

The genus *Phelsuma* GRAY, 1825 on the Ampasindava peninsula, Madagascar

EMMANUEL VAN HEYGEN

Winketkaai 16, 2800 Mechelen, BELGIUM
[emmanuel@vanheygen.com]

Abstract.— Several key locations were researched on the Ampasindava peninsula, north-western Madagascar in June 2004. These locations were chosen for their probability of having remaining patches of primary vegetation. Next to the unexpected records of *Phelsuma quadriocellata*, a species normally occurring on Madagascar's eastern coast, a new species, *P. vanheygeni* (LERNER 2004) was discovered. Known distribution ranges for other species were extended, however their presence on the peninsula was expected. These species are; *P. abbotti*, *P. dubia*, *P. laticauda*, *P. madagascariensis*, *P. klemmeri* and *P. seippi*. The first detailed report on the habitat of *P. klemmeri* is made since the description of the species by SEIPP in 1991.

Keywords.— *Phelsuma*, Ampasindava peninsula, Madagascar

INTRODUCTION

The Ampasindava peninsula is located in north-western Madagascar and is part of the district (fivondronana) of Ambanja, province of Antsiranana. Very few primary vegetation is present, except for a few lower altitude rainforests in the higher regions of the peninsula. The 18.000 inhabitants, composed of fisherman, farmers and herdsman, live in smaller villages spread over the region, resulting in a high rate of “tavy” or slash-and-burn technique. Large patches of forest are cut and burned to plant crops like rice and coffee. The region is very poor and almost entirely depending on its natural resources, increasing the pressure on the unique ecology. There are several footpaths, not wider than 1 m, connecting the villages and sea accesses.

Due to its isolation, the region has been very poorly researched for its herpetofauna in contrast to Nosy Be, which lies about 20 km north of the peninsula, particularly Lokobé forest, the only remaining primary forest area of significance on the island. As late as 1987 a new distinct species, *P. seippi* (MEIER 1987), was described from the reserve. *P. klemmeri*, also recently described (SEIPP 1991) holds an even more taxonomically isolated position. *P. klemmeri* was so far only known from the type locality, indicated by SEIPP (1991) as the coast of north-western Madagascar. A previous survey in 1994 (E. VAN HEYGEN *unpubl.*) revealed that *P. laticauda laticauda* and *P. madagascariensis grandis* are present in the coastal areas (beaches) of the peninsula.

The peninsula lies within the Sambirano climate belt, like the island of Nosy Be and is climatologically influenced by the Massif of Tsaratanana. The Sambirano domain (WHITE 1983) has a typical microclimate with frequent heavy rain alternating with clear skies. Nosy Be gets an average rainfall of 2030 mm a year on 175 days. The temperatures at higher elevations are mainly moderate, between 15° and 25°C. There is a cool, dry season between June and September and a warmer wet season during the rest of the year.

The Sambirano domain is a centre of endemism and a biogeographical transition zone between the species compositions of plants and animals, of the western deciduous forests and eastern rainforests (GOODMAN *et al.* 2003). Relatively little remains of the lowland forest between sea level and about 800 m on the mainland. The highest peak on

the Ampasindava peninsula is 730 m, situated in the central part and is still covered by a relatively large lowland forest. The other primary forest patches are highly fragmented and confined to the higher elevation areas. Some *Phelsuma* species seem to benefit from deforestation and are more abundant in open or cultivated areas than in their natural habitat (GLAW & VENCES 1994), but others like *P. seippi* are only found in or on the edge of primary forests. The Ampasindava peninsula has a high degree of secondary mature vegetation which also can be considered as beneficial for many species of *Phelsuma*, since they seem to be more adaptive than other reptile genera or their predators.



Fig.1 Map of the Ampasindava peninsula and part of the Sambirano region indicating the primary forest zones

METHODS

Prior to the survey, maps and satellite images were compared to locate the remaining patches of primary vegetation and mature secondary forests on the Ampasindava peninsula. Detailed maps of the region were composed, including rivers, footpaths, equal altitudes and other topographic features. A total 5 different survey areas were selected for their isolation, vegetation type and altitude spread over the peninsula.

When a survey area was reached, the different vegetation types were determined and the localities selected. Endemic palms, *Cocos nucifera*, *Ravenala madagascariensis* and bamboo patches were the main focus next to the primary forests. These localities were surveyed for several days, during different hours of the day for possible *Phelsuma* populations.

