The Amphibian Fauna of Sri Lanka

Sushil K. Dutta and Kelum Manamendra-Arachchi

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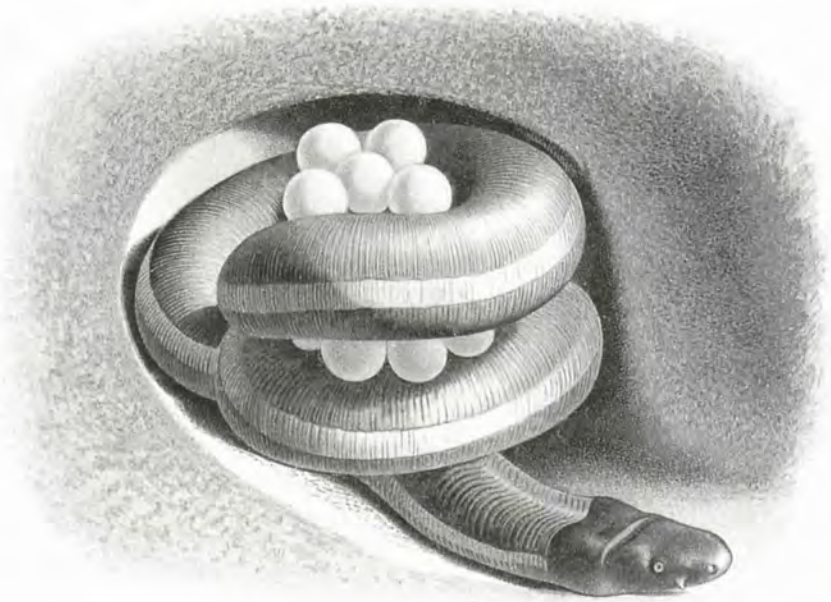

Ichthyophis glutinosus guarding its eggs: reproduced from P.B. and C.F. Sarasin's (1887) *Ergebnisse naturwissenschaftlicher Forschungen auf Ceylon in den Jahren, 1884-1886,* vol. 2.

The amphibian fauna of Sri Lanka

by

Sushil K. Dutta and Kelum Manamendra-Arachchi

Wildlife Heritage Trust
of Sri Lanka

Dedicated to the memory of P. B. Karunaratne
Who knew the wilderness of Sri Lanka better than any man
Who all his life walked hand in hand with Nature
And showed the way to so many

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Preface

It is now almost exactly 50 years since Parakrama Kirtisinghe's review of Sri Lanka's amphibian fauna was published. We wish we could say that much has happened since in the field of Sri Lankan (or for that matter south Asian) herpetology, but this would be deviating from the truth. Granted, a few papers on the biology of amphibians have been published; a handful of new species has been described; the systematics of two genera have been revised. But the enormous problems that yet remain in this field, as regards both taxonomy and biology, are by and large yet to be addressed.

The vertebrate fauna of Sri Lanka is generally regarded as being well known. Yet, new taxa continue to be discovered (see Appendix), and it is clear that much more exploration is necessary in order to obtain an objective evaluation of the island's true biodiversity. Given the rapid and alarming diminution of natural habitats, this task has taken on an added urgency.

The "museum work" presented in this review was done in the early 1980s by the first author (S.K.D.) as part of a Ph.D. programme at Kansas University. In 1993 K.M.-A. independently began a WWF-sponsored study of the Sri Lankan Amphibia. The idea of collaboration was first mooted during a visit by S.K.D. to Sri Lanka in 1995, and our results were combined only after this.

This work owes its genesis at least in part however, to a train of events quite unrelated to ourselves. After a gap of many years since Kirtisinghe's work in the 1950s, Ranil Senanayake, Victor Athukorale and Walter Erdelen became independently involved in examining different aspects of Sri Lanka's amphibians during the 1970s. Their enthusiasm no doubt inspired many others and by the early 1990s interest in Sri Lanka's Amphibia underwent something of a renaissance. P.B. Karunaratne, Sarath Kotagama, Prithiviraj Fernando (and his many able colleagues) and the second author were independently but in loose collaboration investigating different aspects of the Sri Lankan Amphibia; Anslem de Silva had in 1991 incorporated ARROS, the Amphibian and Reptile Research Organisation of Sri Lanka and succeeded in a remarkably short time in mobilising popular interest in amphibians, at the best of times not an easy task; W.R. Breckenridge and K.D. Arudpragasam, as Co-Chairs of the IUCN Declining Aphibian Populations Task Force, began monitoring activities essential for long-term conservation planning; in 1995 Indraneil Das, through ARROS, had become involved in research on Sri Lankan "herp" problems and helped put this fauna on the official conservation map by being associated with training programmes for wildlife conservation personnel.

All this resulted in an abundance of goodwill amongst the various workers, and also in an increasing realisation that an illustrated review of the Amphibia would help draw attention to them by both wildlife managers and the public; provide the increasing number of field workers with a common reference for identification purposes; and provide a platform from which future exploration and research could be launched.

Several obstacles to this immediately presented themselves. For example, the ranges in continental south Asia (or at least peninsular India) of almost all the species thought to be common to the two countries are very extensive, invariably including the whole of the southern part of the Western Ghats mountains of western India. It should not occasion surprise if in the future, such widely-distributed species such as *Limnonectes limnocharis* or *Polypedates maculatus* prove to comprise more than a single taxon. It is equally possible that some of the widely-distributed species presently considered endemic to Sri Lanka, such as *Rana gracilis* and *Polypedates cruciger* may in the future be recorded from India. Our work here presented pays very little attention to the Indian fauna: we intend as the next phase of our work to make a systematic comparison of mainland and insular species hitherto thought to be common to the two countries in order the better to understand their relationships. It has not been possible to present these results here because of the very limited preserved material from southern India available to us at present.

We also recognise that much remains to be done with respect to groups such as the Rhacophoridae where conventional taxonomic techniques such as those used here, based as they are on external morphology alone, are clearly unable to cope with the subtle differences that certainly exist between populations now lumped in catch-all species. Further, information on ontogeny is as yet scant; and many "difficult" habitats remain to be investigated (e.g. the rain forest canopy).

The amphibian fauna of Sri Lanka does not pretend to be a taxonomic revision: as mentioned above, that will only be possible in conjunction with a comparative study of the Indian fauna. It is however intended to review the "state of the art" insofar as taxonomic knowledge of the Sri Lankan amphibians is concerned, laying a foundation upon which future researches by ourselves and others could be based. It also serves to provide a field key to the amphibian species of Sri Lanka; presents for the first time colour photographs of almost all the species; maps the distribution of each species; and updates the nomenclature. What we do attempt to provide is a work that will serve as a reliable means of identification until a full-fledged revision of the fauna is published: but this is at best some years away yet.

Information on the breeding, development, ecology, sexual dimorphism and secondary sexual characteristics of most amphibian species in Sri Lanka is scant. We do not cite references to published information in these fields because this is primarily a taxonomic work and also because a comprehensive bibliography of the Sri Lankan reptiles and amphibians, edited by Anslem de Silva, is planned for publication by ARROS later this year.

We hope that this work will stimulate further research on population declines, biology and ecology, which are essential if long-term conservation programmes are to be implemented.

S.K.D. & K.M.-A.
July, 1996.

Acknowledgements

Several people have directly or indirectly helped to enrich this book. It is therefore very much a team effort, and we are very grateful to all our colleagues who either knowingly or otherwise assisted and encouraged our work. We are extremely grateful to each one of them for, in various ways, helping us to prepare this book.

Photographs of living amphibians were provided by Indraneil Das (ID), Kaushik Deuti (KD), Prithiviraj Fernando (PF), Carl Gans (CG), Rahula Perera (RP), Rohan Pethiyagoda (WHT), Anslem de Silva (AS) and Vimukthi Weeratunga (VW). Saman Liyanage (SL), worked closely with us throughout and went to great pains to take excellent photographs of most of our specimens in life. Each photograph that is not the property of the authors or WHT has been acknowledged with the photographer's initials in the figure captions.

Dinesh Gabadage and Mohomed Bahir between them made extensive field observations and collections—without their industry and zeal this book would not have been possible. In their time off from curation activities, they also assisted greatly in collating distribution information, preparing the figures and checking the species descriptions. They are in effect unnamed co-authors of this work.

Indraneil Das and Prithiviraj Fernando reviewed the manuscript and we are grateful to them for their critical remarks. We have addressed most of these, and absolve them of any responsibility for errors that remain.

P.B. Karunaratne, Anslem de Silva and Sarath Kotagama have been sources of great inspiration to us, and have gone to great pains in sharing with us the deep intuitive understanding and enthusiasm they have for the Sri Lankan Amphibia.

The field work associated with this book was funded by the WWF Small Grants Programme, and we thank Mangala de Silva for helping us to obtain this. Additional funding was made available by the Wildlife Heritage Trust of Sri Lanka.

We also offer a special word of thanks to Dharmasri Kandamby (NMSL) for giving us access to the Museum's collections and for drawing our attention to much interesting information on the Sri Lankan Amphibia.

Several other colleagues, especially the following, helped in diverse ways to enrich this book: Nandana Abethissa, Dharmasiri Geekiyanage, Sampath Goonatilake, Jayanath Karunaratne, Manori Nandasena, Jude Perera, Ranil Perera, Mahesh Priyadarshana and Hemantha Wijesinghe. We also thank Mahinda Gunawardhana (NMSL), who went to much trouble to locate much of the older literature for us and helped in many other ways.

S.K.D. would also like to place on record his sincere gratitude to Carl Gans, who has in many ways been an inspiration, for helping in ways too numerous to list individually here, to further his research.

Finally we thank Rohan Pethiyagoda, whose idea this book was, for bringing us into contact and for his close association with our work at every stage. He was intimately involved in the preparation of the manuscript, taking hundreds of photographs and making sure the necessary funds and resources were always at hand.

Introduction

The history of amphibian studies of Sri Lanka began in 1735 with Albertus Seba's description of a caecilian by the name "Serpens caecilia ceylonica" in his *Thesaurus*. The first faunal summary of the amphibians of Sri Lanka was by Kelaart (1852a), who recorded ten species from Sri Lanka. Subsequently, many workers (e.g. Günther, 1858, 1864; Tennent, 1861; Ferguson, 1877; Boulenger, 1882a, 1882b,1890; Haly, 1886, 1891; Mehely, 1897; De Silva, 1955a, 1956, 1957; Deraniyagala, 1956; Kirtisinghe, 1957; Morgan-Davies, 1958a, 1958b, 1958c) contributed significantly to the faunal list, natural history, ecology and systematics of the Sri Lankan Amphibia. Boulenger (1920) provided diagnostic characters and the first keys to the identification of some of the species. Several publications (Ahl, 1931; Nieden, 1913, 1923, 1926, 1931; Boulenger, 1920; Parker, 1934; Wolf, 1936) deal with the systematics of different groups of amphibians.

Prior to Kirtisinghe (1957), little information was available on the distribution of most amphibian species in the island, and most publications cited "Ceylon" as the type or distribution locality for most species. Kirtisinghe however, provided the first useful distribution data for each species he recognised. Although useful for this reason, Kirtisinghe's work was limited by the fact that he had no opportunity to examine type material of species described from Sri Lanka or comparative material from India. (We too, have been at least partially limited by the same constraint: but a majority of extant types have been examined by us.)

Since Kirtisinghe (*op. cit.*) there has been no attempt to revise the taxonomy of the Sri Lankan amphibians except Nussbaum and Gans, 1980 (Ichthyophiidae), and Clarke, 1983 (*Nannophrys*). Bogert and Senanayake (1966); Fernando et al. (1994); Fernando & Dayawansa (1996); Manamendra-Arachchi & Gabadage (1996); and others have shown that more amphibian species await discovery. Unless the pace of exploration is accelerated—especially given the rate of habitat loss—it is conceivable that at least some of these may vanish even before they are discovered. We expect there to be a dramatic increase in the diversity of amphibians in Sri Lanka, especially amongst the Rhacophoridae. Several taxa of which we have preserved material have eluded identification up to now: we have nevertheless in the Appendix presented photographs of some of these if only to draw attention to the riches that await formal description.

The amphibian fauna of Sri Lanka as recognised here consists of 53 species represented by two orders—Salientia and Caecilia. Kirtisinghe (1957) recognised 35 species-group amphibian taxa, and the increase in the number of species recognised here is due more to the retrieval of valid species from the still-rich synonymy than to the discovery of new species.

Materials

The material examined is deposited at the following institutions: AMNH, American Museum of Natural History, New York; AMS, Australian Museum, Sydney; ANSP, Academy of Natural Sciences, Philadelphia; BMNH, Natural History Museum, London; CAS, California Academy of Sciences, San Fran-

cisco; CAS-SU, California Academy of Sciences, Stanford; CG, Carl Gans Collection, University of Michigan, Ann Arbor; NMSL, National Museum of Sri Lanka, Colombo; FMNH, Field Museum of Natural History, Chicago; MCZ, Museum of Comparative Zoology, Harvard; MHNG, Museum d'Histoire Naturelle, Genova; NHMB, Naturhistorisches Museum, Basel, Switzerland; NHMW, Naturhistorisches Museum, Vienna; NHRM, Naaturhistoriske Riksmuseum, Stockholm; RMNH, Rijksmuseum van Natuurlijke Historie, Leiden; SMNS, Staatliches Museum fur Naturkunde; USNM, United States National Museum, Washington, D.C.; UZM, Universitetes Zoologiske Museum, Copenhagen; WHT, Wildlife Heritage Trust of Sri Lanka, Colombo; ZSIC, Zoological Survey of India, Calcutta.

Methods

Diagnoses and descriptions are based on external morphology and in a few cases, osteological characters. This work is based on examination of museum specimens, specimens collected between 1993 and 1996 by the WHT under a WWF project (Fig.1) and the synthesis of information from published works. We examined almost all the available type specimens of Sri Lankan amphibians and for those species common to both Sri Lanka and India, also limited numbers of specimens from India, particularly types or topotypes. The locality records for each species include museum specimen data as well as published locality records. We have not listed data for non-Sri Lankan material examined.

The keys are based on the characters used for diagnosis of the species. Almost all photographs are backed by voucher specimens, the catalogue details of which are provided in the legends to the figure and in the Material Examined section in each species article.

In some cases, specimens were dissected to obtain data on reproductive condition, but this was not possible for every species because of the limited number of specimens available. Frogs were sexed by gonadal examination and the presence of nuptial pads. Males with swollen testes, vocal slits, and/or nuptial pads were considered to be adults, and females with enlarged oviducts and eggs were considered gravid.

All measurements were taken to the nearest 0.05 mm with dial callipers. For most species, the largest observed length and the range of snout-vent length of mature males and gravid females is included.

Figures 2-5 show the anatomical labels used in the text. In the description of fingers and toes, the word "inner" always refers to the medial side of the digit. Altitudes are given in metres above mean sea level except when quoting from museum specimen labels, in which case they are reproduced as given therein. Serials are cited in full when referring to original taxon descriptions, but books are cited only by author and year, bibliographic information being provided in the Literature Cited section.

Sri Lanka: climate and geography

The island of Sri Lanka is situated in the Indian Ocean, south-west of the Indian peninsula, between longitudes 79°39' and 81°53' E and latitudes 5°54' and 9°52' N, and has a total land area of 65,600 km². The island is about 60 km from

Table 1. Alphabetical listing of the 235 sites sampled; altitudes are given in metres above sea level.

Adam's Peak: 06°49'N, 80°30'E, 1850m; Akuressa: 06°06'N, 80°28'E, 20m; Ambalamehena (Atweltota): 06°32'N, 80°18'E, 150m; Ambulawa (nr. Gampola): 07°10'N, 80°33'E, 915m; Andunoruwa Wela (nr. Palatupana): 06°22'N, 81°31'E, 9m; Anuradhapura: 08°20'N, 80°24'E, 90m; Arakawila: 06°49'N, 80°09'E, 50m; Atgalla (Gampola): 07°08'N, 80°34'E, 540m; Attidiya-Bellanwila: 06°50'N, 79°53'E, 8m; Atweltota: 06°33'N, 80°17'E, 60m. **Badulla:** 06°59'N, 81°03'E, 580m; Balangoda: 06°39'N, 80°42'E, 450m; Bambarakanda (nr. Belihul Oya): 06°46'N, 80°50'E, 1070m; Bandarawela: 06°50'N, 80°59'E, 1220m; Banduradeniya (Nahitiya Mukalana): 06°30'N, 80°34'E, 458m; Batadombalene (Kuruwita): 06°47'N, 80°23'E, 460m; Battaramulla: 06°54'N, 79°55'E, 15m; Batticaloa: 07°43'N, 81°42'E, 1m; Belihul Oya: 06°43'N, 80°46'E, 610m; Belipola (nr. Bandarawela): 06°52'N, 80°57'E, 850m; Berragalla: 06°46'N, 80°55'E, 1220m; Bibilegama: 06°54'N, 81°08'E, 1067m; Bogowantalawa: 06°47'N, 80°40'E, 1375m; Boralesgomuwa Wewa (nr. Maharagama): 06°51'N, 79°55'E, 10m; Botale (nr. Ingiriya): 06°42'N, 80°10'E, 120m; Bulutota Pass: 06°28'N, 80°38'E, 760m; Buttala: 06°40'N, 81°15'E, 160m. **Chilaw:** 07°35'N, 79°47'E, 1m; China Bay: 08°33'N, 81°11'E, 5m; Colombo: 06°56'N, 79°50'E, 2m; Corbet's Gap: 07°22'N, 80°51'E, 1150m. **Dartonfield** (nr. Agalawatta): 06°31'N, 80°10'E, 30m; Dellawa: 06°20'N, 80°27'E, 150m; Demodera: 06°56'N, 81°04'E, 915m; Deniyaya: 06°21'N, 80°34'E, 460m; Devonford Estate (between Bogowantalawa and Balangoda): 06°45'N, 80°41'E, 1525m; Dewatura: 06°51'N, 81°08'E, 670m; Digher Vapi: 07°17'N, 81°47'E, 15m; Dimbula: 06°57'N, 80°38'E, 1220 m; Diyatalawa: 06°48'N, 80°57'E, 1320m; Dodangaslanda: 07°34'N, 80°32'E, 160m; Dolosbage: 07°05'N, 80°28'E, 915m; Dombagaskanda (Ingiriya): 06°44'N, 80°09'E, 60m. **Elahera:** 07°44'N, 80°47'E, 110m; Elamalewala (Labugama): 06°53'N, 80°08'E, 150m; Elapata: 06°39'N, 80°22'E, 48m; Elavankulam: 08°16'N, 79°52'E, 30m; Ella: 06°52'N, 81°03'E, 1230m. **Gal Oya:** 07°14'N, 81°31'E, 65m; Galaha, Loolcondera Group (Deltota): 07°08'N, 80°42'E, 1580m; Galge: 06°33'N, 81°19'E, 90m; Galle: 06°02'N, 80°13'E, 5m; Gammaduwa: 07°34'N, 80°42'E, 760m; Gampola: 07°10'N, 80°34'E, 600m; Ginigathena: 06°59'N, 80°29'E, 580m; Giritale: 07°59'N, 80°55'E, 30m; Gonewala (nr. Pallegama): 07°32'N, 80°49'E, 200m. **Habarana:** 08°05'N, 80°45'E, 120m; Hakgala: 06°55'N, 80°49'E, 1830m; Hal Mandiya: 06°25'N, 80°24'E, 460m; Hali Ela: 06°57'N, 81°02'E, 900m; Halpe (nr. Ella): 06°53'N, 81°00'E, 1067m; Hambantota: 06°08'N, 81°07'E, 2m; Hantana (no. 3, nr. SLBC radio tower, Kandy): 07°15'N, 80°37'E, 1140m; Hapugala: 06°04'N, 80°12'E, 15m; Haputale: 06°46'N, 80°52'E, 1525m; Hare Park: 07°21'N, 80°50'E, 1370m; Haycock (Hiniduma): 06°20'N, 80°18'E, 660m; Hidogama (Anuradhapura): 08°16'N, 80°24'E, 90m; Hikkaduwa: 06°08'N, 80°06'E, 2m; Hiniduma: 06°18'N, 80°19'E, 150m; Hokandara: 06°53'N, 79°58'E, 30m; Hunawala N.: 06°37'N, 80°36'E, 150m. **Ilukkumbura** (nr. Laggala): 07°33'N, 80°45'E, 600m; Induruwa (Ratnapura): 06°45'N, 80°26'E, 150m; Inginiyagala: 07°13'N, 81°32'E, 150m. **Jaffna:** 09°39'N, 80°01'E, 3m. **Kabaragala** (nr. Rakwana): 06°27'N, 80°35'E, 760m; Kahagala: 06°03'N, 80°35'E, 30m; Kahanagama: 06°42'N, 80°22'E, 30m; Kalatuwana (Labugama): 06°52'N, 80°11'E, 150m; Kalmunai: 07°25'N, 81°50'E, 2m; Kalupahana: 06°46'N, 80°51'E, 760m; Kandalama Wewa: 07°53'N, 80°41'E, 100m; Kandapola: 07°00'N, 80°49'E, 1982m; Kandy: 07°17'N, 80°38'E, 465m; Kanneliya: 06°15'N, 80°20'E, 150m; Karadikkuli: 08°36'N, 79°56'E, 2m; Kataragama: 06°25'N, 81°20'E, 44m; Katubedda: 06°48'N, 79°54'E, 5m; Kegalla: 07°15'N, 80°21'E, 90m; Kimbiya (Galle): 06°08'N, 80°15'E, 40m; Kirigalpota: 06°48'N, 80°46'E, 2300m; Kitulgala: 07°00'N, 80°24'E, 1100m; Kodagoda: 06°02'N, 80°23'E, 45m; Kohuwala: 06°52'N, 79°53'E, 15m; Konketiya: 06°42'N, 81°16'E, 185m; Koralawella (Moratuwa): 06°46'N, 79°53°E, 5m; Koskulana (nr. Panapola): 06°25'N, 80°27'E, 460m; Koslanda: 06°44'N, 81°01'E, 610m; Kotagala: 06°56'N, 80°37'E, 1220m; Kotmale: 07°01'N, 80°35'E, 915m; Kottawa (Galle): 06°06'N, 80°20'E, 60m; Kuda Oya: 07°01'N, 80°44'E, 1677m; Kudawa (nr. Weddagala): 06°26'N, 80°25'E, 460m; Kumaradola (Monaragala): 06°53'N, 81°22'E, 305m; Kurunegala: 07°29'N, 80°22'E, 87m; Kuruwita: 06°46'N, 80°22'E, 25m. **Labookellie:** 07°01'N, 80°42'E, 1525m; Labugama: 06°51'N, 80°11'E, 90m; Laggalla: 07°33'N, 80°44'E, 1220m; Lakegala: 07°28'N, 80°50'E, 1318m; Landuyaya: 06°45'N, 80°44'E, 1230m; Laxapana: 06°50'N, 80°32'E, 1220m; Lihinigala (Yatapatha): 06°23'N, 80°17'E, 150m; Lindula: 06°55'N, 80°41'E, 1265m; Linihela (Peak Wilderness): 06°48'N, 80°28'E, 1070m. **Madampe:** 07°30'N, 79°50'E, 10m; Madulkele: 07°24'N, 80°44'E, 915m; Maha Kalupahana: 06°28'N, 80°10'E, 150m; Maha Pelessa: 06°23'N, 81°31'E, 10m; Mahakema: 06°25'N, 81°21'E, 30m; Mahawalatenna: 06°35'N, 80°45'E, 515m; Mahiyangana: 07°19'N, 80°59'E, 90m; Makumbura: 06°07'N, 80°20'E, 30m; Malabe: 06°54'N, 79°57'E, 30m; Maligawila: 06°43'N, 81°17'E, 130m; Mapakada nr. Mahiyangana: 07°16'N, 81°03'E, 90m; Maradankadawala: 08°08'N, 80°34'E, 120m; Marawila: 07°25'N, 79°50'E, 8m; Marichchukkaddi: 08°35'N, 79°57'E, 22m; Massenna FR: 06°40'N, 80°38'E, 1070m; Matale: 07°28'N, 80°37'E, 355m; Mawanella: 07°15'N, 80°26'E, 260m; Mediripitiya: 06°21'N, 80°29'E, 365m; Migoda: 06°50'N, 80°03'E, 40m; Mihintale: 08°21'N, 80°30'E, 150m; Mimure: 07°24'N, 80°51'E, 460m; Minneriya: 08°04'N, 80°54'E, 80m; Minuwangoda: 07°10'N, 79°57'E, 6m; Modera: 06°58'N, 79°52'E, 4m; Monaragala: 06°52'N, 81°20'E, 150m; Maratenna: 06°45'N, 80°42'E, 1525m; Morawaka: 06°16'N, 80°28'E, 150m; Moray Estate: 06°48'N, 80°31'E, 1370m; Morningside (nr.

Rakwana): 06°24'N, 80°38'E, 1060m; Mount Lavinia: 06°50'N, 79°52'E, 3m; Mousakanda (Gammaduwa): 07°34'N, 80°42'E, 915m; Mullaitivu: 09°16'N, 80°49'E, 1m; Mundel: 07°49'N, 79°49'E, 2m. **Nagagamuwa** (Puttalam): 08°10'N, 79°50'E, 2m; Nagoda: 06°34'N, 79°59'E, 10m; Nagrak Div. (Nonpareil Est.): 06°46'N, 80°47'E, 2135m; Namunukula (nr. Palagolla): 06°55'N, 81°08'E, 1370m; Namunukula (nr. Passara): 06°54'N, 81°07'E, 1370m; Namunukula Peak: 06°56'N, 81°07'E, 1982m; Nanu Oya: 06°56'N, 80°44'E, 1555m; Narahenpitiya (Colombo): 06°54'N, 79°52'E, 10m; Navadakulam: 07°50'N, 79°51'E, 3m; Navinna: 06°04'N, 80°12'E, 15m; Negombo: 07°13'N, 79°50'E, 2m; Neligama (Merigama): 07°14'N, 80°08'E, 60m; Nelundeniya: 07°14'N, 80°16'E, 150m; Nikapota (nr. Lemastota): 06°44'N, 80°59'E, 700m; Nikawewa: 08°06'N, 80°37'E, 35m; Nugegoda: 06°53'N, 79°53'E, 4m; Nuwara Eliya: 06°57'N, 80°47'E, 1710m. **Ohiya:** 06°49'N, 80°50'E, 1800m; Okkampitiya: 06°45'N, 81°17'E, 120m; Opata (Kannelia Forest): 06°16'N, 80°24'E, 213m; Opatha (Kotugoda): 07°08'N, 79°55'E, 6m; Owilikanda (Matale): 07°27'N, 80°35'E, 610m. **Palabaddale** (Ratnapura): 06°47'N, 80°27'E, 335m; Palatupana (Kirinda): 06°16'N, 81°24'E, 5m; Palavi (Puttalam): 07°59'N, 79°50'E, 5m; Pallegama (Knuckles): 07°32'N, 80°49'E, 185m; Pallekele (nr. Kurunegala): 07°47'N, 80°29'E, 150m; Pallewatta: 07°21'N, 80°58'E, 150m; Palugaswewa: 08°03'N, 80°42'E, 168m; Pambahinna (nr. Belihul Oya): 06°42'N, 80°47'E, 490m; Panagula: 06°53'N, 80°10'E, 275m; Pannipitiya (nr. Maharagama): 06°51'N, 79°56'E, 30m; Parantan: 09°26'N, 80°24'E, 6m; Parawalatenne (nr. Kithulgala): 06°59'N, 80°24'E, 150m; Pattipola: 06°51'N, 80°50'E, 1890m; Peradeniya: 07°15'N, 80°36'E, 460m; Pidurutalagala: 06°59'N, 80°46'E, 2200m; Piliyandala: 06°48'N, 79°55'E, 12m; Pingarawa: 06°53'N, 81°06'E, 1465m; Polgahawala: 07°20'N, 80°18'E, 75m; Polonnaruwa: 07°56'N, 81°00'E, 55m; Potuvil: 06°51'N, 81°50'E, 5m; Pundalu Oya: 07°01'N, 80°40'E, 1500m; Pupulagala (nr. Nagrak): 06°45'N, 80°45'E, 1375m; Pussella Est. (Parakaduwa): 06°49'N, 80°19'E, 60m; Puttalam: 08°02'N, 79°50'E, 2m. **Queenwood** (nr. Dimbula): 06°54'N, 80°38'E, 1525m. **Rakwana:** 06°28'N, 80°37'E, 450m; Ramboda: 07°03'N, 80°42'E, 1310m; Ranamure (nr. Pallegama): 07°30'N, 80°50'E, 350m; Ratnapura: 06°41'N, 80°24'E, 30m; Rattota: 07°31'N, 80°40'E, 245m; Ritigala: 08°07'N, 80°40'E, 400m; Rumassala (Galle): 06°01'N, 80°14'E, 5m. **Sigiriya:** 07°57°N, 80°45'E, 175m; Silverkanda (Deniyaya): 06°23'N, 80°37'E, 915m; Sinharaja: 06°25'N, 80°24'E, 460m; Siyambalakotuwa Wewa: 07°47'N, 79°53'E, 20m. **Talipotenna** (Nikapota): 06°43'N, 80°58'E, 370m; Tembiliyana (Awissawella): 06°58'N, 80°15'E, 120m; Trincomalee: 08°34'N, 81°14'E, 2m; Tunukkai: 09°09'N, 80°17'E, 30m. **Uda Pussellawa:** 07°00'N, 80°54'E, 1420m; Uda Walawe: 06°26'N, 80°52'E, 100m; Udugama (Galle): 06°14'N, 80°20'E, 30m; Udugama (nr. Kadigomuwa): 07°19'N, 80°25'E, 150m; Usgala (nr. Maliboda): 06°52'N, 80°26'E, 700m. **Waga** (Labugama): 06°54'N, 80°07'E, 150m; Waitalawa: 07°19'N, 80°49'E, 915m; Wakwella (Galle): 06°06'N, 80°11'E, 30m; Walandura (Kuruwita): 06°46'N, 80°23'E, 150m; Warahana Wewa: 06°24'N, 81°27'E, 12m; Warakapola: 07°14'N, 80°12'E, 90m; Warnagala (Peak Wilderness): 06°50'N, 80°27'E, 760m; Watawala (Benachie Est.): 06°56'N, 80°31'E, 1060m; Watugala (nr. Deniyaya): 06°23'N, 80°28'E, 600m; Watura (nr. Kegalla): 07°11'N, 80°23'E, 305m; Weliara (nr. Wellawaya): 06°45'N, 81°07'E, 460m; Weligatta (Bundala): 06°11'N, 81°16'E, 5m; Weliweriya (Gampaha): 07°02'N, 80°01'E, 20m; Werelugahamulla (Rakwana): 06°30'N, 80°36'E, 305m; Wewagama (nr. Kuliyapitiya): 07°25'N, 80°06'E, 45m; Wewesse Group (nr. Badulla): 06°57'N, 81°06'E, 1130m; Wilpita (nr. Akuressa): 06°06'N, 80°31'E, 30m; Wirawila: 06°16'N, 81°13'E, 30m; Woodside (nr. Urugala): 07°16'N, 80°50'E, 915m. **Yala:** 06°22'N, 81°31'E, 5m; Yogama: 06°55'N, 80°15'E, 120m;

Figure 1. Locations sampled under the WHT-WWF amphibian survey of Sri Lanka, 1993-96. An alphabetic listing of these locations is given in Appendix 2.

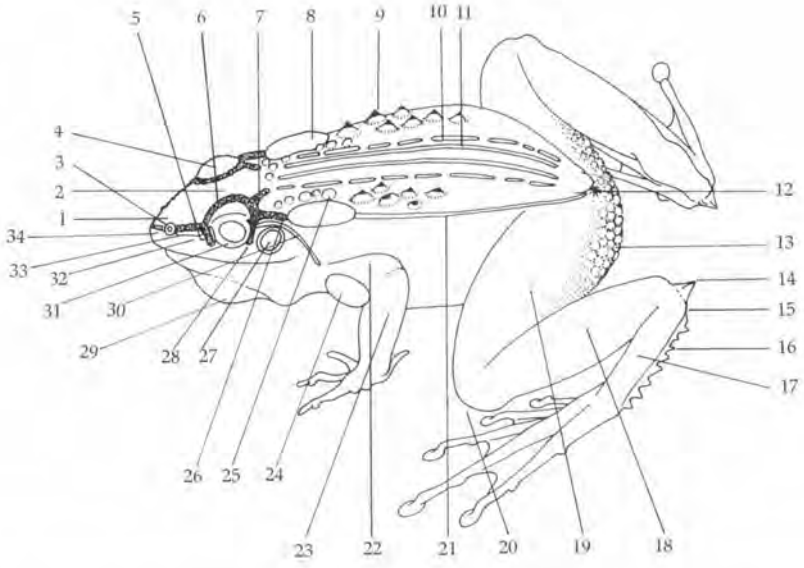

Figure 2. Nomenclature of external anuran anatomy referred to in the text: 1, internarial area; 2, interorbital area; 3, naris; 4, upper eyelid; 5, preorbital ridge; 6, supraorbital ridge; 7, parietal ridge; 8, parotid gland; 9, spinous wart; 10, interrupted longitudinal fold; 11, uninterrupted longitudinal fold; 12, vent; 13, granules; 14, calcar; 15, heel; 16, fringe on tarsus; 17, tarsus; 18, tibia; 19, femur; 20, knee; 21, dorsolateral glandular fold; 22, upper arm; 23, lower arm; 24, humeral gland; 25, tubercle; 26, supratympanic ridge; 27, tympanum; 28, postorbital ridge; 29, gular sac; 30, supratympanic fold; 31, eye; 32, loreal region; 33, dermal flap; 34, canthus rostralis.

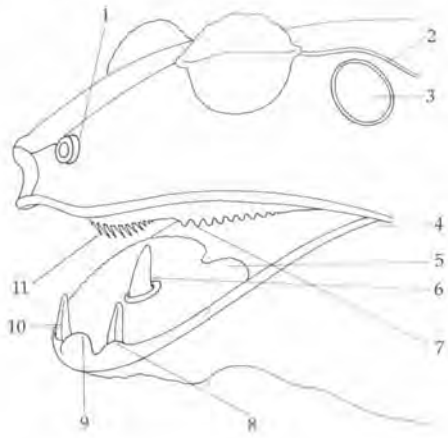

Figure 3. Nomenclature of features of the anuran head used in the text: 1, postnarial ridge; 2, supratympanic fold; 3, tympanum; 4, gape; 5, tongue; 6, (conical) papilla; 7, serrated denticular processes; 8, apophyse; 9, symphysial knob; 10, fang-like odontoid process; 11, teeth.

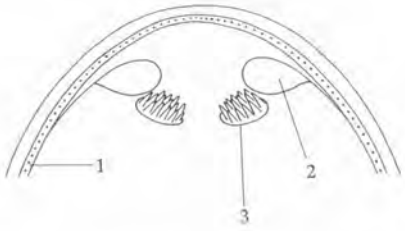

Figure 4. Scheme of anuran palate, showing: 1, teeth; 2, choana; 3, vomerine teeth patch.

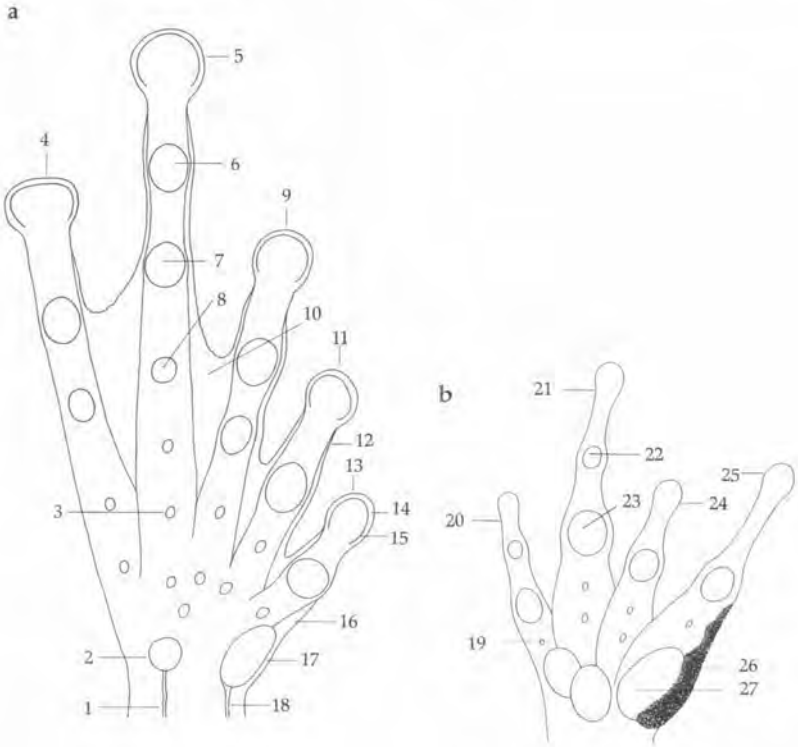

Figure 5. Scheme of anuran right foot (a) and hand (b) (ventral aspects) showing: 1, outer tarsal ridge; 2, outer metatarsal tubercle; 3, supernumerary tubercle; 4, fifth toe; 5, fourth toe; 6, distal subarticular tubercle; 7, penultimate subarticular tubercle; 8, antepenultimate subarticular tubercle; 9, third toe; 10, web; 11, second toe; 12, dermal fringe; 13, first toe; 14, disc; 15, circum-marginal groove; 16, cutaneous fringe; 17, inner metatarsal tubercle; 18, inner tarsal ridge; 19, supernumerary tubercle; 20, fourth finger; 21, third finger; 22, distal subarticular tubercle; 23, penultimate subarticular tubercle; 24, second finger; 25, first finger; 26, nuptial pad; 27, palmar tubercle.

the south-western tip of the India, this interval being bridged partially by "Adam's Bridge," a series of small islands and outcrops.

As has been noted by Wayland (1922), Wadia (1941; 1943), Jacob (1949), Cooray (1967) and Das (1996a), Sri Lanka bears many geological similarities with parts of the Indian peninsula. A land connection between the nothern tip of Sri Lanka and the southern tip of the Indian peninsula has existed from time to time in the past, and was most recently re-established by slow uplift of the ocean floor since the Miocene—Lower Pliocene border (Deraniyagala, 1958). Later, minor oscillations in the levels of land and sea were of sufficient magnitude to disturb this land connection between the mainland and Sri Lanka at intervals (Jacob, 1949). The last land connection between Sri Lanka and the mainland appears to have been existence until the late Pleistocene, approximately 25,000 to 10,000 years ago.

