunga Volcanoes and in Rugezi swamp. Eastern Congo (Kahuzi-Biega), Uganda (Virunga volcanoes, Kigezi), Burundi. Notes: Albertine Rift endemic.

### 3.2.5 Amphibians

#### 3.2.5.1 Amphibian species recorded

Altogether 6 species of Amphibians could be recorded in Rugezi Marsh, among them 2 Albertine Rift endemics (tab. 3). The composition of the fauna is remarkable as high montane species like *Hyperolius castaneus* occur sympatrically with lowland species like *Hyperolius viridiflavus* (Fig. 45).

#### 3.2.5.2 Endemic and/or remarkable species

#### *Amietia angolensis* (Fig. 45)

This is a large species of frog, reaching a body length of 75 mm in males and 110 mm in females. It is distributed throughout Rwanda at elevations below about 2000 m a.s.l. The species is always found close to water or in the water. The species is widespread in Africa but its systematics are currently under investigation (A).



Fig. 45. *Amietia angolensis* (above), *Hyperolius viridiflavus* (below).



Fig. 46. *Phrynobatrachus* spec. 1 (above),, *Ptychadena mascareniensis* (below).



Fig. 47. Habitat of *Phrynobatrachus* spec. 1 with Muhabura in the background.

CHANNING, pers. comm.) and this might also turn out to be a complex of several cryptic species.

*Hyperolius viridiflavus* (Fig. 45)

This medium-sized tree frog (males and females reach a body length of up to 40 mm) is distributed from Ethiopia southwards to Tanzania, Burundi and the Democratic Republic of the Congo. In Rwanda it is found in swampy areas up to an altitude of nearly 3000 m a.s.l. It is absent only in the forests of Nyungwe and Gishwati. The species is highly variable. Even at a single pond, many colour morphs and patterns can be observed.

*Phrynobatrachus* spec. 1 (Fig. 46, 47)

A small species of puddle frog. We found several males in the Rugezi marshland, calling from small puddles. Species of the genus *Phrynobatrachus* are difficult to distinguish morphologically. We are currently comparing this species to its congeners genetically. It might be new to science. If so, it must be considered endemic to the Rugezi marshland.

### 3.2.6 Reptiles

#### 3.2.6.1 Reptile species recorded

A total of only 3 species of reptiles has been recorded in Rugezi Marsh (tab. 4). Among them, only *Adolfus vauereseli* is an Albertine Rift Endemic (see Kamiranzovu chapter).

#### 3.2.6.2 Endemic and/or remarkable species

*Natriciteres olivacea* – Olive Marsh Snake (Fig. 48)

Diagnosis: Small snake; total length usually less than 50 cm; head large; tail relatively short; dorsal scales smooth; basic colouration of the back variable, from brown or grey, olive or bluish black to yellow, usually with a darker longitudinal band along the spine. Distribution: Widespread in Africa, from West Africa (Guinea) to East Africa (Kenya, Tanzania), southeastwards to Angola and Zimbabwe.



Fig. 48. *Natriciteres olivacea*.

### **3.2.7 Birds**

#### 3.2.7.1 Bird species recorded

A total of 37 bird species has been recorded in Rugezi Marsh (tab. 5, Fig. 49-51). Only one Albertine Rift Endemic is known from that area. One species, the Papyrus Yellow Warbler (see Akagera chapter), is IUCN listed. As Rugezi is surrounded by cultivated landscape, many widespread bird species which are not typical for swamps are occurring.

#### 3.2.7.2 Endemic and/or remarkable species

##### *Bradypterus graueri*

The globally endangered Grauer's Swamp Warbler has already been briefly discussed in the Kamiranzovu chapter. Rugezi Swamp is probably the most important site worldwide for its conservation as it represents the largest population. The global population is estimated to represent less than 10.000 individuals (BYARUHANGA et al. 2006).

### **3.2.8 Mammals**

#### 3.2.8.1 Mammal species recorded

In Rugezi Marsh, only two mammal species (*Aonyx capensis* and *Tragelaphus scriptus*) have been observed. As no detailed inventory has ever been performed, no further data from the literature are available.



Fig. 49. *Balearica regulorum*.



Fig. 50. *Threskiornis aethiopicus* (above), *Bostrychia hagedash* (below).



Fig. 51. *Saxicola torquata*.



Fig. 52. Rweru-Mugesera complex, view of swamp.



Fig. 53. Rweru-Mugesera complex, view of swamp.



Fig. 54. Anthropogenic impact in the swamp.

### 3.3 Rweru-Mugesera Complex

#### 3.3.1 Geography and geology

The Rweru-Mugesera Complex is situated in the southeastern plateau at about 1300 m and consists of several lakes and part of the Akagera River (Fig. 52-53). It is characterized by colluvial soils at the base of the valley. The water supply for these swamps derives from Nyabarongo/Akagera River which then continues towards Lake Victoria. The geological base consists mainly of precambrian granitic and quartzitic rocks.

#### 3.3.2 Previous studies

The only published study dealing with the vegetation of this swamp complex is that by DEUSE (1966). A brief description in an unpublished report is provided by EXPERCO DES GRANDS LACS (2003).

#### 3.3.3 Anthropogenic impact and use

The Rweru-Megesera Swamps are highly affected by the following human activities: agriculture (Fig. 54), cattle grazing, production of loam bricks and cutting of plants for animal feeding and construction purpose. In March 2011 a regular burning could be observed. Also invasive plants, especially the water hyacinth *Eichhornia crassipes*, are a mayor threat to the natural vegetation. The area is actually not protected.

#### 3.3.4 Flora and vegetation

##### 3.3.4.1 Plant communities

The swamp is covered by Papyrus reed classified as Cypero papyri-Dryopteridetum gongylodis which forms a species-poor plant community with dominating *Cyperus papyrus* (Fig. 53). Other reed communities are the Phragmitetum mauritiani with dominating *Phragmites mauritianus*, the Echinochloetum pyramidalis (Fig. 55) and the Cyperetum latifolii. Along the rivers, a community with *Sesbania sesban* and *Phoenix reclinata* is developed (Sesbanio-Phoenicetum reclinatae). The open water surfaces are colonized by communities of aquatic plants, e.g. the Nymphaeetum calliantho-mildbraedii with *Nymphaea lotus* and *Nymphaea nouchalii* (Fig. 52), and the Ceratophylletum demersi (Fig. 55). Free floating species are *Azolla nilotica* and the neophytic *Eichhornia crassipes*.

#### 3.3.4.2 Flora of vascular plants

In this study area 53 species of vascular plants have been recorded. This rather low number is not surprising as mid and low altitude swamps with *Cyperus papyrus* are known for their low diversity. However, this type of vegetation is quite typically developed and harbours a more diverse fauna.

#### 3.3.4.3 Endemic and/or remarkable species

No Albertine Rift Endemic could not be recorded. Within the flora one rare species occurs in larger populations.