RESULTS

The different sites and species are individually described below. Exact and accurate locations are not given due to respect for R. SEIPP's decision to not reveal the type locality for *P. klemmeri* for conservation purposes. It has to be mentioned however that neither this species is as critically endangered as previously suggested, nor is *P. seippi* and *P. vanheygeni*.

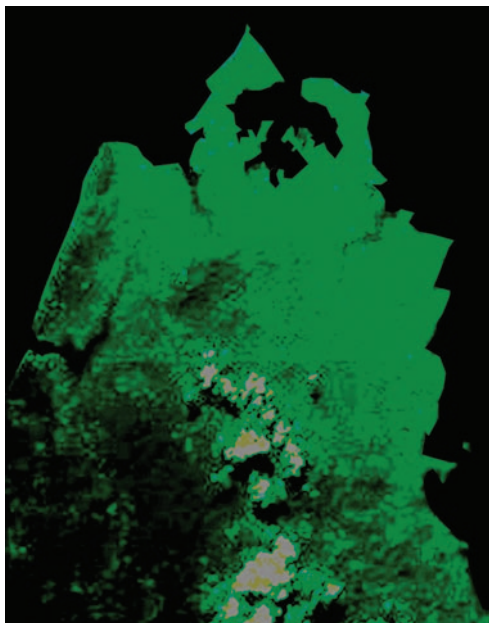


Fig.2: Satellite image of the peninsula, clearly showing the higher density vegetation areas

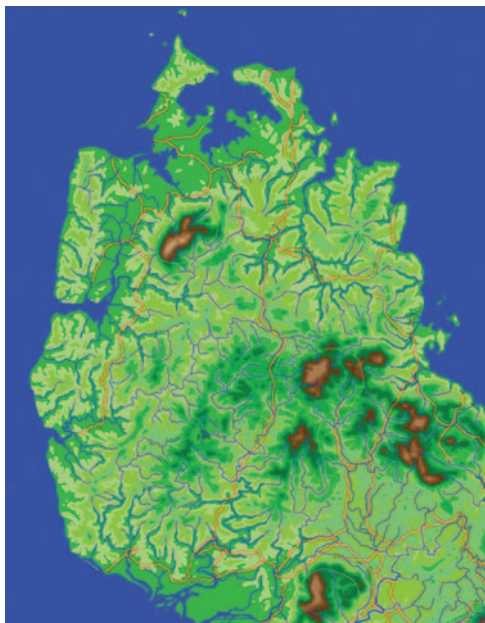


Fig.3: Sample of one of the composed maps, indicating the higher altitudes

Site 1

The first area surveyed is located along the western coast of the peninsula ranging from 0 to 200m altitude. It concerns a relatively long patch of primary forest on a mountain ridge along the coastline. The long beaches are separated from the inland by long rows of *C. nucifera* with underlying low scrub and grasses. The coconut palms are inhabited mainly by *Phelsuma laticauda laticauda*. Surprisingly, *P. dubia* is rather rare in this region and only a few isolated animals were found. The lower regions more inland, up to 50 m, are covered by secondary vegetation and extensive grasslands for Zebu grazing near the few villages along the coast. A few immense bamboo patches were examined near a small river; these were inhabited by *P. laticauda laticauda* and *P. madagascariensis grandis*. In the mature secondary vegetation on trees up to 5 m *P. quadriocellata parva* was found, basking on a \varnothing 4cm branch. *P. quadriocellata parva* was so far only known from Madagascar's eastern coast. In a coffee plantation nearby many juveniles of *P. q. parva* were sighted, indicating it is certainly an established population. Considering the remoteness of the area and the little economic activity, it is very unlikely that this is a case of anthropogenic dispersal. Within the primary forest itself very few *Phelsuma* were found, except for the occasional *P. abbotti chekei* on the larger deciduous trees.