Most of the land area of Sri Lanka divides into two distinct climatic regimes: the wet zone has a minimum annual precipitation in excess of 2000 mm (average 2400 mm) and includes much of the central hills and the whole of the south-western corner of the island (Fig. 6); the dry zone has a maximum annual precipitation of 2000 mm (average 1450 mm) and occupies most of the islands land area, particularly the northern and eastern tracts.

Rainfall is seasonal and related to periods of characteristic monsoonal winds. The south-west monsoon (May to September) results in rainfall mainly in the wet zone, whereas the north-east monsoon (November-February) causes rainfall in all parts of the island. The windward slopes of the central massif and the area south-west of them receive the highest rainfall (4000-6000 mm / yr) and are rich in tropical montane and rain forests. The dry zone is characterized mainly by scrub jungles.

The biogeography of the Sri Lankan Amphibia is discussed in Manamendra-Arachchi & Pethiyagoda (in press).

Conservation

No data are available on population trends of Sri Lankan amphibians, although monitoring programmes are now in place (A. de Silva, pers. comm.). The present study suggests that no extinctions have taken place, at least among the species recognised here (the unassessed synonymy is still rich, particularly amongst the Rhacophoridae). However, it is equally clear that almost all the endemic species are dependent on moist, near closed-canopy forest habitats. Further, many of them were found to comprise small, localised populations (whether localisation was caused by habitat fragmentation or for other reasons is not known).

Small, localised faunas run a higher risk of falling prey to catastrophic declines than more widely distributed ones (Diamond, 1975), e.g. because of severe droughts or forest fires. For this reason, it is alarming that (as at 1983) only 9.1% of the lowland wet zone was forested, and of that forest only 22% was considered still undisturbed (Gunatilleke & Gunatilleke, 1983).

The position as regards the highlands of the central massif is even more critical. Habitat degradation here has been even more severe (Pethiyagoda, 1994), and a decline in precipitation of as much as 25% during the past century (Abeywickrema et al., 1991) can have only worsened an already bad situation.

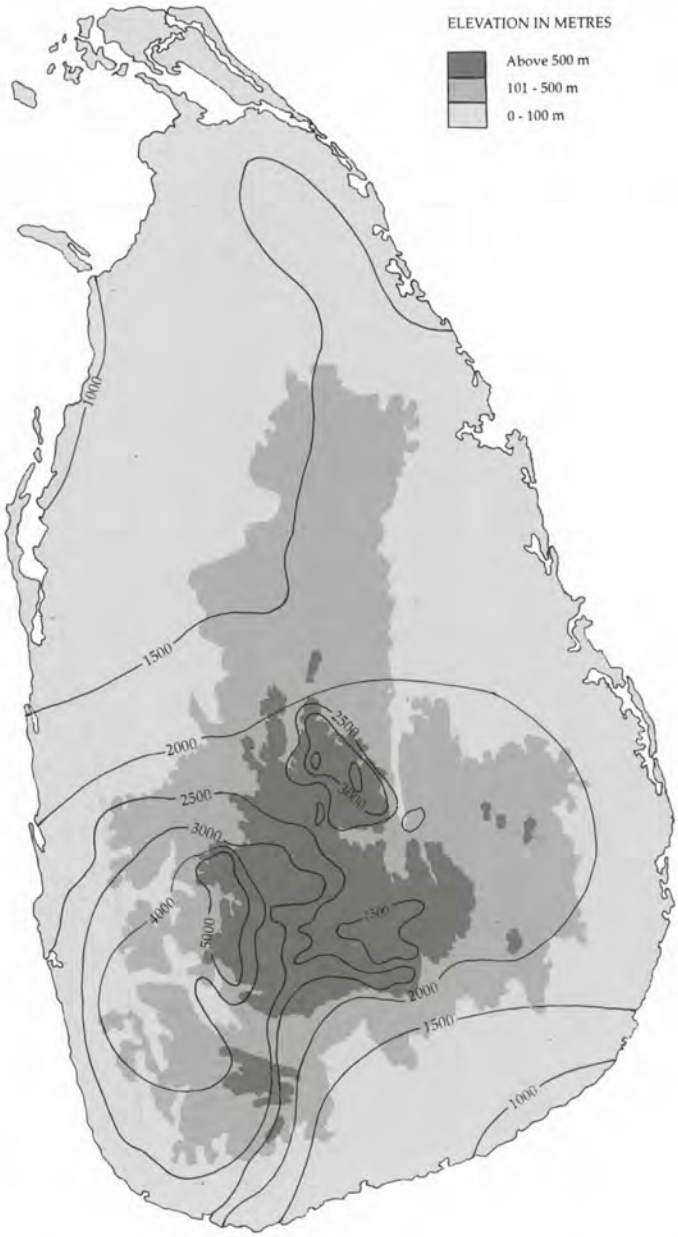

Figure 6. Sri Lanka: relief and rainfall. The altitudinal ranges 0-100m, 100-500m and >500m are stippled; average annual rainfall contours indicate (in mm yr-1): 1000, 1500, 2000, 2500, 3000, 4000 and 5000 (source: *National Atlas of Sri Lanka,* Survey. Dept., Colombo, 1989).

ICHTHYOPHIIDAE

Ichthyophis Fitzinger, 1826 (type species *Caecilia glutinosus* Linnaeus, 1759, by monotypy). About 30 species in South and south-east Asia; three in Sri Lanka.

The literature on *Ichthyophis* in Sri Lanka dates back to Seba (1735), who described a Sri Lankan caecilian (evidently *Ichthyophis glutinosus*) under the name "Serpens caecilia ceylonica". Linnaeus (1754) erected the name *Caecilia glutinosa* and noted the type locality as "Indiis" (= Indies). Sarasin & Sarasin (1887-1890) later published the now well known illustration of *Ichthyophis glutinosus* guarding its eggs (see frontispiece).

Since then, numerous authors have referred to examples of "*I. glutinosus*" from India, the Malay Archipelago, and Sri Lanka. Indeed, prior to the work of Taylor (1960), almost all Asian species of *Ichthyophis* were referred to either *I. glutinosus* (striped species)or *I. monochrous* (non-striped species). Deraniyagala (1933) and Kirtisinghe (1957) listed two species, *I. glutinosus* and *I. monochrous*, from Sri Lanka. Taylor (1968) however, restricted *I. glutinosus* to Sri Lanka and Nussbaum and Gans (1980) noted that *I. monochrous* occurs only in Borneo and not in either India or Sri Lanka.

Subsequent works by Taylor (1968; 1969) recognised five species of caecilians from Sri Lanka: *Ichthyophis glutinosus* Linnaeus, 1758; *I. orthoplicatus* Taylor, 1965; *I. pseudangularis* Taylor, 1968; *I. taprobanicensis* Taylor, 1969; and *Caudacaecilia asplenia* (Taylor, 1965). The most recent work on the Sri Lankan *Ichthyophis* (Nussbaum & Gans, 1980) recognises only the three species from the island. In addition to three species of *Ichthyophis*, Taylor (1968) also included *Caudacaecilia asplenia* based on two specimens (NHMB 5 and NHMW 9090) labelled as being from "Ceylon". Taylor suspected that the locality data of these specimens was erroneous, for *C. asplenia* had previously been reported only from Borneo, Malaysia and Thailand (type locality "Boven Mahakkam, Borneo"). A third specimen of *C. asplenia* referred to by Nussbaum & Gans, 1980 (SMNS 2242, apparently from Sri Lanka), leaves open the question of the occurrence of this species in the island.

Key to the Sri Lankan Ichthyophiidae

1. Lateral stripes absent ..... *I. orthoplicatus*
   Lateral stripes present 2
2. Maximum total length 315 mm; annuli 269-304 ..... *I. pseudangularis*
   Maximum total length 415 mm; annuli 329-415 ..... *I. glutinosus*

Ichthyophis glutinosus
Figures 7-10

Caecilia glutinosa Linnaeus, 1758: 229 (holotype: NHRM, from "Indiis").

Ichthyophis forcarti Taylor, 1965: University of Kansas Science Bulletin, 48(9): 281-296 (holotype: NHMB 4411, from "Ceylon").

Diagnosis. *Ichthyophis glutinosus* is distinguished from *I. Orthoplicatus* by the presence of a lateral stripe (absent in *I. Orthoplicatus*); and from *I. pseudangularis* by having 329-415 annuli (vs. 269-304).

Description. Mature males 165-369 mm, gravid females 235-410 mm in length, from snout to tip of tail. Head small, oval, with distinct eye, tentacle, and upwardly-directed narial openings (Figs. 7-9). Annuli 329-415 including vent annuli 3-5 and tail annuli 4-10; posterior annuli transverse, posteriorly directed; anterior annuli forming midventral angles. Vertebrae 109-121 (Fig. 10). Maxillary-premaxillary teeth 24-50; vomeropalatine teeth 26-51; dentary 21-44 teeth; splenial teeth 11-37.

Colour. Dark brown or black, with a distinct cream-yellow lateral stripe from angle of jaw to tip of tail, broken on first collar, spotted at the angle of jaw (Fig. 11). Vent surrounded by a pale patch.

Comments. The name *Ichthyophis glutinosus* has been applied by many authors to different Asian caecilians. Prior to Taylor (1968), all Asian members of this genus were assigned either to *I. glutinosus* or *I. monochrous*. Taylor (op. cit.) restricted the type locality of *I. glutinosus* to Sri Lanka.

There is considerable variation in total length, in numbers of annuli (total, vent, and tail), vertebrae, and teeth (maxillary-premaxillary, vomeropalatine, dentary, and splenial) (Nussbaum & Gans, 1980). Taylor (1968) described a new species, *I. forcarti*, based on smaller size (238 mm) and reduced number of splenial teeth (10), as compared to *I. glutinosus* (11-37). Because of the range of variation both in the size and numbers of teeth observed in *I. glutinosus* however (Nussbaum & Gans, 1980), we consider *I. forcarti* to be a synonym of *I. glutinosus* (or at least not separable by the characters provided by Taylor).

Figure 7. *Ichthyophis glutinosus*, UMMZ 135095, dorsal view of head.

Figure 8. *Ichthyophis glutinosus*, UMMZ 135095, lateral view of head.

Figure 9. *Ichthyophis glutinosus*, UMMZ 135095, ventral view of head.

Figure 10. *Ichthyophis glutinosus*, UMMZ 135104, radiograph.

Figure 11. *Ichthyophis glutinosus*, not preserved, in life (photo: CG).

Figure 12. Distribution of *Ichthyophis glutinosus* in Sri Lanka.

Distribution. Throughout the higher elevations central and southern Sri Lanka (Fig.12), up to 1355 m altitude. Found under stones etc., and in rotting vegetation in very wet places. Species endemic to Sri Lanka.

Etymology. *Glutinosus*, Latin, = viscous, sticky.

Material examined

No specific locality: AMNH 18657-59 (larvae), AMNH 20868, CAS 55184, MCZ 3495, RMNH 2416, USNM 5895; Balangoda, Cinchona Estate road, 835 m: UMMZ 135095; Deniyaya on Rakwana road, 510 m: UMMZ 135111; Dewature: AMNH 117285, USNM 235810; Dewatura lines, below Namunukula, 860 m: UMMZ 135181, 135187, 135189;

Gammaduwa Lines, 800 m: UMMZ 135190-92; Gampola, 470 m: UMMZ 13610; Harasbeda, 1355 m: UMMZ 135193; Hilagama on Bibilegama road, near Namunukula, 1020 m: UMMZ 135107; Hindagala, near Kandy: UMMZ 138597-600; Kandy: UMMZ 135113-14, USNM 135178-79, USNM 235811; Malgale edge of Sinharaja, near Akuressa: UMMZ 135109; Namunukula, Pingarawa Estate on Dewature road, 1250 m: UMMZ 135104; Peradeniya, Central Province: AMNH 74200; Peradeniya, Hantana Estate, about 800 m: UMMZ 135096; 135103, 135180; Rakwana: AMNH 117284; WHT1310, 205 mm, Dellawa, alt. 150 m; WHT1311, 105 mm, Atgalla (Gampola), alt. 540 m.

Ichthyophis orthoplicatus
Figures 13-17

Ichthyophis orthoplicatus Taylor, 1965: University of Kansas Science Bulletin, 46(6): 253-302 (holotype: ZSI C17010, from "Ceylon", amended to "Pattipola, Central Province, Ceylon" by Taylor (1968).

Ichthyophis taprobanicensis Taylor, 1969: University of Kansas Science Bulletin, 48(9): 281-296 (holotype: AMNH 64515, from "Ohiya Area, 5500 feet, Ceylon").

Diagnosis. This species is distinguished from the other two species of Sri Lankan *Ichthyophis* by the absence of a lateral stripe (present in both *I. glutinosus* and *I. pseudangularis*).

Description. Mature males 210-307, gravid females 208-303 mm in length from snout to tip of tail. Head small, oval; eye distinct (Figs. 13-15). Tentacular opening distinct, with a horseshoe-shaped groove. Nostril visible when viewed from dorsal side. Up to 335 annuli: vent annuli 3-5; tail 4-7. Vertebrae 117 in 1 ex. (UMMZ 135096) (Fig. 16). Posterior folds and grooves complete on the first collar. Teeth: maxillary-premaxillary 35-49; vomeropalatine 25-47; dentary 31-47; splenial 16-27. Body colour lavender-slate. Tentacular opening white; light ring around eye; white patch around vent. Tail with white cap.

Colour. Body dark brown or black above, lighter below (Fig. 17).

Comments. Deraniyagala (1933) and Kirtisinghe (1957) misidentified as *I. monochrous* specimens of *Ichthyophis orthoplicatus* (*I. monochrous* does not occur in Sri Lanka). Nussbaum and Gans (1980) synonymized *I. taprobanicensis* (which

Figure 13. *Ichthyophis orthoplicatus*, UMMZ 135101, dorsal view of head.

was distinguished from *I. orthoplicatus* mainly by angulate rather than transverse annuli crossing the ventral surface of the anterior part of the body) with *I. orthoplicatus*.

Distribution. Mountains of south-central Sri Lanka up to 1890 m alt. (Fig. 18). Species endemic to Sri Lanka.

Etymology. *Orthos*, Greek, = straight; *plicatus*, Latin, = folds, folded. A reference to the annuli.

Material examined

No specific locality: UMMZ 135112; Badulla: USNM 235807-808; Bandarawela: AMNH 117589; Bibilegama: AMNH 235806, UMMZ 135102, USNM 235809; Demodera, 2.5 km NE of Ella, 800 m: UMMZ 135184-86, 138593-94; Dewature: AMNH 117289; Dewature line below Namunukula, 860 m: UMMZ 135105-35, 135182-83, 135188; Halpe, 7 km by road NE of Ella, 900 m: UMMZ 135101; Hilagama, 1020 m: UMMZ 135096, 135108; Nicapota, near Lemastota, 600m: UMMZ 135110; Ohiya: AMNH 64515 (holotype of *I. taprobanicensis*); Weliare, 3 km NW Wellawaya, 460 m: UMMZ 135098.

Figure 14. *Ichthyophis orthoplicatus*, UMMZ 135101, lateral view of head.

Figure 15. *Ichthyophis orthoplicatus*, UMMZ 135101, ventral view of head.

Figure 16. *Ichthyophis orthoplicatus*, UMMZ 135096, radiograph.

Figure 17. *Ichthyophis orthoplicatus*, not preserved (photo: CG).

Figure 18. Distribution in Sri Lanka of *Ichthyophis orthoplicatus*.

Ichthyophis pseudangularis
Figures 19-23

Ichthyophis pseudangularis Taylor, 1965: University of Kansas Science Bulletin, 46(6): 253-302 (holotype: NHMB 4412, from "Ceylon").

Diagnosis. See diagnosis of *Ichthyophis glutinosus*.

Description. Mature males 198-308 mm, gravid females 199-314 mm in length from snout to tip of tail. Head small, bluntly pointed, narrower than body (Figs. 19-21). Eyes, tentacular openings and nostrils distinct. Annuli 269-304; vent annuli 3-4; tail annuli 3-5. Vertebrae 109 (Gans, 1980) in 1 ex., (see also Fig. 22). Dorsal folds and grooves transverse, curving forward on mid-line; ventral folds angular except the posterior fifth of body. Teeth: maxillary-premaxillary 28-45, vomeropalatine 26-41, dentary 21-41, splenial 11-31.

Colour. (See Fig. 23). A distinct, narrow, creamy-yellow stripe, narrow or broken on collars, terminating posteriorly behind level of vent; a creamy-yellow bifurcated spot at angle of jaws; indistinct cream spots on chin; one symmetrical spot above second collar; vent surrounded by a light patch. Tip of snout pale cream.

Distribution. Forested areas of south-central Sri Lanka up to 1525 m (Fig. 24). Species endemic to Sri Lanka.

Etymology. *Pseudes*, Latin, = false; *angulus*, Latin, = angle, corner; a reference to the angulated annuli of this species.

Material examined
No specific locality: AMNH 51623, USNM 5895, 58751; Akuressa, 20 m: UMMZ 135099; Pangukaragedera Farm, 3 km S Ratnapura: UMMZ 135094; Watawala, 2 km S in Benage Estate, 1060 m: UMMZ 135100; WHT1172, 268 mm, near Devonford Estate (between Bogawantalawa and Balangoda, alt. 1525 m); WHT736, 170 mm, Silvakanda (Deniyaya, alt. 760 m).

Figure 19. *Ichthyophis pseudangularis*, UMMZ 135094, dorsal view of head.

Figure 20. *Ichthyophis pseudangularis*, UMMZ 135094, lateral view of head.

Figure 21. *Ichthyophis pseudangularis*, UMMZ 135094,ventral view of head.

Figure 22. *Ichthyophis pseudangularis*, UMMZ 135099,radiograph.

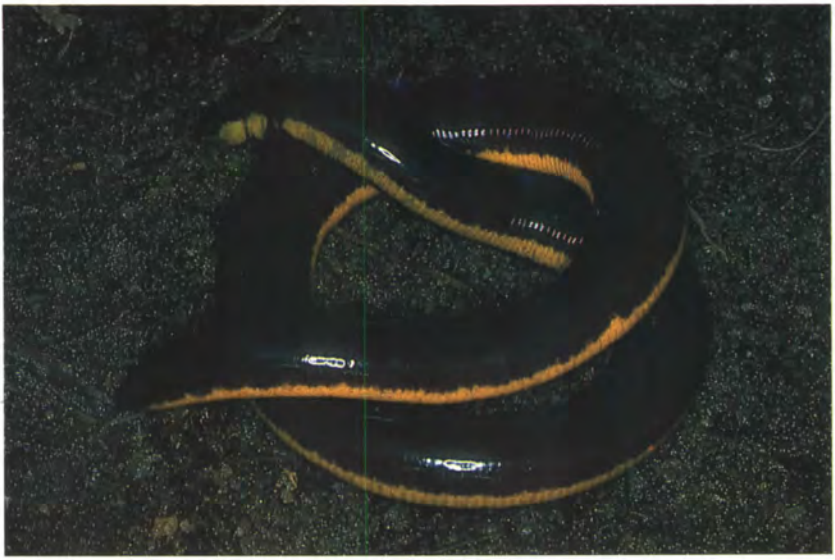

Figure 23. *Ichthyophis pseudangularis*, 268 mm SVL, WHT 1172.

Figure 24. Distribution in Sri Lanka of *Ichthyophis pseudangularis*.

MICROHYLIDAE

Key to the Sri Lankan Microhylidae

1 Tips of digits rounded, without discs (Fig. 34) 2
Tips of digits dilated into discs; or tips of fingers dilated and truncate or dilated into a terminal triangle 4

2 A pair of papillae behind each choana (Fig. 59) ..... *Uperodon systoma*
No such papillae behind the choanae 3

3 Two "normal" metatarsal tubercles (Fig. 34) ..... *Microhyla ornata*
Two shovel-shaped metatarsal tubercles (Fig. 38) ..... *Microhyla rubra*

4 Tips of digits dilated into discs 5
Tips of fingers dilated and truncate or dilated into a terminal triangle 6

5 Median cleft on dorsal side of disc (Fig. 30a) ..... *Microhyla karunaratnei*
Median cleft absent (Fig.44a) ..... *Microhyla zeylanica*

6 A bony ridge along the posterior border of each choana (Fig. 25), fingers with well-developed truncate tips (Fig. 26) ..... *Kaloula taprobanica*
A dermal ridge a short distance posterior to each choana (Fig. 48); fingers with well-developed triangular tips (Fig. 49) 7

7 Toes with rudimentary webbing (Fig. 56) ..... *Ramanella variegata*
Toes with developed webbing 8

8 Fourth toe webbing to penultimate subartiular tubercle or antepenultimate subarticular tubercle or between them on outer side (Fig. 47) ..... *Ramanella obscura*
Fourth toe webbing to distal subarticular tubercle on outer side (Fig. 53) ..... *Ramanella palmata*

Kaloula Gray, 1831 (type species *Kaloula pulchra* Gray, 1831, by monotypy). *Kaloula* is represented by ten species in south-east Asia, China, India and Sri Lanka. Only one species occurs in continental India and Sri Lanka. *Kaloula pulchra* Gray, 1831 (type locality: China) was formerly considered to range from Sri Lanka, across India to southern China and south-east Asia: however Parker (1934) proposed the subspecies *K. pulchra taprobanica* for the Indian and Sri Lankan populations of *Kaloula* on the basis of their distinct colouration and smaller size.

Kaloula taprobanica
Figures 25-28

Kaloula pulchra taprobanica Parker, 1934: 86-87 (types: BMNH, from "Punduloya, Ceylon, 4000 feet").

Kaloula pulchra Gray, 1831, Zoological Miscellany, 1: 38: (type: Not traced, from "China").

Diagnosis. *Kaloula taprobanica* is distinguished from all other Sri Lankan microhylids except *Ramanella* by the presence of two prominent bony ridges along the posterior edge of the choanae (Fig. 25) (vs. a dermal ridge slightly posterior to each choana in *Ramanella*).

Description. Globular in shape. Maximum snout-vent length, 56.4 mm. Head broader than long. Snout short, subequal to horizontal diameter of eye, rounded when viewed dorsally and truncate laterally. Nostril nearer to tip of snout than to eye. Canthus rostralis indistinct. Loreal region slightly oblique, concave. Interorbital width less than width of upper eyelid, subequal to snout. A small symphysial knob on anterior edge of mandible. Two prominent bony ridges along the posterior edge of choanae (Fig. 25). Tympanum hidden. Supratympanic fold present. Fingers free, with broad and truncate tips (Fig. 26). First and second fingers with one subarticular tubercle and third and fourth with two subarticular tubercles. Relative length of fingers 1<2<4<3 or 1=2<4<3. Three palmar tubercles; the inner one well developed and the middle one small. Subarticular tubercles rounded or oval. Toes and fingers depressed, their edges with dermal fringes. Toes with rounded or slightly truncate tips, webbed, the webbing to distal subarticular tubercle or between tip and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on inner side and distal subarticular tubercle or between tip and distal subarticular tubercle on outer side of second toe; to penultimate subarticular tubercle on inner side and distal subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle on outer side of third toe; to antepenultimate subarticular tubercle or between penultimate subarticular tu-

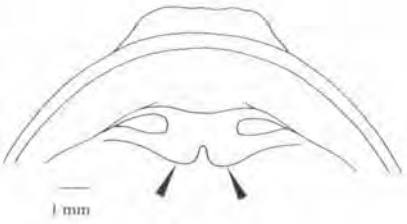

Figure 25. *Kaloula taprobanica*, 56.4 mm SVL, WHT 1180, ventral aspect of palate (ararrow indicates bony ridge).

Figure 26. *Kaloula taprobanica*, 56.4 mm SVL, WHT 1180, ventral aspect of right hand.

Figure 27. *Kaloula taprobanica*, 56.4 mm SVL, WHT 1180, ventral aspect of left foot.

bercle and antepenultimate subarticular tubercle on inner side and antepenultimate subarticular tubercle on outer side of fourth toe; and to distal subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle on inner side of fifth toe (Fig. 27). Relative length of toes 1<2<5<3<4. Two metatarsal tubercles, the inner compressed, shovel-shaped, larger than outer; the outer one compressed or not, its length more than half that of inner metatarsal tubercle. Dorsum smooth or with numerous small tubercles; belly smooth or granular. Vent surrounded by fine granules. Throat in males strongly granular. Males with an external gular vocal sac.

Colour. Colour in life (Fig. 28): dorsally greyish-black, an interorbital bar present. Dorsolaterally reddish-orange. An orange bar from posterior edge of eye to base of upper arm. Venter pale yellowish-grey, spotted with dark brown or black. Some specimens with the throat black (males?). Dorsal colour (in alcohol) grey or brown with variable markings; dark brown median area; narrow and black

Figure 28. *Kaloula taprobanica*, 28.2 mm SVL, WHT 1009.

interorbital band; broad dorsolateral band, interrupted in some specimens; venter pale grey spotted or marbled with brown.

Comments. Specimens of *Kaloula taprobanica* from Sri Lanka are similar to those from southern and north-eastern India, which differ from those from south-east Asia in having distinct dorsal colour markings and being smaller in size. Parker (1934) considered the populations in Sri Lanka and India to be subspecifically distinct and referred the Sri Lankan taxon to *K. pulchra taprobanica*. Based on similarities in the digital tips, proportions of the toes and interdigital webbing, he considered *K. pulchra taprobanica* to have an affinity to *K. baleata* (Müller, 1836) from south-east Asia. Kirtisinghe (1958) showed that the tadpoles of *K. taprobanica* from Sri Lanka are similar to those from India.

Distribution. This burrowing species is distributed in both the wet and the dry zone up to 460 m elevation (Fig. 29).

Etymology. Taprobane, a classical name for the island of Sri Lanka.

Material examined

No specific locality: FMNH 81239, MCZ 1338, NHMB 4410, 4413, NHMW 4017(3), 13363; Chilaw, North Western Province: AMNH 74277-78, FMNH 83481; Deniyaya, Sinharaja Camp Forest Reserve, Southern Province: CM 67954; Northern Province: NHMB 1423-24; Trincomalee, Eastern Province: FMNH 122623-35; Warakapola, 500 feet, Western Province: AMNH 74253-57; NMSL (uncatalogued), 48.4 mm, Habarana, alt. 120 m; WHT1178, 44.2 mm, Ritigala, alt. 200 m; WHT1179, 48.4 mm, WHT1182, 45.5 mm, WHT1183, 2 ex., 28.3-29.1 mm, WHT1307, 42.8 mm, WHT1308, 27.1 mm, Modera, alt. 4 m; WHT1180, 56.4 mm, WHT1181, 3 ex., 37.2-54.9 mm, WHT1184, 48.8 mm, Navinna (Galle), alt. 15 m; WHT1185, 48.9 mm, Mihintale, alt. 150 m; WHT1009, 28.2 mm, Kohuwala (near Colombo), alt. 15 m; WHT1186, 30.7 mm, Boralesgomuwa, alt. 10 m;

Figure 29. Distribution in Sri Lanka of *Kaloula taprobanica*.

WHT1187, 30.5 mm, Sigiriya, alt. 175 m; WHT1281, 22.6, 32.5 mm, Opata (Kotugoda, alt. 6 m); WHT1306, 28.2 mm, Kodagoda (Imaduwa, Galle), alt. 45 m.

Microhyla Tschudi, 1838 (type species *Microhyla achatina* Tschudi, 1838, by monotypy). There are four species of *Microhyla* in Sri Lanka (*M. ornata*, *M. rubra*, *M. zeylanica* and *M. karunaratnei*). *Microhyla zeylanica* and *M. karunaratnei* are endemic to the island, and *Microhyla zeylanica* clearly bears a close relationship to *M. ornata*, which ranges from Pakistan to Sri Lanka, China, Japan, Thailand and the Malaya Peninsula. *Microhyla rubra* occurs in both India and Sri Lanka.

Microhyla karunaratnei
Figures 30-32

Microhyla karunaratnei Fernando and Siriwardhane, 1996: Journal of South Asian natural History, 2(1): 135-142 (holotype: AMS R 148277, from Morningside Estate, Sinharaja World Heritage Site, Sri Lanka).

Diagnosis. *Microhyla karunaratnei* is distinguished from all other *Microhyla* species known from Sri Lanka by the combination of the following characters: median cleft on dorsal side of digits (Fig. 30a) (vs. digits lacking cleft in the other species); venter marbled in black and white in living specimens and grey-brown and white in alcohol-preserved specimens (vs. venter uniformly coloured).

Description. Snout-vent length of mature males of type series 15.8-19.1 mm, 19.6 mm in the only female examined. Head broader than long. Snout rounded when viewed dorsally and laterally, almost equal in length to horizontal diameter of eye. Nostrils positioned dorsolaterally, nearer tip of snout than to

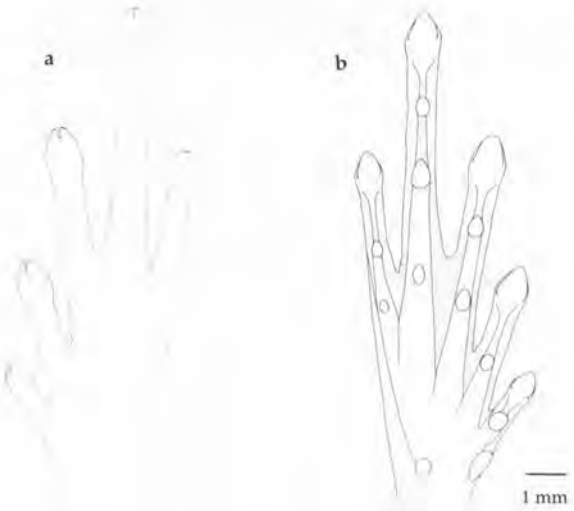

Figure 30. *Microhyla karunaratnei*, 19.6 mm SVL, WHT 1196 (a) dorsal aspect; (b) ventral aspect, of right foot.

eye. Internarial distance equal to or greater than distance from eye to nostril. Post-narial margin distinct. Pupil circular. Canthus rostralis rounded. Loreal region oblique. Upper jaw edentate. Tongue entire. A small symphysial knob on anterior edge of mandible. Interorbital distance broader than width of upper eyelid and interorbital distance subequal to snout. Tympanum hidden. Supratympanic fold present in mature individuals. Tips of digits dilated into discs with circum-marginal grooves, each with a distinct median groove on its dorsal surface (Fig. 30a). Subarticular tubercles prominent, rounded or oval. Fingers free, their relative lengths 1<2<4<3. Discs on fingers poorly developed, with a median notch on the dorsal surface. Two palmar tubercles, the outer completely divided. Discs on toes more developed than those on fingers. Toes webbed, webbing to distal subarticular tubercle on outer side of first toe, to distal subarticular tubercle (or rudimentary webbing between first and second toes) on inner side and distal subarticular tubercle or between tip and distal subarticular tubercle on outer side of second toe; to distal subarticular tubercle or penultimate subarticular tubercle on inner side and distal subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle on outer side of third toe; to penultimate subarticular tubercle or between penultimate subarticular tubercle and antepenultimate subarticular tubercle on inner side and between penultimate subarticular tubercle and antepenultimate subarticular tubercle on outer side of fourth toe; and to distal subarticular tubercle on inner side of fifth toe. Relative length of toes 1<2<5<3<4 or 1<2<3=5<4. Both inner and outer edges of toes with lateral fringes, a prominent cutaneous fringe on outer edge of fifth toe. Two metatarsal tubercles, the inner one oval and the outer one rounded (Fig. 30b). The heels meet when the hind limbs are adpressed. Skin smooth on dorsum and venter. Adults with a very thin median dermal ridge from tip of snout to vent.

Figure 31. *Microhyla karunaratnei*, holotype, 16.5 mm SVL, AMS R 148277 (photo: VW).

Figure 32. *Microhyla karunaratnei*, holotype, 16.5 mm SVL, AMS R 148277, ventral aspect (photo: VW).

Area surrounding the vent and hind side of thighs with tubercles in some mature specimens. A glandular fold extends from the posterior angle of eye to forelimb.

Figure 33. Distribution in Sri Lanka of *Microhyla karunaratnei*.

Colour. In life (Fig. 31), a dark brown mid-dorsal marking that commences between the eyes, narrowing behind the occiput, broadening between the shoulders, narrowing and broadening again, giving rise to two posteriorly-directed bands of variable length. In some specimens the marking continues on narrowing and broadening again, and in others it is interrupted between the broad patches. Pinkish grey-brown with a dusky lateral stripe extending from the eye to the groin. Limbs with dark cross-bars. Ventrally marbled with black and white (Fig. 32). Gular region blackish to dark brown with fine white spots. A blackish or dark brown mark on the anterior side of the thigh, and an incomplete bar on its dorsal side. Vent enclosed in a black patch.

Distribution. Species restricted to wet forests up to 1100 m (Fig. 33). Found on wet leaf litter. Species endemic to Sri Lanka.

Etymology. The species name is an eponym honouring P. B. Karunaratne, the Sri Lankan naturalist.

Material examined

NMSL, 15.6 mm (paratype), WHT1174, 2 ex., 18.0-21.0 mm, WHT1196, 3 ex., 16.0-19.6 mm, Morningside (near Rakwana), alt. 1060 m; WHT1195, 2 ex., 16.5-17.7 mm; Mahawalatenna (Balangoda), alt. 515 m.

Microhyla ornata
Figures 34-37

Engystoma ornata Duméril and Bibron, 1841: 745 (type: not traced, from "Malabar coast", India).

Diagnosis. *Microhyla ornata* is distinguished from all other Sri Lankan *Microhyla* except *M. karunaratnei* and *M. zeylanica* by its normal (Fig. 34) metatarsal tubercles (vs. shovel shaped metatarsal tubercles in *M. rubra* (Fig. 38)) and hav-

Figure 34. *Microhyla ornata*, male, 20.7 mm SVL, WHT 1207, ventral aspect of right foot.

ing rounded and normal (without disks) tips of digits (vs. dilated into disks in *M. karunaratnei* (Fig. 30a) and *M. zeylanica* (Fig. 44a)).

Description. Snout-vent length of mature males 17.0-22.0 mm, gravid females 22.0-25.0 mm. Head broader than long. Snout obtusely pointed when viewed laterally, rounded when viewed dorsally. Interorbital width subequal to snout length. Horizontal diameter of eye more than distance between anterior edge of orbit and nostril. Nostrils dorsolateral, nearer tip of snout than eye, post narial ridge prominent. A shallow internarial groove. Internarial distance subequal to distance from anterior edge of orbit to nostril. Canthus rostralis indistinct. Loreal region slightly concave. A small symphysial knob on anterior edge of mandible. Interorbital width broader than width of upper eyelid. Tympanum hidden; supratympanic fold absent, but a deep groove from posterior edge of orbit to base of forearm in adults. Fingers free; relative length of fingers 1<2<4<3 or 1<2=4<3. Three distinct palmar tubercles, and several supernumerary tubercles. Subarticular tubercles on fingers rounded. Tips of digits rounded, without disks. Toes webbed, webbing to distal subarticular tubercle on outer side of first toe (rudimentary webbing between first and second toes) and to distal subarticular tubercle on outer side of second toe; to penultimate subarticular tubercle on inner side (or rudimentary webbing between second and third toes) and penultimate subarticular tubercle on outer side of third toe; to antepenultimate subarticular tubercle on inner side of fourth toe (or rudimentary webbing between third and fourth toes) and antepenultimate subarticular tubercle on outer side of fourth toe (or rudimentary webbing between fourth and fifth toes); and to between distal subarticular tubercle and penultimate subarticular tubercle or penultimate subarticular tubercle on inner side of fifth toe. Outer edge of fifth toe with a cutaneous fringe. Lateral fringes present on toes (Fig. 34). Relative length of toes 1<2<5<3<4. Two meta-

Figure 35. *Micihyla ornata,* CM 83613, dorsal aspect.

Figure 36. *Micihyla ornata,* male, FMNH 124548, dorsal aspect.

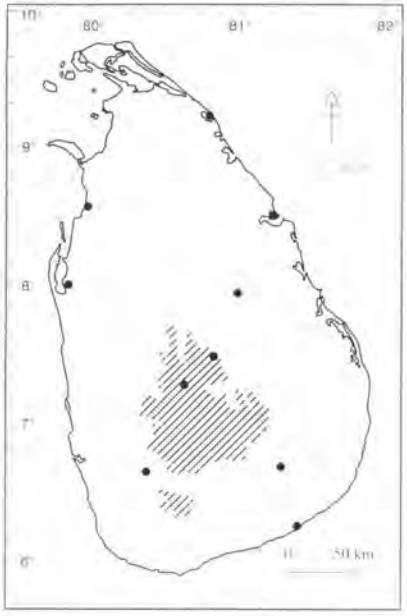

Figure 37. Distribution in Sri Lanka of *Micrhyla ornata*.

tarsal tubercles, the inner one oval and larger than (or equal to) the rounded and conical outer metatarsal tubercle. Dorsum smooth in juveniles and subadults (14.1 mm snout-vent length), tubercular or granular in adults. Head smooth. More tubercles around the vent; small warts forming longitudinal series from eye to groin. Some specimens with raised median line on dorsum; an oblique fold of skin behind eye extending ventrally, separating chest from belly; glandular fold from posterior corner of eye to groin. Hind side of thighs granular; venter smooth. Males with a black gular vocal sac.

Colour. Dorsal colouration (in alcohol) light brown with pinkish-olive or grey markings from behind eye to sacral region. Belly whitish-yellow. Chest and throat speckled with brown. Limbs with black cross bars (Figs. 35-36).

Comments. *Microhyla ornata* is superficially similar to *M. zeylanica* from which it differs by having pointed digital tips. Although Parker (1934) included *M. ornata* in his list of species from Sri Lanka, Parker and Hill (1948) doubted the presence of *M. ornata* on the island and referred their insular specimens to *M. zeylanica*. But as pointed out by Kirtisinghe (1957), *M. ornata* was described by Ferguson (1877) from Sri Lanka, and in recent years the species has been collected from several parts of the island.

Distribution. This species is distributed in both the wet and the dry zone, up to 465 m alt. (Fig. 37).

Etymology. *Ornata*, Latin, = decorated, embellished.