##### *Pycnostachys dewildemaniana* (Fig. 56)

Perennial erect herb, pubescent, stems up to 60-120 cm long. Leaves opposite, linear-lanceolate, sessile or very shortly petiolate, 3-7 x 0.4-0.8 (-1.2) cm, acute at apex. Flowers in dense thyrsi, corolla pale violet, pubescent. Habitat and distribution: Swamps, 1300-1400 m. In Rwanda only in the Rweru-Mugesera Complex. Eastern Congo (Katanga).

### 3.3.5 Amphibians

#### 3.3.5.1 Amphibian species recorded

13 species of amphibians have been recorded from Rweru-Mugesera, however, no Albertine Rift Endemic (tab. 3). For a description of the species, see the Akagera chapter.

### 3.3.6 Reptiles

#### 3.3.6.1 Reptile species recorded

A total of 6 species of reptiles has been observed, among them no Albertine Rift Endemic.



Fig. 55. *Echinochloa pyramidalis* (above), *Ceratophyllum demersum* (below).



Fig. 56. *Pycnostachys dewildemanianus*.

### 3.3.6.2 Endemic and/or remarkable species

#### *Philothamnus heterolepidotus* – Slender Green Snake (Fig. 63)

Diagnosis: Medium-sized snake; total length to about 100 cm; body very slender; tail very long; head small and narrow; eye large; dorsal scales smooth; colour variable, most often green, lightening to yellowish on the flanks. Distribution: Widespread in Africa, from West Africa (Sierra Leone) to East Africa (Sudan, Kenya), southeastwards to Angola.

## 3.3.7 Birds

### 3.3.7.1 Bird species recorded

40 bird species have been observed in the Rweru-Mugesera Complex (tab. 5, Fig. 64). No Albertine Rift Endemic has been recorded. Two species, the Papyrus Gonolek and the Papyrus Yellow Warbler (see Akagera chapter), are IUCN listed.

### 3.3.7.2 Endemic and/or remarkable species

#### *Laniarius mufumbiri*

This is a black and scarlet bird up to 19 cm long. It is restricted to dense *Papyrus* swamps and can be classified as a Victoria Lake Endemic known from Eastern Rwanda, Southeastern Uganda, Northwestern Tanzania and Southwestern Kenya. The populations in Rwanda are still considered to be abundant. The species is listed as near threatened due to destruction of its habitats.

## 3.3.8 Mammals

### 3.3.8.1 Mammal species recorded

In Rweru-Mugesera 16 species of mammals have been observed (tab. 6). No Albertine Rift Endemic has been recorded and no species is IUCN listed. The populations of large mammals, e.g. Hippopotamus, are considerably declining due to habitat destruction. Other large mammals like Bushbuck and Sitatunga have been observed grazing on the agricultural fields in the evening. Also the Jackal could be seen hunting at night outside the reed.



Fig. 57. *Afrixalus quadrivittatus* (above), *Amieta angolensis* (middle), *Amietophrynus regularis* (below).



Fig. 58. *Kassina senegalensis* (above), *Leptopelis bocagei* (below).



Fig. 59. *Hyperolius acuticeps* (above, middle), *Hyperolius lateralis* (below).



Fig. 60. *Phrynobatrachus natalensis* (above), *Phrynobatrachus kakamikro* (below).



Fig. 61. *Ptychadena anchietae* (above), *Ptychadena porosissima* (below).

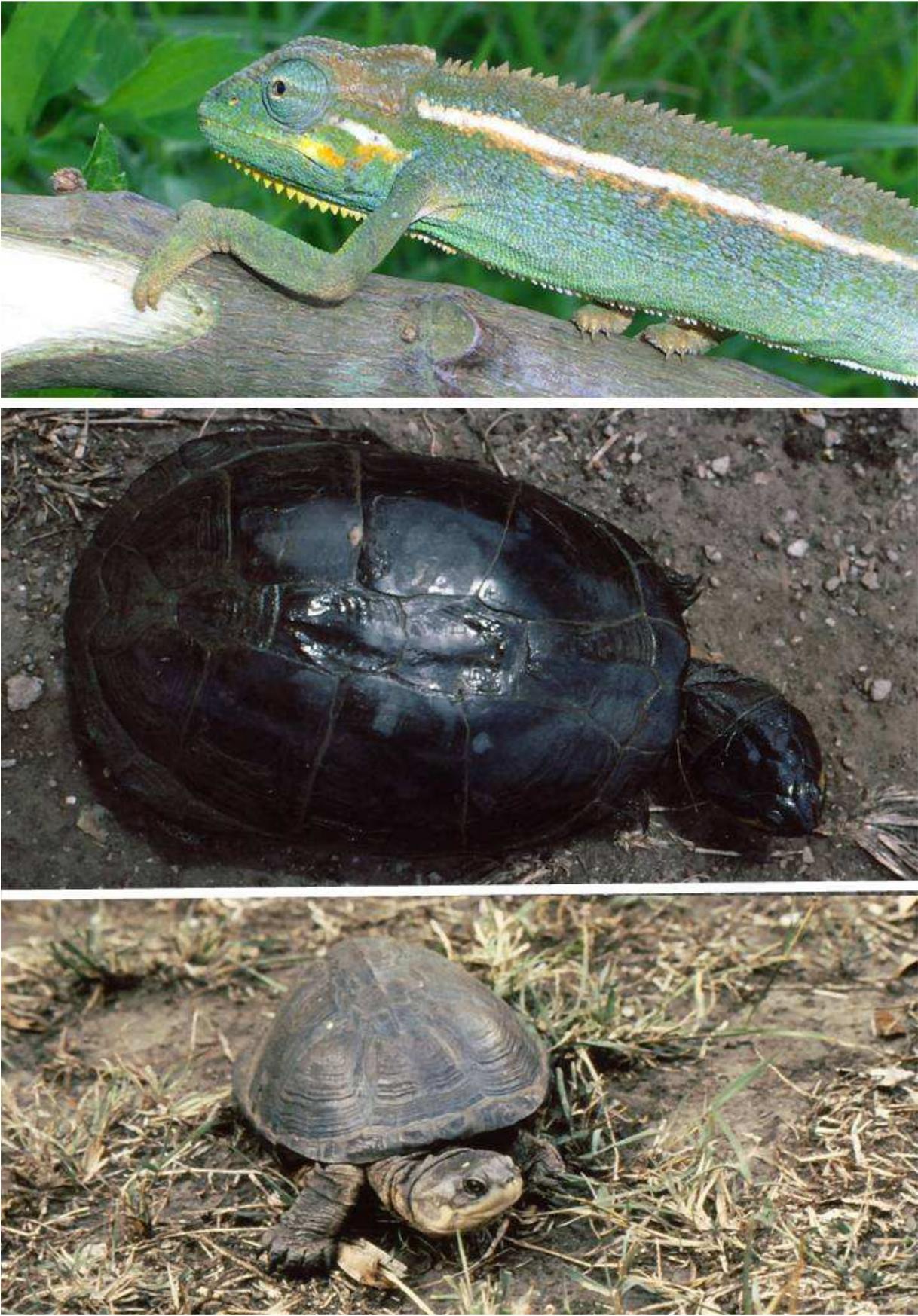


Fig. 62. *Trioceros ellioti* (above), *Pelusios subniger* (middle, below).