Fig.4 Bamboo forests at site 2

Site 2

This site is situated at higher elevations at the edge and in the primary rainforest on a major mountain slope. The lower slopes are all cleared, mainly for rice and coffee plantations. In the forest are small patches of medium sized bamboo (\varnothing 5 cm), confined by larger deciduous trees and lush and thick vegetation. There where the forest has been cleared by “tavy”, all vegetation has been destroyed, except for the bamboo roots, which lie deep enough under ground to survive the flames. Large bamboo forests are formed (Fig. 4) there since the competition for light and space is non existent, especially not at the growing rate of this bamboo. In bamboo patches within the thick forest, as well as in the secondary bamboo forests, *Phelsuma klemmeri*, *Phelsuma madagascariensis grandis*, *Phelsuma seippi* and the new species *Phelsuma vanheygeni* was found. *Phelsuma abbotti chekei* was not present, although it is mentioned by SEIPP (1991) that *Phelsuma klemmeri* shares its habitat with this species in the type locality. Only one *Phelsuma quadriocellata parva* was found at the edge of one of the bamboo forests and does not seem to be common at this site. The presence of *Phelsuma klemmeri*, *Phelsuma seippi* and *Phelsuma vanheygeni* in the secondary bamboo forests indicates that these species are less vulnerable then suggested earlier. Before their habitat was confined in fragmented bamboo “islands” within the primary forest, but the destructive slash-and-burn technique of the Malagasy farmers gave at least these species new opportunities because new bamboo forests arose in previously cleared areas.

Site 3

Site 3 was chosen for its interesting setting; the primary forest remains lie isolated within a valley, completely surrounded by lower mountains of max. 300 m altitude. This site was only briefly examined during the day and only *P. abbotti chekei* and *P. madagas-*

cariensis grandis was found on the larger deciduous trees and *P. laticauda laticauda* on *Cocos nucifera* and *Ravenala madagascariensis*. A nightly survey of the area exposed a large specimen (300 mm) of *Uroplates henkeli* with orange coloured eyes. Animals found on Nosy Be are noticeably smaller, around 250 mm, and have less conspicuous eye patterns (GLAW & VENCES, 2004).



Fig. 5: *Uroplates henkeli* with unusual eye pattern and colour

Site 4

This site had the highest human population density resulting in a limited amount of pristine forest, however bamboo forest were abundant as expected. The terrain was relatively flat with minor hills up to 150 m, covered with very dense bamboo forests. Within these forests was a relatively high number of *Ravenala madagascariensis* present. On the *Ravenala*, *P. laticauda laticauda* and *P. seippi* was found in high numbers. The bamboo itself was inhabited by *P. seippi* as well and by *P. vanheygeni*. The latter was found only on the medium sized bamboo, never on any other type of vegetation. Extensive searches for *P. klemmeri* were unrewarding, although it seemed to be the ideal habitat. An unknown, rather small species of *Lygodactylus* was also spotted on the bamboo to which it seemed very well adapted. Down at the river, a mangrove patch was inspected and a very blue form of *P. abbotti chekei* (fig. 10) was found on one of the bigger mangrove trees. One *P. dubia*, several *P. laticauda laticauda* and *P. madagascariensis grandis* occupied the palm trees around the villages.

Site 5

This site was located within a pristine forest area at higher altitudes (400 m). Within this forest a high number of endemic palms (*Dypsis sp.*) could be found including several bamboo and *Ravenala* patches. The palms were only populated by *P. quadriocel-*



Fig. 6 Bamboo forest mixed with *Ravenala madagascariensis* at site 4

lata parva while the other two types of vegetation were inhabited by mainly *P. seippi*. On some of the mature deciduous trees *P. abbotti chekei* and *P. madagascariensis grandis* was found. On one of the mountain slopes a exceedingly large bamboo forest was surveyed. The searches for *P. klemmeri* and *P. vanheygeni* were rewarded and several animals were carefully observed. Within the same habitat *P. madagascariensis grandis* and *P. seippi* were found. The unknown *Lygodactylus* sp., as found at site 4, was also present.



Fig. 7 *Lygodactylus* sp. recorded at site 4 & 5

Climate

This survey was carried out in June-July, within the typical dry season for the Sambirano domain. There was very little rain in this period, and the relative humidity during the day measured as low as 45-50% at all sites. Even it did not rain for over a week, the relative humidity at night was always around 75%. Towards dawn, it rose even above 90%, generating high amounts of dew, turning everything wet as if it had just rained. This phenomenon was caused by the extreme drop in temperature at night, especially in the early morning were temperatures as low as 16 ° C were recorded at all inland sites. Day-

time temperatures varied between 28 and 32° C. The maximum relative humidity and maximum temperature values are constant all year round (see Fig. 9) while during the dry season, from June till September, the minimum temperatures (night time) drop drastically, up to 50 %.