Material examined

No specific locality: USNM AL 263; USNM 57869-70; Marichchukkaddi: CM 83613; Polonnaruwa, North Central Province: CM 67545-51; Puttalam, Western Province:

AMNH 74265-67; Trincomalee, Eastern Province: FMNH 124547-63; NMSL AM 6 (a), 2 ex., 19.9-20.1 mm, Mullaittivu, alt. 1 m; 15.9 mm, 18.0 mm, Kandy, alt. 465 m; 16.6 mm, Ranamure (near Pellegama), alt. 350 m; 18.7 mm, 19.3 mm, Ratnapura, alt, 30 m; WHT1207, 5 ex., 19.7-20.7 mm, Sigiriya, alt. 175 m; WHT432, 13.4 mm, Ritigala, alt. 460 m; WHT1208, 15.0 mm, Palatupana (Kirinda, alt. 5 m); WHT1209, 20.8 mm, Maligawila, alt, 130 m.

Microhyla rubra

Figures 38-42

Engystoma rubrum Jerdon, 1854: Journal of the Asiatic Society of Bengal, 22: 534 (type: lost, from "the Carnatic", India).

Diagnosis. *Microhyla rubra* is distinguished from all other Sri Lankan *Microhyla* by its shovel-shaped metatarsal tubercles (Fig. 38) (vs. "normal" metatarsal tubercles in other *Microhyla* spp. (Fig. 30a, 34, 44a)).

Description. Snout-vent length of mature males 20.0-27.5 mm, gravid females 20.5-29.5 mm. Head broader than long. Snout rounded whether viewed dorsally or laterally. Interorbital distance subequal to snout. Nostril dorsolateral; a post-narial ridge present, and an internarial groove in mature specimens. Canthus rostralis indistinct. Loreal region oblique. Internarial width equal to or greater than distance between anterior edge of orbit and nostril. Horizontal diameter of eye subequal to snout length. Interorbital width broader than width of upper eyelid. A small symphysial knob on anterior edge of mandible. Tympanum hidden; a supratympanic fold present. Tips of digits rounded, not dilated into disks. Subarticular tubercles on both fingers and toes distinct: rounded or oval. Lateral fringes on digits, prominent on toes. Fingers free, their relative length 1<2<4<3 or 1<2=4<3. Two distinct palmar tubercles, the outer completely divided in most individuals and many supernumerary tubercles. Toes webbed, webbing to between tip and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on inner side and distal subarticular tubercle or between tip and distal

Figure 38. *Microhyla rubra*, 28.3 mm SVL, WHT 245, ventral aspect of right foot.

Figure 39. *Microhyla rubra*, 28.3 mm SVL, WHT 245 (photo: SL).

Figure 40. *Microhyla rubra*, not preserved, from Trincomalee, Sri Lanka (photo: ID).

subarticular tubercle on outer side of second toe; to between distal subarticular tubercle and penultimate subarticular tubercle or penultimate subarticular tubercle on both inner and outer sides of third toe; to between penultimate subarticular tubercle and antepenultimate subarticular tubercle or antepenultimate subarticular tubercle on inner side and antepenultimate subarticular

Figure 41. *Microhyla rubra*, AMNH 74268, dorsal aspect.

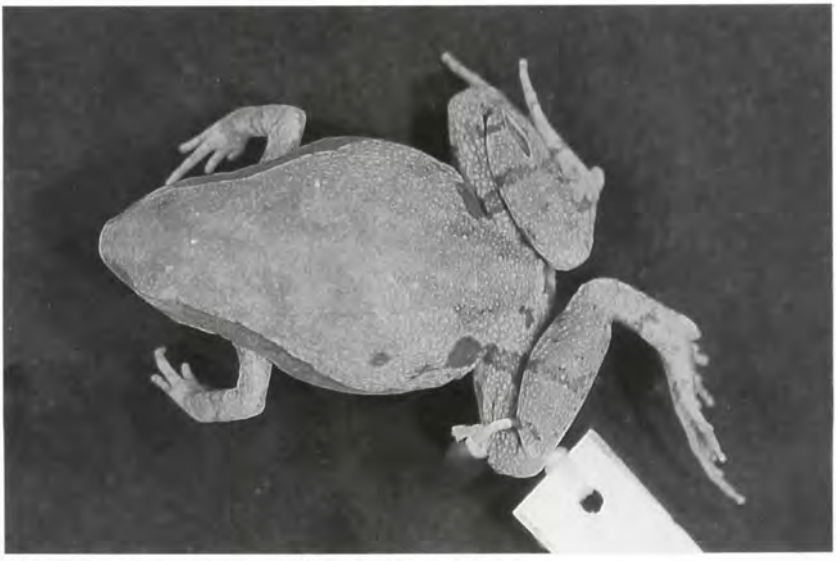

Figure 42. *Microhyla rubra*, FMNH 124160, dorsal aspect.

tubercle on outer side of fourth toe; and to between distal subarticular tubercle and penultimate subarticular tubercle on inner side of fifth toe (Fig. 38). Relative length of toes 1<2<5<3<4 or 1<2<3=5<4. Outer edge of fifth toe with distinct cutaneous fringe. Two large shovel-shaped metatarsal tubercles, the lengths of which are subequal to length of first toe. Outer metatarsal tubercle

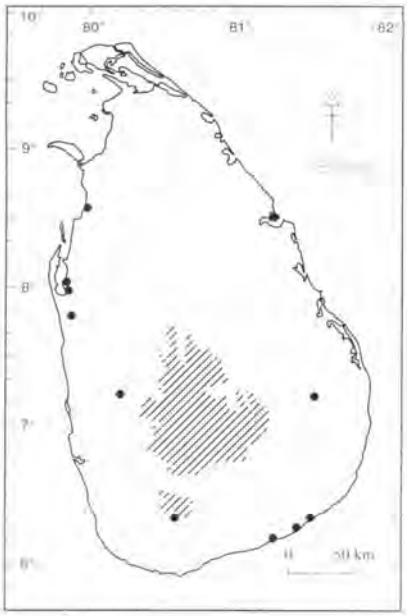

Figure 43. Distribution in Sri Lanka of *Microhyla rubra*.

larger than inner, its outer edge rounded; inner metatarsal tubercle elongate. Dorsum smooth or tuberculated; many small warts laterally from behind eye to flank; some specimens with a distinctly raised median ridge on dorsum; a glandular fold from behind eye to groin. Venter smooth. Anal region granular. Males with a gular vocal sac.

Colour. In life, dorsal colour light brown or reddish-brown (Fig. 39-40); a pinkish-brown or sepia line from behind eye gradually expanding on to groin; a black lateral band from tip of snout through eye to groin. Lips with fine white spots. Belly white, with light brown spots on throat in some specimens. Limbs with distinct cross bands; belly white. For colour in alcohol see Figs. 41 and 42.

Distribution. This species is distributed throughout Sri Lanka up to 460 m (Fig. 43). Common in the dry zone. Found in leaf litter in the daytime.

Etymology. *Rubra*, Latin, = red, reddish (F).

Material examined

No specific locality: NHMB 1368, NHMW 3953-54 (2); Deniyaya, Southern Province: CM 67955-56; Eastern Province, 12 miles N Trincomalee: FMNH 124124-79; Inginiyagala: CM 83550; Marichchukkaddi: CM 83614; North Western Province: NHMB 1369-70; Uva Provicne: FMNH 131386-400; Wariyapola: BMNH 1955.1.10.74-75; Western Province, 10 miles north of Puttalam: AMNH 74268-69; Yala (sea level), Southen Province: AMNH 74291-92; WHT612, 18.6 mm, Weligatta (Bundala, alt. 5 m); WHT245, 28.3 mm, Palavi (Puttalam, alt. 5 m); WHT1199, 27.3 mm, Debaragaswewa (near Habarana), alt. 120 m; WHT1200, 21.9 mm, Palatupana (Kirinda, alt. 5 m); WHT1201, 23.4 mm, Siyambalakotuwa Wewa, Kiriyankali (near Mundel, alt. 20 m); WHT612, 18.7 mm, Weligatta (Bundala, alt. 5 m).

Microhyla zeylanica
Figures 44-45

Microhyla zeylanica Parker and Hill, 1949: Annals and Magazine of Natural History, (12)1: 759 (holotype: BMNH 1948.1.1.3, from "Bopatalawa, Central Province, altitude 6000 feet", Sri Lanka).

Diagnosis. *Microhyla zeylanica* is distinguished from all other Sri Lankan Microyhlidae except *M. karunaratnei* by the presence of circum-marginal grooves on the discs at the tips of digits (vs. absent in all other species). Its differs from *M. karunaratnei* by lacking disk with a distinct median groove on its dorsal surface (Fig. 44a) (vs. present in *M. karunaratnei* (Fig. 30a)).

Description. Maximum snout-vent length, 22.5 mm. Head broader than long. Snout rounded whether viewed dorsally or laterally. Narial opening upwardly directed, equidistant from tip of snout and anterior border of orbit. Post-narial ridge prominent. Internarial width subequal to distance from anterior border of orbit to nostril. Canthus rostralis indistinct. Loreal region oblique, convex. Interorbital distance broader than width of upper eyelid, and interorbital distance subequal to snout. A small symphysial knob on anterior edge of mandible. Tympanum hidden. Supratympanic fold present. Fingers free, tips rounded, with poorly developed discs, with or without circum-marginal grooves. Subarticular tubercles on fingers rounded or oval. Relative length of fingers 1<2<4<3. Two oval palmar tubercles, the outer completely divided. Toes webbed, webbing to distal subarticular tubercle on outer side of first toe, to distal subarticular tubercle (or rudimentary webbing between first and second toes) on inner side and between tip and distal subarticular tubercle on outer side of second toe;

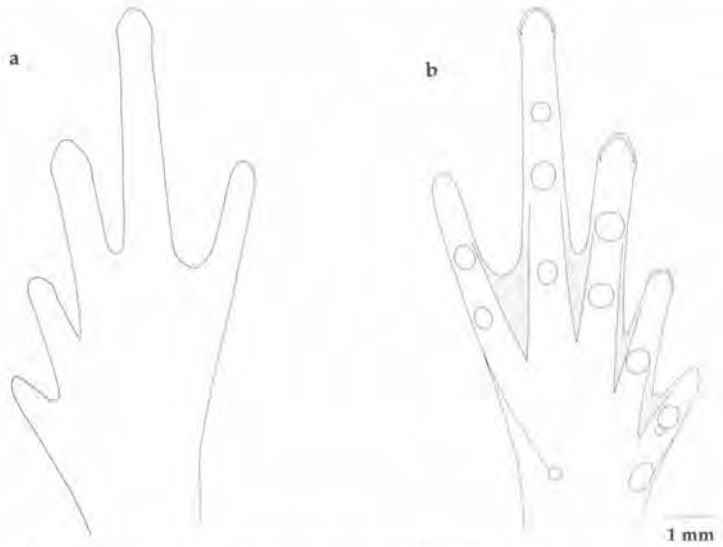

Figure 44. *Microhyla zeylanica*, 18.3 mm SVL, WHT 1198, (a) dorsal aspect; (b) ventral aspect of right foot.

Figure 45. *Microhyla zeylanica*, 20.0 mm SVL, WHT 1211.

penultimate subarticular tubercle on inner side and distal subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle on outer side of third toe; to between penultimate subarticular tubercle and antepenultimate subarticular tubercle on inner side and between penultimate subarticular tubercle and antepenultimate subarticular tubercle on outer side of fourth toe; and to distal subarticular tubercle on inner side of fifth toe (Fig. 44b). Relative length of toes 1<2<5<3<4. Tips of toes subtriangular or rounded, dilated into disks with circum-marginal grooves. Subarticular tubercles on toes distinct, oval. Lateral fringes present on toes. Outer edge of fifth toe with a prominent cutaneous fringe. Two metatarsal tubercles, the inner one larger than outer, shovel-shaped or elongate, the outer one rounded. Dorsum smooth or tubercular; a raised median ridge from tip of snout to vent. A glandular fold extends from the posterior angle of eye to middle of flank, and another glandular fold from the infraorbital to the base of the upper arm. Venter smooth; throat separated from pectoral region by a transverse groove. Males with gular vocal sacs.

Colour. In life (Fig. 45), dorsal colour light to reddish-brown with dark-brown or sepia markings starting from behind eye and gradually extending to groin. Both limbs with reddish patches. Loreal region and area between supratympanic fold black. Small white spots scattered all over the body. Belly white or yellowish. Limbs with or without cross bars.

Comments. Morphologically, *Microhyla zeylanica* resembles *M. ornata* from which it differs mainly by having more webbing between the toes, dorsally directed nostrils and distinctive colour markings on the dorsum.

Figure 46. Distribution in Sri Lanka of *Microhyla zeylanica*.

Distribution. *Microhyla zeylanica* is restricted to the central hills up to an elevation of about 1890 m (Fig. 46). Species endemic to Sri Lanka.

Etymology. The species name is an adjective derived from Zeylan, a Latinized form of Ceylon, the colonial British name for Sri Lanka.

Material examined

No specific locality: MCZ 281(2), 8200-202; Bopatalawa, Central Province, 6000 feet: BMNH 1948.1.1.48 (paratypes); Nuwara-Eliya: CAS 38822, MCZ 3488; WHT1198, 4 ex., 14.4-18.3 mm, Hakgala (near Nuwara Eliya), alt. 1830 m; WHT1211, 5 ex., 15.8-20.0 mm, Pattipola, alt. 1890 m.

Ramanella Rao and Ramanna, 1926 (type species by monotypy, *Ramanella symboitica* [apparently in error for *Ramanella symbiotica* Rao and Ramanna, 1925, considered synonymous with *Callulla variegata* Stoliczka, 1872]). The genus is confined to India and Sri Lanka and is related to *Kaloula*. Of the eight species in the genus, three (*Ramanella obscura*, *R. palmata* and *R. variegata*) occur in Sri Lanka. *Ramanella obscura* and *R. palmata* are closely related; both are endemic to the island.

Ramanella obscura

Figures 47-51

Callula obscura Günther, 1864: 438 (type: BMNH 58.11.28.42, from "Ceylon").

Diagnosis. *Ramanella obscura* is distinguished from *R. palmata* and *R. variegata* by the webbing on the outer side of the fourth toe: fourth toe webbing to penultimate subarticular tubercle or antepenultimate subarticular tubercle or between them (Fig. 47) (vs. fourth toe webbing to distal subarticular tubercle in *R. palmata* (Fig. 53); and toes with only rudimentary webbing in *R. variegata* (Fig. 56)).

Figure 47. *Ramanella obscura*, 25.3 mm SVL, WHT 1194, ventral aspect of right foot.

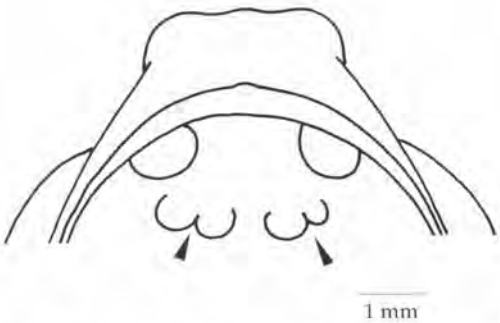

Figure 48. *Ramanella obscura*, 29.0 mm SVL, WHT 1206, ventral aspect of palate (arrow indicates dermal ridge).

Description. Body habitus globular. Maximum snout-vent length 32.0 mm. Head broader than long. Snout short, truncate when viewed laterally, blunt when viewed dorsally. Nostril much nearer to tip of snout than to eye. Internarial width subequal to distance from enterior border of orbit to nostril. An internarial groove in adults. Horizontal diameter of eye subequal to snout length. Canthus rostralis rounded. Loreal region vertical. Interorbital width greater than width of upper eyelid. Two dermal ridges on posterior edges of choanae (Fig. 48). A small symphysial knob on anterior edge of mandible. Tympanum and supratympanic fold indistinct. Fingers free, their tips with triangular dilations. Relative lengths of fingers 1<2<4<3. Two distinct palmar tu-

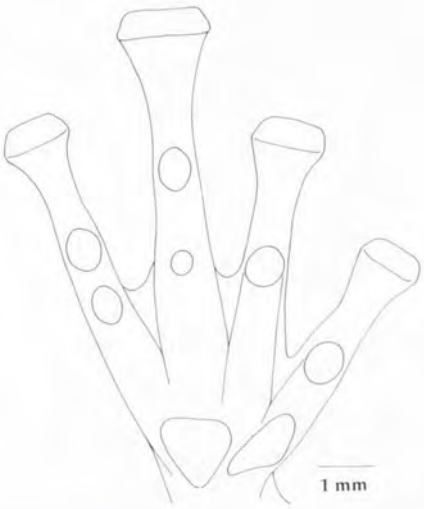

Figure 49. *Ramanella obscura*, 29.0 mm SVL, WHT 1206, ventral aspect of right hand.

Figure 50. *Ramanella obscura*, not preserved, from Gampola, Sri Lanka (photo: ID).

bercles, the outer one larger than the inner (Fig. 49). Both fingers and toes with distinct, oval subarticular tubercles. Finger tips with triangular dilations, toe tips normal (not dilated). Toes webbed: webbing to distal subarticular tubercle or between tip and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle (or rudimentary webbing between first and second finger) on inner side and between tip and distal subarticular tubercle on outer side of second toe; to penultimate subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle on inner side and distal subarticular tubercle or between tip and distal subarticular tubercle on

Figure 51. *Ramanella obscura*, 21.9 mm SVL, WHT 263, (a) lateral aspect; (b) dorsal aspect (photo: SL).

outer side of third toe; to penultimate subarticular tubercle or between penultimate subarticular tubercle and antepenultimate subarticular tubercle (or rarely between distal subarticular tubercle and penultimate subarticular tubercle) on inner side and penultimate subarticular tubercle or antepenultimate subarticular tubercle (or between them) on outer side of fourth toe; and to distal subarticular tubercle or between tip and distal subarticular tubercle on

Figure 52. Distribution in Sri Lanka of *Ramanella obscura*.

inner side of fifth toe (Fig. 47). Relative lengths of toes 1<2<5<3<4. Lateral fringes present on toes. Two metatarsal tubercles, the inner one shovel shaped or elongate and larger than outer, the outer one rounded or oval. Dorsum with numerous small tubercles; venter smooth. Males with a gular vocal sac and dark throat, and more webbing on toes.

Colour. Dorsal colour (in life) orangish-brown with black spots on snout; a black dorsal marking from behind eye, narrowing immediately, broadening on the mid-dorsum, narrowing and broadening again posteriorly. Belly black or dark brown spotted with black. Limbs with black cross bars (Figs. 50-51).

Distribution. *Ramanella obscura* is distributed throughout the low country wet zone, having been recorded from the central hills, Sinharaja Forest, Knuckles Range and Namunukula, up to 1220 m elevation (Fig. 52). Found on leaf litter in heavily-shaded forest. Species endemic to Sri Lanka.

Etymology. *Obscura*, Latin, = dark, indistinct (F).

Material examined

No specific locality: NHMW 4007 (2); Gammaduwa: BMNH 1955.1.1.10.77; Tonocomba Estate, 4000 feet, Namunukula, Uva Province: BMNH 1975.852; WHT1194, WHT248, 25.0 mm, 25.3 mm, 27.1 mm, Koskulana (near Panapola, alt. 460 m); WHT463, 3 ex., 22.5-26.3 mm, Kandy, alt. 465 m; WHT263, 21.9 mm, Mousakanda-Gammaduwa, alt. 915 m; WHT1206, 3 ex., 28.0-29.0 mm, Illukkumbura (near Laggala, Knuckles), alt. 600 m; WHT1259, 25.1 mm; WHT1295, 29.1 mm, Peradeniya, alt. 460 m; WHT1303, 13.5 mm, 10.2 mm, Kotagala, alt. 1220 m.

Ramanella palmata
Figures 53-54

Ramanella palmata Parker, 1934: 93 (holotype: BMNH 90.11.8.62, from "Nuwara-Eliya", Sri Lanka).

Diagnosis. See diagnosis of *Ramanella obscura*.

Description. Body elongate. Snout-vent length of mature males 27.5-31.0 mm, gravid females 29.0-35.0 mm. Head broader than long. Snout short, subequal to horizontal diameter of eye, truncate laterally and blunt dorsally. Nostrils nearer to tip of snout than to anterior border of eye. Internarial distance subequal to width of upper eyelid. Interorbital width subequal to snout length. Postnarial ridges short. Canthus rostralis indistinct. Loreal region vertical. Two dermal ridges behind each choana. A small symphysial knob on anterior edge of mandible. Tympanum indistinct. Supratympanic fold present. Fingers with rudimentary webbing; their tips with triangular dilations. Subarticular tubercles on fingers rounded or oval. Two palmar tubercles, the inner one smaller than the outer. Relative lengths of fingers, 1<2<4<3. Toes webbed, webbing to tip on outer side of first toe, to distal subarticular tubercle on inner side and tip on outer side of second toe; to between distal subarticular tubercle and penultimate subarticular tubercle on inner side and between tip and distal subarticular tubercle on outer side of third toe; to penultimate subarticular tubercle on inner side and distal subarticular tubercle on outer side of fourth toe; and to between tip and distal subarticular tubercle on inner side of fifth toe (Fig. 53). Relative lengths of toes 1<2<5<3<4. Subarticular tubercles on toes oval. Toes with lateral fringes. Two rounded metatarsal tubercles, the inner one larger than the outer. Dorsum with numerous small or large, rounded or oval tubercles; venter smooth. Males with a gular vocal sac.

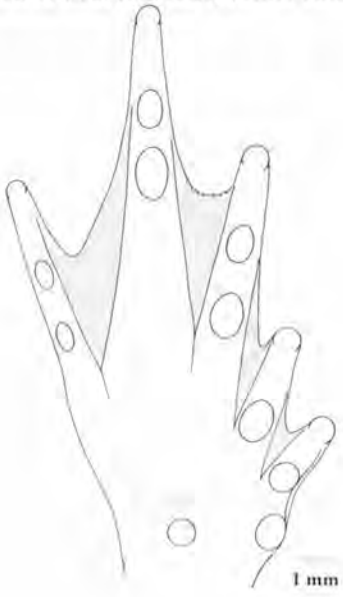

Figure 53. *Ramanella palmata*, 28.5 mm SVL, WHT 1197, ventral aspect of right foot.

Figure 54. *Ramanella palmata* (paratype), NHMB 1415, dorsal aspect.

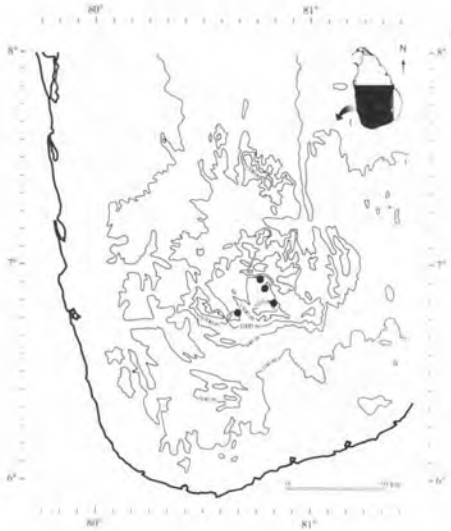

Figure 55. Distribution in Sri Lanka of *Ramanella palmata*.

Colour. Dorsal colour (in alcohol) (Fig. 54) grey or brown with irregular black patches on head; an indistinct interorbital band. Loreal and tympanic regions black. A black pattern on back, starting from behind eye, broadening between shoulders, narrowing on mid-dorsum and again broadening on sacral region (or broken into irregular patches). Black patches laterally on both sides of dorsum. A black patch around vent. Limbs with black patches and cross bars. Throat black in males.

Comments. *Ramanella palmata* is similar in appearance to *R. obscura*; the two species were confused by Müller (1887).

Distribution. *Ramanella palmata* has a restricted distribution in central Sri Lanka up to elevations of about 1890 m (Fig. 55). Species endemic to Sri Lanka.

Etymology. *Palmata*, Latin, = palm-like.

Material examined

No specific locality: AMNH 74213, NHMW 16112, USNM 58095-96; Bogawantalawa: USNM 67896-98; Nuwara-Eliya, 7000 feet: NHMB 1414-15 (paratypes); WHT1197, 28.5 mm, Pattipola, alt. 1890 m; WHT1302, 12.2 mm, 12.1 mm (tadpoles), Hakgala (near Nuwara Eliya), alt. 1830 m.

Ramanella variegata

Figures 56-57

Callula variegata Stoliczka, 1872: Proceedings of the Asiatic Society of Bengal, 1872: 111-112 (syntype?: ZSI 2761; syntype?: NHMW 4019; syntype?: BMNH 74.11.12.2, from "Ellore", India).

Callula olivacea Günther, 1875: Proceedings of the Zoological Society of London, 1875: 576, pl. LXIV, fig. B (syntypes: BMNH 1925.9.18.1-2, from "Bangalore", India).

Diagnosis. See diagnosis of *Ramanella obscura*.

Description. Body elongate. Maximum snout-vent length 35.0 mm. Head broader than long. Snout short, as long as or slightly shorter than horizontal diameter of eye, truncate when viewed laterally, blunt when viewed dorsally. Nostril much nearer to tip of snout than to eye; postnarial ridges feeble. Internarial width subequal to distance from anterior border of orbit to nostril.

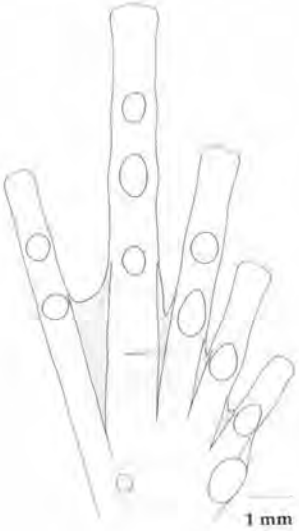

Figure 56. *Ramanella variegata*, 29.7 mm SVL, WHT 1191, ventral aspect of right foot.

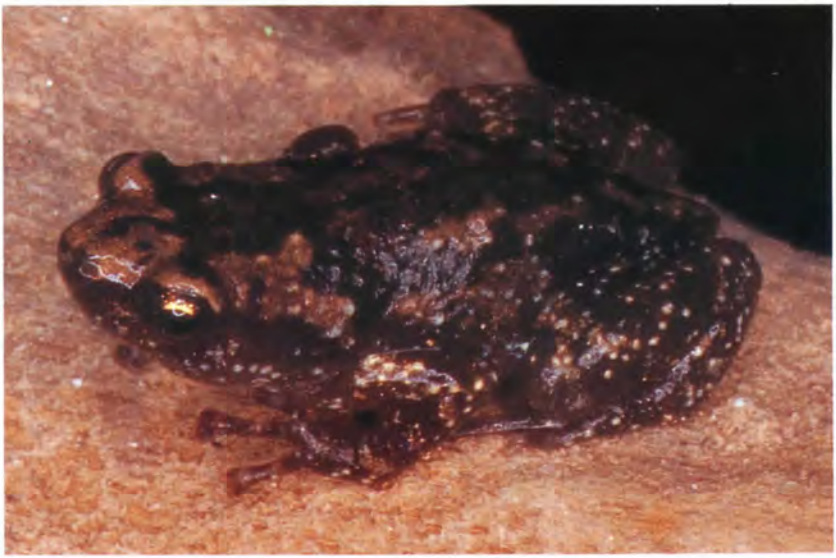

Figure 57. *Ramanella variegata,* 23.5 mm SVL, WHT 1192 (photo: SL).

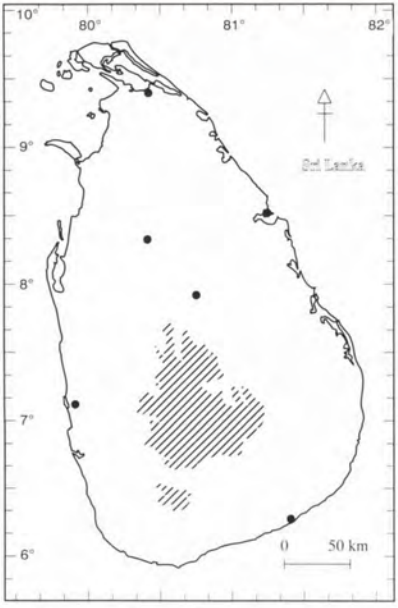

Figure 58. Distribution in Sri Lanka of *Ramanella variegata.*

Canthus rostralis rounded, indistinct. Loreal region oblique. Interorbital width great than width of upper eyelid. Two dermal ridges on posterior edge of each choana. A small symphysial knob on anterior edge of mandible. Tympanum indistinct. Supratympanic fold present. Fingers free, triangular dilations on

tips. Two palmar tubercles, the inner one larger than the outer, elongate and elevated, the outer one rounded and conical. Relative lengths of fingers, 1<2<4<3. Subarticular tubercles on both finger and toes oval or rounded. Toes with rudimentary webbing between them; without triangular dilations on their tips; lateral fringes present; subarticular tubercles small, rounded. Relative lengths of toes 1<2<5<3<4. Two metatarsal tubercles, the inner one larger than the outer one, oval; outer tubercle rounded (Fig. 56). Dorsum smooth or granular; fine tubercles laterally, from behind eye to groin. Anal region granular. Venter smooth. Males with internal vocal sac.

Colour. For colour in life, see Fig. 57. Dorsal colour (in alcohol) pale brown with olive or with irregular dark brown patches. A dark lateral streak from behind eye to base of forelimbs. An interorbital band present. Belly white, with pale brown spots on throat, the throat darker in males.

Comments. *Ramanella variegata* differs from *R. triangularis* (Günther, 1876) from southern India by having rudimentary webbing between the toes and a distinct dorsal colour pattern. *Ramanella variegata* is different from the other endemic species of *Ramanella* in Sri Lanka by having less webbing between toes, a smooth dorsum, smaller size and different dorsal colour markings.

Distribution. *Ramanella variegata* is distributed throughout the low country dry zone (Fig. 58). Found on the rough barks of trees.

Etymology. *Variegata*, Latin, = of different sorts, especially colours.

Material examined

No specific locality: USNM AL 988, FMNH 81230; Eastern Province, 12 miles N Trincomalee: FMNH 124690-702, 172926-28; Northern Province: NHMB 1431-33; NMSL (uncat:), 26.8 mm, Parantan (Jaffna), alt. 3 m; WHT1188, 28.4 mm, Sigiriya, alt. 175 m; WHT1189, 28.0 mm, WHT1193, 15.9 mm, Anuradhapura, alt. 90 m; WHT1190, 28.7 mm, Mihintale, alt. 150 m; WHT1191, 29.7 mm, WHT1192, 23.5 mm, Palatupana (Kirinda, alt. 5 m); WHT1280, 20.9 mm, Opata (Kotugoda, alt. 6 m).

Uperodon Duméril and Bibron, 1841 (type species *Engystoma marmoratum* Guérin-Méneville, 1838, by monotypy). Two species in the genus, *Uperodon globulosum* and *U. systoma*, distinguished from each other by their dorsal colour patterns. The latter is distributed in both India and Sri Lanka, whereas the former is confined to eastern India (West Bengal and Orissa).

Uperodon systoma

Figures 59-63

Rana systoma Schneider, 1799: 144 (type: not traced, from eastern India).

Diagnosis. *Uperodon systoma* is distinguished from all other Sri Lankan microhylids by the presence of a prominent papilla posterior to each choana (Fig. 59) (absent in all other species).

Description. The largest of the Sri Lankan microhylids: snout-vent length of mature males 45.0-53.0 mm, gravid females 50.0-65.5 mm. Body habitus globular. Head broader than long. Snout short, subequal to internarial width,

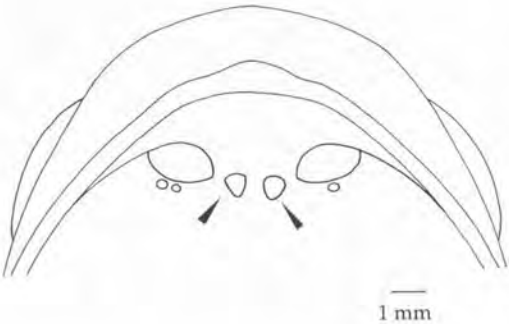

Figure 59. *Uperodon systoma*, 56.7 mm SVL, NMSL AM 5 (a), ventral aspect of palate (arrow indicates papilla).

Figure 60. *Uperodon systoma*, 51.6 mm SVL, NMSL AM 5 (a), ventral aspect of right foot.

rounded when viewed dorsally. Nostril nearer to eye than to tip of snout. Loreal region oblique, convex. A prominent papilla behind each choana (Fig. 59). A small symphysial knob on anterior edge of mandible. Tympanum hidden; supratympanic fold present. Limbs small. Fingers free in adults, rudimentary

Figure 61. *Uperodon systoma,* USNM 254922, from Kurunegala, Sri Lanka (photo: CG).

Figure 62. *Uperodon systoma,* CG (AL276), dorsal aspect.

webbing at base in juveniles 28.7 mm (NMSL AM 5 [a]) snout to vent length. First finger shorter than second, third finger longest; all finger tips rounded and slightly swollen; relative lengths of fingers 1=4<2<3. Distal subarticular tubercles on first and second fingers; penultimate subarticular tubercles on third and fourth fingers larger and conical. Two palmar tubercles. Subarticular

Figure 63. *Uperodon systoma,* not preserved, from Orissa, India.

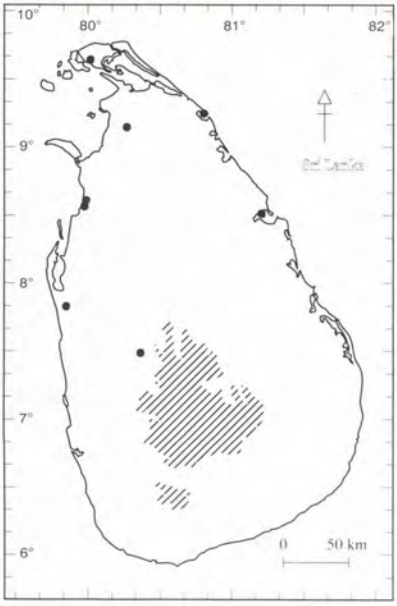

Figure 64. Distribution in Sri Lanka of *Uperodon systoma.*

tubercles on both finger and toes rounded or oval, conical and distinct. Toe tips obtusely pointed. Toes webbed, webbing to between tip and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on inner side and distal subarticular tubercle or between tip and distal subarticular tubercle on outer side of second toe; to distal subarticular tuber-

cle or penultimate subarticular tubercle on inner side and distal subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle on outer side of third toe; to antepenultimate subarticular tubercle on both inner and outer sides of fourth toe; and to distal subarticular tubercle on inner side of fifth toe (Fig. 60). Relative length of toes 1<2=5<3<4. Two shovel-shaped metatarsal tubercles: length of the outer one subequal to half that of the inner one. Thigh partially hidden in body cavity. Dorsum smooth or slightly (or heavily) tubercular. Snout, throat and both lips with small tubercles. Venter smooth or granular. Anal region granular. Males with gular vocal sac.

Colour. In life, dorsal colour dark brown to black, marbled with yellow or orange (Figs. 61). Dorsal colour (in alcohol) dark or pale brown with variable patterns, irregular pinkish spots on head, dorsum and limbs; some specimens without dorsal markings and with black spots on the groin (Figs. 62). Belly white. Throat of males black; females with their throats mottled with brown. Figure 63 shows a living specimen of *U. systoma* from Orisa, India, the type locality.

Comments. Pearson's (1910) report of *Cacopus globulosus* (= *Uperodon globulosum*) from Maha Illuppallama (north-central dry zone of Sri Lanka) is probably a misidentification of *U. systoma*; *U. globulosum* is confined to Orissa and West Bengal in India.

Distribution. *Uperodon systoma*, a burrowing species, is distributed in the low country of Sri Lanka, in both the intermediate and the dry zones (Fig. 64). The specimen illustrated in Fig. 61 was found in a rubbish heap.

Etymology. *Systoma*, Latinization of the Greek *systomos*, = having a narrow mouth.

Material examined

No specific locality: CG AL 276; CAS 85287; Alutnuwara, Uva Province: BMNH 1955.1.10.78, NHMB 2626; China Bay, northern Trincomalee: CM 83626-27; Jaffna: NHMB 1437; Karadikkuli, Northern Province: CM 67902; Kurunegala, North Western Province: AMNH 75123-26; Marichchukkaddi, Northern Province: CM 83607-11; Nawadamkulama, North western Province: CM 67791-97; NMSL AM 5 (a), 28.7 mm, 27.9 mm, Mullaittivu, alt. 1 m; 56.7 mm, Mallimaduwa; 51.6 mm, Tunukkai, alt. 30 m.

BUFONIDAE

Key to the Sri Lankan Bufonidae

1 Cranial ridges present 2
Cranial ridges absent 6

2 Parietal ridges absent 3
Parietal ridges present 4

3 Tympanum equal to one third or more of eye diameter (Fig. 76) ..... *Bufo melanostictus*
Tympanum less than one third of eye diameter (Fig. 79) ..... *Bufo microtympanum*

4 Parotid glands rounded (Fig. 69) ..... *Bufo fergusonii*
Parotid glands elongate 5

5 Parotid gland lobulated (Fig.67) ..... *Bufo atukoralei*
Parotid gland unlobulated (Fig. 84) ..... *Bufo kotagamai*

6 First finger longer than the second ..... *Bufo stomaticus*
First finger shorter than the second ..... *Bufo kelaartii*

Bufo Laurenti, 1768 (type species *Bufo viridis* Laurenti, 1768, by subsequent designation of Fitzinger, 1843. Cosmopolitan distribution (except for Antarctica and Australia) with about 210 species worldwide; seven in Sri Lanka.

Bufo atukoralei
Figs. 65-67

Bufo atukoralei Bogert and Senanayake, 1966: American Museum Novitates, 2269: 1-18 (holotype: AMNH 74290, "near the Buttuwa Circuit Bungalow at Yala, Southern Province, Ceylon").

Diagnosis. *Bufo atukorali* is distinguished from all other Sri Lankan *Bufo* except *B. fergusonii* and *B. kotagamai* by the presence of parietal ridges. It is distinguished from *B. fergusonii* by its parotid glands being elongate (vs. rounded). It differs from *B. kotagamai* by having rough, tuberculated parietal ridges (vs. smooth in adults) and broad, anteriorly-enlarged (lobulate) parotid glands (vs. narrow and symmetrical (unlobulate)) (Figs. 67 and 84).