Fig. 63. *Philothamnus heterolepidotus*.



Fig. 64. *Actophilornis africanus* (above), *Ploceus cucullatus* (below).



Fig. 65. Akagera Complex near Nasho.



Fig. 66. Swamp with *Cyperus papyrus* and different shrubs.



Fig. 67. Cutting of Papyrus at swamp edge.



Fig. 68. Cattle grazing at swamp edge.



Fig. 69. Goat grazing at swamp edge.



Fig. 70. *Syzygium cordatum* (above left), *Polygonum senegalense* (above right), *Ficus verruculosa* (below).



Fig.71. *Ludwigia abyssinica*.



Fig. 72. *Eulophia angolensis*.

### **3.4 Akagera Complex**

#### **3.4.1 Geography and geology**

The Akagera Complex is situated south of the Akagera National Park in the Akagera valley at about 1300 m and consists of several lakes (Nasho, Cyambwe, Mpanga) and part of the Akagera River (Fig. 65-66). It is characterized by colluvial soils at the base of the valley. The water supply for these swamps derives from Nyabarongo/Akagera River which then continues towards Lake Victoria. The geological base consists mainly of precambrian granitic and quartzitic rocks.

#### **3.4.2 Previous studies**

The only published study dealing with the vegetation of this swamp complex is that by DEUSE (1966). A brief description in an unpublished report is provided by EXPERCO DES GRANDS LACS (2003).

#### **3.4.3 Anthropogenic impact and use**

The area remained nearly untouched until the mid of the 1980s, and large swamps dry forests revealed a high diversity (including large mammals). Since 1990 and especially after the genocide, the area was inhabited by refugees and survivors of the massacres. Thus, a heavy pressure on all ecosystems occurred which led to a nearly complete deforestation. The remaining swamps are endangered by the following human activities: agriculture, cattle grazing, production of loam bricks and cutting of plants for animal feeding and construction purpose (Fig. 67-69).

#### **3.4.4 Flora and vegetation**

##### **3.4.4.1 Plant communities**

As in the Rweru-Mugesera Complex, the swamp is covered by Papyrus reed classified as *Cypero papyri-Dryopteridetum gongylodis* (Fig. 65) which forms a species-poor plant community with dominating *Cyperus papyrus*. Other reed communities are the *Phragmitetum mauritiani* with dominating *Phragmites mauritianus*, the *Echinochloetum pyramidalis* and the *Cyperetum latifolii*. Another community dominated by small shrubs is characterized by *Syzygium cordatum* (Fig. 70) and *Myrica kandtiana*. Along the lakes, a community with *Sesbania sesban* and *Phoenix reclinata* is developed (*Sesbanio-Phoenicetum reclinatae*). Also stands of *Aeschynomene elaphroxylon* and *Mimosa pigra* occur. The open water surfaces are colonized by communities of aquatic plants, e.g. the *Nymphaeetum calliantho-*

mildbraedii with *Nymphaea lotus* and *Nymphaea nouchalii*, and the Ceratophylletum demersi. Free floating species are *Azolla nilotica* and the neophytic *Eichhornia crassipes*.

#### 3.4.4.2 Flora of vascular plants

A total of 77 vascular plant species has been recorded in the Akagera Complex (tab. 2). The situation is similar as in the Rweru-Mugesera Complex which also harbours species- poor mid- and low-altitude swamps. Also no Albertine Rift Endemic could be observed.

#### 3.4.4.3 Endemic and/or remarkable species

Two remarkable and endangered orchid species, *Eulophia angolensis* and *Eulophia guineensis*, occur in the Akagera Complex. Especially *Eulophia angolensis* (Fig. 72) is restricted to swamps and reed habitats. The species was formerly widespread in Rwanda, but is rapidly declining actually due to swamp draining and conversion into agricultural landscape.

### 3.4.5 Amphibians

#### 3.4.5.1 Amphibian species recorded

16 species have been recorded in the Akagera Complex, one taxon is a possible Albertine Rift Endemic.

#### 3.4.5.2 Endemic and/or remarkable species

##### *Afrixalus quadrivittatus* (Fig. 57)

The small tree frog is easily recognized by its dorsal pattern which consists of four dark longitudinal lines – hence the scientific name. The species is commonly encountered in the lower elevations (< 1800 m a.s.l.) of Eastern Rwanda and is widespread in Central Africa. Individuals are found along the edges of ponds and other lentic water bodies. The eggs are laid on a leaf and then the leaf is folded around the eggs and its edges are glued together.

##### *Amietophrynus regularis* (Fig. 57)

One of the most commonly encountered toads of the lower elevations (<1800 m a.s.l.) of Rwanda, *A. regularis* can be found all over the country in natural as well as



Fig. 73. *Hyperolius acuticeps* (above left), *Hyperolius kivuensis* (above right), *Hyperolius viridiflavus* (below).

in cultivated areas. At higher elevations, it appears to be replaced by *A. kisoensis*. There are a few localities in Rwanda where both species occur syntopically. *A. regularis* is a large toad, with males reaching a body length of up to 90 mm, females to 120 mm. It can be distinguished from *A. kisoensis* by the more rounded snout, less extensively webbed toes, larger size, and colouration. Eggs are deposited in lentic water bodies.



Fig. 74. *Hylarana albolabris* (above), *Hylarana gallamensis* (middle), *Phrynobatrachus* spec. 2 (below).



Fig. 75. *Ptychadena mascareniensis* (above), *Schismaderma carens* (below)

*Hylarana albolabris* (Fig. 74)

A comparatively large frog, reaching a body length of 57 mm in males, 74 mm in females. The back is brown with small dark spots. The edges of the mouth are white, hence the name. In Rwanda, it is known only from the Akagera region. Otherwise it is widespread in western and Central Africa.

*Hylarana galamensis* (Fig. 74)

This species is larger than *H. albolabris*, reaching a body length of 78 mm in males and 86 in females. The basic colouration of the back is black but there is a broad golden band on each side of the body and many more irregularly shaped blotches of the same colour between the bands. This is distributed in the savannah belt from Senegal to Ethiopia and then southwards to Mozambique. In Rwanda it is only known from the Akagera region.

*Hyperolius acuticeps* (Fig. 59, 73)

A very small species of the genus with a green back and a fine white to yellowish dorsolateral line running along each side of the body. The snout is long and sharp. The species belongs to a complex of several cryptic species, the systematics of which is currently under investigation. The form occurring in Rwanda is found in the lower parts of Eastern Rwanda and is otherwise known from several locations in the Great Lakes region.