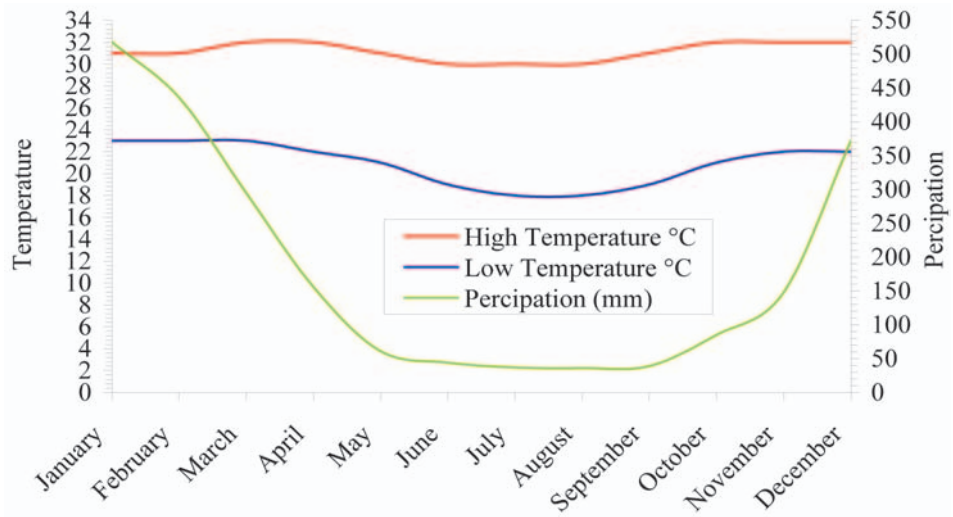


Fig. 8 Average temperature and precipitation values for the Sambirano domain (Alt. 50 m)

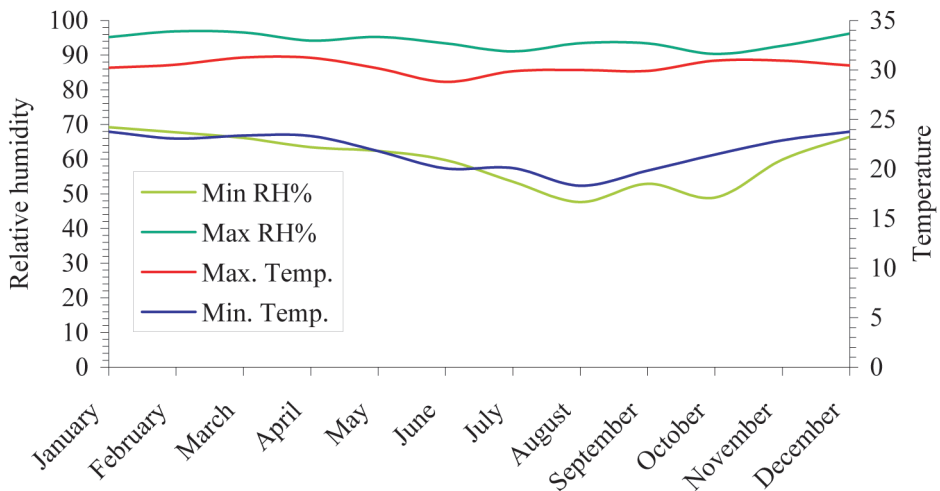


Fig. 9 Relative Humidity, Dew point temperature and Temperature values for 2002

Phelsuma species***Phelsuma abbotti chekei* BÖRNER & MINUTH, 1984**

The coloration of *P. abbotti chekei* varies from one individual to the other. It ranges from blue to green or grey, with marbled flanks and legs. The dorsal pattern consists of red-brown dots and sometimes a median vertebral line is present. It is a medium sized species that reaches lengths up to 145 mm, the females are generally a little smaller and duller in colouration.

Their distribution range is for a Malagasy form quite extensive, it occurs along Madagascar's western coast from Antsiranana in the north, as far south as Antsalova.