Description. Snout-vent length of mature males 21.2-26.6 mm, gravid females 27.5-34.9 mm. Head broader than long. Snout rounded when viewed laterally, projecting beyond lower jaw. Nostril nearer to tip of snout than to orbit. Canthus rostralis angular, distinct. Canthal ridges extend from supraorbital crests to end of snout. Loreal region oblique, concave. Head with bony ridges,

Figure 65. *Bufo atukoralei*, 34.9 mm SVL, WHT 1142.

parietal and postorbital crests well developed; parietal ridges often confluent with anterior end of parotid gland. Supratympanic ridges confluent with anterior end of parotid gland. Tympanum rounded or vertically oval, smaller than half the diameter of the orbit. Parotid glands elongate, anteriorly enlarged (Fig. 67). Fingers free, the outer palmar tubercle larger than the inner. First finger shorter than second; the fourth longer than first and second; third finger longest. Both inner and outer edges of fingers and toes with distinct dermal ridges. Finger and toe tips rounded; subarticular tubercles rounded or oval, conical, some having the appearance of two confluent tubercles. Toes webbed, webbing to tip or between tip and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle or between tip and distal subarticular tubercle on inner side and tip or between tip and distal subarticular tubercle on outer side of second toe; to distal subarticular tubercle on inner side and tip or between tip and distal subarticular tubercle on outer side of third toe; to penultimate subarticular tubercle or between penultimate and antepenultimate tubercle on inner side and between penultimate subarticular tubercle and antepenultimate subarticular tubercle on outer side of fourth toe; and tip or between tip and distal subarticular tubercle on inner side of fifth toe. Relative length of toes 1<2<5<3<4. Rounded and conical inner, and rounded outer metatarsal tubercle. Dorsum tubercular, with conical warts. Skin on dorsum, sides of head, snout and sides of both limbs bearing tubercles forming distinct clusters (warts); tubercles below and posterior to tympanum large, not cornified; venter granular. Male with subgular vocal sac. Nuptial pads not observed in any specimens.

Colour. Dorsal colour (in alcohol) greyish-brown with irregular black patches (Fig. 66); sides of head pale grey; broad pale-grey stripe extending from tym-

Figure 66. *Bufo atukoralei* (holotype), AMNH 74290.

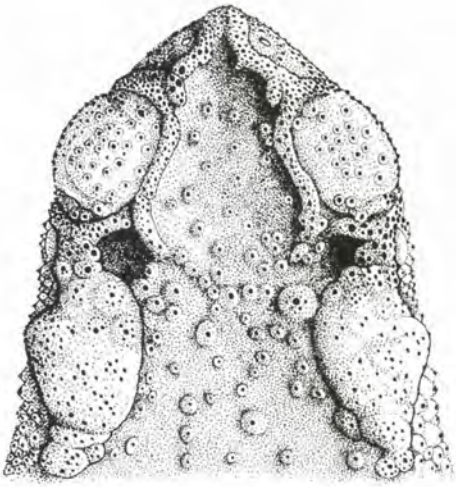

Figure 67. *Bufo atukoralei*, 30.5 mm SVL, WHT 617, dorsal aspect of head.

panum posteroventrally on to forearm. Venter white with black patches, darker in males than females. For colour in life, see Fig. 65.

Comments. *Bufo atukoralei* was previously confused with *B. fergusonii* because the two are superficially similar except for the rounded parotid gland and fewer

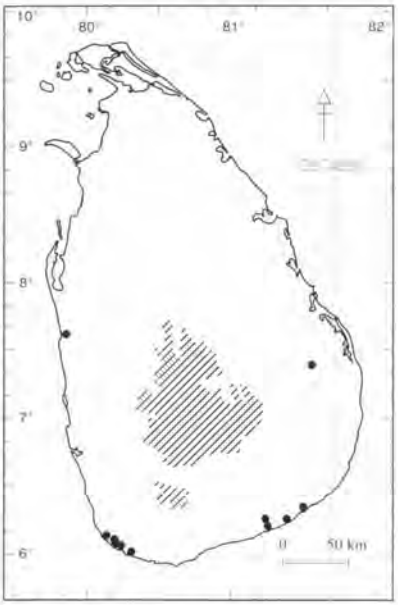

Figure 68. Distribution in Sri Lanka of *Bufo atukoralei*.

tubercles below it in *B. fergusonii*. As pointed out by Bogert and Senanayake (1966), *B. atukoralei* is restricted to a narrow belt along the southern coast of Sri Lanka (Fig. 68), whereas, *B. fergusonii* inhabits western, southern and eastern India, the Northern Province of Sri Lanka, and Analativu Island off the coast of Jaffna (northern Sri Lanka). These species are thus allopatric in Sri Lanka. De Silva (1955b) included specimens of both *B. fergusonii* and *B. atukoralei* in his study of *B. fergusonii;* some of these specimens were designated as paratypes of *B. atukoralei*. Kirtisinghe (1957) reported *B. fergusonii* from Batticaloa (Eastern Province) and Hambantota (Southern Province). We suspect that his specimens were in fact *B. atukoralei:* our collections suggest that *B. fergusonii* does not occur in those areas.

Distribution. Recorded from both the wet zone and the dry zones (which includes the arid zone) up to 150 m alt., especially the coastal belt in western and southern Sri Lanka (Fig. 68). A single specimen collected from a ditch at Giritale reported by I. Das (pers. comm.). Species endemic to Sri Lanka.

Etymology. The species name commemorates Victor Atukorale, a Sri Lankan naturalist, collector and artist.

Material examined

Chilaw: MCZ 20844; Galle, Southern Province: AMNH 75296-97 (paratypes); Hikkaduwa: AMNH 75298-301; Inginiyagala: CM 83551; Yala, Southern Province: AMNH 74290 (holotype); WHT617, 30.7 mm, 30.5 mm, 24.9 mm, Weligatta (Bundala, alt. 5 m); WHT1119, 23.5 mm, Navinna (Galle, alt. 15 m); WHT1142, 34.9 mm, Rumassala (Galle, alt. 5 m); NMSL, (uncatalogued), 23.4 mm, 15.8 mm, 15.0 mm, 12.7 mm, 11.9 mm, Wirawila, alt. 40 m; WHT1221, 25.7 mm, WHT1223, 26.5 mm, Hapugala (Galle), alt. 15 m; WHT1305, 14.6 mm, Palatupana (Kirinda, alt. 5 m).

Bufo fergusonii
Figs. 69-71

Bufo fergusonii Boulenger, 1892: Journal of the Bombay Natural History Society, 7: 317-318, pl. 1 (Holotype: BMNH 1947.2.21.17, from "Trivandrum (Kerala), on the cavalry parade ground", India).

Diagnosis. See diagnosis of *Bufo atukorali*.

Description. Snout-vent length of mature males 21.9-29.9 mm, gravid females 24.2-36.0 mm. Head broader than long. Snout obtusely pointed. Nostrils nearer to tip of snout than to orbit. Canthus rostralis angular. Canthal, preorbital, supraorbital, postorbital, supratympanic, and parietal ridges present, supratympanic ridges confluent with anterior end of parotid gland (Fig. 69). Loreal region oblique, concave. Tympanum rounded, its diameter equal to or less than that of horizontal diameter of orbit. Parotid glands rounded, with spinous tubercles below. Fingers free, first finger subequal to second; fourth longer than first and second; third finger longest. Tips of digits rounded. Subarticular tubercles rounded or oval, conical, some having the appearance of two confluent tubercles. Toes webbed; webbing to tip or between tip and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle or between tip and distal subarticular tubercle on inner side and tip or between tip and distal subarticular tubercle on outer side of second toe; to distal subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle on inner side and tip or distal subarticular tubercle (or between them) on outer side of third toe; to penultimate subarticular tubercle or between penultimate subarticular tubercle and antepenultimate subarticular tubercle on inner side and between penultimate subarticular tu-

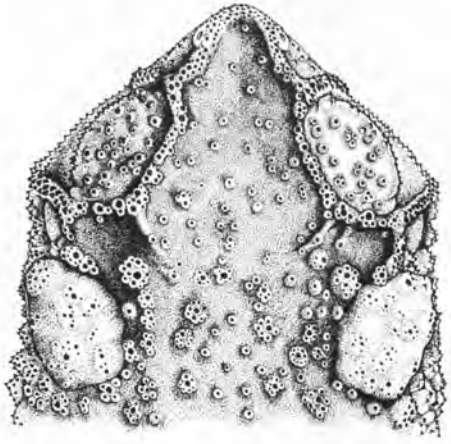

Figure 69. *Bufo fergusonii*, 36.0 mm SVL, WHT 1071, dorsal aspect of head.

Figure 70. *Bufo fergusonii*, AMNH 176342, dorsal aspect.

Figure 71. *Bufo fergusonii*, not preserved, from Giritale, Sri Lanka (photo: ID).

bercle and antepenultimate subarticular tubercle on outer side of fourth toe; and to tip or between tip and distal subarticular tubercle on inner side of fifth toe. Relative length of toes 1<2<3<5<4. Two metatarsal tubercles, the inner one oval, conical and more elevated when viewed laterally; the outer one rounded. Dorsum with numerous small spinous tubercles; smaller tubercles

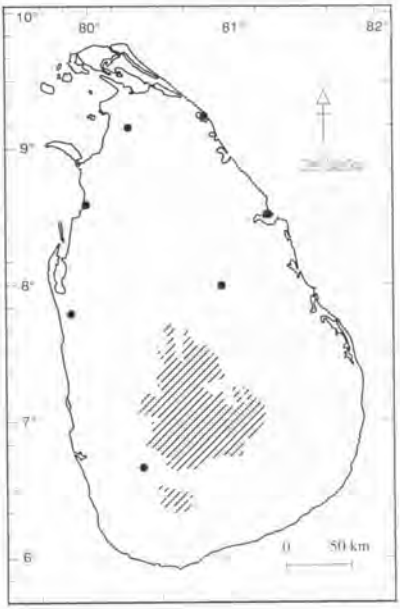

Figure 72. Distribution in Sri Lanka of *Bufo fergusonii*.

on venter; spinous tubercles on sides of head; enlarged whitish tubercles below tympanum and laterally on dorsum. Numerous small tubercles on ventral side of toes and on tarsus. Male with subgular vocal sac.

Colour. Dorsal colour (in alcohol) grey with a whitish band between eyes (Fig. 70); light patch behind parotid glands; rest of dorsum with dark patches; venter with or without black patches; parotid glands whitish-yellow to brown. Limbs with black bands. Dark reddish (in life) band from below base of parotid to groin on each side (Fig. 71); throat, chest and belly bright yellow with blackish markings; females with bright yellow bands below parotids, lacking black markings on throat, chest and belly; dorsum with light and dark brown patches.

Distribution. See Fig. 72. A single specimens was recorded from Puttalam, from among the marginal grass of a reservoir; several records from northern Sri Lanka.

Comments. Although *Bufo fergusonii* is superficially similar to *B. atukoralei*, it is easily distinguished by its rounded parotid glands. Descriptions of *B. fergusonii* given by De Silva (1955a) and Kirtisinghe (1957) are based on specimens of both *B. atukoralei* and *B. fergusonii* (see account of *B. atukoralei*).

Etymology. The species name is an eponym honouring William Ferguson (1820-1887), a British surveyor who lived almost his entire adult life in Sri Lanka (1839-1887). Ferguson is commemorated by the genus name *Fergusonia* Hoffmann, 1878, and several species group names (see index).

Material examined
No specific locality: CAS 85271; Marichchukkaddi: CM 67834; North Central Province: FMNH 172820; Trincomalee: FMNH 122054-78, 176341-42, 196119; WHT1071, 36.0 mm, Siyambalakotuwa Wewa, Kiriyankali (near Mundel, alt. 20 m); NMSL AB 5 (a), 10 ex., 25.8-38.5 mm, Mullattivu, alt. 1 m; NMSL AB 5 (b), 30.3 mm, Tunukkai, alt. 30 m; 32.0 mm, Elapata, alt. 48 m.

Bufo kelaartii
Figs. 73-74

Bufo kelaartii Günther, 1858 (publ. 1859): 140, pl. 10, Fig. A (syntypes: BMNH 1947.1.20.58-62, from "Ceylon").

Adenomus badioflavus Cope, 1860: Proceedings of the Academy of Natural Science of Philadelphia, 1860: 371 (holotype, ANSP 2720; not examined). Synonymized by Nieden, 1923.

Bufo kandianus Günther, 1872: Annals and Magazine of Natural History, (4)9: 87 (types: BMNH, from "Ceylon"; not examined). Synonymized by Nieden, 1923.

Diagnosis. *Bufo kelaartii* is readily distinguished from all other Sri Lankan *Bufo* except *B. stomaticus* by the absence of bony ridges on the head; it is distinguished from *B. stomaticus* by having the first finger shorter than the second (vs. first finger longer than second in *B. stomaticus*).

Description. Snout-vent length of mature males 25.1-31.2 mm, gravid females 34.0-50.0 mm. Head width more or less equal to its length. Snout obtusely

Figure 73. *Bufo kelaartii*, 42.4 mm SVL, WHT 247 (photo: SL).

pointed. Nostrils nearer to tip of snout than to eye. Canthus rostralis distinct, angular. Loreal region concave. Without bony ridges. Tympanum small, distinct, rounded or vertically oval, its horizontal diameter less than one-third that of orbit. Parotid glands narrow and elongate. Fingers free; first finger shorter than second; second shorter than fourth; third finger longest. One palmar tubercle. Tip of digits rounded. Subarticular tubercles rounded or oval, conical and some having the appearance of two confluent tubercles. Toes webbed; to tip on outer side of first toe; to tip on both sides of second toe; to distal subarticular tubercle on inner side and to tip on outer side of third toe; to penultimate subarticular tubercle on both sides of fourth toe; and to disc on inner side of fifth toe. Ventral side of hands and feet with blunter and fewer tubercles than are present in other Sri Lankan *Bufo*. Relative length of toes 1<2<3<5<4. Two oval metatarsal tubercles. Tarsal ridge present. Dorsum with small, rounded and sometimes spinous tubercles. Outer side of limbs tubercular; venter granular. Male with more webbing between toes (than females), subgular vocal sac and nuptial pad on inner and dorsal sides of first finger.

Colour. Dorsal colour (in life) light to deep brown (Fig. 73); a black or dark brown interorbital bar sometimes present; transverse black bars on forearm; a chevron-shaped patch on dorsum posteriorly, which continues to thigh, shank and tarsus. Limbs with cross bars. Venter spotted with white and brown. For colour markings in alcohol, see Fig. 74.

Note. Blair (1972) noted: "*Bufo kelaarti* Günther is a peculiar species questionably assigned to this genus," [i.e. *Bufo*]. Although he mentions that the relationship of *Bufo kelaarti* to *Bufo* would be the subject of a separate paper, we have been unable to trace such a publication.

Figure 74. *Bufo kelaartii*, MCZ 8197, dorsal aspect.

Figure 75. Distribution of *Bufo kelaartii*.

Distribution. This semi-arboreal species was recorded only from wet zone, especially the mid-hills in western, southern and central Sri Lanka up to elevations of about 1700 m (Fig. 75). Some specimens were collected from the top of a palm tree (*Caryota urens*) about 15 m above ground level. Species endemic to Sri Lanka.

Etymology. Named for Edward Frederick Kelaart (1819-1860), the 19th century Sri Lankan naturalist.

Material examined

No specific locality: CAS 85272, FMNH 1580 (2), 176343, MCZ 1323, NHMB 1727-35, 1737-42, 1747, 1749-50, 1764-68, 1770-71, UMMZ 64325 (2), USNM 57629-30; Kitulgala, Sabaragamuwa Province: AMNH 74230-31; Labukelle: CM 67532-39; Laxapana: AMNH 76987, 77465; Nuwara-Eliya: BMNH 90.11.864, MCZ 3490, 8197, NHMB 1626, 1629, 1632; WHT1065, 4 ex., 18.0-30.2 mm, WHT446, 19.4 mm, WHT1067, 2 ex., 16.0-16.4 mm, WHT247, 9 ex., 25.1-42.4 mm, WHT1219, 13 ex., 18.5-46.8 mm, Koskulana (near Panapola, alt. 460 m); WHT1066, 2 ex., 26.5-28.7 mm, Mederipitiya (near Deniyaya, alt. 365 m); WHT268, 46.2 mm, WHT597, 2 ex., 18.6-19.6 mm, Batadombalene (Kuruwita, alt. 460 m); WHT455, 28.8 mm, Walandure (Kuruwita, alt. 150 m); WHT1069, 34.4 mm, Palabaddale (Ratnapura, alt. 335 m); WHT1070, 9 ex., 13.1-21.8 mm, WHT654, 21.0 mm. Induruwa (Ratnapura, alt. 150 m); WHT1073, 28.4 mm, Kanneliya (Galle, alt. 150 m); WHT1075, 2 ex., 10.9-17.9 mm, Kabaragala near Rakwana, alt. 760 m; WHT1112, 48.8 mm, Silvakanda (Deniyaya, alt. 760 m); NMSL AB 1 (a), 8 ex., 27.6-41.2 mm, Ratnapura, alt. 30 m; 26.8 mm, Hunuwala (near Opanake), alt. 150 m; WHT1220, 5 ex., 30.3-50.0 mm, Haycock, (Hiniduma, Galle), alt. 660 m; WHT1237, 17.9 mm, Parawalatenna (Kitulgala, alt. 150 m); WHT1309, 19.2 mm, Landuyaya, alt. 1230 m.

Bufo melanostictus
Figs. 76-77

Bufo melanostictus Schneider, 1799: 216 (type: not traced, from "India orientalis").

Diagnosis. *Bufo melanostictus* is distinguished from all the other *Bufo* species of Sri Lanka except *B. microtympanum* by a combination of the following characters: parietal ridges absent; tympanum large, distinct, its diameter equal to one third or more of orbit diameter (Fig. 76). It is distinguished from *B. microtympanum* by having the tympanum diameter equal to or greater than one-third of orbit diameter (vs. tympanum diameter less than one-third of orbit diameter).

Description. Snout-vent length of mature males 50.3-90.0 mm, gravid females 70.0-95.0 mm. Head broader than long. Snout obtuse. Distinct ridges on head. Interorbital space concave. Nostril nearer to tip of snout than to eye. Canthus rostralis angular; loreal region concave. Head with canthal; preorbital, supraorbital, postorbital and supratympanic ridges also present. Supratympanic ridges confluent with anterior end of parotid gland. Tympanum vertically oval, close to posterior border of eye. Parotid glands kidney shaped, elongate, swollen. Dorsum and border of lower jaw and chin with numerous spinous tubercles. Some specimens with two longitudinal rows of large warts mid-dorsally, and smaller ones laterally. Venter distinctly granular. Small tubercles on outer sides of limbs; no tubercles on head in specimens larger than 60.4 mm SVL (juveniles have tubercles on head). Fingers free; first finger subequal to second; fourth finger longer than first and second; third finger longest. Outer palmar tubercle larger than the inner. Tips of digits rounded. Subarticular tubercles rounded or oval, conical and some having the appearance of two confluent tubercles. Both edges of finger and toe tips with distinct dermal ridges. Toes webbed; to between distal subarticular tubercle

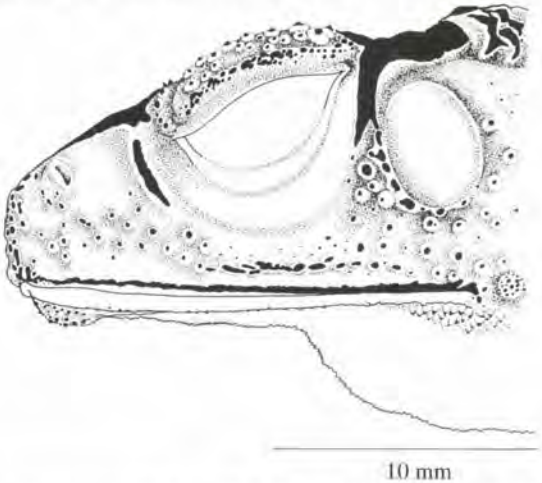

Figure 76. *Bufo melanostictus*, 51.9 mm SVL, WHT 91, lateral aspect of head.

Figure 77. *Bufo melanostictus*, 71.1 mm SVL, WHT 1063 (photo: SL).

and tip on outer side of first toe; to distal subarticular tubercle on inner side and between distal subarticular tubercle and tip on outer side of second toe; to penultimate subarticular tubercle on inner side and distal subarticular tubercle on outer side of third toe; to between penultimate subarticular tubercle and antepenultimate subarticular tubercle on both sides of fourth toe; and distal subarticular tubercle or between distal subarticular tubercle and tip on inner side of fifth toe. Relative length of toes 1<2<5<3<4. Tarsal ridge present. Inner metatarsal tubercle oval, conical, elevated when viewed laterally; outer metatarsal tubercle rounded or oval. Males with subgular vocal sac; nuptial pad on inner and dorsal sides on first finger (rarely on both first and second fingers).

Colour. Dorsal colour (in life) variable, olive, brown or brick red (Fig. 77); cranial ridges and warts black; venter whitish-brown, with brown spots on throat in some specimens; throat of mature males chestnut.

Distribution. Entirely terrestrial. *Bufo melanostictus* is the most widely distributed amphibian in Sri Lanka and occurs up to elevations of about 1700 (Fig. 78). It was often found close to human habitation, but was not recorded from undisturbed forests.

Etymology. Melano-, Greek, = black; stictos, Greek, = spotted.

Material examined

No specific locality: CAS 16936, CAS-SU 2649-50, 16917-21; Bandarawela, Uva Province: CM 67729; Bogawantalawa: UMMZ 61080, USNM 67890-95; Central Province: AMNH 74228; Chilaw: MCZ 20844; Colombo: MCZ 20841-43; Deniyaya, Southern Province: CM 67839-41; Ella, Uva Province: CM 67667-68; Gampola, Central Province: CM 67836; Harasbedda, Central Province: CM 67726-28; Kanneliya, Southern Province: AMNH 78917-23; Kitugala: AMNH 74232-33; Kottawa, Southern Province: AMNH 80084-85; Kudawa. Sabaragamuwa Province: CM 67725; Kuruwita, Sabaragamuwa Province: CM

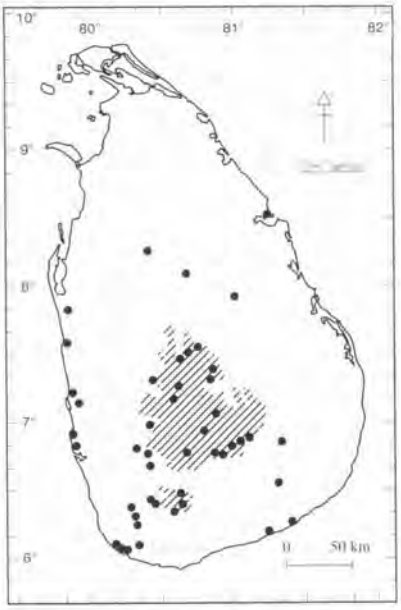

Figure 78. Distribution in Sri Lanka of *Bufo melanostictus*.

67835; Mapakada, Uva Province: 67715-24; Mt. Lavinia, Western Province: CM 67540-44; Nawadamkulama: CM 67670-71, 89517-19; Negombo, Western Province: CAS 154288; Peradeniya: USNM 20295, 120296; Pingarawa, Uva Province: CM 67669; Rakwana: CM 89470, 89487-88; Ratnapura, Sabaragamuwa Province: CM 67837; Rattota, Central Province: USNM 120297-308; Trincomalee: FMNH 98095, 123271-78; Udugama, Kandy District: CM 89937; WHT1103, 16.0 mm, Nuwara Eliya, alt. 1710 m; WHT1104, 56.9 mm, WHT95, 3 ex., 56.1-71.0 mm, WHT100, 3 ex., 55.1-73.3 mm, WHT1063, 6 ex., 36.9-71.1 mm, WHT97, 3 ex., 65.0-66.2 mm, WHT91, 3 ex., 35.0-51.9 mm, WHT93, 3 ex., 58.1-66.4 mm, WHT92, 3 ex., 47.0-63.0 mm, Laggala (Knuckles), alt. 1220 m; WHT1106, 4 ex., 36.1-49.1 mm, Matale, alt. 335 m; WHT1052, 2 ex., 42.8-67.8 mm, Moneragala, alt. 150 m; WHT1053, 33.3 mm, WHT1056, 22.6 mm, WHT1057, 2 ex., 34.6-47.0 mm, Navinna (Galle, alt. 15 m); WHT1058, 5 ex., 20.3-38.6 mm, Negombo, alt, 2 m; WHT1059, 61.3 mm, Morningside (near Rakwana), alt. 1060 m; WHT1110, 2 ex., 50.3-54.3 mm, Kanneliya (Galle, alt. 150 m); WHT1060, 2 ex., 42.5-55.2 mm, Mimure (near Corbets Gap, Kunckles), alt. 460 m; WHT1107, 33.1 mm, Rumassala (Galle, alt. 5 m); WHT1061, 44.6 mm, Waitalawa near Urugala (Knuckles, alt. 915 m); WHT1062, 69.1 mm, Palatupana (Kirinda, alt. 5 m); WHT1111, 32.5 mm, Wakwella (Galle, alt. 30 m); WHT1064, 41.6 mm, Berragalla, alt. 1220 mm, WHT1068, 2 ex., 14.9-20.0 mm, Koskulana (near Panapola, alt. 460 m); WHT1072, 3 ex., 50.8-66.2 mm, Pussella Estate (Parakaduwa, alt. 60 m); WHT1074, 46.5 mm, Galge (between Kataragama and Buttala, alt. 90 m); WHT1076, 51.8 mm, WHT435, 11 ex., 20.3-57.7 mm, Ritigala, alt. 460 m; WHT1078, 32.1 mm, Hidogama (Anuradhapura, alt. 90 m); WHT464, 3 ex., 52.3-60.4 mm, Kotmale, alt. 915 m; WHT642, 2 ex., 39.0-40.1 mm, Weralugahamulla (near Rakwana), alt. 305 m; WHT207, 79.8 mm, Weligatta (Bundala, alt. 5 m); WHT201, 55.7 mm, Lihinigala-Yattapatha (Moragala near Agalawatta, alt. 150 m); WHT1218, 5 ex., 17.5-51.8 mm, Peradeniya, alt. 460 m; WHT1225, 61.6 mm, Polonnaruwa, alt. 55 m; WHT1236, 2 ex., 39.0-47.1 mm, Parawalatenna (Kitulgala, alt. 150 m); WHT1224, 4 ex., 21.8-29.4 mm, Opata (Kotugoda, alt. 6 m); WHT1260, 2 ex., 50.0-50.9 mm, Kottawa (Galle, alt. 60 m); WHT1265, 24.6 mm, Hiniduma (Galle), alt. 150 m; WHT1298, 20.5 mm, Kodagoda (Imaduwa, Galle), alt. 45 m.

Bufo microtympanum
Figure 79-80

Bufo microtympanum Boulenger, 1882: 307, pl. XXII, Fig. 1 (syntypes: BMNH 74.429.1146 57, from "Malabar", India).

Diagnosis. *Bufo microtympanum* is similar to *B. melanostictus*, but is distinguished by its very small tympanum (Fig. 79), the diameter of which is less than one-third the orbit diameter, partially hidden by a fold of skin at the posterior border (vs. more than one third orbit diameter; not partially hidden).

Description. Snout-vent length of mature male 45.2 mm. Head broader than long. Canthal, preorbital, supraorbital, postorbital and supratympanic ridges present. Supratympanic ridges confluent with anterior end of parotid gland. Tympanum small (Fig. 79). Parotid glands kidney-shaped, swollen. Fingers free; first finger longer than second and fourth; second finger shorter than fourth; third finger longest. Outer palmar tubercle larger than the inner. Tips of digits rounded. Subarticular tubercles rounded or oval, conical and some having the appearance of two confluent tubercles. Both fingers and toes with distinct dermal ridges on their edges. Toes webbed; webbing to between distal subarticular tubercle and tip on outer side of first toe; to distal subarticular tubercle on inner side and between distal subarticular tubercle and tip on outer side of second toe; to penultimate subarticular tubercle on inner side and distal subarticular tubercle on outer side of third toe; between penultimate subarticular tubercle and antepenultimate subarticular tubercle on both sides of fourth toe; and distal subarticular tubercle on inner side of fifth toe. Relative length of toes 1<2<5<3<4. Inner metatarsal tubercle oval, more elevated; outer metatarsal tubercle oval and conical. Tarsal ridge present. Dorsum tuberculated with spinous warts. Some specimens with two rows of large warts on dorsum. No warts on head (but some specimens, 35.8 mm to 45.2 mm SL (4

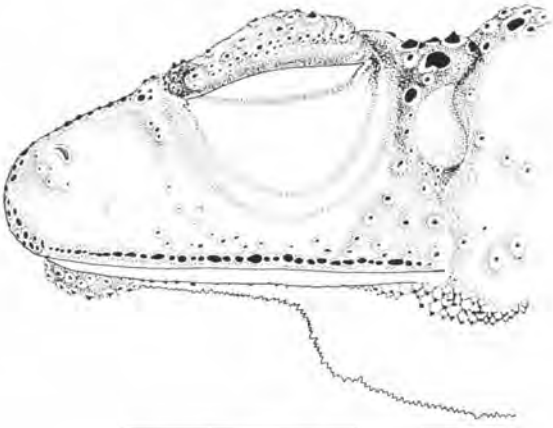

Figure 79. *Bufo microtympanum*, 37.2 mm SVL, WHT 1079, lateral aspect of head.

Figure 80. *Bufo microtympanum*, not preserved, from Giritale, Sri Lanka (photo: ID).

Figure 81. Distribution in Sri Lanka of *Bufo microtympanum*.

ex.), with very small tubercles). Dorsal surface of limbs with numerous warts. Venter distinctly granular.

Colour. Dorsal colour (in alcohol) brown; venter yellowish-white with brown spots and marbling. Some specimens with a black interorbital bar. For colours in life, see Fig. 80.

Distribution. This species is distributed in southern and central Sri Lanka up to about 1320 m (Fig. 81). It occurs close to human habitation, but has not been recorded from undisturbed forests.

Etymology. Micro-, Greek, = small; a reference to the small tympanum of this species.

Material examined
WHT1079, 37.2 mm, Laggala (Knuckles), alt. 1220 m; WHT1105, 43.3 mm, Lakegala (Knuckles), alt. 1318 m; WHT1108, 35.8 mm, Rumassala (Galle, alt. 5 m); WHT1109, 45.2 mm, Kanneliya (Galle, alt. 150 m); WHT1222, 29.5 mm, Hapugala (Galle), alt. 15 m; WHT1286, 35.7 mm, Bambarakanda, Kalupahana (near Belihul Oya, alt. 1070 m).

Bufo stomaticus
Figure 82-83

Bufo stomaticus Lütken, 1862: Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i Kjøbenhavn, 1862: 305 (type: not traced, from "Assam", India).

Diagnosis. See diagnosis of *B. kelaartii*.

Description. Maximum snout-vent length 63.0 mm. Head broader than long. Snout obtuse. Canthus rostralis angular. Loreal region oblique, concave. Head without bony ridges. Interorbital space concave. Tympanum distinct, vertically oval, close to posterior border of eye. Parotid glands kidney-shaped, swollen, about three times as long and as broad. Fingers free, first finger longer than second; small inner and larger outer palmar tubercles. Subarticular tubercles on fingers and toes small, tips of digits rounded. Webbing to base of terminal phalanx of first, second, third, and fifth toes, to distal subarticular tubercle on fourth toe. Two small, rounded metatarsal tubercles. Tarsal ridge present. Dorsum tuberculated with flat tubercles and spiny warts. Male with subgular vocal sac and nuptial pads on dorsal surface of first and second fingers.

Colour. Dorsal colour (in alcohol) variable (Fig. 82); yellowish-green to olive green above with dark spots; venter white or spotted with white and brown. Figure 83 shows the colours of a living specimen of *B. stomaticus* from West Bengal.

Distribution. The only report of this species from the island is that by Kirtisinghe (1957), who collected three specimens from Mutwal, a coastal suburb north of Colombo, in 1932. Kirtisinghe (1957) suggested that the species may have been inadvertently transported to Sri Lanka from India by means of sailing vessels.

Etymology. The species name is derived from the Greek *stomatikos* (= "of the mouth"), probably a reference to the large mouth of this toad.

Material examined
Colombo: BMNH 1932.5.7.2-3; Ceylon: BMNH 1955.1.10.85.

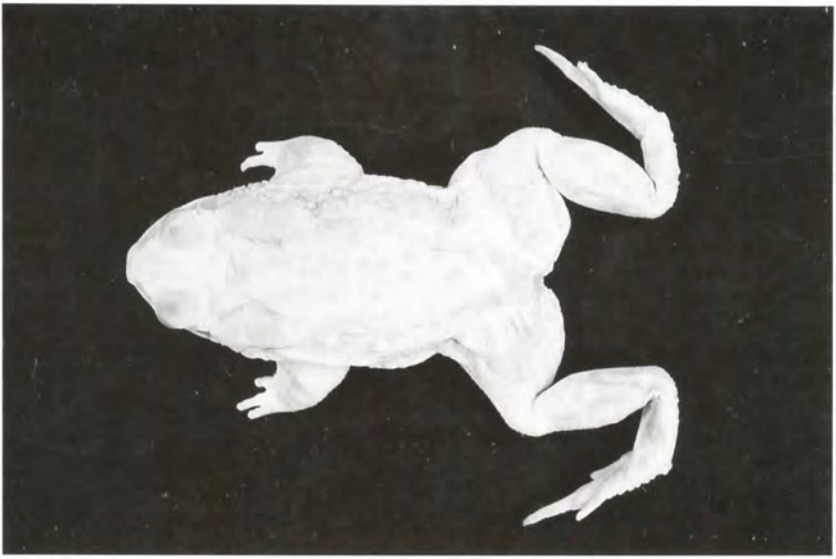

Figure 82. *Bufo stomaticus,* BMNH 1955.1.10.85, dorsal aspect.

Figure 83. *Bufo stomaticus,* not preserved, from Bengal, India.

Bufo kotagamai
Figures 84-86

Bufo kotagamai Fernando, Dayawansa and Siriwardhane, 1994: Journal of South Asian natural History, 1(1): 119-124 (holotype: USNM 311595 H, from Sinharaja World Heritage Site, Sri Lanka (missing?—I. Das, pers. comm.)).

Diagnosis. *Bufo kotagamai* is distinguished from all other *Bufo* known from Sri Lanka by the combination of following characters: prominent, smooth, inwardly-curved parietal ridges (Fig. 84); first finger slightly longer than the second; and long, narrow, unlobulated parotid glands.

Description. Snout-vent length of mature males 33.1-40.3 mm, females 55.5-62.7 mm. Head broader than long, depressed. Snout obtusely pointed when viewed dorsally and truncate when viewed laterally. Nostril nearer to tip of snout than to eye. Canthus rostralis angular, distinct. Canthal ridge extends from supraorbital crest to end of snout. Loreal region oblique, concave. Head with prominent supraorbital, supratympanic and parietal ridges, preorbital and postorbital ridges feebly defined. Supratympanic ridges confluent with anterior end of parotid gland. Interorbital space deeply concave, its width greater than upper eyelid width. Tympanum distinct, rounded or vertically oval, subequal to half diameter of the orbit. Parotid gland length about 2.8-3.3 times its width. Fingers free; first finger slightly longer than second; the fourth longer than first and second; third finger longest. The outer palmar tubercle larger than the inner. Both inner and outer edges of fingers and toes with feebly-defined dermal ridges. Finger and toe tips rounded; subarticular tubercles moderately developed, rounded or oval. Toes webbed, webbing to tip or between tip and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on inner side and tip or between tip and distal subarticular tubercle on outer side of second toe; to distal or penultimate subarticular tubercle (or between them) on inner side and tip or distal subarticular tubercle

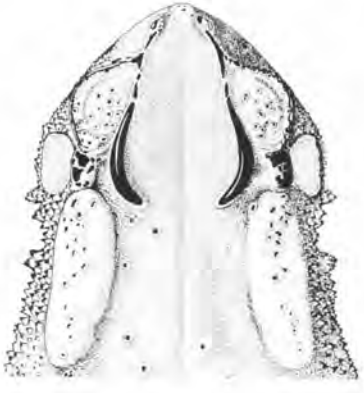

Figure 84. *Bufo kotagamai*, paratype (USNM), 62.7 mm SVL, dorsal aspect of head.

Figure 85. *Bufo kotagamai*, paratype (USNM), 62.7 mm SVL, dorsal aspect (photo: SL).

Figure 86. *Bufo kotagamai*, paratype (NMNH), 38.6 mm SVL (photo: RP).

on outer side of third toe; to penultimate or antepenultimate subarticular tubercle (or between them) on inner side and between penultimate subarticular tubercle and antepenultimate subarticular tubercle on outer side of fourth toe; and tip or distal subarticular tubercle on inner side of fifth toe. Relative length of toes 1<2<5<3<4. Inner metatarsal tubercle oval, subequal or distinctly larger than outer; outer metatarsal tubercle rounded or oval. Skin dry, covered with

Figure 87. Distribution in Sri Lanka of *Bufo kotagamai*.

small tubercles and spinous warts. Larger tubercles scattered on the upper eyelids, dorsum, edges of both lips and dorsally and ventrally on both limbs (Fig. 85). Outer edge of upper eyelid glandular. Ventral surface granular.

Colour. In life (Fig. 86), orange brown on dorsal surface, mottled with dark brown. A light cross band between the eyes. A distinct dark cross band on forearm, forefoot, tarsus and tibia. A less distinct cross bar on upper arm and femur. Lower jaw with alternate dark and light markings. Ventral surface whitish, mottled with dark brown, the mottling present in the form of a median dark band especially evident over the sternum. Supraorbital and parietal ridges, tips of digits and tips of spinous warts black. In specimens preserved in alcohol the dorsal colour tends to become duller and take on a greyish hue.

Distribution. Recorded only from wet zone, especially the mid-hills in western and southern Sri Lanka up to elevations of about 1070 m (Fig. 87). *Bufo kotagamai* has only been observed during the night and in close proximity to streams. It is usually seen on collections of leaf debris, sand banks, rocks on side of streams and on rocky stream banks. Species endemic to Sri Lanka.

Etymology. An eponym honouring Sarath W. Kotagama (1950-) a Sri Lankan zoologist.

Material examined

NMSL AB 6 (a), paratype, 40.3 mm, WHT481, 34.8 mm, Kitulgala Forest Reserve, 150 m; USNM 62.7 mm, WHT482, 55.5 mm, Massena Forest Reserve, alt. 1070 m; WHT483, 21.6 mm, Sinharaja Man and Biosphere Reserve, Hal Mandiya, alt. 460 m.