*Hyperolius kivuensis* (Fig. 73)

A medium sized tree frog (males up to 30 mm, females 38 mm). Two colour morphs exist, a greyish-brown one and a more common green one. This species is commonly found in swamps in natural as well as cultivated areas. The swamp at the Rugezi site is the highest known distribution locality of this species in Rwanda. *Hyperolius kivuensis* is found in Eastern and Southeastern Africa from Ethiopia to Mozambique and Angola.

*Hyperolius lateralis* (Fig. 59)

This species is a small tree frog, reaching a body length of about 25 mm. The back is either green or brown and a broad light line runs along each side of the body from the nostril to the groin. The species is distributed in the Great Lakes region, in swamps at elevations of up to 2000 m a.s.l. *Hyperolius lateralis* is ecologically very similar to *H. castaneus* and is replaced by this species at higher altitudes.

*Kassina senegalensis* (Fig. 58)

Although *Kassina senegalensis* belongs to a family of tree frogs, it lives almost exclusively on the ground. Males of this beautifully coloured, medium-sized species are most often found calling from small ponds or the edges of those. The short, frequency-modulated call is one of the characteristic voices of the African savannah. In Rwanda it can be found in swamps up to an elevation of about 2100 m a.s.l. Otherwise, the species is widespread in Africa and occurs from Senegal to Ethiopia and southwards to South Africa, being absent only from the Congo Basin.

*Phrynobatrachus kakamikro* (Fig. 60)

A very small species of Puddle Frog. Males reach a snout-vent-length of only 18 mm. The species was described only in February 2010 from Kakamega Forest in western Kenya and had so far been known only from this area. We found this species at several localities in Rwanda, including the Bugesera Marais and the Akagera floodplains. It is locally common but hard to find because of its small size and the habit to call out of dense vegetation.

*Phrynobatrachus natalensis* (Fig. 60)

A medium-sized species of puddle frog which can be found in swampy areas all over Rwanda at elevations below 2000 m a.s.l. It is absent from closed forest. The species is otherwise widespread in Africa. It is characterized by its stocky build, short legs, and rough skin. This frog is found calling from puddles or the edges of larger bodies of stagnant water.

*Phrynobatrachus spec. 2* (Fig. 74)

A very small species of puddle frog. We found many individuals in the swamps of the Akagera floodplain. It appears to be new to science and we are currently comparing it genetically to its congeners.

*Phrynomantis bifasciatus*

A large microhylid (males up to 53 mm, females to 65 mm body length) with an unmistakable colouration. The back is black with two red line running along both sides of the body. The frog has wide geographic distribution range from Kenya to

South Africa. In Rwanda, it reaches its northwesternmost distributional area and is so far known only from the plains close to the Akagera River.

*Ptychadena anchietae* (Fig. 61)

One of the so-called rocket frogs, this species is always found close to stagnant water. *P. anchietae* is characterised by its exceptionally long hind limbs, the very long snout, and the reddish dorsal colouration. The species is widespread in Eastern and Southern Africa. In Rwanda, it is known from many localities at elevations below 2000 m a.s.l. It is absent from closed forest. *P. anchietae* is often found syntopically with *P. mascareniensis* and *P. porosissima*.

*Ptychadena mascareniensis* (Fig. 75)

This is one of the most commonly encountered frog species in Rwanda. It is found in swampy areas at elevations of up to about 2100 m a.s.l., always close to bodies of stagnant water. It is absent from closed forest. *Ptychadena mascareniensis* belongs to a complex of several cryptic species which are commonly distributed all over Africa. *P. mascareniensis* is often found syntopically with *P. anchietae* and *P. porosissima*.

*Ptychadena porosissima* (Fig. 61)

*P. porosissima* is widespread in Eastern and Southern Africa. In Rwanda, it is found in swampy areas below 1800 m a.s.l. *P. porosissima* is often found syntopically with *P. anchietae* and *P. mascareniensis*. At first glance very similar to each other, the three species can be distinguished based on differences in their advertisement calls, body proportions, and aspects of colouration.

*Ptychadena spec.*

We heard and recorded the call of this species in the marshland of the Akagera region but we could not find the calling frog itself. The characteristics of the advertisement call are typical for the genus and the call differs from those of *P. anchietae*, *P. mascareniensis*, and *P. porosissima*. However, we were not able to identify the species which is due to a confuse taxonomy of the whole group.

*Schismaderma carens* (Fig. 75)

The only representative of a monotypic genus, *Schismaderma carens* is widespread in southern and eastern Africa. In the Akagera area of Rwanda it reaches its northwesternmost point of geographic distribution. The medium-sized toad is characterised by its smooth dorsal skin and red dorsal colouration. It reproduces in lentic water bodies.

*Xenopus victorianus*

A medium-sized species of clawed frogs. This species is commonly encountered in almost every body of water throughout Rwanda below an altitude of about 2000 m a.s.l. It is otherwise widespread in the Great Lakes region. Clawed frogs spend most of their life in the water.

### 3.4.6 Reptiles

#### 3.4.6.1 Reptile species recorded

A total of 13 reptile species has been recorded, among them no Albertine Rift Endemic (tab. 4).

#### 3.4.6.2 Endemic and/or remarkable species

*Bitis arietans* – Puff Adder

Diagnosis: Large snake; total length usually 1 m, maximum to nearly 2 m; body very stout; head triangular, flat; eye small; tail very short; basic colouration of the back variable, ranging from brown, grey, reddish brown to yellow or orange; pattern consisting of a series of v-shaped blotches along the spine. Distribution: All over Africa south of the Sahara and isolated populations in southern Morocco and Yemen; from sea level to at least 2400 m a.s.l.

*Chamaeleo anchietae* – Angolan Chameleon (Fig. 76)

Diagnosis: Medium-sized chameleon; total length to 19 cm; body much longer than tail; tail prehensile; canthus rostralis strongly developed, continuing as supraorbital, then lateral crest, not joining parietal; gular and ventral crest weak; no ear flaps; no rostral process; body colouration green, brown, or yellowish brown. Distribution: Eastern Africa (Tanzania, Rwanda, Burundi) to Angola; at elevations below 1500 m a.s.l. In Rwanda known only from the Akagera region.



Fig. 76. *Chamaeleo anchietae* (above), *Varanus niloticus* (middle), *Crocodylus niloticus* (below).



Fig. 77. *Kinixys spekii* (above), *Python sebae* (below).

*Crocodylus niloticus* – Nile Crocodile (Fig. 76)

Diagnosis: Large crocodile; total length 300 cm, maximum to 550 cm; body stout; snout long and broad with prominent teeth; limbs short; tail massive, slightly shorter than body. Distribution: All over Africa, from Senegal to North Sudan, south to South Africa, also Madagascar; from sea level to about 1600 m a.s.l.



Fig. 78. *Dasypeltis scabra*.