Phelsuma abbotti chekei is mainly found on large sun exposed tree trunks outside and at the edge of primary forest patches. On Nosy Be and on the Ampasindava peninsula the species is also found in the coastal mangroves and mangrove trees along swamps and rivers. In western Madagascar, in the seasonal dry forests near Antsalova, the animals are found in the larger deciduous trees. In urban areas like Antsiranana and southern Nosy Be, they can be found on houses and in gardens.

Two further subspecies or known; *Phelsuma abbotti abbotti* (STEJNEGER, 1893) from the Aldabra Atoll, Seychelles and *Phelsuma abbotti sumptio* (CHEKE, 1982) from Assumption Island, Seychelles.



Fig. 10 Extremely blue specimen of *P. abbotti chekei* at site 4



Fig. 11 Normal form of *P. abbotti chekei*

***Phelsuma dubia* (BOETTGER, 1881)**

Phelsuma dubia is a medium sized day gecko, males can reach a total length of 155 mm; females remain somewhat smaller with 140 mm. These altogether flat, however strongly built animals, possess a variable colouring, which can go from light grey over grey green up to leafy green. The tail can in some males appear bluish. On the back appear usually small spots, only consisting of a few scales, which are brown to reddish-brown. The ventral side is bright, partially dirty white coloured. A distinguishing feature is the blue eye ring and the enlarged dorsolateral scales. There is no substantial sexual dichromatism except that the anal region of the males is yellowish .

Phelsuma dubia has the largest distribution area within the genus. In Madagascar the species occurs along the western coast, more concentrated in the north west. *Phelsuma*



Fig. 12 *Phelsuma dubia* at site 1

dubia is also found on all four Comoro Islands, the south Kenyan coast near Mombassa, along the Tanzanian coast and its offshore islands; Pemba, Zanzibar and Mafia Island. On the Ampasindava *Phelsuma dubia* is not that abundant

This species is extremely flexible, can inhabit a variety of different habitats and is extremely anthropophilic. *Phelsuma dubia* has a strong preference for palm trees, *Cocos nucifera*, for which it competes with *P. laticauda laticauda*. It can also be found on coastal *Ravenala madagascariensis* and banana trees

***Phelsuma laticauda laticauda* (BOETTGER, 1880)**

Phelsuma laticauda laticauda can reach about 130 mm in total. The main coloration is vivid green to yellowish green, with three pear shaped spots on the lower back. The neck region is speckled with fine yellow dots, forming often two parallel lines along the vertebrae. Two red lines are present on the head, one is V-shaped before the eye, the other runs from eye to eye. Sometimes a third line is present behind the eyes. The eye rings are blue. Males sometimes can possess a bluish tail, normally it is yellowish with fine reddish dots.

P. laticauda laticauda is without doubt the most abundant species of the Sambirano Domain. It is mainly found in the humid regions of northern Madagascar. Outside Madagascar it occurs, on two of the Comoro Islands; Anjouan and Mayotte, on the Farquhar atoll in Seychelles and it has been introduced onto the Hawaiian Islands.

Like *P. dubia*, it can be found in a variety of habitats except in denser forest re-



Fig. 13 *Phelsuma laticauda laticauda* at site 5

gions. Palms and banana trees are the preferred vegetation, but they can also be found on *Ravenala madagascariensis*, smaller deciduous trees and often in gardens and on houses. Juvenile *P. laticauda laticauda* was sometimes found on medium sized bamboo, where the adults were also found only on the bigger species of bamboo.

***Phelsuma madagascariensis grandis* GRAY, 1870**

This is the largest species found on the Ampasindava peninsula and in the Sambirano domain with a total length up to 300 mm. The main coloration is bright green with irregular patterns of red dots on the back. A red line is present from the nostril to the eye, not behind the eye like in the nominate form.

The southern part of the Ampasindava peninsula is the start of the transition zone between *P. madagascariensis grandis* and *P. madagascariensis kochi* as some animals found clearly showed the latter's characteristics; marbled flanks and smaller red spots on the lower back.

The distribution area is similar to *P. laticauda laticauda* and restricted to the humid parts of northern Madagascar. These two species are very abundant in the Sambirano domain and the Ampasindava peninsula.