RANIDAE

Key to the Sri Lankan Ranidae

1. Tips of digits pointed or blunt, but not forming flat discs 2
   Tips of digits enlarged, rounded or with discs 9

2. Toes fully webbed (Fig. 106a) 4
   Toes not fully webbed (Figs. 97a and 154) 3

3. Fourth toe webbing to between penultimate subarticular tubercle and tip (Figs. 94a and 97a) 7
   Fourth toe webbing to between penultimate subarticular tubercle and antepenultimate subarticular tubercle (Figs. 116) 12

4. Skin of back with prominent longitudinal ridges 5
   Skin of back without prominent longitudinal ridges 6

5. Inner metatarsal tubercle shovel-shaped or crescentic, strongly compressed (Fig. 106b) ..... *Hoplobatrachus crassus*
   Inner metatarsal tubercle elongate, not strongly compressed, (Fig. 110) ..... *Hoplobatrachus tigerinus*

6. Gular area always smooth (Fig. 125) ..... *Euphlyctis cyanophlyctis*
   Gular area with distinct warts (Fig. 129) (rarely smooth in juveniles and subadults) ..... *Euphlyctis hexadactylus*

7. Skin of mid-back with interrupted longitudinal ridges or rounded tubercles (Fig. 101) ..... *Limnonectes limnocharis*
   Skin of mid-back with uninterrupted longitudinal ridges (Figs. 95 and 99) 8

8. A prominent cutaneous fringe along the inner side of first toe (Fig. 94a) ..... *Limnonectes greenii*
   No prominent cutaneous fringe along the inner side of first toe (Fig. 97a) ..... *Limnonectes kirtisinghei*

9. Tympanum indistinct; skin of back with numerous transverse folds (Fig. 91) ..... *Limnonectes corrugatus*
Tympanum distinct and prominent; skin of back without transverse folds 10

10. Tips of digits with comparatively small discs (Fig. 138); hind limbs with longitudinally dark stripes along the outer side of shank (Fig. 139) ..... *Rana gracilis*
Tips of digits with comparatively large discs (Figs. 134 and 142); hindlimbs with dark cross-bars (Fig. 143) 11

11. Webbing to disc on outer side and between distal subarticular tubercle and disc or to the disc itself on inner side of fourth toe (Fig. 142) ..... *Rana temporalis*
Webbing to distal or between penultimate and distal subarticular tubercle on outer side and penultimate subarticular tubercle (rarely distal subarticular tubercle) on inner side of fourth toe (Fig. 134) ..... *Rana aurantiaca*

12. Scattered white-tipped tubercles present or not present on upper surface of head, shoulders and limbs; inner metatarsal tubercle elongate, not compressed (Figs. 116 and 122) 14
No white-tipped tubercles on upper surface of head, shoulders and limbs; inner metatarsal tubercle elongate, compressed, shovel-shaped and with a sharp ridge (Fig. 154) 13

13. A tubercle at the tibio-tarsal articulation; snout rounded when viewed laterally (Fig. 152); no distal subarticular tubercle on first toe (Fig. 154) ..... *Tomopterna rolandae*
No tubercle at the tibio-tarsal articulation; snout truncate when viewed laterally (Fig. 145) and with a distal subarticular tubercle on first toe ..... *Tomopterna breviceps*

14. Snout truncate when viewed laterally (Fig. 114); mandible with serrated denticular processes in adults of both sexes ..... *Nannophrys ceylonensis*
Snout smoothly rounded or slightly truncate when viewed laterally; no serrated denticular processes on mandible 15

15. Snout smoothly rounded when viewed laterally (Fig. 121); prominent white-tipped tubercles, often conical, scattered over upper surfaces of the head ..... *Nannophrys marmorata*
Snout slightly truncate when viewed laterally; white-tipped tubercles absent (Fig.120) ..... *Nannophrys guentheri*

Limnonectes Fitzinger, 1843 (type species: *Rana kuhlii* Tschudi, 1838, by original designation). Elevated to rank of subgenus by Dubois (1987) and genus by Dubois (1992), to include about 60 species from Africa, southern and eastern Asia, although Emerson & Berrigan (1993) raised several objections. We follow Dubois here for reasons of consistency with other recent authors (e.g. de Silva, 1995; Das, 1996b).

Limnonectes corrugatus
Figures 88-91

Rana corrugata Peters, 1863: Monatsberichte der Preussischen Akademie der Wissenschaften zu Berlin, 1863: 412 (type: ZMB, from "Rambodde", Sri Lanka); placed in *Limnonectes* by Dubois (1987).

Diagnosis. *Limnonectes corrugatus* is distinguished from all other Sri Lankan Ranidae by having the dorsum of body with numerous transverse folds (vs. no such folds).

Description. Snout-vent length of mature male 35.5 mm; gravid females 37.1-71.3 mm. Head longer than broad. Snout short, subequal to diameter of orbit and rounded when viewed dorsally. Nostrils nearer to tip of snout than to eye. Canthus rostralis indistinct. Loreal region oblique. A pair of prominent, fang-like odontoid processes and a hard symphysial knob on anterior edge of mandible (Fig. 88). Upper jaw with finely-pointed teeth; vomerine teeth in two short oblique series on posterior level of choanae. Interorbital width greater than width of upper eyelid. Tympanum indistinct. Supratympanic fold present but not prominent, extending from the posterior corner of the orbit to little beyond the insertion of forelimb. Subarticular tubercles oval or rounded, conical and more elevated when viewed laterally. Fingers free or rudimentarily webbed, their tips rounded; first finger subequal to second; fourth longer than first and second; third finger longest. Distal subarticular tubercles on first and second fingers, and penultimate subarticular tubercles on third and fourth fingers more elevated when viewed laterally. Two or three palmar tubercles. Toes fully and broadly webbed, their tips enlarged and rounded but lacking a circum-

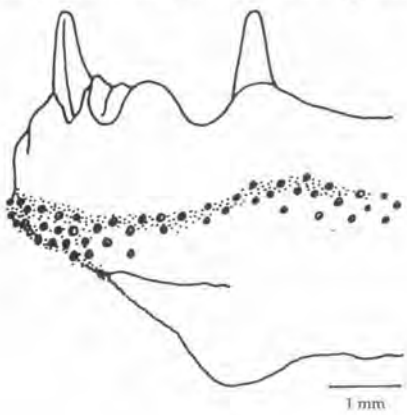

Figure 88. *Limnonectes corrugatus*, 62.0 mm SVL, WHT 785, anterolateral aspect of anterior margin of mandible.

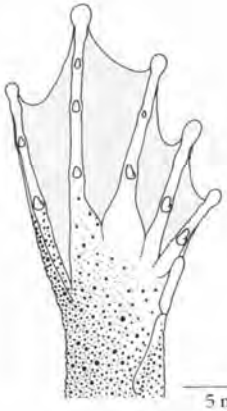

Figure 89. *Limnonectes corrugatus*, 44.5 mm SVL, WHT 853, ventral aspect of right foot.

marginal groove. Relative length of toes 1<2<5<3<4. Inner metatarsal tubercle narrow, elongate, prominent and elevated when viewed laterally; outer metatarsal tubercle absent. A prominent tarsal ridge continues from tibio-tarsal articulation to inner metatarsal tubercle. Cutaneous fringes on inner side of first toe and outer edge of fifth toe (Fig. 89). Throat granulated, belly and undersurfaces of thighs smooth. Small white-tipped tubercles on upper eyelids and also sides of the body between the limbs, around the vent and on both limbs. Male with two external vocal sacs.

Colour. In life (Fig. 90), dorsally brown or brownish orange with black blotches and spots. Interorbital with a yellow transverse band. Limbs with or without black crossbars. White or light brown below, mottled with brown (in some specimens), especially on throat and under legs. Prominent dark brown or black stripe between eye and forelimb. Some specimens have a white or yellowish-orange mid-vertebral band (Fig. 91).

Comments. Günther (1864), Jerdon (1870) and Ferguson (1877) confused *Limnonectes corrugatus* with the allopatric (south-eastern Asia) *Limnonectes kuhlii* (Tschudi, 1838). Annandale (1910) commented on the similarities between *L. corrugatus* from Sri Lanka and *Rana travancoria* from southern India.

Annandale (1917) provided descriptions of the tadpoles of *Limnonectes corrugatus*, but Kirtisinghe (1957) thought that these belong to *Euphlyctis cyanophlyctis*. The identity of the tadpoles of *L. corrugatus* therefore remains uncertain.

We examined a gravid female (snout-vent length 40.1 mm) containing 94 developed and approximately 50 developing eggs that are pigmented, with an average diameter of 2.1 mm.

Distribution. *Limnonectes corrugatus* is entirely aquatic and appears to be essentially a submontane species, being recorded between elevations of approximately 60-1525 m in the hills of western, southern and central Sri Lanka (Fig. 92). This frog was found in the margins of shaded, narrow, shallow, slow-flowing streams and also under grass tussocks in marshes. It was observed

Figure 90. *Limnonectes corrugatus*, 44.5 mm SVL, WHT 853.

Figure 91. *Limnonectes corrugatus*, 29.3 mm SVL, WHT 246 (photo: SL).

with only the tip of its snout and eyes exposed. It is distinguished also by its distinctive call, "Urrm...". Endemic to Sri Lanka.

Etymology. *Corrugatus*, Latin, = wrinkled, ridged.

Material examined

No specific locality: CAS 85273; FMNH 81229, MCZ 1335(2), NHMW 2543(3); Bogawantalawa, Central province: MCZ 15020, UNMZ 61072-73; Deniyaya, Southern

Figure 92. Distribution in Sri Lanka of *Limnonectes corrugatus*.

Province: CM 67960-63; Sinharaja. 1000-1200 ft.: AMNH 77474-78; Warakapola, 500 ft., Western Province: AMNH 74244-46; WHT854, 30.5 mm, Waitalawa near Urugala (Knuckles, alt. 915 m); WHT823, 26.3 mm, WHT246, 2 ex., 25.3-29.3 mm, WHT945, 38.0 mm, Koskulana (near Panapola, alt. 460 m); WHT826, 35.2 mm, Kabaragala near Rakwana, alt. 760 m; WHT613, 3 ex., 24.0-41.7 mm, WHT853, 44.5 mm, Tembiliyana (Awissawella, alt. 120 m); WHT603, 30.9 mm, WHT992, 38.0 mm, WHT1004, 34.5 mm, WHT1032, 37.8 mm, WHT1028, 2 ex., 25.3-30.3 mm, WHT1040, 10 ex., 15.5-31.7 mm, Kottawa (Galle, alt. 60 m); WHT655, 33.4 mm, WHT386, 37.4 mm, Batadombalene (Kuruwita, alt. 460 m); WHT816, 42.1 mm, Kalatuwawa (Labugama, alt. 150 m); WHT458, 23.1 mm, WHT875, 3 ex., 27.5-46.3 mm, Kanneliya (Galle, alt. 150 m); WHT810, 23.0 mm, Namunukula, Gonakelle (Palagolla, alt. 1370 m); WHT785, 28.4-62.0 mm, Linihela (Peak Wilderness, alt. 1070 m); WHT885, 18.2 mm, Ovilikanda (Matale, alt. 610 m); WHT912, 45.5 mm, Ambalamahena (Atweltota, alt. 150 m); WHT869, 23.7-29.9 mm, Moray Estate, Rajamally (near Mousakelle, alt. 1370 m); WHT860, 15.1 mm, Mederipitiya (near Deniyaya, alt. 365 m); WHT882, 34.1 mm, near Devonford Estate (between Bogawantalawa and Balangoda, alt. 1525 m); WHT984, 21.9 mm, Kudawa (near Weddagala, alt. 460 m); WHT1018, 4 ex., 17.4-25.8 mm, Morningside (near Rakwana), alt. 1060 m; WHT1231, 2 ex., 19.0-35.2 mm, Pupulagala, alt. 1375 m; WHT1264, 24.1 mm, Haycock (Hiniduma), alt. 660 m; WHT1274, 20.2 mm, Mahawalatenna (Balangoda), alt. 515 m; WHT1288, 47.1 mm, Panagula (between Tunmodera and Puwakpitiya), alt. 275 m; WHT1299, 2 ex., 35.4-37.8 mm, Yogama, alt. 120 m.

Limnonectes greenii
Figures 93-95

Rana greenii Boulenger, 1904a: Spolia Zeylanica, 2: 73-74 (syntypes: BMNH 60.3.19.1100; 53.3.31.38-39; 76.3.21.17;69.7.24.8-9; lectotype: MCZ 15361, from Pundulu Oya, Sri Lanka); referred to *Limnonectes* and the subgenus (of *Limnonectes*) *Fejervarya* Bolkay, 1915 (type species *Rana limnocharis* Gravenhorst, 1829, by subsequent designation of Dubois, 1981) by Dubois (1987).

Diagnosis. See diagnoses of *Limnonectes limnocharis* and *L. kirtisinghei*.

Description. Snout-vent length of mature males 30.3-41.8 mm, gravid females 32.5-49.8 mm. Head longer than broad. Snout obtusely pointed (Fig. 93). Nostrils nearly half way between tip of snout and eye or slightly closer to snout. Canthus rostralis indistinct and smooth. Loreal region oblique, concave. Internarial width more than interorbital width. Interorbital width less than width of upper eyelid. A hard symphysial knob on anterior edge of mandible. Upper jaw with finely-pointed teeth; vomerine teeth in two groups. Tympanum distinct, horizontally elongate or rounded, its horizontal diameter subequal to three fourths of orbit diameter. Supratympanic fold not prominent, extending from behind eye to base of forelimbs. Fingers rudimentarily webbed. First finger longer than second; fourth longer than first and second; third finger longest. Two or three palmar tubercles. Finger and toe tips rounded. Subarticular tubercles slightly conical, prominent on fingers. Toe webbing to between tip and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle or between distal subarticular tubercle and tip on inner side and between tip and distal subarticular tubercle on outer side of second toe; to distal subarticular tubercle on inner side and between distal subarticular tubercle and tip on outer side of third toe; to distal subarticular tubercle on inner side and distal or between distal subarticular tubercle and tip on outer side of fourth toe; and between distal subarticular tubercle and tip on inner side of fifth toe. Relative length of toes 1<2<3=5<4. Toes two, three and four with distinct dermal fringes on both sides, dermal fringe on first toe only on outer side; fifth toe with fringe only on inner side. Outer edge of fifth toe with well-developed cutaneous fringe. A prominent cutaneous fringe along the inner side of first toe (Fig. 94b). Inner metatarsal tubercle oval, slightly com-

Figure 93. *Limnonectes greenii*, lectotype, MCZ 15361 (photo: ID).

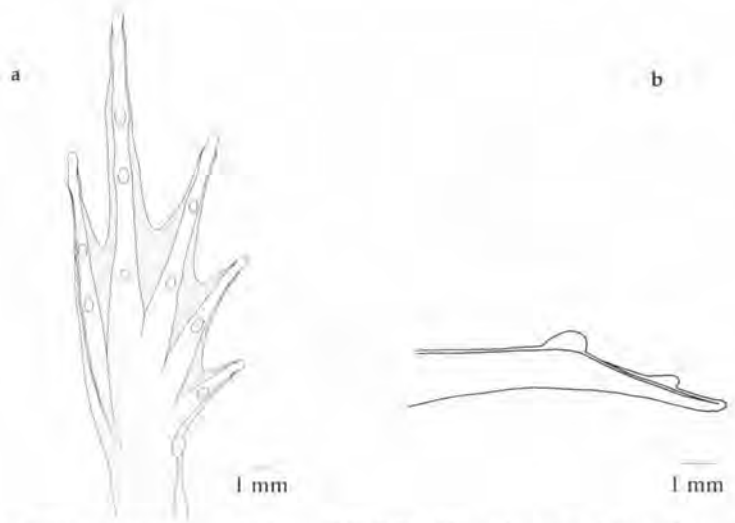

Figure 94. *Limnonectes greenii*, 38.3 mm SVL, WHT 437, right foot, (a) ventral aspect; (b) lateral aspect of first toe and inner metatarsal tubercle.

pressed laterally and more elevated than in *Limnonectes kirtisinghei*; a minute, oval, outer metatarsal tubercle at the commencement of the cutaneous fringe along the outer toe. The prominent tarsal ridge extends to the inner metatarsal tubercle (Fig. 94a). Dorsum with six to eight uninterrupted longitudinal ridges between posterior level of upper eyelid and cloaca. Sides with interrupted longitudinal ridges and small tubercles. Fine, pointed white-tipped tubercles scattered all over body. Rear of thighs, area around the vent and sides granular. Hind limbs with fine warts (more evident in mature males). Males with two external vocal sacs and a prominent nuptial pad on inner side of first finger, velvety in texture.

Colour. In life, olive green above, with dark spots (Fig. 95). A yellow mid-vertebral band. Upper lip with four indistinct vertical bars or spots, and lower jaw with or without dark olive spots. Dorsal side of limbs light olive with distinct cross-bars or blotches: lower arm with three or four, thigh with four to six, tibia with four to five, and tarsi and toes with seven to nine. Trailing edge of thighs marbled with brown. Belly whitish-yellow. Vocal sacs and throat speckled with grey. Dorsal skin with eight or fewer uninterrupted longitudinal ridges; sides with interrupted longitudinal ridges and small tubercles; hind limbs with fine warts. Dorsal colour (in alcohol) grey or reddish-brown with dark patches over; no "V", ">-<" or "W"-shaped patterns on dorsum; lips with distinct black and white bars; limbs distinctly cross-barred; inner side of thighs mottled with brown (not speckled); belly whitish-yellow.

Comments. We consider *Limnonectes greenii* part of the *L. limnocharis* complex. Annandale (1917) considered *L. greenii* to be a geographical race of *L. limnocharis*, and Boulenger (1920) and Kirtisinghe (1957) treated it as a sub-

Figure 95. *Limnonectes greenii*, not preserved, Hakgala, Sri Lanka (photo: ID).

species of *L. limnocharis*. Morphologically, *L. greenii* is similar to *L. limnocharis* but can be distinguished from it by its longer fingers and toes, less webbing between the toes, and uninterrupted longitudinal ridges on the dorsum. The tadpoles of *L. greenii* differ from those of *L. limnocharis* by having a darkly pigmented tail fin. Morgan-Davies (1958c) suspected some specimens of *L. limnocharis* with a heavily tuberculated dorsum to be hybrids between *L. limnocharis* and *L. greenii*.

Distribution. This montane species was recorded at elevations of approximately 1700-2135 m in the central hills (Fig. 96). Semi-aquatic. This frog was found in the margins of shallow, slow-flowing streams, and under grass tussocks in marshes and small water holes. In the Horton Plains, a large breeding aggregation of about 20-30 specimens was observed in March 1994. Endemic to Sri Lanka.

Juveniles of SVL 13.0-19.6 mm were observed on 19 March 1994 and of SVL 19.4-22.6 mm on 10 August 1995 at the Horton Plains and at Ohiya.

Etymology. We have been unable to establish the exact identity of the Green for whom this frog was named: Henry Frederick Green was a horticulturist born to English parents in Sri Lanka in 1868, and worked at the Royal Botanic Gardens at Kew in 1888-1890, and later in Bengal, India (Desmond, 1994).

Material examined

Pundalu Oya: MCZ 15361 (lectotype). WHT437, 13 ex., 13.0-39.1 mm, WHT976, 37.2 mm, 28.7 mm, Nagrak Division, Nonpareil Estate (adjoining Horton Plains, alt. 2135 m); WHT977, 2 ex., 19.4-22.6 mm, Ohiya (Railway Station), alt. 1800 m; WHT1026, 10 ex., 14.3-32.2 mm, WHT1129, 15 ex., 13.9-46.2 mm, 19.8 mm (tadpole), Hakgala (near Nuwara Eliya), alt. 1830 m; WHT1128, 37.5 mm, Nuwara Eliya, alt. 1710 m; WHT1258, 6 ex., 17.5-37.7 mm, Pattipola, alt. 1890 m.

Figure 96. Distribution in Sri Lanka of *Limnonectes greenii*.

Limnonectes kirtisinghei
Figures 97-99

Limnonectes kirtisinghei Manamendra-Arachchi & Gabadage, 1996: Journal of South Asian natural History, 2(1): 31-42 (holotype, AMS R 148272, "Moray Estate, Rajamally, near Mousakelle," Sri Lanka).

Diagnosis. *Limnonectes kirtisinghei* is distinguished from *L. limnocharis* by the presence of interrupted dorsal ridges (vs. uninterrupted dorsal ridges in *L. limnocharis*) and from *L. greenii*, which it resembles closely, by the absence of prominent cutaneous fringe along the inner side of first toe (Fig. 97a, 97b).

Description. Snout-vent length of mature males 25.9 to 39.1 mm, females 33.0 to 43.7 mm. Head longer than broad. Snout smoothly rounded in lateral view, slightly pointed in dorsal view. Eye to nostril distance subequal to nostril to snout-tip distance. Canthus rostralis indistinct and smooth; loreal region oblique and concave. Interorbital and internarial region flat. A hard symphysial knob on anterior edge of mandible. Upper jaw with finely-pointed teeth and vomerine teeth in two groups. Tympanum distinct, vertically elongate, its horizontal diameter 36.0-48.9% of orbit diameter. Supratympanic fold fleshy but not prominent, commencing from behind the posterior margin of the orbit and continuing over the tympanum, terminating a little beyond the insertion of the forelimb. Fingers with rudimentary webbing, the second to fourth with indistinct dermal fringes on both sides; fringe on first finger only on outer side. Subarticular tubercles on hand small, oval, the proximal tubercles larger than the distal tubercles, and on toes large and oval. Three palmar tubercles (Fig. 98). Finger and toe tips rounded. Relative length of fingers, 2<1<4<3; toes, 1<2<5<3<4. Toe webbing to between tip and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on inner side and between

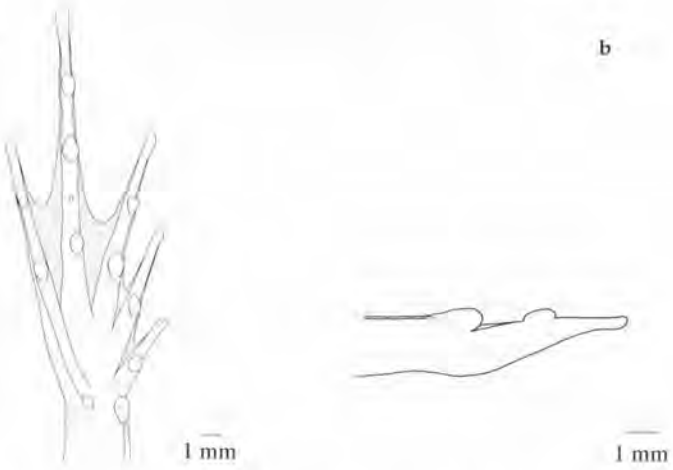

Figure 97. *Limnonectes kirtisinghei*, holotype, 32.3 mm SVL, AMS R 148272, right foot, (a) ventral aspect; (b) lateral aspect of first toe and inner metatarsal tubercle.

tip and distal subarticular tubercle on outer side of second toe; to penultimate or between penultimate and distal subarticular tubercle on inner side and distal or between distal subarticular tubercle and tip on outer side of third toe; to distal or penultimate subarticular tubercle on inner side and distal or between distal and penultimate subarticular tubercle on outer side of fourth toe; and to distal or between distal subarticular tubercle and tip on inner side of fifth toe. Outer edge of fifth toe with a feebly-defined cutaneous fringe. Second to fifth toes with distinct dermal fringes on both sides, the dermal fringe on first toe only on outer side. Outer metatarsal tubercle oval and smaller than the inner; the inner one oval, slightly compressed, not as elevated as in *L. greenii* when viewed laterally. Tarsal ridge extends to inner metatarsal tubercle (Fig. 97a, 97b). Dorsum with 4-10 discrete, uninterrupted longitudinal ridges (between posterior level of upper eyelid and cloaca), interrupted laterally, comprising oval and rounded tubercles. White-tipped tubercles scattered dorsally, around the cloaca and on limbs, more prominent in mature males. Hind side of thighs and around the vent granular or tuberculated. Males with two external vocal sacs. Mature males with a well developed, velvety nuptial pad on base and inner side of first finger.

Colour. In life, brown on dorsal surface with dark brown oval or rounded patches, with or without mid-vertebral band, bright chestnut to pale yellow (Fig. 99). Both lips with 4-5 wide dark brown bands or blotches. Supratympanic fold black. Dorsal surface of forelimb with 2-4, thigh with 4 or 5, tibia with 5 and tarsi with 4 dark brown bands or oval patches, hind side of lower arm with a dark band. Ventrally pale yellow. Throat, breast and under side of thigh and tibia with dark speckles in some specimens.

Distribution. *Limnonectes kirtisinghei* appears to be essentially a montane species, having been recorded between altitudes of approximately 150-1580 m in

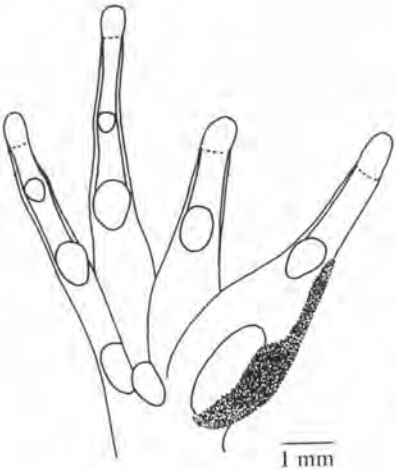

Figure 98. *Limnonectes kirtisinghei*, holotype, 32.3 mm SVL, AMS R 148272, ventral aspect of right hand.

the hills of western, southern, central (including the Knuckles Range) and eastern (including Moneragala) Sri Lanka (Fig. 100). This frog was found in the margins of shaded, narrow, shallow, slow-flowing streams, under grass tussocks in marshes, on leaf debris, sand banks and rocks on sides of streams, where it sometimes occurred in sympatry with the ranid frogs *Limnonectes corrugatus*, *Nannophrys ceylonensis* and *Rana temporalis*.

Comments. This species was formerly included in *L. greenii* sensu lato, and the former syntype series of *L. greenii* could include some specimens referable to *L. kirtisinghei*. This has been stabilized by the designation of MCZ 15361 as lectotype by Manamendra-Arachchi & Gabadage (1996).

Etymology. The species name commemorates Parakrama Kirtisinghe (1903-1981), a Sri Lankan zoologist and author of the book 'The Amphibia of Ceylon', published in 1957.

Material examined

32.6 mm, AMS R 148274 (paratype), 26.2 mm, AMS R 148275 (paratype), 40.4 mm, ZRC (paratype), 25.0 mm, WHT905, 15.4 mm, 31.7 mm, AMS R 148273 (paratype), 25.9 mm, ZRC (paratype), Koskulana (near Panapola, alt. 460 m); WHT794, 30.3 mm, WHT1117, 34.6 mm (paratype), 21 ex., 27.7-38.3 mm, Kumaradola Group (Moneragala, alt. 305 m); 30.2 mm, ZRC (paratype), Waitalawa near Urugala (Knuckles, alt. 915 m); WHT808 23.1 mm (paratype), Bambarakanda, Kalupahana (near Belihul Oya, alt. 1070 m); 40.8 mm, AMS R 148276 (paratype), Namunukula Group (near Passara, alt. 1370 m); WHT919, 2 ex., 14.9-20.4 mm (paratype), Silvakanda (Deniyaya, alt. 760 m); 32.3 mm, AMS R 148272 (holotype), WHT867, 24.3 mm, Moray Estate, Rajamally (near Mousakelle, alt. 1370 m); 40.7 mm, ZRC, Usgala, Ambagahakanda (near Maliboda), alt. 700 m; 37.0 mm, NMSL AR13(b) (paratype), WHT1015, 8 ex., 21.6-25.8 mm, Morningside (near Rakwana), alt. 1060 m; WHT1017, 16.2 mm (paratype), Bulutota, alt. 760 m; 39.8 mm, NMSL AR 13 (a) (paratype), WHT1050, 11ex., 27.2-39.5 mm, WHT1115, 30.0 mm, Laggala (Knuckles), alt. 1220 m; WHT1116, 2 ex., 28.2-32.5 mm (paratype), WHT1131, 5 ex., 19.5-42.6 mm,

Figure 99. *Limnonectes kirtisinghei*, holotype, 32.3 mm SVL, AMS R 148272.

Figure 100. Distribution in Sri Lanka of *Limnonectes kirtisinghei*.

Kanneliya (Galle), alt. 150 m; WHT1118, 41.8 mm (paratype), 4 ex., 11.4-13.2 mm (paratype), Kotagala, alt. 1220 m; WHT1126, 8 ex., 16.1-32.6 mm, 33.0 mm (paratype), Parawalatenna (Kitulgala, alt. 150 m); WHT1127, 39.1 mm (paratype), 7 ex., 33.1-35.6 mm, Ramboda, alt. 1310 m; WHT1130, 43.7 mm (paratype), 5 ex., 19.5-42.5 mm, Opata,

Kanneliya Forest (Galle), alt. 213 m; WHT1226, 4 ex., 24.3-34.2 mm, Hantane (Kandy), alt. 1140 m; WHT1229, 18.6-30.5 mm, Pupulagala, 1375 m; WHT1234, 23.9 mm, Landuyaya, alt. 1230 m; WHT1235, 3 ex., 27.8-32.0 mm, Matratenna (Balangoda), alt. 1525 m; WHT1245, 24.3 mm, Atgalla (Gampola), alt. 540 m; WHT1253, 6 ex., 14.8-41.6 mm, 13.9 mm (tadpole), Pallegama (Knuckles), 185 m; WHT1257, 2 ex., 30.0-30.4 mm, Galaha, Loolecondera Group (Deltota), alt. 1580 m; WHT1277, 14.0 mm, Mahawalatenna (Balangoda), alt. 515 m; WHT1282, 10 ex., 27.0-33.1 mm, Haputale, alt. 1525 m; WHT1290, 3 ex., 25.2-38.5 mm, Panagula (between Tunmodera and Puwakpitiya), alt. 275 m.

Limnonectes limnocharis
Figures 101-103

Rana limnocharis Boie, 1835: in Weigmann, Nova Acta Academiae Caesareae Leopoldino-Carolinae Germinicae Naturae Curiosorum, Halle, 17: 225 (type: not traced, from "Java"); placed in the subgenus *Fejervarya* by Dubois (1984).

Diagnosis. *Limnonectes limnocharis* is distinguished from *Euphlyctis cyanophlyctis*, *Limnonectes greenii* and *L. kirtisinghei* as follows: the toes of *E. cyanophlyctis* are fully webbed (vs. webbing to distal or between distal and penultimate subarticular tubercle on inner side and distal subarticular tubercle on outer side of fourth toe in *L. limnocharis*); both *L. greenii* and *L. kirtisinghei* have uninterrupted dorsal ridges (vs. interrupted dorsal ridges, or rounded or oval tubercles and small lateral tubercles in *L. limnocharis*).

Description. Snout-vent length of mature males 19.2-37.0 mm, gravid females 23.0-50.0 mm. Head longer than broad. Snout obtusely pointed. Nostril nearer to tip of snout than to eye. Canthus rostralis obtuse. Loreal region oblique, concave. Internarial width more than interorbital width. Interorbital width less than width of upper eyelid. A hard symphysial knob on anterior edge of mandible. Upper jaw with finely-pointed teeth; vomerine teeth in two groups. Tympanum distinct, rounded, its horizontal diameter subequal to three-fourths that of orbit. A supratympanic fold present, extending from behind eye to base of forelimb. Fingers free: first finger subequal to fourth; second shorter the first and fourth; third finger longest. Distal subarticular tubercles on first and second fingers; penultimate subarticular tubercles on third and fourth fingers larger and more elevated when viewed laterally. Conical and slightly oval subarticular tubercles on fingers. Three palmar tubercles. Fingers and toes with dermal fringes on both sides and tips obtusely pointed. Toe webbing to between tip and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on inner side and between tip and distal subarticular tubercle on outer side of second toe; to distal or between distal and penultimate subarticular tubercle on inner side and between distal subarticular tubercle and tip on outer side of third toe; to distal or between distal and penultimate subarticular tubercle on inner side and distal subarticular tubercle on outer side of fourth toe; and to between distal subarticular tubercular and tip on inner side of fifth toe. Relative length of toes 1<2<5<3<4 or 1<2<3=5<4. Subarticular tubercles on toes rounded or oval, smaller. Inner metatarsal tubercle oval, laterally compressed, more elevated when viewed laterally and more prominent than the outer one, which is smaller and rounded or slightly

Figure 101. *Limnonectes limnocharis*, 27.8 mm SVL, WHT 870.

Figure 102. *Limnonectes limnocharis*, (a) CM 89468, (b) CM 25331d (c) CM 25331: dorsal aspects.

Figure 103. *Limnonectes limnocharis*, 28.4 mm SVL, WHT 835, dorsal aspect.

oval. Tarsal ridge prominent, from inner metatarsal tubercle to almost the middle of the tarsi, its anterior extremity with a less-elevated oval tubercle. A cutaneous fold on outer side of fifth toe. White-tipped tubercles on dorsum, tibia, tarsi and around the vent. Ventrally smooth but hind surfaces of the thighs granular. Mature males with more prominent, conical tubercles dorsally. Males with two external vocal sacs and a prominent nuptial pad on inner side of first finger, velvety in texture.

Colour. In life, dorsally greenish or grayish-olive (Fig. 101). Interorbital with a dark brown V-shaped mark. A dark brown W-shaped marking extends from interorbital along the back, up to the vent. Lips with four or five vertical bars. Limbs with complete or (more often) incomplete cross-bars. Back of thighs marbled with black. Some specimens with a light yellow mid-vertebral stripe (usually narrow or very thin (Fig. 102), rarely broad (Fig. 103) extending from the snout, along the dorsum, to the vent. Rarely, some specimens with dark patches (subequal to eye) scattered all over the dorsal side, with bright red patches on the dorsum. Throat of mature males grayish-black or dark brown. Underside uniformly whitish or pale yellowish-white.

Comments. *Limnonectes limnocharis* is widely distributed throughout the island. Some variations are observed, although we do not wish here to attach any taxonomic significance to these: examples examined by us are with or without a mid-vertebral band from the tip of the snout to the vent; where the mid-vertebral band is present, it is either narrow or broad. Morphologically, the specimens with a wide stripe are similar to *Limnonectes pierrei* (Dubois, 1975), a species in the *L. limnocharis* complex from Nepal. This wide-striped "form" also is common throughout India. There is considerable variation in

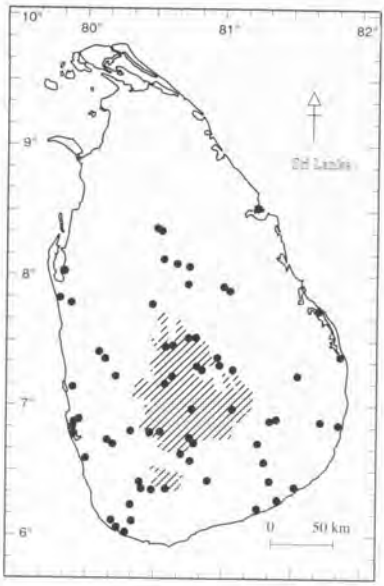

Figure 104. Distribution in Sri Lanka of *Limnonectes limnocharis*.

the amount of dorsal tuberculation in specimens from Sri Lanka. Morgan-Davies (1958) suspected some specimens of *L. limnocharis* with heavily tuberculated dorsums to be hybrids of *L. limnocharis* and *L. greenii*. Further field studies on the *L. limnocharis* complex in Sri Lanka are necessary before the systematic status of these morphs can be established.

Distribution. Occurs throughout Sri Lanka in both the dry and wet zones up to 1380 m (Fig. 104). Abundant in the vicinity of water bodies but apparently absent in undisturbed rain forests. This semi-aquatic species usually hides in damp places during the day and emerges only at night. Specimens were found hiding under stones and logs during the dry season. *Limnonectes limnocharis* was often observed in the same water body as *Euphlyctis cyanophlyctis*. It usually floats with only its head exposed above the water and dives when disturbed, whereas *E. cyanophlyctis*, in the same circumstances, tends to skip on the surface of the water.

Etymology. *Limno*, Greek, = marsh, pool, lake; *charis*, Greek, an allusion to loveliness or beauty.