*Dasypeltis scabra* – Rhombic Egg Eater (Fig. 78)

Diagnosis: Medium-sized snake; total length to 110 cm; head small and narrow; tail comparatively short; scales heavily keeled; basic colouration variable, from brown to yellowish or grey; pattern on the back most often consisting of a series of dark rhombic spots. Distribution: Eastern and Southern Africa from Sudan to Namibia and South Africa. Isolated populations in Northern Egypt and Southwestern Arabian Peninsula.

*Grayia tholloni* – Thollon's Water Snake (Fig. 79)

Diagnosis: Medium-sized snake; head large; eye big; tail very long; colour of the back brown to greyish brown, lightening towards the flanks; pattern of slightly darker transverse bands along the body. Distribution: From the Great Lakes region in East Africa to Central Africa (Nigeria) and Southern Africa (Angola).

*Kinixys spekii* – Speke's Hinged Tortoise (Fig. 77)

Diagnosis: Small tortoise; shell flattened, its length up to 22 cm, usually 15 to 19 cm; head rounded; tail short, bearing a terminal spine; shell colouration yellow to light brown with dark edges. Distribution: East Africa (Kenya, Tanzania, Rwanda, Democratic Republic of the Congo) to Northern Botswana; from sea level to 1600 m a.s.l. In Rwanda only recorded from the Akagera region.

*Naja melanoleuca* – Forest Cobra

Diagnosis: Very long snake; total length to 270 cm, usually less than 200 cm; body comparatively stout for a cobra; head big; neck spreadable to form a hood; basic colouration of the body black; chin and throat yellowish. Distribution: West Africa to East and Southern Africa; from sea level to 2500 m a.s.l.

*Naja nigricollis* – Black-necked Spitting Cobra

Diagnosis: Large snake; total length 100-150 cm, seldom to 200 cm; body comparatively stout; head broad; neck spreadable to form a hood; colouration of the body black. Distribution: West Africa to East and Southern Africa; from sea level to 1700 m a.s.l.



Fig. 79. *Grayia tholloni* (above), *Psammophis mossambicus* (below).

*Pelusios subniger* – Pan-hinged Terrapin (Fig. 62)

Diagnosis: Small terrapin; shell length of adults up to 20 cm; plastron hinged; head comparatively big; tail short; shell colouration dark brown to greyish brown, flanks yellow with black edges. Distribution: Widespread in Eastern and Southeastern Africa, from Tanzania to South Africa and Botswana, eastwards to Democratic Republic of the Congo, also on Madagascar, Mauritius, and the Seychelles. In Rwanda known from Rweru-Mugesera and Akagera.

*Psammophis mossambicus* – Olive Sand Snake (Fig. 79)

Diagnosis: Large snake; total length to 170 cm; body comparatively stout; head large; eye big; tail long, not prehensile; dorsal scales smooth; colouration of the back uniformly olive-brown, brown, or grey. Distribution: Widespread in Eastern Africa, southwards to South Africa.

*Python sebae* – Central African Rock Python (Fig. 77)

Diagnosis: Huge snake; total length up to more than 7.5 m, although most specimens much smaller; complex pattern of black, yellow, and brown; yellow stripe running from tip of snout to back of head on each side of the head. Distribution: West, Central, and East Africa, from Mauritania to Ethiopia, Angola, and Tanzania; from sea level to about 1500 m a.s.l.

*Trioceros ellioti* – Montane Side-striped Chameleon (Fig. 62)

Diagnosis: Medium-sized chameleon; total length to 18 cm, usually 10 cm to 13 cm; tail prehensile, slightly shorter than body; no rostral appendage; gular and ventral crest very prominent; colouration very variable. Distribution: Grasslands of the Albertine Rift (Uganda, Democratic Republic of the Congo, Rwanda, and Burundi) and forests of Western Kenya.

*Varanus niloticus* – Nile Monitor (Fig. 76)

Diagnosis: Large monitor; total length up to 250 cm; snout pointed; neck very long; body cylindrical, long, and slender; tail slightly longer than body, strong, triangular in transversal section; Basic colouration black, brown, or greyish green, spotted with yellow. Distribution: Widespread in Africa from Mauritania, south of the Sahara desert



Fig. 80. *Vidua macroura* (above), *Plectropterus gambensis* (middle), *Hirundo abyssinica* (below).

to Northern Egypt, south to South Africa; at elevations from sea level to about 1600 m a.s.l. In Rwanda known from the Akagera region.



Fig. 81. *Casmerodius albus* (above left), *Ceryle rudis* (above right), *Scopus umbretta* (below).



Fig. 82. *Ploceus cucullatus*.

### 3.4.7 Birds

#### 3.4.7.1 Bird species recorded

The Akagera Complex with 54 species is by far the most bird species-rich swamp (tab. 5, Fig. 80-83). As in Rweru-Mugesera, no Albertine Rift Endemic has been recorded. Two species are IUCN listed.

#### 3.4.7.2 Endemic and/or remarkable species

Beside *Laniarius mufumbiri* (seen Rweru-Mugesera chapter) the Papyrus Yellow Warbler *Chloropeta gracilirostris* has been recorded. It is olive green with a yellow underside and up to 14 cm long. It occurs in dense *Papyrus* thickets and has a local distribution from Eastern Congo, Rwanda, Burundi to Southwestern Uganda and Southwestern Kenya and Northwestern Tanzania. The species is listed as vulnerable due to habitat destruction.



Fig. 83. *Vanellus senegallus*.

### 3.4.8 Mammals

#### 3.4.8.1 Mammal species

A total of 11 mammal species has been recorded from the Akagera Complex (tab. 6). No Albertine Rift Endemic has been recorded and no species is IUCN listed. As these swamps are situated outside Akagera National Park, the density of large mammals is low. However, there are still considerable populations of Hippopotamus.

#### **4. Discussion and recommendations for protection and management**

The four swamp complexes investigated are hotspots of biodiversity and deserve strict protection. Among them, Kamiranzovu and Rugezi are high altitude swamps while Rweru-Mugesera and Akagera are mid altitude swamps (see also DEUSE 1966).

For an assessment of the similarity, a cluster analysis was performed using 4 model groups (vascular plants, amphibians, reptiles and birds). The comparison was made within these groups for all swamps and additionally for all 4 groups combining all study sites. The results show that for vascular plants, amphibians and reptiles Rweru-Mugesera and Akagera Complex are most similar, while Kamiranzovu and Rugezi have a similarity of about 60% (see Fig. 84). Surprisingly, the pattern for birds is quite different. Here, Rugezi and Akagera are most similar, and Akagera and Rweru-Mugesera show a similarity of about 55%. The bird fauna of Kamiranzovu is nearly completely different from that of the three other swamp complexes (see below).

This pattern can be explained by the fact that Rweru-Mugesera and Akagera are mid-altitude swamps dominated by *Cyperus papyrus*. They also belong to same biogeographical region in Rwanda, i.e. the savannas and dry forests of the Eastern Plateau. Thus the flora and the herpetofauna are very similar. Kamiranzovu and Rugezi are both high altitude bogs but with a rather different vegetation. Also the herpetofauna differs considerably. As many birds of reed habitats and open water are present in Rugezi and Akagera, the high similarity of the avifauna in these two areas can be explained. Kamiranzovu has a quite isolated bird fauna composed mainly of forest birds.