P. madagascariensis grandis is found on a wide variety of vegetation, also within the primary forest regions. Here it is found on *Ravenala madagascariensis*, bamboo and the larger deciduous trees. In the secondary vegetation areas the species can be found on



Fig. 14 *Phelsuma madagascariensis grandis* at site 2 on medium sized bamboo



Fig. 15 *Phelsuma madagascariensis grandis* (?) showing strong characteristics of *P. madagascariensis kochi*

the larger trees, *Cocos nucifera*, *Ravenala madagascariensis* and in the bamboo forests together with *P. klemmeri*, *P. seippi* and *P. vanheygeni*. The species is also common in gardens, on houses and in cultivated areas.

No aggression was noticed towards the other smaller species of the genus even not when they share the same tree. On one occasion a *Ravenala madagascariensis* contained three species, *P. laticauda laticauda*, *P. seippi* and *P. madagascariensis grandis*.

***Phelsuma klemmeri* SEIPP, 1991**

Without doubt the most conspicuous of all species is *Phelsuma klemmeri*. The dorsal coloration is brown to turquoise with turquoise dorsilateral bands. A black lateral line runs from the eyes towards the hind legs and is interrupted at the ear openings. Before and after the ear *P. klemmeri* has one or more larger turquoise tubercle scales. This unique feature is only found this explicit in two other species of the genus; *P. nigistriata*, a bamboo dwelling endemic to Mayotte and *P. pronki*, a recently discovered arboreal species of central Madagascar. The head and neck are yellow, the ventral coloration is whitish while the region of the femoral pores is yellow in males. *P. klemmeri* has a very flat appearance and the scales are extremely small and smooth.

P. klemmeri was so far only known from the type locality, indicated by SEIPP (1991) as the coast of northern Madagascar. The species is widespread on the Ampasi-nadava peninsula and is not as endangered as previously suggested due to the fact that its habitat is actually extended by human action as described earlier in the "Site 2" section.

This gecko could only be found on medium sized bamboo. When disturbed they immediately retrieve in their hiding, usually one of the many cracks in older dead bamboo which they easily can access due to their flattened bodies. This species is very well adapted to bamboo. Eggs are deposited in these cracks as well. They avoid the hotter parts of the day and can only be seen in the early mornings, in late afternoon or right after a shower when the sun comes through again.



Fig. 16 *Phelsuma klemmeri* close to its hide, a crack in a live bamboo



Fig. 17 *Phelsuma klemmeri* basking on a sun exposed bamboo

Phelsuma quadriocellata parva MEIER, 1983

Phelsuma quadriocellata parva is one of the smallest forms within the genus with a total length of maximum 80 mm. The main coloration is green with an irregular pattern of large red dots on the back. These dots often form a line along the upper vertebrae. A post humeral black spot is present often surrounded by a bluish ring. The eye ring is yellow, the tail is strongly segmented and bluish in males.



Fig. 18 *Phelsuma quadriocellata parva* at site 1

The distribution of *P. quadriocellata parva* was so far restricted to eastern Madagascar around Toamasina. HALLMANN (1997) reports from a population in south-eastern Madagascar in a primary rainforest patch near Befasy. BUDZINSKI (2001) reported a population on Nosy Be, but assumed its presence was due to anthropogenic dispersal since it was only found at one location near a hotel which might have used building materials from eastern Madagascar. The new records of the Ampasindava peninsula indicate a natural occurrence in the region and probably also on the island Nosy Be. This considerably expands the known distribution range of the form and suggests a distribution pattern similar to *P. laticauda laticauda* and *P. madagascariensis grandis*.

On the peninsula *P. quadriocellata parva* was mainly found within the primary forests on high indigenous palms and in the secondary vegetation on smaller deciduous trees and coffee plantations. Populations seem to be very fragmented.

Phelsuma seippi MEIER, 1987

Phelsuma seippi is a small species, males reach up to 117 mm in length (GLAW & VENCES, 1994) whereas females are slightly smaller. The main colour is green with scattered smaller red dots that often form a median line along the vertebrae. A red chevron is present on the head and a darker red stripe runs from the nostril through the eye. The ven-



Fig. 19 Female *Phelsuma seippi*



Fig. 20 Juvenile *Phelsuma seippi*, stalking a bamboo fly

tral coloration is pinkish with two dark chevrons on the throat. Its closest relative is the from the east coast known *Phelsuma guttata*

This gecko was known from its type locality on Nosy Be, Nosy Komba and from Benavony (GLAW & VENCES, 1994) in the Sambirano domain. *Phelsuma seippi* is actually widespread on the Ampasindava peninsula and seems to be more abundant than on Nosy Be.