Material examined

No specific locality: CM 89468, CM 25331d, CM 25331, CAS 85274, CAS-SU 2652-53, FMNH 10894, 173435-42, 173949-52, NHMB 861; Badulla: MCZ 20864; Batticaloa: CM 83585; Deniyaya. Southern Province: CM 67879-83; Ella: CM 67679-81; Gampola: CM 67871-77, 83572-81; Kalmunai: CM 83590; Iginiyagala: CM 83543-45; Mapakada (Wewa): CM 67756; Nuwara-Eliya, Central Province: AMNH 74223; Palawatta, Uva Province: CM 67564; Polonnaruwa, North Central Province: CM 67565-80; Puttalam, Western Province: AMNH 74260-63, 117712-16; Ratnapura-Sabaragamuwa Province: CM 67878; Sinharaja Army Camp-Forest Reserve: CM 67884-87; Trincomalee: FMNH 98312-18

(skeleton), 98348, 123002-3056, 172374-75, 174510-14; Warakapola: AMNH 74249; WHT795, 9 ex., 22.0-33.6 mm, WHT834, 3 ex., 17.8-30.0 mm, Waitalawa near Urugala (Knuckles, alt. 915 m); WHT920, 5 ex., 21.1-25.9 mm, Nagoda (Kalutara, alt. 10 m); WHT938, 5 ex., 20.0-29.3 mm, Palatupana (near Kirinda, alt. 3 m); WHT904, 23.1 mm, WHT918, 29.1 mm, Galge (between Kataragama and Buttala, alt. 90 m); WHT907, 25.2 mm, Konketiya (between Kataragama and Buttala, alt. 185 m); WHT917, 5 ex., 17.7-21.5 mm, Boralasgomuwa (near Maharagama, alt. 10 m); WHT818, 21.6-29.3 mm, Attidiya-Bellanwila, alt. 8 m; WHT841, 26.2 mm, Owilakanda (Matale, alt. 610 m); WHT883, 28.5 mm, Koralawella (Moratuwa, alt. 5 m); WHT886, 25.7 mm, Kanneliya (Galle, alt. 150 m); WHT902, 23.8 mm, Ambalamahena (Atweltota, alt. 150 m); WHT861, 29.8 mm, Mederipitiya (near Deniyaya, alt. 365 m); WHT862, 2 ex., 17.0-21.7 mm, Rumassala (Galle, alt. 5 m); WHT881, 25.0 mm, WHT836, 18.9 mm, WHT994, 2 ex., 27.6-31.3 mm, WHT995, 30.3 mm, WHT1023, 25.5 mm, Kottawa (Galle, alt. 60 m); WHT868, 31.4 mm, Moray Estate, Rajamally (near Mousakelle, alt. 1370 m); WHT870, 27.8 mm, WHT857, 3 ex., 23.2-27.5 mm, WHT599, 2 ex., 24.7-27.2 mm, WHT648, 25.2 mm, WHT793, 4 ex., 18.7-26.3 mm, Pussella Estate (Parakaduwa, alt. 60 m); WHT937, 4 ex., 17.4-30.7 mm, Pallekele (near Kurunegala, alt. 150 m); WHT939, 3 ex., 16.9-18.2 mm, Mahakema (Kataragama, alt. 30 m); WHT940, 4 ex., 14.4-20.5 mm, Malabe (between Kaduwela and Battaramulla, alt. 30 m); WHT941, 12.7 mm, WHT780, 4 ex., 13.6-23.7 mm, Wewagama (Kuliyapitiya, alt. 45 m); WHT825, 3 ex., 15.8-33.2 mm, Botale (Ingiriya, alt. 120 m); WHT830, 29.3 mm, Potuvil, 5 m; WHT831, 2 ex., 17.6-18.7 mm, Ellepola (Balangoda, alt. 150 m); WHT835, 3 ex., 23.3-28.4 mm, Lahugala (near Potuvil, alt. 30 m); WHT614, 6 ex., 17.9-27.6 mm, Weligatta (Bundala, alt. 5 m); WHT820, 32.7 mm, WHT1240, 4 ex., 23.0-29.8 mm, Moneragala, alt. 150 m; WHT773, 26.3 mm, Hare Park near Rangala (Knuckles, alt. 1370 m); WHT775, 2 ex., 25.4-26.9 mm, Pambahinna (Belihul Oya, alt. 490 m); WHT776, 2 ex., 22.1-24.6 mm, Elamalawala (Labugama, alt. 150 m); WHT595, 23.4 mm, Habarana, alt. 120 m; WHT802, 3 ex., 21.7-24.5 mm, Opatha (Kotugoda, alt. 6 m); WHT806, 2 ex., 19.3-30.1 mm, Woodside near Urugala (Knuckles, alt. 915 m); WHT783, 18.7 mm, Maradankadawala (Anuradhapura, alt. 120 m); WHT450, 26.6 mm, Pannipitiya (near Maharagama, alt. 30 m); WHT784, 2 ex., 23.6-30.0 mm, Linihela (Peak Wilderness, alt. 1070 m); WHT792, 28.0 mm, Kumaradola Group (Moneragala, alt. 305 m); WHT431, 6 ex., 18.9-29.8 mm, WHT787, 32.7 mm, WHT791, 28.5 mm, Ritigala, alt. 460 m; WHT953, 4 ex., 17.9-28.0 mm, Andunoruwa wela (near Palatupana, alt. 9 m); WHT961, 3 ex., 14.7-23.9 mm, Mahiyangana, alt. 90 m); WHT990, 29.7 mm, Dombagaskanda (Ingiriya, alt. 60 m); WHT991, 18 ex., 15.8-22.9 mm, Wakwella (Galle, alt. 30 m); WHT998, 33.1 mm, Mundel (near Puttalam, alt. 2 m); WHT999, 23.4 mm, WHT1027, 2 ex., 21.6-27.6 mm, Siyambalakotuwa Wewa, Kiriyankali (near Mundel, alt. 20 m); WHT1002, 30.3 mm, WHT1033, 37.0 mm, Navinna (Galle, alt. 15 m); WHT1038, 8 ex., 22.6-24.9 mm, Mihintale, alt. 150 m; WHT1039, 32 ex., 17.0-33.6 mm, Anuradhapura, alt. 90 m; WHT1043, 34.1 mm, Udawalawe, alt. 100 m; WHT1227, 22.7 mm, Hantane (Kandy), alt. 1140 m; WHT1242, 29.9 mm, Laggala (Knuckles), alt. 1220 m; WHT1246, 17 ex., 13.0-32.8 mm, Pallegama (Knuckles), alt. 185 m; WHT1255, 5 ex., 24.7-26.8 mm, Matale, alt. 335 m; WHT1256, 4 ex., 21.7-29.3 mm, Pupulagala, alt. 1375 m; WHT1276, 2 ex., 24.5-28.9 mm, Mahawalatenna (Balangoda), alt. 515 m; WHT1287, 12 ex., 11.9-35.2 mm, Sigiriya, alt. 175 m; WHT1291, 2 ex., 27.5-35.0 mm, Hapugala (Galle), alt. 15 m.

Hoplobatrachus Peters, 1863. Type species *Hoplobatrachus ceylanicus* Peters, 1863, by monotypy. Elevated to rank of genus by Dubois (1992). Five species in Africa, India and Indochina; two in Sri Lanka.

Hoplobatrachus crassus
Figures 105-108

Rana crassa Jerdon, 1853: Journal of the Asiatic Society of Bengal, 22:531 (type: lost, from "Carnatic", India); placed in *Hoplobatrachus* Peters, 1863 by Dubois (1992).

Hoplobatrachus ceylanicus Peters, 1863 (synonymy by Boettger, 1892). Types at ZMB? (not seen).

Diagnosis. *Hoplobatrachus crassus* is distinguished from *H. tigerinus*, which it resembles, by its relatively shorter hindlimbs and by having a shovel-shaped inner metatarsal tubercle (Fig. 106b) (vs. inner metatarsal tubercle elongate and less elevated when viewed laterally (Fig. 110)); and also by its olive-brown or yellowish-green (vs. bluish) dorsum.

Description. Snout-vent length of mature males 60.0-90.0 mm, gravid females 70.0-130.5 mm. Head longer than broad. Snout pointed when viewed laterally and equal to 2.0-3.7 of interorbital width. Nostril nearer to tip of snout than to eye. Loreal region oblique. Interorbital distance less than width of upper eyelid. A hard symphysial knob on anterior edge of mandible. Upper jaw with finely-pointed teeth; vomerine teeth in two groups. Tympanum distinct, rounded or oval, horizontally elongate, its horizontal diameter almost two-thirds that of orbit. Supratympanic fold prominent, extending from behind eye to base of forelimbs. Fingers free; the first finger subequal to the fourth; second shortest; third finger longest (Fig. 105). Distal subarticular tubercles on first and second fingers and penultimate subarticular tubercles on third and fourth fingers larger than other subarticular tubercles. Two palmar tubercles. Well developed cutaneous fringes on both sides of fingers. Subarticular tubercles on fingers prominent, rounded or oval; subarticular tubercles on toes small when compared with other Sri Lankan ranids. Finger and toe tips rounded. Toes fully and broadly webbed (Fig. 106a). Relative length of toes 1<2<5<3<4. Inner metatarsal tubercle shovel-shaped, strongly compressed, crescent-shaped (Fig. 106b). Outer metatarsal tubercle absent. Tarsal ridge continuous to the inner metatarsal tubercle. A well developed cutaneous fold on outer side of the fifth toe; a less well developed fold on inner edge of first toe. Dorsum and sides with interrupted or uninterrupted longitudinal ridges or rounded or elongated tubercles. Numerous small white-tipped tubercles around the vent on and both limbs (Fig. 107). Ventrally smooth. Male with two external vocal sacs and a well developed, velvety nuptial pad on inner side on first finger.

Colour. In life (Fig. 108), dorsally olive brown or yellowish green, marbled with characteristic large, irregular blackish or dark brown spots. A "W"-shaped marking on the middle of the back in some specimens. Throat sometimes marbled with black and yellow or white. Both lips with black and white bars. Side of body and hind side of thighs marbled with black and yellow; regularly-spaced dark spots on the upper surface of the limbs give these a more or less cross-barred appearance. Belly and underside of limbs white or yellowish. A yellow vertebral stripe often present. Young specimens with a prominent black stripe between tip of upper jaw and anterior border of eye.

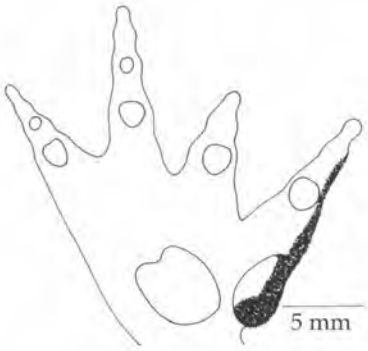

Figure 105. *Hoplobatrachus crassus*, 79.2 mm SVL, WHT 800, ventral aspect of right hand.

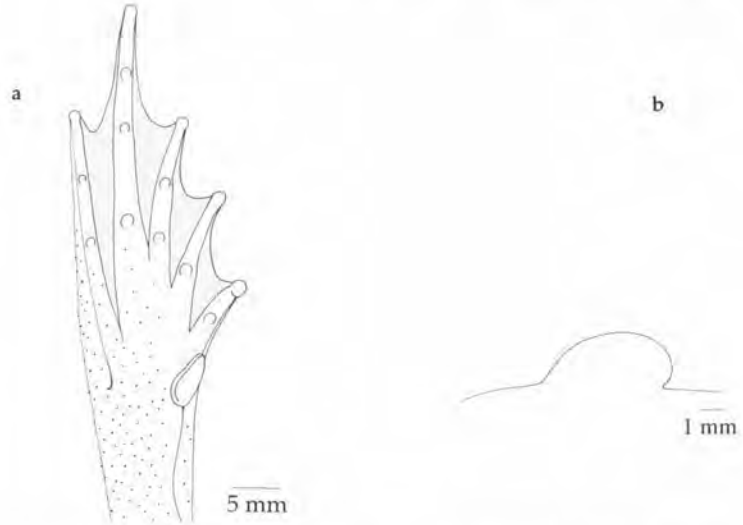

Figure 106. *Hoplobatrachus crassus*, 79.2 mm SVL, WHT 800, right foot, (a) ventral aspect, (b) lateral aspect of inner metatarsal tubercle.

Comments. *Hoplobatrachus crassus* is the largest frog recorded from Sri Lanka. Kirtisinghe (1957) confused *H. crassus* with *H. tigerinus* in Sri Lanka. He considered the former to be a subspecies of *H. tigerinus*, but did not include Sri Lanka in its distribution. Thus, the description of the tadpoles of *Rana tigerina crassa* by Kirtisinghe (1957) might belong to either *H. crassus* or *H. tigerinus*. Morphologically, these two species are similar, but *H. crassus* differs from *H. tigerinus* by its relatively shorter hindlimbs, smaller size, larger, shovel-shaped inner metatarsal tubercle, and the absence of a yellowish-white dorsolateral band.

Figure 107. *Hoplobatrachus crassus*, 102.3 mm SVL, WHT 956.

Figure 108. *Hoplobatrachus crassus*, 79.2 mm SVL, WHT 800 (photo: SL).

Distribution. Semi-aquatic. Common in reservoirs, rivers and lowland marshes but apparently absent in undisturbed forests. Specimens were found hiding under stones, logs and leaf litter during the dry season. Widely distributed throughout lower elevations of both wet and dry zones up to 465 m (Fig. 109).

Etymology. *Crassus*, Latin, = fat, thick.

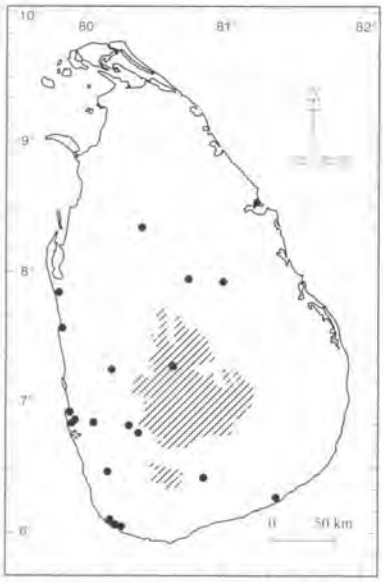

Figure 109. Distribution in Sri Lanka of *Hoplobatrachus crassus*.

Material examined

No specific locality: AMNH 74298, FMNH 81238, NHMB 898; Chilaw: AMNH 74285; Colombo: MCZ 20868-69; Kandy: NHMW 16108; Trincomalee: FMNH 123805-807; Urraniya, Uva Province: CM 67684-86; Warakapola, 500 ft., Western Province: AMNH 74250-52; WHT451, 105.6 mm, Migoda (between Homagama and Padukka, alt. 40 m); WHT387, 66.8 mm, Mahakalupahana (Matugama, alt.150 m); WHT600, 31.0 mm, WHT645, 33.2 mm, Pussella Estate (Parakaduwa, alt. 60 m); WHT601, 2 ex., 35.2-49.6 mm, Walandure (Kuruwita, alt. 150 m); WHT800, 79.2 mm, WHT956, 102.3 mm, WHT996, 130.5 mm, Attidiya-Bellanwila, alt. 8 m; WHT838, 46.6 mm, Rumassala (Galle, alt. 5 m); WHT837, 90.0 mm, Boralesgomuwa Wewa (near Maharagama, alt. 10 m); WHT955, 71.7 mm, Palatupana (Kirinda, alt. 5 m); WHT1044, 89.6 mm, Udawalawe, alt. 100 m; WHT1047, 90.6 mm, Anuradhapura, alt. 90 m; WHT1005, 2 ex., 57.0-85.9 mm, Mundel (near Puttalam, alt. 2 m); WHT1251, 2 ex., 107.0-108.7 mm, Wakwella (Galle, alt. 30 m); WHT1283, 45.0 mm, Sigiriya, alt. 175 m; WHT1284, 60.0 mm, Polonnaruwa, alt. 55 m; WHT1292, 28.8 mm, Hapugala (Galle), alt. 15 m.

Hoplobatrachus tigerinus
Figures 110-112

Rana tigerina Daudin, 1802: 42, pl. XX (type: lost, from "Bengale" (= Bengal)); referred to *Hoplobatrachus* by Dubois, 1992.

Diagnosis. See diagnosis of *Hoplobatrachus crassus* above.

Description. Snout-vent length of mature males 65.0-80.0 mm, gravid females 75.0-121.0 mm. Head longer than broad. Snout obtusely pointed in lateral view. Nostril nearer to tip of snout than to eye. Canthus rostralis obtuse. Loreal region oblique, concave. Interorbital distance nearly half width of upper eyelid.

A hard symphysial knob on anterior edge of mandible. Upper jaw with finely-pointed teeth; vomerine teeth in two groups. Tympanum distinct, rounded, its diameter nearly two-thirds that of orbit; supratympanic fold extends from behind eye to angle of mouth. Fingers free, the first finger longer than the second. Tips of digits obtusely pointed. Toes fully and broadly webbed; subarticular tubercles distinct, inner metatarsal tubercle blunt, narrow (Figs. 110, 111b), outer metatarsal tubercle absent. Tarsal ridge extends to inner metatarsal tubercle; a cutaneous fringe along the outer toe. Dorsal skin with numerous uninterrupted longitudinal ridges; large, rounded or elongate warts scattered on back and sides, from behind eye to vent; venter smooth. Male with two external vocal sacs. A well-developed nuptial pad on base of first finger.

Colour. Dorsal colour (in alcohol) brown or greenish brown; most specimens with a narrow, yellowish-white mid-vertebral band from tip of snout to vent (Fig. 111a); a dorsally wide, yellowish-white band from behind eye to groin. Lips with black and white bars. Inner side of thigh speckled with black and white. Limbs with black cross bars. Belly white. Body bright yellow during courtship and mating. For picture in life (of an Indian specimen), see Figure 112.

Comments. The species exhibits a wide morphological variation between populations. Kirtisinghe (1957) considered *H. crassus* to be a subspecies of *H. tigerinus*. Some specimens (CM 83567; 89934 and CAS 16925-26) seem to be intermediates between *H. tigerinus* and *H. crassus*. These specimens possess the typical, narrow mid-dorsal stripe, two dorsolateral bands, and longitudinal dorsal ridges of *H. tigerinus*. However, these specimens also showed the characteristic shovel-shaped inner metatarsal tubercle of *H. crassus*. Field studies are necessary to determine whether hybridization between these two species occurs in Sri Lanka.

Distribution. *Hoplobatrachus tigerinus* is distributed in the coastal areas of western and eastern Sri Lanka (Fig. 113).

Etymology. The original species name *tigerinus* has been incorrectly emended to *tigrinus* (the correct Latin spelling, a reference to the tiger) by several authors including Boulenger (1918) and Kirtisinghe (1957).

Figure 110. *Hoplobatrachus tigerinus*, lateral aspect of inner metatarsal tubercle (after Annandale, 1918).

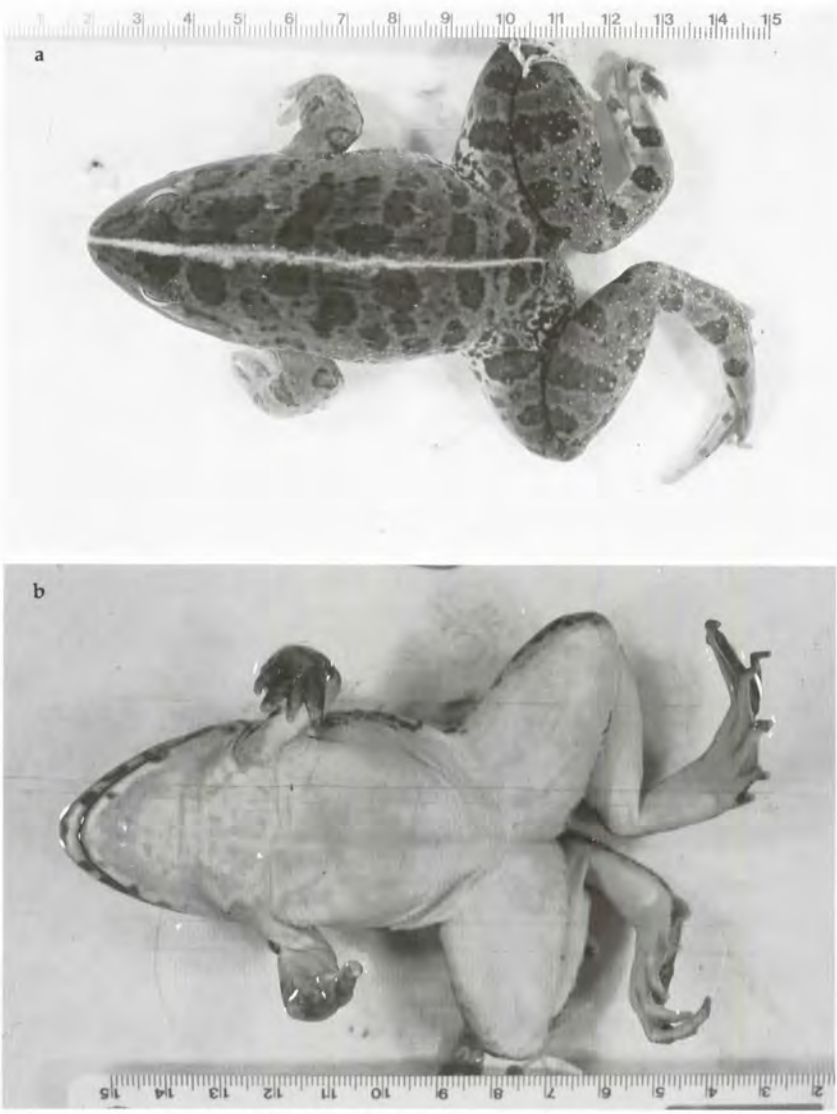

Figure 111. *Hoplobatrachus tigerinus*, AMNH 74250, (a) dorsal aspect, (b) ventral aspect.

Material examined

No specific locality: AMNH 74250; CAS 12800, 16925-26, CAS-SU 2651, NHMW 2621, 3379; Deegawapi: CM 83567; Kalmunai: CM 89934; Mundel, North Western Province: CM 67773-88; Puttalam: CM 67768-72; Trincomalee: NHMB 854; Warahana, Uva Province: FMNH 142387-89.

Figure 112. *Hoplobatrachus tigerinus*, not preserved, from Bengal, India (photo: KD).

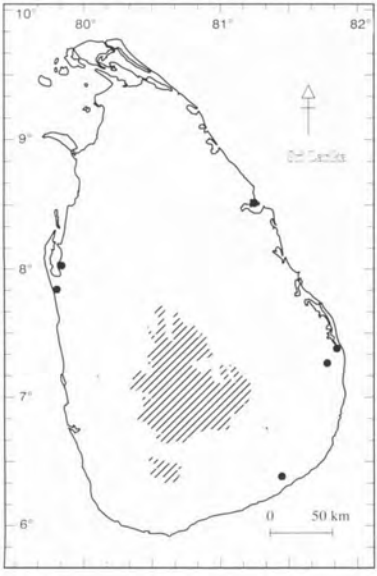

Figure 113. Distribution in Sri Lanka of *Hoplobatrachus tigerinus*.

Nannophrys Günther, 1869 (dated 1868) (type species *Nannophrys ceylonensis* Günther, 1869, by monotypy). Hoffmann (1878) considered *Trachycephalus* Ferguson, 1875 (type species *Trachycephalus ceylonicus* Ferguson, 1875, by monotypy) to be a synonym of *Nannophrys* and pointed out that it was preoccupied by *Trachycephalus* Tschudi, 1838, while proposing the replacement name *Fergusonia*. Misspelled *Nannofrys* by Palacky (1898). Referred to Ranixalinae Dubois, 1992. Clarke (1983) revised the genus and recognized three species, all endemic to Sri Lanka.

Nannophrys ceylonensis
Figures 114-118

Nannophrys ceylonensis Günther, 1868 (publ. 1869): Proceedings of the Zoological Society of London, 1868: 482 (syntypes: BMNH 68.3.17.36-39, from "Ceylon"), type species of *Nannophrys* Günther, 1869, by monotypy.

Diagnosis. Distinguished from *N. marmorata* and *N. guentheri* by the truncate snout (Fig. 114) and having the mandible with serrated denticular processes in adults of both sexes (vs. snout smoothly rounded (Fig. 121) or slightly truncate when viewed laterally and such processes absent in *N. marmorata* and *N. guentheri*).

Description. Snout-vent length of mature males 33.0-42.5 mm, gravid females 45.0-52.5 mm. Head broader than long, depressed (height at occiput 31.1%-47.1% of head length in adults). Snout rounded when viewed dorsally (Fig. 115), truncate when viewed laterally (Fig. 114). Nostril closer to snout than to eye. Nasal capsules elevated, separated by a prominent, longitudinal internasal groove. Canthus rostralis concave. Loreal region oblique, concave. A hard symphysial knob and a pair of apophyses on anterior edge of mandible. Mandible with serrated, denticular processes in adults of both sexes (no denticular processes in juveniles less than 31.1 mm SVL). Upper jaw with finely-pointed teeth; vomerine teeth in two straight series behind posterior level of choanae. Skin attached to anterior half of fronto-parietals; casquing of maxilla, premaxilla, nasal, fronto-parietal and squamosal. Tympanum distinct, vertically oval, with few white-tipped tubercles; its horizontal diameter equal to about half diameter of orbit. Supratympanic fold prominent and strong, from behind eye to base of forelimb. Head and trunk separated by a narrow groove running transversely behind the posterior level of the eyes. Fingers free; first finger shorter than second, second shorter than fourth; third finger longest. Each finger with a subarticular tubercle; two palmar tubercles. Both fingers and toes with elongate subarticular tubercles. Tips of fingers and toes bluntly rounded in adults, but not dilated; slightly pointed in juveniles. Webbing to distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on outer side of second toe; to penultimate subarticular tubercle on outer side of third toe; to antepenultimate subarticular tubercle on inner side of fourth toe and to penultimate subarticular tubercle on inner side of fifth toe. Relative length of toes 1<2<5<3<4. Subarticular tubercles on toes moderately elongate, less elevated in lateral view, and less prominent than in *N. marmorata*. Distal

Figure 114. *Nannophrys ceylonensis*, 35.1 mm SVL, WHT 261, lateral aspect of head.

Figure 115. *Nannophrys ceylonensis*, 35.1 mm SVL, WHT 261 (photo: SL).

and penultimate subarticular tubercles on fourth toe in contact or very close (rarely distinctly separate). Inner metatarsal tubercle distinct, elongate, not compressed (Fig. 116); outer metatarsal tubercle absent. Adults and juveniles with conical white-tipped tubercles scattered over upper surface (middle of back nearly smooth or only finely tuberculated), on tympanum, edge of lower lip and both limbs. The sides of the body and hind sides of forelimbs with prominent coarse tubercles. Juvenile (SVL 14.1-21.9 mm) specimens have more

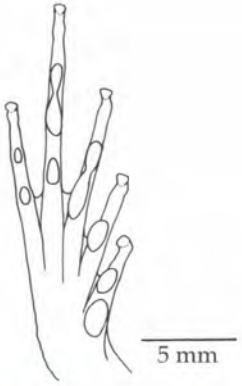

Figure 116. *Nannophrys ceylonensis*, 35.1 mm SVL, WHT 261, ventral aspect of right foot.

Figure 117. *Nannophrys ceylonensis*, 16.3 mm, WHT 257 (photo: SL).

prominent and large, coarse tubercles on dorsal region (Fig. 117) (resembling Kirtisinghe's (1957) description and illustration of *N. guentheri*). Ventrally smooth. Male with a pair of internal vocal sacs and a brown throat.

Colour. In life (Figs. 115, 117, 118), upper surface of body yellowish or olive green, marbled with brown. Limbs with brown cross bars (more distinct in juveniles). Juveniles with rounded brown spots on dorsum and limbs, ventrally whitish.

Comments. *Nannophrys ceylonensis* can be distinguished from *N. marmorata*, by dentigerous processes on the mandible and elevated nasal capsules separated by a medial, longitudinal groove. Kirtisinghe (1958) and Clarke (1983)

Figure 118. *Nannophrys ceylonensis*, 40.1 mm SVL, WHT 980 (photo: ID).

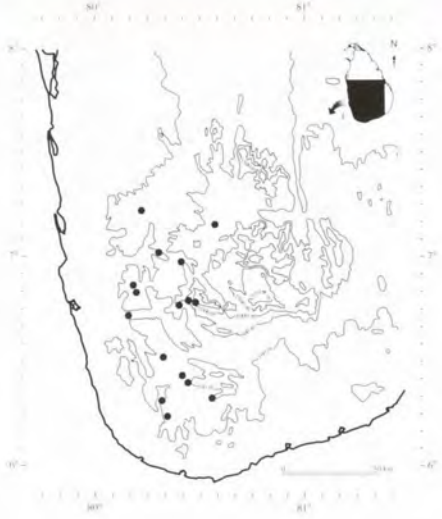

Figure 119. Distribution in Sri Lanka of *Nannophrys ceylonensis*.

described the tadpoles of *N. ceylonensis*. According to Kirtisinghe (*op. cit.*), the tadpoles are morphologically similar to those of *Rana beddomei* from India in showing a ventrally orientated mouth, reduced tail fin, and a spiracle opening without a tube. Kirtisinghe suggested that the tadpole is adapted for hopping over wet ground instead of swimming in water, but Clarke (1983) maintained that the early larval stage (Gosner stage 36) leads a fully aquatic mode of life.

Distribution. *Nannophrys ceylonensis* appears to be essentially a submontane species, being recorded from and restricted to elevations of approximately 60-1070 m in the hills of western, southern and central Sri Lanka (Fig. 119). *Nannophrys ceylonensis* is found mainly on rocks in cascades and under wet boulders. The habitat of *N. ceylonensis* tadpoles is apparently closely allied to that of the adult. During drier weather they receded into crevices were flooded by the cascade. Species endemic to Sri Lanka.

Biology. Juveniles SVL 14.1-20.7 mm were observed during most months of the year.

Etymology. *Ceylonensis* = "of Ceylon" in Latin.

Material examined

No specific locality: AMNH 23825, CAS 85279, FMNH 81227; Deniyaya: CM 67957-58; Sinharaja, 1200 ft.: AMNH 77467-73; Southern Province, Sinharaja Army Camp-Forest Reserve: CM 67842-43; Warakapola, 500 ft., Western Province: AMNH 74238; Yatiyantota, Western Province: AMNH 74286 (9 tadpoles); NHMB 2675-76; WHT449, 2 ex., 14.6-44.1 mm, WHT456, 3 ex., 16.5-29.5 mm, Dombagaskanda (Ingiriya, alt. 60 m); WHT821, 2 ex., 36.1-38.9 mm, Linihela (Peak Wilderness, alt. 1070 m); WHT811, 2 ex., 14.1-42.1 mm, WHT959, 2 ex., 20.7-25.5 mm, Parawalatenna (Kitulgala, alt. 150 m); WHT261, 12 ex., 15.6-35.1 mm, WHT980, 13 ex., 14.1-40.1 mm, Batadombalene (Kuruwita, alt. 460 m); WHT260, 32.4 mm, Kudawa (near Weddagala, alt. 460 m); WHT799, 4 ex., 29.2-30.3 mm, WHT985, 18.3 mm, Warnagala near Kuruwita (Peak Wilderness, alt. 760m); WHT812, 18.2 mm, Labugama, alt. 90 m; WHT914, 3 ex., 20.7-39.4 mm, Ambalamahena (Atweltota, alt. 150 m); WHT950, 3 ex., 17.0-41.2 mm, Panagula (between Thunmodera and Puwakpitiya, alt. 275 m); WHT257, 16.3 mm, WHT1243, 12 ex., 18.2-46.3 mm, Kanneliya (Galle, alt. 150 m); WHT1244, 2 ex., 46.5-47.6 mm, Ambulawa (near Gampola), alt. 915 m; WHT1263, 42.3 mm, Haycock (Hiniduma), alt. 660 m.

Nannophrys guentheri
Figure 120

Nannophrys guentheri Boulenger, 1882b: 115, pl. 12, Fig. 4 (syntypes: BMNH 1947.2.5.20-21, from "Ceylon").

Diagnosis. See diagnosis of *N. ceylonensis*.

Description. Snout-vent length 28.2 mm in syntypes: BMNH 1947.2.5.21. Head distinctly broader than long, and triangular. Snout truncate when viewed laterally, rounded when viewed dorsally (Fig. 120). Nostril closer to tip of snout than to eye. Nasal capsules slightly elevated. No longitudinal internasal groove. Canthus rostralis indistinct. Loreal region oblique, concave. Vomerine teeth in two small series behind posterior level of the choanae. No dentigerous processes on mandible. Skull co-ossified with exostosis and casquing. Skull less co-ossified than in *N. ceylonensis*. Tympanum distinct, rounded, with supratympanic fold. Fingers free, first finger shorter than second. Relative length of fingers 1<2, subequal to 4<3. Fingers and toes with rounded to oval subarticular tubercles and slightly pointed tips. Finger and toe tips slightly pointed, not bluntly rounded. Toes without webbing or with only rudimentary webbing between first and second toe. Inner metatarsal tubercle indis-

Figure 120. *Nannophrys guentheri*, syntype, BMNH 1947.2.5.21.

tinct, elongate, not compressed; no outer metatarsal tubercle.

Comments. The present description of the species is based on one of the syntypes (BMNH 1947.2.5.21) and on notes by Clarke (1983). The other syntype, a bleached specimen, was figured by Clarke (1983). Both syntypes are in a poor state of preservation for recording colouration. As was pointed out by Clarke (1983), the description of *N. guentheri* by Kirtisinghe (1957) is based on juveniles of *N. ceylonensis* that possess rounded brown patches over the dorsum.

Distribution. Kirtisinghe (1946a, 1957) cited Labugama as the only known locality for *N. guentheri*, but according to Clarke (1983), the specimens studied by Kirtisinghe have apparently been lost (and in any case do not appear to have belonged to this species). Thus, the current distribution of *N. guentheri* in Labugama is questionable (a search by K.M.-A. showed that only *N. ceylonensis* was present). The original description of the species specifies "Ceylon" as the type locality. Haly (1886) referred to two specimens from Ramboda (near Nuwara Eliya); a search for the species in the Ramboda area (which is now densely planted with tea) proved fruitless (K.M.-A.). Species endemic to Sri Lanka.

Etymology. The species name commemorates Albert Günther (1813-1914), Boulenger's predecessor as Keeper of Zoology in the British Museum (Natural History).

Material examined

No specific locality: BMNH 1947.2.5.20-21 (syntypes).

Nannophrys marmorata
Figures 121-123

Nannophrys marmorata Kirtisinghe, 1946a: Ceylon Journal of Science (B), 23: 105 (type: lost, from "Mousakanda, Gammaduwa, Central Province", Sri Lanka).

Diagnosis. See account of *N. ceylonensis*, above.

Description. Snout-vent length of mature males 25.9-38.6 mm, females 30.6-52.5 mm. Head broader than long, depressed (height at occiput 31.3%-39.0% of head length) in adults. Snout smoothly rounded (rarely slightly truncate in subadults, 22.4-36.1 mm) when viewed laterally (Fig. 121) and dorsally. Nostril nearer to tip of snout than to eye. Nasal capsules not elevated. Longitudinal internarial groove absent or only feebly defined. Canthus rostralis smooth. Loreal region oblique, flat. A hard symphysial knob and a pair of apophyses on anterior edge of mandible. Upper jaw with finely-pointed teeth; vomerine teeth in two small series behind posterior level of choanae. No denticular processes in mandible. Edge of upper lip with scallops. Skull heavily co-ossified. Tympanum distinct, rounded or slightly vertically oval, its horizontal diameter equal to about half the diameter of the orbit. Supratympanic fold more prominent than in *N. ceylonensis*, extending from behind eye to base of forelimb. Fingers free, the first finger shorter than the second; second shorter than fourth; third finger longest. Two palmar tubercles. Each finger with a rounded or oval subarticular tubercle. Relative length of fingers 1<2<4<3. Tips of fingers and toes bluntly rounded both in juveniles and adults. Subarticular tubercles on toes moderately elongate, more elevated in lateral view and more prominent (in both juveniles and adults) than in *N. ceylonensis*. Webbing to

Figure 121. *Nannophrys marmorata*, 46.2 mm SVL, WHT 89, lateral aspect of head.

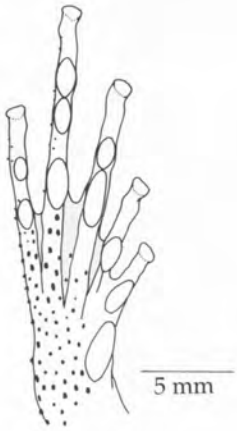

Figure 122. *Nannophrys marmorata*, 46.2 mm SVL, WHT 89, ventral aspect of right foot.

distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on outer side of second toe; to penultimate subarticular tubercle on outer side of third toe; to antepenultimate subarticular tubercle on inner side of fourth toe; and to penultimate subarticular tubercle on inner side of fifth toe (Fig. 122). Relative length of toes, 1<2<5<3<4. Penultimate and distal subarticular tubercles on fourth toe separated or rarely indistinguishably close (very rarely confluent). Inner metatarsal tubercle distinct, elongate, not compressed; outer metatarsal tubercle absent. Dorsum tubercular with scattered, fine, white-tipped tubercles on head, shoulder and limbs; skin smooth postcranially; warty pustules on sides of body; venter smooth. More white-tipped tubercles on feet

Figure 123. *Nannophrys marmorata*, 46.2 mm SVL, WHT 89 (photo: SL).

Figure 124. Distribution in Sri Lanka of *Nannophrys marmorata*.

of both juveniles and adults than in *N. ceylonensis*. No white-tipped tubercles or pustules on the tympanum. Males with more white-tipped tubercles on back and a well developed nuptial pad on inner side of first finger, velvety in texture.

Colour. In life, upper surface of body and limbs marbled with dark brown (or black) and yellow (Fig. 123). Ventrally whitish-yellow. Deep brown irregular patches on dorsum and on limbs.

Comments. Morphologically, *Nannophrys marmorata* is similar to *N. ceylonensis*; this led Kirtisinghe (1946a) to consider the former to be a subspecies of *N. ceylonensis*. We follow Clarke (1983) by treating *N. marmorata* as a valid species.

Distribution. A montane species, restricted to the Knuckles Range, being recorded between elevations of 200-1220 m (Fig. 124). It was observed mainly under boulders on wet, flat, rocky surfaces. Species endemic to Sri Lanka.

Etymology. *Marmor*, Latin, = marble; *marmorata*, marbled.

Material examined

No specific locality: FMNH 81231; Laggala, Central Province: AMNH 80088-89. WHT89, 17 ex., 26.2-46.2 mm, WHT1051, 63 ex., 25.9-52.5 mm, Laggala (Knuckles, alt. 1220 m); WHT269, 3 ex., 32.6-33.5 mm, Mousakanda-Gammaduwa (Knuckles, alt. 915 m); WHT1252, 36.7 mm, Gonewala (near Pallegama, Knuckles), alt. 200 m.

Euphlyctis Fitzinger, 1843. Type species *Rana leschenaultii* Duméril and Bibron, 1841, by original designation. Considered a subgenus of *Rana* by Dubois (1981), and elevated to rank of genus by Poynton & Broadley (1985). Four species (in north-west Africa, south Asia and Indomalaya); two in Sri Lanka.

Euphlyctis cyanophlyctis
Figures 125-127

Rana cyanophlyctis Schneider, 1799: 137 (type: not traced, from "India Orientalis").

Diagnosis. *Euphlyctis cyanophlyctis* resembles *E. hexadactylus* but its distinguished from it by its smaller size (maximum of SVL 65.0 mm, vs. SVL 120.0 mm in *E. hexadactylus*) and smooth throat (Fig. 125) (vs. distinctly porous, warty ventral surface (Fig. 129), rarely smooth in juveniles and subadults of *E. hexadactylus*).

Description. Snout-vent length of mature males 35.0-45.0 mm, gravid females 50.0-65.0 mm. Head longer than broad. Snout obtusely pointed. Nostrils equidistant from eye and tip of snout or slightly nearer to snout than to eye. Canthus rostralis indistinct. Loreal region oblique, concave. Interorbital width less than width of upper eyelid. A hard symphysial tubercle on anterior edge of mandible. Upper jaw with finely-pointed teeth; vomerine teeth in two groups. Tympanum distinct, its horizontal diameter about two-thirds of orbit diameter. Supratympanic fold not prominent, extending from behind eye to base of forelimb. Fingers free, first finger subequal to fourth; second shorter than first and fourth; third finger longest. Both finger and toe tips slightly rounded. Subarticular tubercles on both fingers and toes rounded and not prominent. Toes fully and broadly webbed to their tips, webbing continuous to between first toe and inner metatarsal tubercle. Inner metatarsal tubercle elongate and laterally compressed, very prominent, somewhat resembling a rudimentary toe. A minute outer metatarsal tubercle at the commencement of the cutane-

Figure 125. *Euphlyctis cyanophlyctis*, 51.2 mm SVL, WHT 849, ventral aspect.

ous fringe along the fifth toe. Relative length of toes 1<2<3<5<4. Tarsal ridge not prominent, continues to inner metatarsal tubercle. A distinct cutaneous fringe on outer edge of fifth toe. Dorsum, flank and both limbs with numerous rounded or granular tubercles; larger and more elevated tubercles around the vent. Both males and females with velvety toes and fingers. Ventral side smooth, but in some adults a row of dark tubercles extends ventrally from the post-tympanic region to the thorax, and from there to the sides of the mid-abdomen; another lateral series of tubercles extends from the axillary region to the mid-pelvic area (Fig. 125). Some mature males with white-tipped tubercles on snout, edges of both lips, anterior edge of chin, dorsum, dorsal sides of both limbs and ventral side of toes. Male with two external vocal sacs and a less well developed nuptial pad on base and inner side of first finger, velvety in texture.