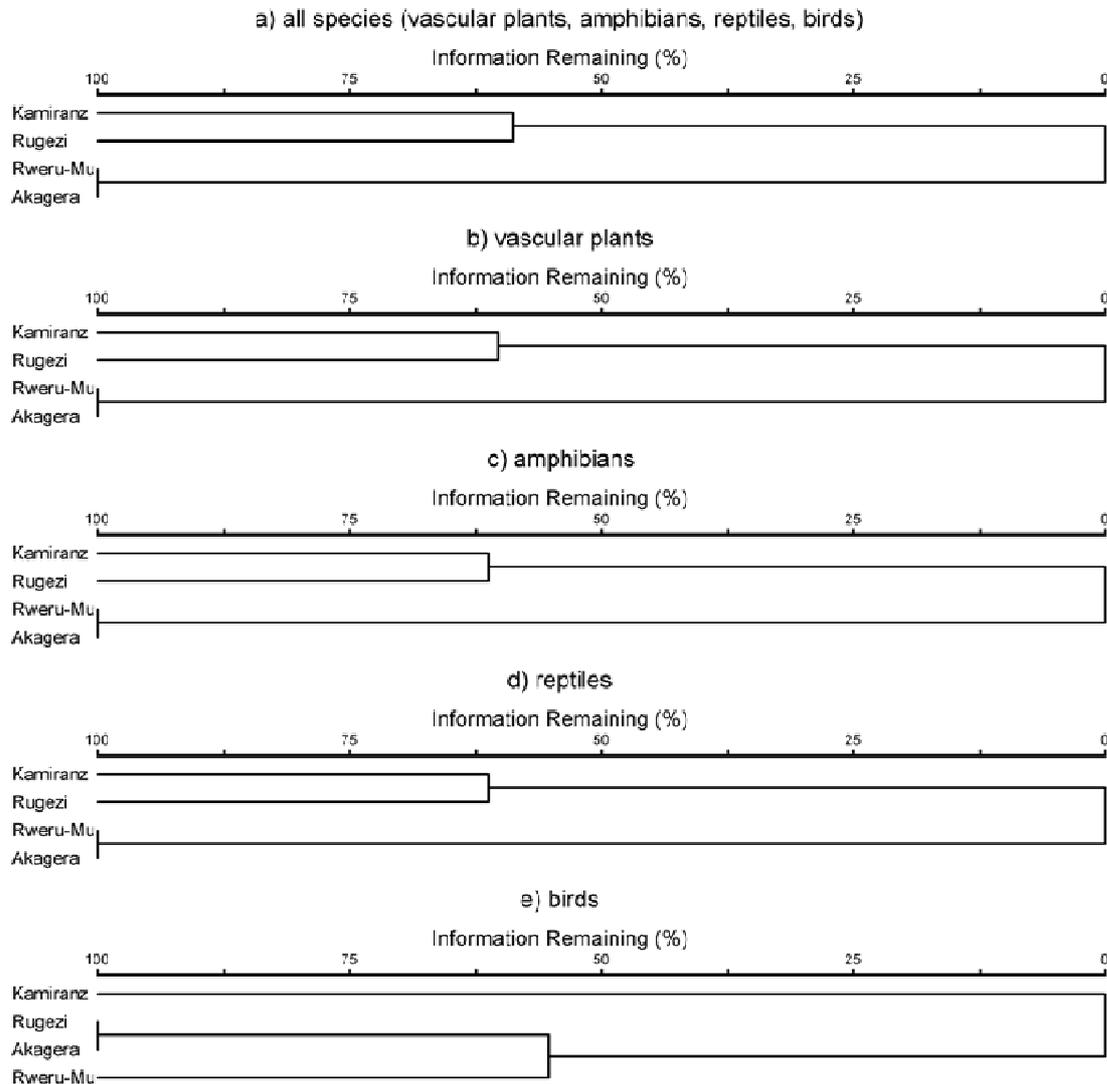


Fig. 84. Dendrogram of the cluster analysis of species (a: all species; b: vascular plants; c: amphibians; d: reptiles; e: birds) from Kamiranzovu, Rugezi, Rweru-Mugesera and Akagera basing on squared Euclidean distance (Ward's method).

Six species of amphibians could not be determined to species level. In two cases (*Ptychadena spec.*, *Amietia spec.*) it is because the species belong to taxonomically difficult genera. In these genera the species are not very well diagnosed and therefore not easy to distinguish. Our morphological and bioacoustic data suggest that they are distinct from the species of the same genus which we found during this investigation and which we assigned to certain species names. A species of *Hyperolius* and three species of *Phrynobatrachus*, on the other hand, appear to be

new to science and also endemic to the area where they were discovered. This highlights the importance of the investigated sites as protected areas

The most important site in terms of biodiversity is the Kamiranzovu Complex which not only harbours the highest species numbers of all study sites but also the highest numbers of endemic species. All 57 Albertine Rift endemics among the vascular plants, 6 Albertine Rift Endemic amphibians out of a total of 9 species, all 5 Albertine Rift Endemic reptiles, all 5 Albertine Rift Endemic birds, and all 6 Albertine Rift Endemic mammals are present in Kamiranzovu. Among the amphibians, 3 possibly undescribed and endemic taxa have been detected. As the area is part of Nyungwe National Park, it is actually not threatened. The ecotourism has only a very little impact on the ecosystem, and on the other hand helps rising public awareness for nature conservation. Also, Kamiranzovu represents the largest peat bog of Africa with a peat layer of about 15 m depth.

Rugezi Marsh is another very important highland peat bog. Despite the rather low diversity with only 94 species of vascular plants, 6 species of amphibians, 3 species of reptiles, 37 species of birds and 2 species of mammals, it is an internationally important site as it represents the world's largest population of Grauer's Swamp warbler *Bradypterus graueri*. Also a possibly endemic and undescribed frog, *Phrynobatrachus spec.*, was discovered. Parts of the marsh are already degraded but especially the southern part is still intact. A management plan is required that will help to delimitate the ecologically most important areas of the marsh that should be left untouched. A higher protection status, e.g. as part of Volcano National Park would be highly desirable.

Rweru-Mugesera-Complex is part of the Nyabarongo/Akagera system and its lakes. Though no endemic species have been recorded, it represents one of the ecologically highly important *Cyperus papyrus* marshes with a typical flora and fauna. It is actually the most endangered site, and establishment of fields as well as the burning of *papyrus* reeds has been observed during our study. The swamps play an important hydrological role for Rwanda and the Victoria-Nile region. A large population of the bird *Laniarius mufumbiri* is still extant. We propose a protection as Nature reserve with strict regulations for its use.