P. seippi prefers like *P. klemmeri* and *P. vanheygeni* bamboo patches located in the primary forests or secondary bamboo forests and *Ravenala madagascariensis*.



Fig. 21 *Phelsuma vanheygeni* male

***Phelsuma vanheygeni* LERNER, 2004**

This recently discovered species is one of the smallest of the genus. The total length is about 75-80 mm in both sexes. The main coloration is bright green with sometimes tiny red dots near the lower back and tail. The ventral coloration is white, yellow around the femoral pores in males. Characteristic is the yellow lateral line, separating the ventral and the dorsal coloration that is continued on the upper lip.



Fig. 22 *Phelsuma vanheygeni*, clearly showing the yellow lateral line continued on the upper lip



Fig. 23 Female *Phelsuma vanheygeni*

P. vanheygeni is only known from the Ampasindava peninsula where it occupies similar habitats like *P. klemmeri* and *P. seippi*. It was found at three sites out of five during the survey.

The species is confined to the medium sized bamboo (ø 5 cm). They are very well adapted to the bamboo, when disturbed they immediately retreat to smaller bamboo branches that are covered with small leaves. These leaves have the same shape and colour as the animals, making it almost impossible to locate them.

Reproduction.— The eggs of *P. vanheygeni* are glued on the inside of bamboo. The young hatch within 25 days at a daytime temperature of about 27° C. The coloration of the juveniles is gold brown with 4 fine green to dark brown median stripes. The young are extremely small and measure about 25 mm. Regenerated skin of the adults is coloured gold brown like in the juvenile stage.



Fig. 24 Juvenile coloration of *P. vanheygeni*



Fig. 25 Male *Phelsuma vanheygeni*, with a strong red pattern on the lower back

ACKNOWLEDGEMENTS

I would like to thank my good friend and travel companion ACHIM LERNER who accompanied me during this trip and who also described *P. vanheygeni*. Further I am grateful to all Malagasy people we met during our trip and who were extremely helpful, especially Laurent, Paul and “Hercule”.

REFERENCES

- ANDREONE F., F. GLAW, R. A. NUSSBAUM, C. J. RAXWORTHY, M. VENCES, and J. E. RANDRIANIRINA. 2003. The amphibians and reptiles of Nosy Be (NW Madagascar) and nearby islands: a case study of diversity and conservation of an insular fauna. *Jour. Natur. Hist.* **37** (17): 2119-2149
- BUDZINSKI, R. 2001. Auf der Insel Nosy Be entdeckt: *Phelsuma quadriocellata parva*. *IG-Phelsuma Rundschreiben* **36**(3)
- GLAW, F. and M. VENCES. 1994. *A Fieldguide to the Amphibians and Reptiles of Madagascar*. Second edition. Vences & Glaw Verlags GbR, Köln, 480 p.
- GOODMAN, S. M. AND J. P. BENSTEAD, editors. 2003. *The Natural History of Madagascar*. The University of Chicago Press, Chicago. 1728 p.
- HALLMANN, G., J. KRÜGER and G. TRAUTMANN. 1997. *Faszinierende Taggeckos. Die Gattung Phelsuma*. Natur und Tier Verlag, Münster, 229 p.
- LERNER, A. 2004. A new taxonomically isolated species of the genus *Phelsuma* Gray, 1825 from the Ampasindava peninsula, Madagascar. *Phelsuma* **12**: 89-96

- MEIER, H. 1987. Vorläufige beschreibung einer neuen art der gattung *Phelsuma* von Madagaskar. *Salamandra* 23(4): 204-211
- SEIPP, R. 1991. Eine neue Art der Gattung *Phelsuma* GRAY, 1825 von Madagaskar (Reptilia: Sauria: Gekkonidae) *Senckenb. Biol.* 71(1/3): 11-14.
- SEIPP, R. 1994. Eine neue Art der Gattung *Phelsuma* GRAY 1825 aus Zentral-Madagaskar (Reptilia: Sauria: Gekkonidae). *Sencken. Biol.*, 74(1/2): 193-197.
- WHITE, F. 1983. The vegetation of Africa, a descriptive memoir to accompany UNESCO/AETFAT Vegetation map of Africa. UNESCO, Paris.