Colour. In life, dorsally brownish or olive brown (Fig. 126), spotted, blotched or marbled (Fig. 127) with black or dark brown. Two dark brown streaks on hind side of thighs almost always present. Limbs with dark brown spots which do not form complete cross-bands. Belly white or speckled black. Ventrally this frog has a dotted appearance, especially during the breeding season. Throat with dark speckles. Vocal sacs brown or black in colour. Some specimens have two brown chin stripes. Ventral warts of mature specimens black or white in colour.

Comments. De Silva (1957, 1958) recognized three colour varieties of *Euphlyctis cyanophlyctis*, "*typicus*", "*fulvus*" and "*flavens*". Being of infrasubspecific rank, these have no nomenclatural validity (International Code of Zoological Nomenclature, Art. 45 (e), (g)).

Figure 126. *Euphlyctis cyanophlyctis*, 39.7 mm SVL, WHT 250 (photo: SL).

Figure 127. *Euphlyctis cyanophlyctis*, not preserved, Gampola, Sri Lanka (photo: ID).

Distribution. Widely distributed in Sri Lanka, *Euphlyctis cyanophlyctis* is the most frequent Sri Lankan frog. It occurs throughout the island; the largest specimen recorded by us being from Nuwara Eliya, elev. 1710 m (Fig. 128). *Euphlycis cyanophlyctis* is especially well adapted to aquatic life (Altevogt, 1986) and active both during day and night. It is seen frequently on the banks of streams or ponds, and usually prefers still water. It skips over the water surface when alarmed. This species was also recorded from brackish water in Weligatta (Bundala). We found the species to be more frequent in disturbed areas such as rubber (*Hevea*) plantations and cultivated areas abutting forests than in undisturbed forest habitats. It is often found together with *Limnonectes limnocharis*.

Etymology. *Cyano* (from *kyanos*, Greek, = dark blue); *phlyctis*, Greek, = blister or pimple.

Material examined

No specific locality: AMNH 23984, CAS 16927-28, FMNH 122648; Balangoda: MCZ 20846-50; Batticaloa: CM 84586-89; Central Province: AMNH 74212, 74219; Chilaw: AMNH 74283; Colombo: MCZ 20845; Ella: CM 67675; Gampola: CM 67858-69, 67964-82; Harasbedda: CM 67745-51; Kuruwita, Sabaragamuwa Province: CM 67847-57; Kuwalgamuwa: CM 67752-53; Madampe: CM 67744; Nikaveritiya, Western Province: CAS-SU 2144-45; Pallewatta, Uva Province: CM 67673-74; Polonnaruwa: CM 675565-57; Rakwana: CM 89464-67, 89482-86; Sinharaja, 1000-1200 ft.: AMNH 77479-84; Trincomalee: FMNH 122641-47, 122649-60; Warakapola: AMNH 74247-48; WHT833, 2 ex., 35.4-41.7 mm, WHT859, 26.5 mm, WHT796, 10 ex., 25.7-38.4 mm, Waitalawa near Urugala (Knuckles, alt. 915 m); WHT828, 4 ex., 27.9-29.2 mm, Talipotenna, Nikapota (between Berragalla and Koslanda, alt. 370 m); WHT829, 37.5 mm, Potuvil, alt. 5 m; WHT865, 2 ex., 29.6-31.4 mm, Kahangama (Ratnapura, alt. 30 m); WHT876, 3 ex., 30.6-43.0 mm, Udugama, near rest house (Galle, alt. 30 m); WHT880, 37.8 mm, WHT993, 54.8 mm,

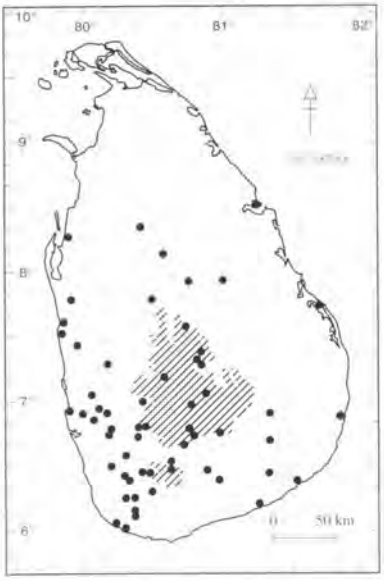

Figure 128. Distribution in Sri Lanka of *Euphlyctis cyanophlyctis*.

WHT1003, 38.7 mm, WHT1034, 2 ex., 20.3-26.3 mm, Kottawa (Galle, alt. 60 m); WHT911, 34.3 mm, Makumbura near Kottawa (Galle, alt. 30 m); WHT847, 31.3 mm, WHT850, 2 ex., 25.1-35.6 mm, Rumassala (Galle, alt. 5 m); WHT849, 52.1 mm, Navinna (Galle, alt. 15 m); WHT908, 28.6 mm, Ambalamahena (Atweltota, alt. 150 m); WHT267, 38.9 mm, Mahakalupahana (near Matugama, alt. 150 m); WHT602, 2 ex., 17.0-39.7 mm, Atweltota, alt. 60 m; WHT851, 3 ex., 32.0-34.6 mm, Nelundeniya (between Warakapola and Kegalla, alt. 150 m); WHT855, 34.6 mm, Hokandara (near Malabe, alt. 30 m); WHT852, 27.3 mm, Kataragama, alt. 44 m; WHT944, 2 ex., 35.3-44.8 mm, Pallekele (near Kurunegala, alt. 150 m); WHT824, 25.6 mm, Botale (Ingiriya, alt. 120 m); WHT447, 5 ex., 33.3-48.0 mm, WHT457, 28.5 mm, WHT817, 3 ex., 25.8-42.7 mm, WHT989, 29.9 mm, Dombagaskanda (Ingiriya, alt. 60 m); WHT790, 29.3 mm, Migoda (between Homagama and Padukka, alt. 40 m); WHT779, 26.6-27.7 mm, Elamalewala (Labugama, alt. 150 m); WHT781, 2 ex., 22.1-23.6 mm, Wewagama (near Kuliyapitiya, alt. 45 m); WHT782, 31.4 mm, Maradankadawala (Anuradhapura, alt. 120 m); WHT594, 41.4 mm, Habarana, alt. 120 m; WHT805, 43.5 mm, Elavankulam, alt. 30 m; WHT807, 6 ex., 27.9-36.4 mm, Woodside near Urugala (Knuckles, alt. 915 m); WHT454, 2 ex., 30.1-37.5 mm, Weliweriya (Gampaha, alt. 20 m); WHT462, 31.2 mm, Morawaka, alt. 150 m; WHT203, 6 ex., 29.0-36.9 mm, Lihinigala-Yattapatha (Moragala near Agalawatta, alt. 150 m); WHT200, 56.3 mm, Nuwara Eliya, alt. 1710 m; WHT265, 2 ex., 22.0-30.4 mm, WHT958, 2 ex., 31.9-34.8 mm, Parawalatenne (Kitulgala, alt. 150 m); WHT271, 3 ex., 23.5-35.8 mm, Waga (Labugama, alt. 150 m); WHT772, 3 ex., 29.0-32.4 mm, Hare Park near Rangala (Knuckles, alt. 1370 m); WHT774, 5 ex., 28.2-47.8 mm, Pambahinna (Belihul Oya, alt. 490 m); WHT615, 38.6 mm, Weligatta (Bundala, alt. 5 m); WHT640, 2 ex., 40.3-43.8 mm, Weralugahamula (Rakwana, alt. 305 m); WHT910, 30.1 mm, WHT250, 3 ex., 35.6-42.0 mm, Koskulana (near Panapola, alt. 460 m); WHT856, 25.8 mm, WHT798, 32.7 mm, WHT598, 2 ex., 25.6-38.6 mm, WHT813, 25.5 mm, Pussella Estate (Parakaduwa, alt. 60 m); WHT951, 34.1 mm, Andunoruwa wela (near Palatupana, alt. 9 m); WHT983, 33.0 mm, Batadombalene (Kuruwita, alt. 460 m); WHT1000, 3 ex., 31.8-55.5 mm, WHT1031, 51.1 mm, Siyambalakotuwa Wewa, Kiriyankali (near Mundel, alt. 20 m); WHT1037, 2 ex., 30.3-

32.5 mm, Anuradhapura, alt. 90 m; WHT1042, 2 ex., 36.3-37.0 mm, Udawalawe, alt. 100 m; WHT1230, 28.7 mm, Pupulagala, alt. 1375 m; WHT1239, 45.9 mm, WHT954, 37.0 mm, Monaragala, alt. 150 m; WHT1241, 2 ex., 33.7-34.6 mm, Laggala (Knuckles), alt. 1220 m.

Euphlyctis hexadactylus
Figures 129-132

Rana hexadactyla Lesson, 1834: 331 (type: not traced, from south India).

Diagnosis. See *Euphlyctis cyanophlyctis* above.

Description. Snout-vent length of mature males 58.0-86.8 mm, gravid females 58.5-120.0 mm. Head longer than broad. Nostril nearer to tip of snout than to eye. Canthus rostralis indistinct. Loreal region oblique, concave. Interorbital distance less than width of upper eyelid. Internarial distance greater than interorbital width. A hard symphysial tubercle on anterior edge of mandible. Upper jaw with finely-pointed teeth; vomerine teeth in two groups. Tympanum distinct, rounded or horizontally oval, its horizontal diameter between half and one orbit diameter. Supratympanic fold present but not prominent, extending from behind eye to base of forelimb. Fingers free or rudimentarily webbed, first finger subequal to fourth; second shortest; third finger longest. The fingers with prominent cutaneous fringes on both edges. Surfaces of fingers and toes velvety in texture. Subarticular tubercles on both fingers and toes small and less elevated. Both finger and toe tips distinctly pointed. Toes broadly and completely webbed right up to their tips. A prominent cutaneous fold on inner side of first toe (continuous to inner metatarsal tubercle) and outer side of fifth toe. Relative length of toes 1<2<3=5<4. Inner metatarsal tu-

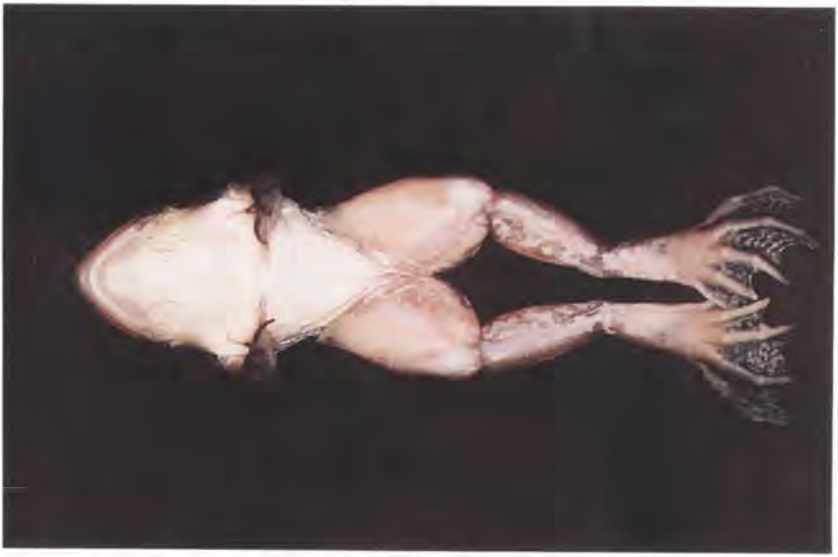

Figure 129. *Euphlyctis hexadactyla*, 61.5 mm SVL, WHT 801, ventral aspect.

Figure 130. *Euphlyctis hexadactyla*, 61.5 mm SVL, WHT 801 (photo: SL).

Figure 131. *Euphlyctis hexadactyla*, 58.2 mm SVL, WHT 243.

bercle very prominent, oval, laterally compressed and elevated; outer metatarsal tubercle absent. A tarsal ridge extends from tibio-tarsal articulation to inner metatarsal tubercle. Dorsal skin smooth or finely granular. Large tubercles behind tympanum, flanks, and around the vent. A row of tubercles extends ventrally from the post-tympanic region on to the thorax, and from there to the

sides of the mid-abdomen; another lateral series of tubercles extends from the axillary region to the mid-pelvic area. White-tipped tubercles on dorsal and hind sides of both limbs (more on legs), ventral side of both fingers and toes, around the vent and on dorsum. Gular area and belly with distinct porous warts (Fig. 129), but rarely smooth in juveniles and subadults. Male with two external vocal sacs and nuptial pad on base and inner side of first finger.

Colour. In life, dorsal surface bright green (Fig. 130) or mud-brown (Fig. 131). A broad, dark blotch along the middle of the back. Elongated dark patches on either side, often with a pale green or yellow mid-vertebral stripe (Fig. 132). Ventrally pale yellow or creamy white. Hind side of thighs with two dark brown bands. Abdomen marbled in some specimens, and a yellowish-white dorsolateral band from behind the tympanum to the groin. Some juveniles (SVL 33.3 mm) have a striped abdomen and dark brown hind limbs.

Distribution. Purely aquatic, common and widely distributed in lower elevations up to 760 m (Fig. 133), in reservoirs, rivers and marshes. It is often found in sympatry with *Hoplobatrachus crassus*.

Etymology. *Hex*, Greek, = six; *dactylos*, Greek, = finger.

Material examined

No specific locality: AMNH 23981, CAS 16929-30, CAS-SU 2654-55; Battaramulla: MCZ 20859-63; Chilaw: MCZ 20852-53; Colombo, Western Province: AMNH 58181, FMNH 74163, UMMZ 61074; Miriswatta: CM 67559; Mt. Lavinia: CM 67560-62, MCZ 20854-58; Nawadamkulama: CM 67676-78; Pallewala, Uva Province: CM 67558; Polonnaruwa, Northern Province: 67754-55; Ratnapura: FMNH 173399-400, MCZ 20851; Trinkomalee: FMNH 122029-34; WHT652, 20.0 mm, WHT848, 18.4 mm, WHT840, 39.1 mm, WHT1022, 17.4 mm, Rumassala (Galle, alt. 5 m); WHT819, 2 ex., 50.4-74.8 mm, WHT801, 61.5 mm,

Figure 132. *Euphlyctis hexadactyla*, 18.4 mm SVL, WHT 848.

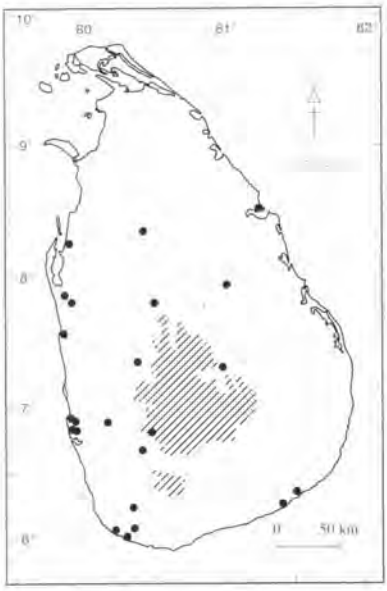

Figure 133. Distribution in Sri Lanka of *Euphlyctis hexadactyla*.

WHT997, 69.3 mm, Attidiya-Bellanwila, alt. 8 m; WHT243, 58.2 mm, Waga (Labugama, alt. 150 m); WHT804, 43.1 mm, Elavankulam, alt. 30 m; WHT916, 31.7 mm, Udugama, near rest house (Galle, alt. 30 m), WHT845, 48.7 mm, Navinna (Galle, alt. 15 m); WHT913, 4 ex., 29.1-51.3 mm, Kottawa (Galle, alt. 60 m); WHT863, 52.0 mm, Warnagala near Kuruvita (Peak Wilderness, alt. 760 m); WHT864, 20.2 mm, Kahangama (Ratnapura, alt. 30 m); WHT948, 23.8 mm, Pallekele (near Kurunegala, alt. 150 m); WHT949, 47.0 mm, WHT1249, 112.8 mm, Palatupana (Kirinnda, alt. 3 m); WHT952, 33.3 mm, Andunoruwa wela (near Palatupana, alt. 9 m); WHT962, 15.1 mm, Mahiyangana, alt. 90 m; WHT1001, 5 ex., 21.1-34.2 mm, Siyambalakotuwa Wewa, Kiriyankali (near Mundel, alt. 20 m); WHT1036, 2 ex., 22.1-37.7 mm, WHT1250, 108.9 mm, Anuradhapura, alt. 90 m; WHT1285, 48.8 mm, Polonnaruwa, alt. 55 m.

Rana Linnaeus, 1758 (type species *Rana temporaria* Linnaeus, 1758, by subsequent designation of Fleming, 1822). Cosmopolitan, with upwards of 200 species, two in Sri Lanka.

Rana aurantiaca
Figures 134-135

Rana aurantiaca Boulenger, 1904: Journal of the Bombay Natural History Society, 15: 340, Fig. 1 (holotype: BMNH 1947.2.2.29, from "Trivandrum", Travancore, Kerala, India).

Diagnosis. Distinguished from *Rana gracilis* and *R. temporalis* by the webbing of the fourth toe (webbed to penultimate subarticular tubercle, rarely the distal subarticular tubercle, on inner side and distal or between penultimate and distal

Figure 134. *Rana aurantiaca*, 62.6 mm SVL, WHT 752, ventral aspect of right foot.

subarticular tubercle on outer side of fourth toe in *R. aurantiaca* (Fig. 134); webbing to disc on outer side and between distal subarticular tubercle and disc or to the disc itself on inner side of fourth toe in *R. temporalis*). *Rana gracilis* is distinguished from *R. aurantiaca* and *R. temporalis* by the absence of cross bars on the limbs, the presence of external vocal sacs and less well developed discs on the fingers and toes.

Description. Snout-vent length of mature males 32.0-55.7 mm, gravid females up to 62.6 mm. Head longer than broad. Snout obtusely pointed in dorsal view. Narial openings lateral and nearer to tip of snout than to anterior border of eye. Interorbital width broader than width of upper eyelid. Canthus rostralis distinct. Loreal region vertical. A hard symphysial tubercle on anterior edge of mandible. Upper jaw with finely-pointed teeth; vomerine teeth in two groups. Tympanum distinct, rounded, horizontal diameter of tympanum 93.1% of orbit diameter in male and 84.0% of orbit diameter in female. Supratympanic fold indistinct. Fingers free, first finger shorter than fourth; second shortest; third finger longest. Subarticular tubercles on fingers oval. Distal subarticular tubercles on first and second finger, penultimate subarticular tubercles on third and fourth finger larger and more elevated when viewed laterally. Three distinct, oval, palmar tubercles. Finger and toe tips with distinct discs, longer than wide; dorsal and ventral surfaces separated by circum-marginal grooves of disks. Subarticular tubercles on both fingers and toes conical and oval. Webbing to disk on outer side of first toe; to distal subarticular tubercle (rarely between disk and distal subarticular tubercle) on inner side and to disk on outer side of second toe; to penultimate subarticular tubercle (rarely half-way between distal and penultimate subarticular tubercle or to distal subarticular tubercle) on inner side and to disk or between disk and distal subarticular tubercle on outer side of third toe; and to disk on inner side of fifth toe. Relative length of toes 1<2<5<3<4. Toes with dermal fringes on both sides. Two metatarsal tubercles, the inner one larger and more elongate, the outer one rounded or slightly oval. Two tarsal ridges: the inner one continues to inner metatarsal tubercle and the outer continues to outer edge of fifth toe, but both

Figure 135. *Rana aurantiaca*, 53.1 mm SVL, WHT 982 (photo: ID).

ridges are not prominent. A less well developed cutaneous fold on outer edge of fifth toe (Fig. 134). Dorsally smooth or finely granular with conical tubercles, but around the vent, hind side of thighs, tibio-tarsal articulation and on the heels with larger tubercles. Some specimens with white-tipped tubercles on dorsal side, around the vent, dorsal and hind sides of thighs, tibia and tarsi. A distinct but narrow dorsolateral glandular fold extends from behind the eye to the region of the vent. Ventrally smooth. Males with humeral glands, nuptial pads on base and inner side of first finger, and internal vocal sacs. External vocal sac absent.

Colour. In life, similar to *R. temporalis*. Dorsally orangish-chocolate brown; ventrally pale yellow (Fig. 135). A dark brown band runs below the dorsolateral glandular fold, from the tip of the snout through the nostril, eye and tympanum, and fades away on the flanks. Upper lip golden. Both limbs with dark cross-bands and spots. Area between limbs and hind side of thigh marbled with dark brown in mature specimens. Lower lip with irregular black patches. Throat gray or marbled with light brown.

Comments. *Rana aurantiaca* was first described from Travancore (Kerala), India; Grandison and Senanayake (1966) reported the species from Sri Lanka. Morphologically, *R. aurantiaca* is similar to *R. gracilis* from Sri Lanka, but can be distinguished from it by its smaller size and distinctive colouration. Rao (1922) described *R. bhagmandlensis* from southern India and considered it to be closely related to *R. aurantiaca*. Comparison of the holotype of *R. bhagmandlensis* (BMNH 1947.2.2.12) with the holotype and other specimens of *R. aurantiaca* from Sri Lanka suggests that *R. bhagmandlensis* is conspecific with *R. aurantiaca*.

Figure 136. Distribution in Sri Lanka of *Rana aurantiaca*.

As reported by Boulenger (1904b), a colour cast of the holotype of *R. aurantiaca* was made by Ferguson, and Boulenger's (1920) description of the colour pattern of the species was based on this colour cast. Grandison and Senanayake (1966) provided information on the colour pattern of live and preserved specimens from Sri Lanka.

Distribution. This semi-arboreal species was recorded only from wet zone, especially the coastal belt and mid-hills in western and southern Sri Lanka up to elevations of about 660 m (Fig. 136).

Etymology. The species name derives from *aurantium*, = orange in Latin.

Material examined

Kanneliya forest, 1500ft.: AMNH 78924-25; Kanneliya, Southern Province: AMNH 80086-87; Udugama, Kanneliya forest, 1000-1500 ft.: BMNH 1967.533-535, 1967.537-538; WHT346, 39.5 mm, WHT448, 26.1 mm, WHT987, 32.7 mm, 28.7 mm, Dombagaskanda (Ingiriya, alt. 60 m); WHT922, 40.0 mm, WHT650, 20.9 mm, WHT752, 62.6 mm, WHT843, 36.9 mm, WHT1029, 27.9 mm, WHT1030, 43.2 mm, Rumassala (Galle, alt. 5 m); WHT844, 20.2 mm, Mederipitiya (near Deniyaya, alt. 365 m); WHT839, 46.1 mm, WHT879, 44.9 mm, WHT1025, 28.4 mm, WHT1046, 5 ex., 30.3-59.8 mm, WHT1269, 62.6 mm, Kottawa (Galle, alt. 60 m); WHT903, 55.0 mm, Koskulana (near Panapola, alt. 460 m); WHT921, 26.8 mm, Wilpita (between Akuressa and Kamburupitiya, alt. 30 m); WHT963, 36.5 mm, Attidiya-Bellanwila, alt. 8 m; WHT982, 53.1 mm, Kudawa (near Weddagala, alt. 460 m); WHT1267, 58.3 mm, Haycock, (Hiniduma, Galle), alt. 660 m; WHT1273, 3 ex., 50.9-55.7 mm, Hapugala (Galle), alt. 15 m; WHT1296, 23 ex., 14.6-39.4 mm, Parawalatenna (Kitulgala, alt. 150 m); WHT 1314, 60.5 mm, Kimbiya (Galle), alt. 40 m.

Rana gracilis
Figures 137-139

Rana gracilis Gravenhorst, 1829: 45, pl. 8, Fig. 3 (type: not traced, from Sri Lanka).

Diagnosis. See diagnosis of *R. aurantiaca* above.

Description. Snout-vent length of mature males 32.3-53.7 mm, gravid females 53.5-67.6 mm. Head longer than broad. Snout bluntly pointed when viewed laterally and dorsally, and equal to or less than twice inter orbital width. Narial opening laterally positioned, nearer to tip of snout than to eye. Internarial distance greater than interorbital distance. Interorbital distance greater than width of upper eyelid. Canthus rostralis obtuse. Loreal region vertical, concave. A hard symphysial tubercle on anterior edge of mandible. Upper jaw with finely-pointed teeth and vomerine teeth in two groups. Tympanum distinct, rounded, its horizontal diameter about two-thirds to three-fourths width of orbit. Supratympanic fold less developed or absent. Fingers free, first finger shorter than fourth; second shortest; third longest. Distal subarticular tubercles on first and second finger, and penultimate subarticular tubercles on third and fourth finger large and more elevated when viewed laterally. Three distinct, oval palmar tubercles (Fig. 137). Fingers and toes long and slender, with less well developed disks than in *R. temporalis* and *R. aurantiaca*; the circum-marginal groove feebly defined or absent. Subarticular tubercles distinct, more elevated when viewed laterally. Toe webbing to disc on outer side of first toe, to distal subarticular tubercle (rarely to disc on inner side) on inner side of second toe and to disc on outer side; to penultimate or between distal and penultimate subarticular tubercle (rarely to disc or distal subarticular tubercle) on inner side, and disc on outer side of third toe; to penultimate subarticular tubercle on inner side (mature males with webbing to disc on both inner and outer side) and to distal subarticular tubercle on outer side of fourth toe; and to disc on inner side of fifth toe. Relative length of toes 1<2<3<5<4. A less well developed cutaneous fold on outer edge on fifth toe. Toes with dermal fringes on both sides. Two metatarsal tubercles, the inner one elongate, the outer one rounded or slightly oval (Fig. 138). Tarsal ridges absent or feebly defined, the inner one continuing to the inner metatarsal tubercle and the outer one to the

Figure 137. *Rana gracilis*, 58.7 mm SVL, WHT 728, ventral aspect of right hand.

Figure 138. *Rana gracilis*, 58.7 mm SVL, WHT 728, ventral aspect of right foot.

outer edge of the fifth toe. Dorsum smooth or granular. Large, elevated tubercles around the vent and heels. Some specimens with white-tipped tubercles on dorsum, around vent, dorsal and hind sides of thighs, tibia and tarsi; more tubercles on males. Shank slightly tubercular or with fine, longitudinal ridges. A dorsolateral glandular fold from above tympanum to groin, another from angle of mouth to groin. Ventrally smooth but undersurfaces of the thighs and around vent finely granular. Males with a pair of poorly-developed external vocal sacs; nuptial pads on base and inner side of first finger velvety in texture; humeral gland; more webbing on toes; and glandular fold on inner side of forelimb.

Colour. Colour in life, dorsally pinkish light brown (Fig. 139). Some specimens have a diffuse dark brown or black vertebral stripe extending from the interorbital region to just behind the pelvis. A yellowish golden stripe extends

Figure 139. *Rana gracilis*, 58.7 mm SVL, WHT 728 (photo: SL).

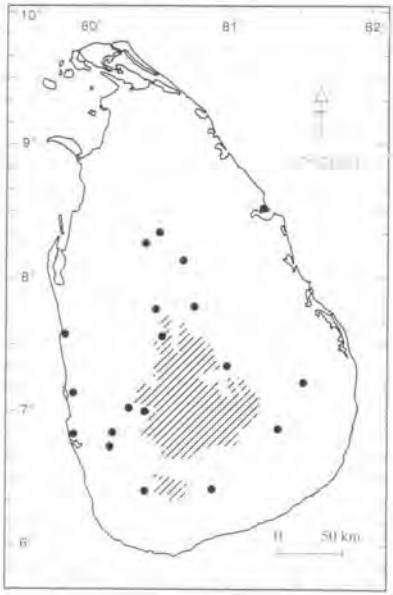

Figure 140. Distribution in Sri Lanka of *Rana gracilis*.

from the upper lip, below the eye and tympanum, along the side to the region of the groin. Between this and between the dorsolateral glandular fold is a broad, black longitudinal stripe extending from the tip of the snout to the groin. Belly pale white or yellow. Limbs without cross-bars but with irregular black patches. Inner side of thigh speckled with black and yellow.

Comments. Morphologically, *Rana gracilis* is similar to *R. temporalis*, from which the former can be distinguished by the absence of cross bars on the limbs, the presence of external vocal sacs, and the less well developed disks on the fingers and toes. Günther (1858) considered the specimens of *R. gracilis* from Sri Lanka to be *R. malabarica* Tschudi, 1838, which is found in India. Rao (1922) described, *R. gracilis montanus* from Mysore, India which we consider conspecific with *R. temporalis*.

Distribution. Semi-arboreal. We collected this species from both wet and dry zones up to 460 m (Fig. 140). Species endemic to Sri Lanka.

Etymology. *Gracilis* (Latin) = slender, thin.

Material examined

No specific locality: CAS 85277, FMNH 81237, 174062, NHMB 943, 961-63, 7521, NHMW 2631, 2637 (3); Chilaw (sea level): AMNH 74281-82; Dodangaslanda: AMNH 76991-93; Inginiyagala: CM 83546, 83549, 83555-56; Kitulgala, 400 ft., Western Province: AMNH 74235-37; Pallewatta, Uva Province: CM 67581; Sinharaja, 1200 ft.: AMNH 77496; Trincomalee: FMNH 124447-49; Yatiyantota, 2100 ft.: AMNH 76990, 77497; WHT430, 32.0 mm, WHT789, 2 ex., 38.3-44.1 mm, Ritigala, alt. 460 m; WHT803, 2 ex., 26.3-29.7 mm, Opata (Kotugoda, alt. 6 m); WHT728, 2 ex., 58.7-67.6 mm, Kumaradola Group (Moneragala, alt. 305 m); WHT777, 40.3 mm, Hidogama (Anuradhapura, alt. 90 m); WHT815, 37.0 mm, Kalatuwawa (Labugama, alt. 150 m); WHT909, 2 ex., 47.9-54.2 mm,

Attidiya-Bellanwila, alt. 8 m; WHT947, 46.6 mm, Pallekele (near Kurunegala, alt. 150 m); WHT988, 32.3 mm, Dombagaskanda (Ingiriya, alt. 60 m); WHT1035, 2 ex., 36.4-36.8 mm, Mihintale, alt, 150 m; WHT1041, 51.3 mm, Udawalawe. alt. 100 m; WHT1254, 7 ex., 29.4-42.9 mm, Sigiriya, alt. 175 m.

Rana temporalis
Figures 141-143

Hylorana temporalis Günther, 1864: 427, pl. XXVI, Fig.6 (types: BMNH 52.2.19.43-44, 58.10.15.5-6, 53.7.19.11 and 58.10.15.18, from "Ceylon").

Diagnosis. See diagnosis of *R. aurantiaca* above.

Description. Snout-vent length of mature males 38.4-56.1 mm, gravid females 50.5-78.0 mm. Head longer than broad. Snout pointed when viewed laterally, its length equal or less than diameter of orbit. Narial opening laterally placed, nearer to tip of snout than to eye. Internarial distance slightly greater than or equal to interorbital distance. Interorbital distance more than width of upper eyelid. Canthus rostralis angular. Loreal region vertical and concave. A hard symphysial tubercle on anterior edge of mandible. Upper jaw with finely-pointed teeth; vomerine teeth in two groups. Tympanum distinct, rounded or vertically oval, its horizontal diameter equal to or less than half the width of the orbit. Supratympanic fold absent or feebly defined. Fingers free, long and slender; first finger shorter than fourth; second shortest; third finger longest. Distal subarticular tubercles on first and second fingers; penultimate subarticular tubercles on third and fourth fingers larger and more elevated when viewed laterally. Three distinct and oval palmar tubercles (Fig. 141). Tips of toes and fingers with distinct discs, a distinct circum-marginal groove separating their dorsal and ventral surfaces. Toe webbing to disc on outer side of first toe; to between distal subarticular tubercle and disc or to the disc itself on inner side and to disc on outer side of second toe; to between distal subarticular tubercle and disc or to the disc itself on inner side and to disc on outer side of third toe; to between distal subarticular tubercle and disc or to the disc itself on inner side and to disc on outer side of fourth toe; and to between distal subarticular tubercle and disc or to the disc itself on inner side of fifth toe. A less developed cutaneous fold on outer edge on fifth toe. Relative length of toes 1<2<3=5<4. Toes with dermal fringes on both sides. Subarticular

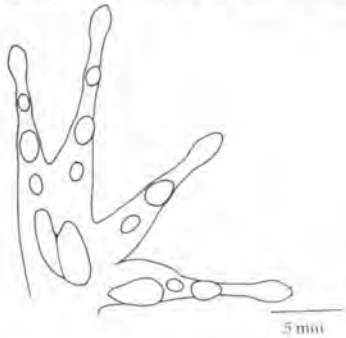

Figure 141. *Rana temporalis*, 74.6 mm SVL, WHT 254, ventral aspect of right hand.

Figure 142. *Rana temporalis*, 74.6 mm SVL, WHT 254, ventral aspect of right foot.

tubercles on toes distinct, more elevated when viewed laterally than in *R. gracilis* and *R. aurantiaca*. Inner metatarsal tubercle elongate and prominent; outer metatarsal tubercle rounded or slightly oval. Two tarsal ridges: the inner one continues to inner metatarsal tubercle and the outer one continues to outer edge of fifth toe; both ridges not well developed (Fig. 142). Dorsum finely granular; larger and more elevated tubercles around the vent, thighs, tibia and heels. Hind side of thighs with smooth granules. Males with more prominent granules and tubercles. A narrow, glandular, dorso-lateral fold from behind eye to groin; another interrupted glandular fold at angle of mouth. Shank granular or slightly tubercular with fine, longitudinal rows of tubercles. Male with humeral glands, nuptial pads on inner side and base of first finger, velvety in texture. External vocal sac absent.

Colour. In life, dorsal side of head and back brown, with or without darker spots Fig. 143). Loreal and temporal regions black, extending on to the sides of

Figure 143. *Rana temporalis*, 74.6 mm SVL, WHT 254 (photo: SL).

Figure 144. Distribution in Sri Lanka of *Rana temporalis*.

the body. Upper lip bright yellow or golden. Ventral side pale yellow or bright orange, or heavily speckled with dark brown, or completely dark brown except on underside of legs. Both limbs with dark cross-bands and spots.

Comments. All specimens examined from Sri Lanka in the present study possess distinct cross bars on the forelimbs, thigh, shank, and tarsus, but some specimens from Kerala, India, provisionally referred to this species, do not possess these bars and instead have distinct longitudinal ridges on the shank.

Distribution. This rocky-stream dwelling or semi-arboreal species was recorded mainly from shaded streams in rain forests throughout the wet zone up to elevations of about 1830 m (Fig. 144). The species is commoner in submontane rain forests than in coastal areas. It was observed mainly on wet boulders in streams rather than in the water itself.

Etymology. *Temporalis* is Latin for "pertaining to the temple (side of head)," which in this species has a distinct dark stripe.

Material examined

No specific locality: BMNH 71.11.14.39-42, NHMW 3236, 3240 (2); Bogawantatawa: MCZ 12916, UMMZ 61071; Deniyaya: NHMW 20236; Harasbedda: CM 67759-67; Kottawa: AMNH 83646; Kubukkama: MCZ 19201-203; Nanu Oya, Central Province: FMNH 131350; Nuwara-Eliya: AMNH 74217-18; Rakwana: CM 89460-63, 89478-81; Sinharaja Army Camp-Forest Reserve, Sourthern Province: CM 67888, 67983; Sinharaja, 3800 ft.: AMNH 77490-95; Yatiyantota, 2100 ft. Western Province: AMNH 76988-89; WHT647, 27.9 mm, WHT858, 20.7 mm, Pussella Estate (Parakaduwa, alt. 60 m); WHT653, 16.5 mm, WHT266, 2 ex., 23.6-24.4 mm, WHT981, 4 ex., 16.4-54.1 mm, Batadombalene (Kuruwita, alt. 460 m); WHT814, 2 ex., 17.3-34.5 mm, Kalatuwawa (Labugama, alt. 150 m); WHT832, 25.6 mm, Watura (near Kegalla, alt. 350 m); WHT827, 18.9 mm, Kabaragala near Rakwana, alt. 760 m; WHT249, 35.1-38.0 mm, WHT1137, 70.2 mm, WHT943, 19.6 mm, WHT453, 3 ex., 53.2-67.5 mm, Koskulana (near Panapola, alt. 460 m); WHT254, 74.6 mm, Walandure

(Kuruwita, alt. 150 m); WHT98, 2 ex., 50.1-57.6 mm, Laggala (Knuckles, alt. 1220 m); WHT788, 42.4 mm, Induruwa (Ratnapura, alt. 150 m); WHT786, 2 ex., 18.3-25.0 mm, WHT960, 20.4 mm, Parawalatenna (Kitulgala, alt. 150 m); WHT866, 4 ex., 27.0-62.2 mm, WHT884, 10 ex., 25.5-46.0 mm, Moray Estate, Rajamally (near Mousakelle, alt. 1370 m); WHT842, 65.2 mm, Kalupahana (between Belihul Oya and Haldummulla, alt. 760 m); WHT846, 52.2 mm, Mederipitiya (near Deniyaya, alt. 365 m); WHT915, 32.0 mm, Devonford Estate (between Bogawantalawa and Balangoda, alt. 1525 m); WHT942, 13.8 mm, Kanneliya (Galle, alt. 150 m); WHT986, 25.2 mm, Warnagala near Kuruvita (Peak Wilderness, alt. 760 m); WHT1013, 56.1 mm, WHT1014, 5 ex., 20.0-68.9 mm, Morningside (near Rakwana), alt. 1060 m; WHT1016, 2 ex., 16.2-17.3 mm, Banduradeniya (Nahitiya Mukalana), alt. 458 m; WHT1024, 25.7 mm, Hakgala (near Nuwara Eliya), alt. 1830 m; WHT1232, 2 ex., 23.5-30.5 mm, Pupulagala, alt. 1375 m; WHT1233, 21.7 mm, Landuyaya, alt. 1230 m; WHT1261, 2 ex., 30.4-50.5 mm, Ambulawa (near Gampola), alt. 915 m; WHT1262, 5 ex., 18.8-72.0 mm, Maratenna (Balangoda), alt. 1525 m; WHT1266, 64.6 mm, WHT1268, 55.7 mm, Haycock, (Hiniduma, Galle), alt. 660 m; WHT1271, 3 ex., 43.4-49.7 mm, Haputale, alt. 1525 m; WHT1272, 4 ex., 26.2-68.1 mm, Ramboda, alt. 1310 m; WHT1275, 2 ex., 22.0-39.4 mm, Mahawalatenna (Balangoda), alt. 515 m; WHT1289, 20.5 mm, Panagula (between Tunmodera and Puwakpitiya), alt. 275 m.