The Akagera complex is also part of the Nyabarongo/Akagera system and its lakes. It is situated south of the Akagera National Park and represents thus an important extension of its swamp flora and fauna. 77 species of vascular plants, 16 species of amphibians, 13 species of reptiles and with 54 species the highest diversity of birds within all study sites is recorded. Additionally 11 species of mammals have been observed. The area is important for the hydrology of the Akagera/Nile system. Numerous species which in Rwanda do not occur elsewhere are observed, e.g. the frogs *Phrynomantis bifasciatus*, *Hylarana albolabris* and a possibly new species of *Phrynobatrachus* are present. The area should be included into an expanded Akagera National Park, as many species not represented in the actual Park are occurring.

In conclusion, all three actually not protected wetland areas should be protected immediately to prevent loss of biodiversity.

## 5. Summary

The present inventory was carried out in spring 2011 during the rainy season in the four wetland areas Kamiranzovu Complex, Rugezi Complex, Rweru-Mugesera-Complex and Akagera Complex. A total of 457 vascular plants, among them 57 Albertine Rift endemics, were recorded in the four study sites. Altogether 33 species of amphibians have been found comprising 9 Albertine Rift endemics. 26 species of reptiles were observed including 5 Albertine Rift endemics. 115 birds with 4 Albertine Rift endemics were observed. 33 mammals (6 Albertine Rift endemics) are known from the four swamps in Rwanda.

In Kamiranzovu swamp 326 species of vascular plants comprising 57 Albertine Rift Endemics were observed. The area also revealed 12 species of amphibians with 6 Albertine Rift Endemics, 12 species of reptiles with 5 Albertine Rift endemics, 26 species of birds with 5 Albertine Rift Endemics, and 18 species of mammals with 6 Albertine Rift Endemics. Rugezi Marsh harboured 94 species of vascular plants comprising 2 Albertine Rift Endemics. Also 16 species of amphibians with 2 Albertine Rift Endemics, 3 species of reptiles, 37 species of birds with 1 Albertine Rift Endemic (*Bradypterus graueri*), and 2 species of mammals were recorded. The Rweru-Mugesera Complex revealed 53 species of vascular plants, 13 species of amphibians, 6 species of reptiles, 40 species of birds and 16 species of mammals. In the Akagera Complex, 77 species of vascular plants, 16 species of amphibians with 1 Albertine Rift Endemic, 13 species of reptiles, 54 species of birds and 11 species of mammals were recorded.

As Kamiranzovu is the only swamp that is fully protected as a National Park, the importance of the three other wetland areas is discussed and measures for protection are proposed.

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## 7. Appendix

### Geographical coordinates of the study sites:

Kamiranzovu (swamp forest)

S 2°28.990

E 29°09.106

1936 m

Kamiranzovu (open swamp)

S 2°29.145

E 29°09.161

1961 m

Rugezi (transect)

S 1°29.134

E 29°53.357

2055 m

Mugesera 1 (bridge)

S 2°12.468

E 30°15.439

1324 m

Mugesera 2 (bridge)

S 2°12.315

E 30°16.302

1325 m

Akagera 1 (swamp)

S 2°13.461

E 30°49.651

1292 m

Akagera 2 (swamp)

S 2°01.890

E 30°49.947

1291 m

Tab. 7: Distribution, IUCN (2011) redlist status, and degree of endemism of the anuran amphibians found in the four investigated areas. LC: Least Concern, VN: Vulnerable, “-“ indicates that the species is not listed by the IUCN. END: 0=widespread in Africa; 1=endemic to the Great Lake region; 2=endemic to the Albertine Rift; 3=locally endemic to the respective investigated area. <sup>1</sup> these are unidentified species with unknown IUCN redlist and endemism status.

Species	IUCN redlist status	END	Marais Rugesi 2055 m	Kamiranzovu 1960 m	Bugesera 1325 m	Akagera 1300 m
<b>Arthroleptidae</b>						
<i>Leptopelis bocagii</i>	LC	0				x
<b>Bufonidae</b>						
<i>Amietophrynus kisoensis</i>	LC	0	x	x		
<i>Amietophrynus regularis</i>	LC	0			x	x
<b>Hyperoliidae</b>						
<i>Afrivalus quadrivittatus</i>	LC	0			x	x
<i>Afrivalus orophilus</i>	VN	2		x		
<i>Afrivalus</i> sp.	-	2		x		
<i>Hyperolius acuticeps</i>	LC	0			x	x
<i>Hyperolius castaneus</i>	VN	2	x	x		
<i>Hyperolius discodactylus</i>	VN	2		x		
<i>Hyperolius kivuensis</i>	LC	0	x		x	x
<i>Hyperolius lateralis</i>	LC	1			x	
<i>Hyperolius viridiflavus</i>	LC	0	x		x	x
<i>Hyperolius</i> sp.	-	3		x		
<i>Kassina senegalensis</i>	LC	0			x	x
<i>Phlyctimantis verrucosus</i>	LC	1				
<b>Phrynobatrachidae</b>						
<i>Phrynobatrachus kakamikro</i>	(LC)	1			x	x
<i>Phrynobatrachus natalensis</i>	LC	0			x	x
<i>Phrynobatrachus versicolor</i>	VN	2				
<i>Phrynobatrachus</i> sp. 1	-	3	x			
<i>Phrynobatrachus</i> sp. 2	-	3				x
<i>Phrynobatrachus</i> sp. 3	-	3		x		
<b>Pipidae</b>						
<i>Xenopus victorianus</i>	LC	1			x	x
<i>Xenopus wittei</i>	LC	2				
<b>Ptychadenidae</b>						
<i>Ptychadena anchietae</i>	LC	0			x	
<i>Ptychadena mascareniensis</i>	LC	0	x		x	x
<i>Ptychadena porosissima</i>	LC	0			x	x
<i>Ptychadena</i> sp. <sup>1</sup>	-	-				x
<b>Pyxicephalidae</b>						
<i>Amietia angolensis</i>	LC	0	x		x	x
<i>Amietia</i> sp. <sup>1</sup>	-	-		x		
<b>Ranidae</b>						
<i>Hylarana albolabris</i>	LC	0				x
<i>Hylarana galamensis</i>	LC	0				x
Total number of species			7	8	14	17

Tab. 8: Distribution, IUCN (2011) redlist status, and degree of endemism of the reptiles found in the four investigated areas. LC: Least Concern, VN: Vulnerable, “-“ indicates that the species is not listed by the IUCN. END: 0=widespread in Africa; 1=endemic to the Great Lake region; 2=endemic to the Albertine Rift.

Species	IUCN redlist status	END	Rugezi complex 2055 m	Kamiranzovu complex 1960 m	Rweru-Mugesera 1325 m	Akagera complex 1300 m
<b>Chamaeleonidae</b>						
<i>Chamaeleo anchietae</i>	-	0				x
<i>Kinyongia adolfifrigerici</i>	-	2		x		
<i>Rhampholeon boulengeri</i>	-	1				
<i>Trioceros ellioti</i>	-	1			x	x
<i>Trioceros johnstoni</i>	-	2		x		
<b>Colubridae</b>						
<i>Dasyplectis scabra</i>	LC	0				x
<i>Grayia thollonii</i>	-	0				x
<i>Lycophidion ornatum</i>	-	0		x		
<i>Natriciteres olivacea</i>	-	0	x	x		
<i>Philothamnus heterolepidotus</i>	-	0	x		x	
<i>Philothamnus ruandae</i>	-	2		x		
<i>Psammophis mossambicus</i>	-	0				x
<i>Rhamnophis aethiopissa</i>	-	1		x		
<i>Thrasops jacksoni</i>	-	0		x		
<b>Crocodylidae</b>						
<i>Crocodylus niloticus</i>	LC	0				x
<b>Elapidae</b>						
<i>Dendroaspis jamesoni</i>	-	0		x		
<i>Naja melanoleuca</i>	-	0			x	x
<i>Naja nigricollis</i>	-	0			x	x
<b>Lacertidae</b>						
<i>Adolfus vauereselli</i>	-	2	x	x		
<b>Pelomedusidae</b>						
<i>Pelusios subniger</i>	LC	0			x	x
<b>Pythonidae</b>						
<i>Python sebae</i>	-	0				x
<b>Testudinidae</b>						
<i>Kinixys spekii</i>	-	0				x
<b>Typhlopidae</b>						
<i>Typhlops angolensis</i>	-	0		x		
<b>Varanidae</b>						
<i>Varanus niloticus</i>	-	0				x
<b>Viperidae</b>						
<i>Atheris nitschei</i>	-	2		x		
<i>Bitis arietans</i>	-	0			x	x
Total number of species			3	11	6	13

Tab. 9: Transect observations of Birds in Rugezi Complex 7.6.2011										
	1	2	3	4	5	6	7	8	9	10
Altitude	2054 m.	2052	2052	2052	2049	2050	2060	2059	2059	2059
Coordinates South	01.29.07.4	01.29.07.5	01.29.07.9	01.29.07.9	01.29.08.3	01.29.08.8	01.29.09.4	01.29.08.5	01.29.10.8	01.29.14.2
Coordinates East	029.53.35.3	029.53.30.0	029.53.25.4	029.53.22.6	029.53.16.0	029.53.11.5	029.53.07.2	029.53.86.2	029.53.39.3	029.53.42.3
hour	8h40	8h55	9h10	9h20	9h30	9h45	10h00	10h30	10h50	11h05
<b>Scientific Name</b>										
Anas undulata			2	2						
Ardea melanocephala							1			
Balearica regulorum			2					2		
Circus ranivorus								1		
Cisticola juncidis	1	1	1		1					
Cisticola sp. ?					1					
Corvus albus				4					2	
Elanus coeruleus		1	1							
Estrilda astrild		1			5	10	2	5		
Estrilda paludicola			1				1			
Euplectes axillaris	4	3	2	4	6	3	3	5	1	1
Euplectes capensis									3	
Euplectes orix						1				
Gallinago nigripennis						1				
Halcyon senegalensis										1
Hirundo abyssinica									2	
Lophaetus occipitalis						1		1		
Milvus migrans	2							1		
Motacilla capensis	1	1		1			2			
Nectarinia famosa										1
Ploceus baglafecht								3		
Ploceus xanthops	1								1	
Pycnonotus barbatus	1									
Saxicola torquata		2	3	1	1	2	1			
Serinus citrinelloides							1			
Serinus striolatus	2	1		1		1	1		2	3
Serinus sulphuratus		1			2	1		1		
Streptopelia semitorquata	1									
Threskiornis aethiopicus		1		1				2		

Tab. 10: Transect observations of Birds in Akagera Complex 8.6.2011										
	1	2	3	4	5	6	7	8	9	10
Altitude	1291 m	1290	1286	1284	1285	1286	1285	1285	1284	1282
Coordinates South	S02.02.003	02.01.57.1	02.01.54.8	02.01.52.3	02.01.49.7	02.01.47.4	02.01.45.1	02.01.44.1	02.01.43.6	02.01.41.6
Coordinates East	E030.49.55.7	030.49.55.3	030.49.55.7	030.49.57.2	030.49.58.8	030.50.00.3	030.50.03.4	030.50.05.3	030.50.07.1	030.50.10.7
hour	8h15	8h30	8h45	9h00	9h15	9h30	9h45	10h00	10h15	10h30
<b>Scientific Name</b>										
<i>Amaurornis flavirostris</i>			2							
<i>Amblyospiza albifrons</i>	2									
<i>Anastomus lamillegerus</i>	3									
<i>Anthus leucophrys</i>			3		1					
<i>Ardea purpureus</i>				1				1		
<i>Balearica regulorum</i>				2						
<i>Bostrychia hagedash</i>			1							
<i>Bubulcus ibis</i>										8
<i>Cisticola sp. ?</i>								2		
<i>Colius striatus</i>							2	1		
<i>Coracias caudata</i>	1			1						
<i>Corythaixoides personata</i>		1								
<i>Eminia lepida</i>		1	2							
<i>Ephippiorhynchus seneg.</i>	3									
<i>Estrilda astrild</i>									2	
<i>Estrilda paludicola</i>	2									
<i>Euplectes albonotatus</i>					1				2	
<i>Euplectes axillaris</i>	1	3	4	2	3				2	
<i>Halcyon senegalensis</i>									1	1
<i>Lagonosticta senegala</i>			2							2
<i>Lamprotornis caudatus</i>	4	2	2	2	2		3	1		
<i>Lamprotornis chalybaeus</i>	7		3	2		6		7		
<i>Laniarius erythrogaster</i>						1				
<i>Laniarius mufumbiri</i>		1								
<i>Merops pusillus</i>							2	1		
<i>Milvus migrans</i>						1				
<i>Muscicapa aquatica</i>									1	
<i>Nectarinia chloropygia</i>	2									
<i>Nectarinia erythrocerca</i>							1	2		1
<i>Passer griseus</i>	1									
<i>Ploceus baglafecht</i>	2									
<i>Ploceus capitalis</i>							2	5	17	
<i>Ploceus cucullatus</i>	3			3						
<i>Ploceus ocularis</i>							1			
<i>Pogoniulus bilineatus</i>					1	1				
<i>Pycnonotus barbatus</i>		1		1	1	1				
<i>Quelia quelia</i>	25	5	5	10	7	9	11	7	18	
<i>Serinus mozambicus</i>		1								
<i>Streptopelia capicola</i>	1	1								
<i>Streptopelia semitorquata</i>						1	2			
<i>Streptopelia senegalensis</i>	3		1	2	1		1			
<i>Turdoides sharpei</i>				5						
<i>Turtur afer</i>		1								
<i>Uraeginthus bengalus</i>	1		1							
<i>Urucolius macrourus</i>									1	
<i>Vanellus senegallus</i>			1							
<i>Vidua macroura</i>				8	2		2	1		

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