Tomopterna Duméril and Bibron, 1841 (type species *Pyxicephalus delalandii* Tschudi, 1838, by subsequent designation by Boulenger, 1918), referred to Tomopterninae Dubois, 1992. Thirteen species in Africa, Madagascar and south Asia; two in Sri Lanka.

Tomopterna breviceps
Figures 145-148

Rana breviceps Schneider, 1799: 140 (syntypes: ZMB, from "Indes Orientales", India).

Diagnosis. Similar to *Tomopterna rolandae*, but lacking a tubercle at the tibiotarsal articulation. Snout truncate when viewed laterally (Fig. 145) (vs. rounded) and a distal subarticular tubercle present on first toe (absent in *T. rolandae*).

Description. Body shape globular. Snout-vent length of mature males 41.0-55.0 mm, gravid females 43.0-57.0 mm. Head small, broader than long. Snout rounded dorsally and truncate laterally (Fig. 145), not projecting beyond lower jaw. Nostrils nearer to tip of snout than to eye. Internarial width slightly greater than interorbital width. Interorbital distance less than width of upper eyelid. Canthus rostralis indistinct. Loreal region oblique, concave. A hard symphysial tubercle on anterior edge of mandible. Upper jaw with finely-pointed teeth and vomerine teeth in two groups. Tympanum distinct, vertically oval or rounded, its horizontal diameter equal to half or more than half that of orbit, and equal also to distance between nostril and anterior edge of orbit. Supratympanic fold distinct, from behind eye to base of forelimb. Fingers free, their tips moderately thick and rounded. First finger shorter than second and fourth; third finger longest. Subarticular tubercles conical, prominent on fingers. Distal subarticular tubercles on first and second fingers; penultimate subarticular tubercles on third and fourth fingers large and more elevated when

Figure 145. *Tomopterna breviceps*, 46.7 mm SVL, WHT 946, lateral aspect of head.

viewed laterally. Two distinct palmar tubercles. Webbing to between tip and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on inner side and between tip and distal subarticular tubercle on outer side of second toe; to penultimate subarticular tubercle on inner side and distal subarticular tubercle on outer side of third toe; to between penultimate and antepenultimate subarticular tubercle on inner side and antepenultimate subarticular tubercle on outer side of fourth toe; and between penultimate and distal subarticular tubercular on inner side of fifth toe. Relative length of toes 1<2<3=5<4. Dermal fringes on both sides of second, third and fourth toes, and inner side of fifth toe. Toe tips rounded. Inner metatarsal tubercle large, strongly compressed, shovel shaped and ridged, longer than first toe. Outer metatarsal tubercle and tarsal ridges absent. Dorsum smooth or granular with small, rounded or elongate warts. Belly and undersurfaces of the thighs granulated; tubercles around the vent more prominent. Throat and breast smooth. Male with external vocal sac.

Colour. (In alcohol) upper surface light yellowish brown, symmetrically marbled with dark brown (Fig. 146). Interorbital bar black. Three vertical dark-brown bars on upper lip. Forelimb and tibia with cross-bars. Hind side of both limbs, flanks and upper surface of femur marbled with dark brown (Fig. 147). Dorsum with a yellowish vertebral band, and also a very fine, brown line within the mid-vertebral band (Figs. 146). Ventral side yellowish white. Throat brown. A prominent yellow patch above supratympanic area. Dorsal colour (in alcohol) light brown or yellowish-brown with rounded or elongate, black, symmetrical patches; a wide mid-vertebral band with triangular dilations on head; interorbital bar black, interrupted by vertebral band; a yellowish-white dorsolateral band from behind eye and above tympanum to groin; lips with distinct white and brown bars; limbs with black cross bars; inner side of thigh

Figure 146. *Tomopterna breviceps*, 46.7 mm SVL, WHT 946, dorsal aspect.

Figure 147. *Tomopterna breviceps*, NHMB 936, Chilaw, Sri Lanka, dorsal aspect.

speckled with white and brown. Male with black patches on the throat; throat of female speckled with brown and white. See Fig. 148 for colour in life in an Indian example.

Comments. *Tomopterna breviceps* shows a wide range of morphological variation in India, Pakistan and Nepal. Two other species, *T. dobsonii* (Boulenger,

Figure 148. *Tomopterna breviceps*, not preserved, Bengal, India (photo: KD)

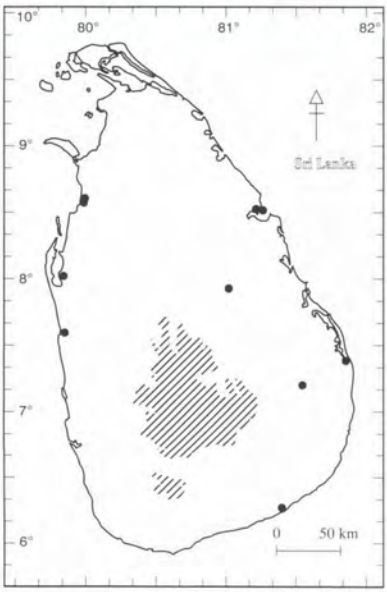

Figure 149. Distribution in Sri Lanka of *Tomopterna breviceps*.

1882) from India, and *T. rolandae* (from India and Sri Lanka) are similar to *T. breviceps*; this led Bhati & Shukla (1975) to consider *T. dobsonii* as conspecific with *T. breviceps*; but Pillai (1982) and Dutta (pers. obs.) consider *T. dobsonii* to be a distinct species.

We suspect that most previous records of *T. breviceps* from Sri Lanka and India are based on specimens of both *T. breviceps* and *T. rolandae*. *Tomopterna*

strachani Murray, 1884 from Pakistan was reported by Khan (1976) to be closely related to *T. breviceps*, who thought the taxa could be conspecific.

Distribution. Nocturnal, terrestrial. During the day, particularly during the dry season, they aestivate in loose soil. Recorded mainly from arid areas (Fig. 149).

Etymology. *Brevis* (Latin) = short; *ceps*, Latin, a reference to the head.

Material examined

No specific locality: NHMB 933, 936-38; Chilaw, Western Province: AMNH 74279; China Bay, near Trincomalee: CM 83623-25; Inginiyagala: CM 83557; Kalmunai: CM 83591-93; Karradikuli, North Eastern Province: CM 67845-46; Marichchukkaddi: CM 89533; Nikaweratiya: BMNH 1955.1.10.6; Northern Province: NHMB 940; Puttalam: CM 677732-43; Trincomalee: FMNH 122661, 12706-28, 174644-46, NHMB 934-35, 939; Yala, Southern Province: AMNH 74293; WHT946, 46.7 mm, WHT1297, 39.6 mm, Palatupana (Kirinda, alt. 5 m); WHT1304, 27.5 mm, Polonnaruwa, alt. 55 m.

Tomopterna rolandae

Figures 150-158

Rana (Tomopterna) breviceps rolandae Dubois, 1983: Alytes, 2: 166 (holotype: BMNH 1973.3024, from "Kurunegala", Sri Lanka).

Diagnosis. See diagnosis of *T. breviceps*.

Description. (See Figs. 150 and 151 for photograph of holotype and radiograph of paratype, BM19.31.2.1.1). Body habitus globular. Snout-vent length of mature males 32.5-38.5 mm, gravid females 33.8-44.5 mm. Head small, dis-

Figure 150. *Tomopterna rolandae*, holotype, BMNH 1973.30.24, Kurunegala, Sri Lanka, dorsal aspect.

Figure 151. *Tomopterna rolandae*, BMNH 1931.2.1.1, Alutnuwara, Sri Lanka, radiograph.

Figure 152. *Tomopterna rolandae*, 42.4 mm SVL, WHT 878, lateral aspect of head.

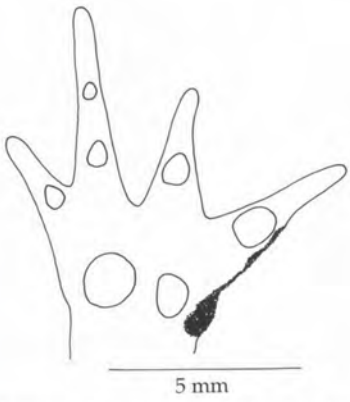

Figure 153. *Tomopterna rolandae*, 34.3 mm SVL, WHT 771, ventral aspect of right hand.

Figure 154. *Tomopterna rolandae*, 34.3 mm SVL, WHT 771, ventral aspect of right foot.

tinct, broader than long. Snout not projecting beyond lower jaw. Snout rounded when viewed both dorsally and laterally (Fig. 152). Nostril nearer to tip of snout than to eye. Internarial width greater than interorbital width. Interorbital distance less than width of upper eyelid. Canthus rostralis indistinct. Loreal region oblique, concave. A hard symphysial tubercle on anterior edge of mandible. Upper jaw with finely-pointed teeth and vomerine teeth in two groups. Tympanum distinct, rounded or vertically oval, its horizontal diameter equal to distance between nostril and anterior edge of orbit. Supratympanic fold present, from behind eye to base of forelimb. Fingers free, moderately thick, their tips rounded. First finger shorter than second and fourth; third finger longest. Subarticular tubercles conical, prominent on fingers; two distinct palmar tubercles (Fig. 153). Webbing almost to tip on outer side of first toe; to distal subarticular tubercle or between distal subarticular tubercle and tip on inner side and between tip and distal subarticular tubercle on outer side of second toe; to penultimate subarticular tubercle or between distal and penultimate subarticular tubercle on inner side and distal subarticular tubercle or between distal subarticular tubercle and tip on outer side of third toe; to penultimate subarticular tubercle or between penultimate and antepenultimate subarticular tubercle on inner side and antepenultimate subarticular tubercle or between penultimate and antepenultimate subarticular tubercle on outer side of fourth toe; and to distal or between penultimate and distal subarticular tubercle on inner side of fifth toe. Relative length of toes 1<2<5<3<4. Toes with dermal fringes on both sides of second, third, fourth, and only inner side on fifth; toe tips rounded. Inner metatarsal tubercle large, strongly compressed, shovel shaped and ridged, longer than the first toe. No outer metatarsal tubercle or tarsal ridge. A small but distinct tubercle at the tibio-tarsal articulation (Fig. 154). Dorsally smooth or granulate, with rounded or elongate scattered tubercles. About 8-10 rows of short, interrupted longitudinal folds sometimes present along the back. Small tubercles on hind limb. Belly and undersurfaces

Figure 155. *Tomopterna rolandae*, 42.3 mm SVL, WHT 244 (photo: SL).

Figure 156. *Tomopterna rolandae*, 42.4 mm SVL, WHT 878, dorsal aspect.

of the thighs granulated. Throat and breast smooth. Male with external vocal sac and nuptial pad on base and inner side of first finger, velvety in texture.

Colour. In life, upper surface light brown or yellow, symmetrically (or not) marbled with dark brown (Fig. 155). Interorbital bar black or dark brown. Some specimens with vertical yellow bars on upper lip; a yellowish-white line from

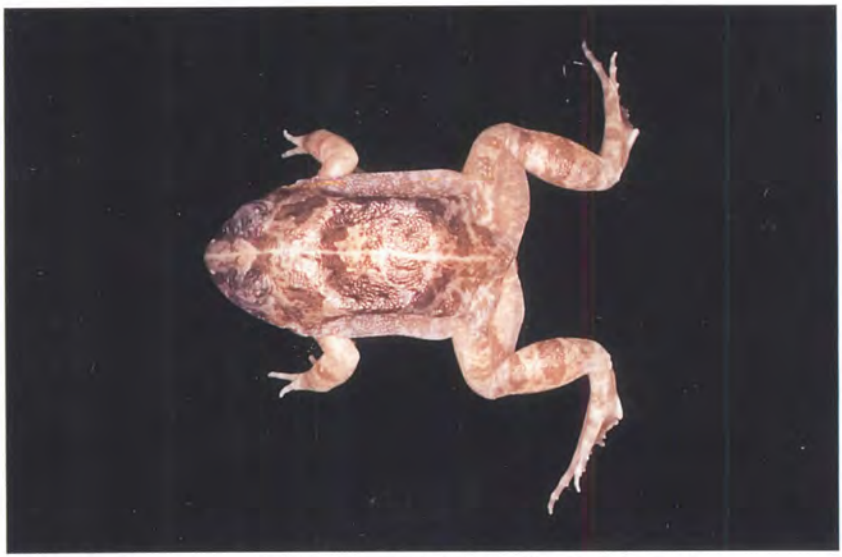

Figure 157. *Tomopterna rolandae*, 29.9 mm SVL, WHT 957, dorsal aspect.

Figure 158. *Tomopterna rolandae*, 34.3 mm SVL, WHT 771, dorsal aspect.

behind eye and above tympanum to groin. Limbs with cross-bars. Dorsum with or without (Fig. 156) a white or yellowish vertebral line (Fig. 157) or band (Fig. 158). Ventral side and undersides of thighs yellowish white or light brown. A male specimen (SVL 34.3 mm) with a dark bluish-black chin, and also some mature females with throat blotched in brown.

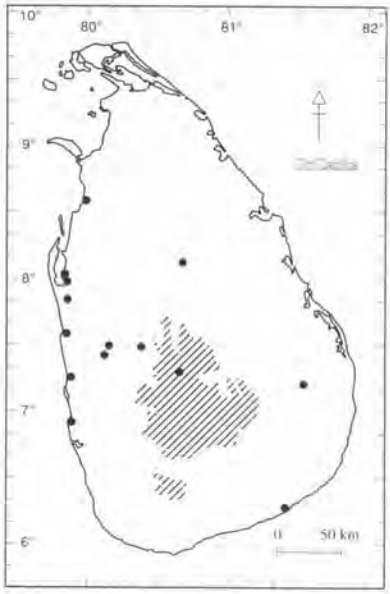

Figure 159. Distribution in Sri Lanka of *Tomopterna rolandae*.

Comments. *Tomopterna rolandae* is a member of the *T. breviceps* complex. Dubois (1983) described *T. rolandae* as a subspecies of *Rana breviceps* (= *T. breviceps*), but based on studies made by one of us (S.K.D.) of specimens of *Tomopterna* from Sri Lanka and India, we consider it a valid species. Outside Sri Lanka, *T. rolandae* is widely distributed in southern and eastern India and is sympatric with *T. breviceps*. Field studies in Orissa, India, revealed that *T. rolandae* has a call that is quite different from that of *T. breviceps*, with which the species was confused by Boulenger (1882, 1920), Bhaduri & Kripalani (1954), Daniel (1975), Mohanty-Hejmadi et al. (1979) and Pillai (1982). *Tomopterna rolandae* can be distinguished from *T. breviceps* by its smaller body size and tympanum diameter, more webbing between the toes, absence of a wide mid-dorsal stripe, presence of a small, rounded, tubercle at the joint of tibia and tarsus, and smooth or only slightly tuberculated dorsum. Two of the syntypes of *Sphaerotheca strigata* Günther, 1859, BMNH 1947.2.28.56 and 58, from Madras, India, possess a tubercle at the joint of tibia and tarsus; perhaps these two specimens belong to *T. rolandae*. None of the specimens of *T. breviceps* examined possesses this tubercle. Specimens of *T. breviceps* from northern India, Nepal, and Pakistan lack a wide mid-dorsal stripe like the those from eastern and southern India and from Sri Lanka. These specimens are similar to *T. rolandae* in their size and the presence or absence of a narrow mid-dorsal line. I concur with Dubois (1983) in his opinion that the continental populations of *T. breviceps* are polychromatic with respect to the mid-dorsal stripe, but none of the specimens of *T. rolandae* either from India or from Sri Lanka possesses the typical wide mid-dorsal stripe of *T. breviceps*. Dubois (1983) examined 12 specimens of *T. rolandae* (including the holotype) from Sri Lanka and commented that

three specimens have a wide stripe. But of these three specimens, one (BMNH 1955.1.10.6) belongs to *T. breviceps* and the other two, without the typical wide vertebral band of *T. breviceps*, which forms a triangular marking on the head, are *T. rolandae*. The original description of *Rana (Tomopterna) breviceps rolandae* Dubois, 1983 was therefore evidently based on specimens of both *T. breviceps* and *T. rolandae*.

Distribution. Nocturnal, terrestrial. During the day, particularly during the dry season, they often burrow in loose soil. Recorded from both wet and dry zones up to 200m (Fig. 159). Absent in rain forests.

Etymology. The species name refers to the type locality, Roland Estate (a rubber plantation) in Kurunegala District, Sri Lanka.

Material examined

No specific locality: BMNH 77.3.9.1-6, 77.3.9.8; Chilaw, Western Province: AMNH 74280, 74284; Colombo: BMNH 1982.1252-54; Inginiyagala, Eastern Province: AMNH 83644; Kandy: BMNH 1974.1137; Kondaichchi: CM 89492; Kurunegala: BMNH 1973.3024 (holotype); BMNH 1931.2.1.1, Alutnuwara; Marichchukkaddi: CM 83612, 67844; Nawadamkulama, Mundel: CM 89947; Puttalam, Western Province: AMNH 74264; WHT878, 42.4 mm, WHT906, 22.2 mm, WHT1045, 32.5 mm, Neligama (Merigama, alt. 60 m); WHT244, 42.3 mm, Palavi (Puttalam, alt. 5 m); WHT771, 3 ex., 19.9-34.3 mm, Wewagama (Kuliyapitiya, alt. 45 m); WHT434, 26.4 mm, Ritigala, alt. 200 m; WHT957, 29.9 mm, Palatupana (Kirinda, alt. 5 m); WHT1279, 37.6 mm, Buttala, alt. 160 m.

RHACOPHORIDAE

The Rhacophoridae in Sri Lanka are represented by four genera and 18 species, of which 14 are endemic. Little information is available on the Sri Lankan rhacophorids, many species being known only from the types and a handful of other specimens. It is difficult to distinguish some of the species from morphology alone.

All the Sri Lankan species of *Philautus* and *Theloderma* can be distinguished from species of *Rhacophorus* and *Polypedates* by the absence of vomerine teeth (present in *Rhacophorus* and *Polypedates*); Sri Lankan *Polypedates* and *Rhacophorus* differ in the size of their vomerine teeth and body colouration, but otherwise are morphologically similar. The only striking difference between these two genera in Sri Lanka concerns their reproductive biology: all Sri Lankan *Rhacophorus* have direct development on land, whereas *Polypedates* lays eggs in foam nests and have aquatic larvae. Here we follow Liem's (1970) generic assignment of the species.

Key to the Sri Lankan Rhacophoridae

1. Vomerine teeth present 2
   Vomerine teeth absent 10

2. Large, distinctly elevated vomerine teeth (Fig. 198) 3
   Small, short series of vomerine teeth (Fig. 226) 6

3. Without calcar 4
   With calcar 5

4. Coossified skull (Fig. 197) ..... *Polypedates cruciger*
   Skull without coossification (Fig. 212) ..... *Polypedates maculatus*

5. Extremely elongate and pointed snout (Fig. 207) ..... *Polypedates longinasus*
   Moderately elongate and pointed snout (Fig. 202) ..... *Polypedates eques*

6. Dorsum tuberculated; posterior margin of lowe arm and tarsus with distinct tuberculated fringe (Fig. 215) ..... *Rhacophorus cavirostris*
   Dorsum smooth or feebly tuberculated; no fringe 7

7. A papilla on middle of tongue 8
Without a papilla in middle of tongue 9

8. A conical papilla on middle of tongue (Fig. 225) ..... *Rhacophorus macropus*
A pointed papilla on middle of tongue (Fig. 245) .... *Rhacophorus reticulatus*

9. Fourth toe webbing to penultimate subarticular tubercle on outerside (Fig. 237) ..... *Rhacophorus microtympanum*
Fourth toe webbing to distal subarticular tubercle on outer side (Fig. 219) ..... *Rhacophorus fergusonianus*

10. A conical papilla on middle of tongue ..... *Philautus eximius*
No papilla on tongue 11

11. Dorsum heavily tuberculated; posterior margin of lower arm and tarsus with distinct, tuberculated fringe (Fig. 251) ..... *Theloderma schmarda*
Dorsum smooth or feebly tuberculated; no fringe 12

12. Fourth toe webbing to distal or penultimate subarticular tubercle or between them on outer side 13
Fourth toe webbing to between penultimate and antepenultimate subarticular tubercle on outer side or toes with rudimentary web at base 15

13. A small calcar present; snout sharply pointed when viewed dorsally ..... *Philautus nasutus*
Calcar absent; snout rounded or obtusely pointed when viewed dorsally 14

14. Fourth toe webbing to distal subarticular tubercle on outer side (Fig. 160); snout rounded when viewed dorsally ..... *Philautus femoralis*
Fourth toe webbing to penultimate subarticular tubercle on outer side (Fig. 184); snout obtusely pointed when viewed dorsally ..... *Philautus variabilis*

15. Snout sharply pointed ..... *Philautus temporalis*
Snout not sharply pointed 16

16. Fourth toe webbing to between penultimate and antepenultimate subarticular tubercle on outer side (Fig. 167) ..... *Philautus leucorhinus*
Toes with rudimentary web at base ..... *Philautus hypomelas*

Philautus Gistel, 1848 (type species *Hyla aurifasciatus* Schlegel, 1837 by monotypy). About 80 species distributed throughout Sri Lanka and India, across to China and the Philippines. The genus *Philautus* is represented in Sri Lanka by eight species, five of which are endemic to the island. The others occur also in southern India. Kirtisinghe (1957) recognised only four Sri Lankan species in this genus, and one of Kirtisinghe's species, *Philautus schmardanum*, was placed in *Theloderma* by Liem (1970). Two species, *P. hypomelas* and *P. temporalis*, which we consider valid, were placed in the synonymy of *P. leucorhinus* by Kirtisinghe (*op. cit.*). Furthermore, he considered *P. femoralis* to be a junior synonym of *P. variabilis*, which we consider a distinct species.

Laurent (1943) placed *Philautus temporalis* in *Pseudophilautus*, a genus he erected specially for this species. Morphologically, *Philautus temporalis* is similar to *P. leucorhinus* and *P. nasutus*, and we are doubtful of the validity of this generic placement. Much work remains to be done on the nominal species presently referred to this genus, and until then, considerable uncertainly will remain in the species and genus level taxonomy.

Philautus femoralis
Figures 160-162

Ixalus femoralis Günther, 1864: 434, pl. 26, Fig. D (type: BMNH 1947.2.26.89, from "Ceylon").

Ixalus pulchellus Günther, 1872: Annals and Magazine of Natural History, (4)9: 88 (holotype: BMNH 71.12.16.7, from "Ceylon").

Ixalus fergusonii Günther, 1876: Annals and Magazine of Natural History, (4)17: 377-380 (syntypes: BMNH 76.3.21.39(3), from "Ceylon").

Diagnosis. *Philautus femoralis* is similar to *P. variabilis*, but is distinguished by fourth toe webbing to distal subarticular tubercle on outer side and snout rounded when viewed dorsally (vs. fourth toe webbing to penultimate subarticular tubercle on outer side; snout obtusely pointed).

Description. Maximum snout-vent length 29.1 mm. Head longer than broad, depressed. Snout equal to diameter of eye, rounded. Narial opening nearer to tip of snout than to eye. Canthus rostralis distinct. Loreal region slightly concave. A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed teeth. Tympanum vertically oval, 30.0-35.1% diameter of eye. Supratympanic fold present. Fingers with rudimentary webbing between them; first finger shorter than second; third finger longest. Two palmar tubercles. Tips of digits with well- developed disks with prominent circum-marginal grooves. Both edges of digits with cutaneous fringes. Both fingers and toes with supernumerary tubercles. Disks on second, third and fourth fingers larger. Subarticular tubercles usually rounded or oval, sometimes conical. Toes webbed, webbing to distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on inner side and distal subarticular tubercle or between disk and distal subarticular tubercle on outer side of second toe; to penultimate subarticular tubercle or between distal subarticular tubercle and

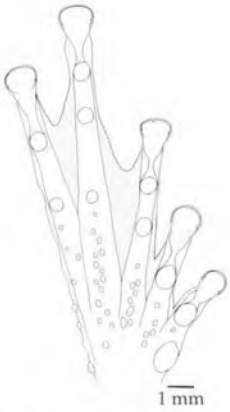

Figure 160. *Philautus femoralis*, 29.1 mm SVL, WHT 1154, ventral aspect of right foot.

penultimate subarticular tubercle on inner side and distal subarticular tubercle or between disk and distal subarticular tubercle on outer side of third toe; to penultimate subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle on inner side and distal subarticular tubercle on outer side of fourth toe; and to disk or between disk and distal subarticular tubercle on inner side of fifth toe (Fig. 160). Relative length of toes 1<2<3<5<4. Inner metatarsal tubercle oval, outer absent. Dorsum smooth or granular; chin smooth; venter granular. Large tubercles on around the vent and hinder side of thighs. Males with internal vocal sac and a well-developed nuptial pad on base of first finger.

Colour. In life, pale green above, a black, blunted chevron mark on dorsum. Limbs with cross bars (Fig. 161). In alcohol, dorsal colour pattern variable;

Figure 161. *Philautus femoralis*, 21.5 mm SVL, WHT 1316.

Figure 162. *Philautus pulchellus*, BMNH 71.12.14.17 (syntype), dorsal aspect.

uniform purple to dark brown on dorsum and forearm; a narrow purple line on thigh and foot; purple, brown or bluish spots on dorsum with white background; lower arm, thigh, foot, and venter yellowish-white.

Comments. Boulenger (1882) synonymized *Philautus fergusonii* and *P. pulchellus* (Fig. 162) from Sri Lanka with *P. femoralis*. Kirtisinghe (1957) considered all these three nominal species to be junior synonyms of *P. leucorhinus*. The types of *P. fergusonii* and *P. pulchellus* are too poorly preserved for de-

Figure 163. Distribution in Sri Lanka of *Philautus femoralis*.

tailed study, but the colouration and general habitus are similar to those of the type and other specimens of *P. femoralis* examined by us. *Philautus femoralis* can be distinguished from *P. leucorhinus* by the distinct colour pattern, rounded snout, indistinct tympanum and smooth dorsum. The specimens we have examined of *P. femoralis* from Kerala, India, are morphologically similar to specimens from Sri Lanka. The variable dorsal colour pattern is possessed by both these populations.

Distribution. This species has a restricted distribution in the central Sri Lanka and the Knuckles Range (Fig. 163), up to elevations of around 2135 m.

Etymology. The species name is a reference to the femur of this frog.

Material examined

No specific locality: BMNH 74.4.29.1231, 74.4.29.1233, BMNH 71.12.14.17, MCZ 15407, NHMW 3548; Nuwara-Eliya, 6000-7000 feet: BMNH 1973.30.37; WHT439, 17.1 mm, Nagrak Division, Nonpareil Estate (adjoining Horton Plains, alt. 2135 m); WHT1154, 29.1 mm, Ramboda, alt. 1310 m; WHT99, 20.5 mm, Laggala (Knuckles), alt. 1220 m; WHT 1316, 21.5 mm, Ilukkumbura (near Laggala), 600 m.

Philautus hypomelas

Figures 164-165

Ixalus hypomelas Günther, 1876: Annals and Magazine of Natural History, (4)17: 377-380 (syntypes: BMNH 74.4.29.552-555; 74.4.29.563-568, from "Ceylon").

Diagnosis. Similar to *Philautus leucorhinus*, but easily distinguished by the webbing on the fourth toe: toes with rudimentary web at base in *P. hypomelas* (vs. fourth toe webbing to between penultimate and antepenultimate subarticular tubercle on outer side in *P. leucorhinus*).

Description. A small *Philautus*; maximum snout-vent length 22.0 mm. Body elongate. Head longer than broad. Snout obtuse, rounded anteriorly. Narial nearer to tip of snout than to eye. Canthus rostralis distinct. Loreal region concave. Tympanum small, indistinct. Fingers completely free. Tips of digits with small disks. Toes with rudimentary web at base. Relative length of toes 1<2<3<5<4. Inner metatarsal tubercle oval; no outer metatarsal tubercle. Dorsum smooth. Belly and thigh granular.

Colour. In alcohol (Fig. 164a), dorsum deep brown or chocolate colour. Black colour patches laterally behind tympanum. Venter black with white and brown spots (Fig. 164b); a white line along midline of ventrum, sometimes crossed by another white line on chest. See Fig. 165 for colour in life.

Comments. *Philautus hypomelas* is known only from a few specimens, all of which are poorly preserved. Kirtisinghe (1957) synonymized the species with *P. leucorhinus*, but *P. hypomelas* is easily distinguished from *P. leucorhinus* by its rounded snout, small, indistinct tympanum, smooth dorsum, less webbing on the toes, and distinct spots on venter.

Distribution. Apart from the type series, this species has been recorded only from central Sri Lanka (Gampola: elevation 1830 m, near Kandy) (Fig. 166).

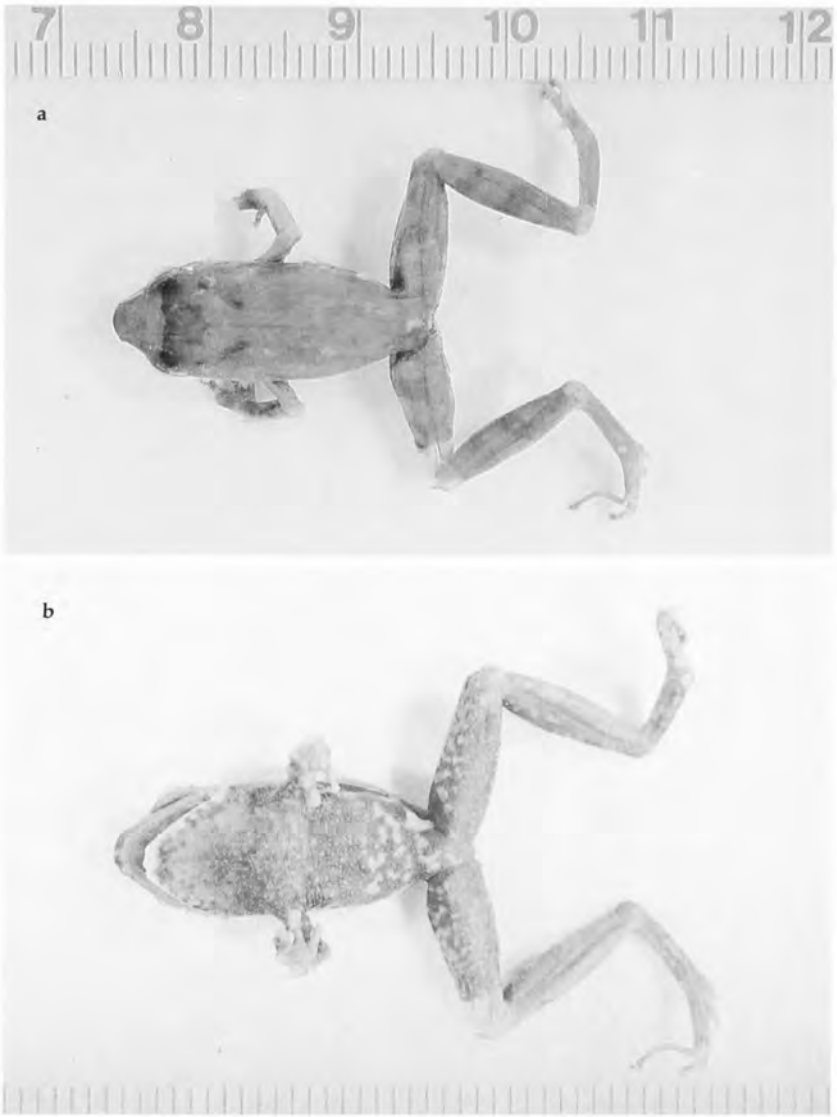

Figure 164. *Philautus hypomelas*, BMNH 1947.2.27.8 (syntype), (a) dorsal aspect, (b) ventral aspect.

"Adults in leaf litter during the day and on low vegetation of shrubs at night," I. Das, pers. comm. Species endemic to Sri Lanka.

Etymology. *Hypo*, Greek, = under; *melas*, Greek, = black.

Figure 165. *Philautus hypomelas*, not preserved, Gampola, Sri Lanka (photo: ID).

Figure 166. Distribution in Sri Lanka of *Philautus hypomelas*.

Material examined

No specific locality: AMNH 23722, BMNH 74.4.29.552-555, 74.4.29.563-568, 76.3.21.31-33 (syntypes); BMNH 1947.2.27.8; Nuwara-Eliya, 6000 feet, Central Province: AMNH 74214-15.

Philautus leucorhinus
Figures 167-171

Ixalus leucorhinus Lichtenstein and Martens, 1856: 36 (type: ZMB, from "Ceylon").

Ixalus halyi Boulenger, 1904: Journal of the Bombay Natural History Society, 15(3): 30-431 (holotype: BMNH 1903.9.26.50, from "Ceylon").

Diagnosis. See diagnosis of *Philautus hypomelas*.

Description. Snout-vent length of mature males 19.6-22.5 mm, gravid females 25.3-32.8 mm. Head longer than broad. Snout short (subequal to diameter of eye), blunt or pointed. Nares nearer to tip of snout than to eye. Canthus rostralis distinct. Loreal region slightly concave. A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed teeth. Tympanum distinct, rounded or vertically oval, its horizontal diameter about 32.1-37.5% diameter of eye. Supratympanic fold present, prominent. Fingers with rudimentary webbing. First finger slightly shorter than second, third finger longest. Two palmar tubercles. Tips of digits with well-developed disks with prominent circum-marginal grooves. Both edges of digits with cutaneous fringes. Disks on second, third and fourth fingers larger. Subarticular tubercles rounded or oval. Toes webbed, webbing to distal subarticular tubercle on outer side of first toe; very rudimentary webbing between first and second toes, to distal subarticular tubercle on outer side of second toe; to penultimate subarticular tubercle on inner side and distal subarticular tubercle on outer side of third toe; to between penultimate subarticular tubercle and antepenultimate subarticular tubercle on both inner and outer sides of fourth toe; and distal subarticular tubercle on inner side of fifth toe (Fig. 167). Relative length of toes 1<2<3<5<4. Inner metatarsal tubercle oval, outer absent. Dorsum smooth or slightly tubercular. Venter granular. Males with internal vocal sac and nuptial pad on base of first fingers.

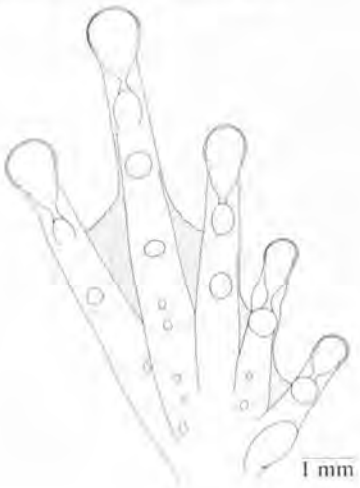

Figure 167. *Philautus leucorhinus*, 22.2 mm SVL, WHT 1168, ventral aspect of right foot.

Figure 168. *Philautus leucorhinus*, 22.2 mm SVL, WHT 1168.

Figure 169. *Philautus leucorhinus*, not preserved, Hakgala, Sri Lanka (photo: ID).

Colour. Dorsal colour in life reddish brown with black patches (Figs. 168-169). Lower arm and fingers with cross-bars; legs with dark, elongate patches. Venter brownish. Loreal and temporal region black. Interorbital bar black; a dark brown dorsolateral band on both sides, connected transversely at shoulder region (Fig. 170); a triangular spot on snout of some specimens; venter

Figure 170. *Philautus leucorhinus*, USNM 192627, dorsal aspect.

Figure 171. *Philautus leucorhinus*, CM 112085, dorsal aspect.

white; limbs with dark brown cross bars. Some specimens have a narrow, light yellow vertebral band which is sometimes branched above the vent and continues on the posterior side of each leg to the sole of foot (Fig. 171).

Comments. *Philautus leucorhinus* is a polymorphic species that is morphologically similar to *P. hypomelas* and *P. temporalis*. Kirtisinghe (1957) consid-

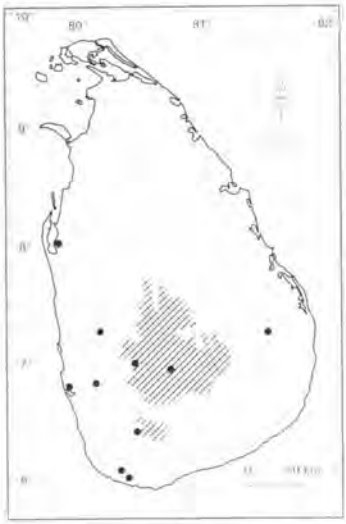

Figure 172. Distribution in Sri Lanka of *Philautus leucorhinus*.

ered *P. hypomelas* and *P. temporalis* to be conspecific with *P. leucorhinus*, but we regard the three species to be distinct. *Philautus temporalis* differs from *P. leucorhinus* by its pointed snout, smooth dorsum, and dorsal colour pattern. *Philautus hypomelas* can be distinguished from *P. leucorhinus* by its smaller size, rounded snout, smooth dorsum and less webbing between the toes. As Annandale (1913) commented, *P. leucorhinus* is also confused with *P. nasutus*, but *P. nasutus* may be distinguished by its sharply pointed snout, the presence of a mid-dorsal vertebral line and smooth dorsum.

Distribution. This bush and ground-dwelling species is distributed in both the wet and dry zones up to elevations of 1710 m (Fig. 172).

Etymology. *Leukos*, Greek, = white; *rhinos*, Greek, = nose.

Material examined

No specific locality: USNM 192627, CM 112085, BMNH 74.4.29.533-536, NHMW 3542, 3545(3); Arakauila, Padukka Rubber Estate: AMNH 83926; Inginiyagala, Eastern Province: AMNH 83651; Kitulgala, 400 feet: AMNH 74234; Nuwara-Eliya, Central Province: AMNH 74288, MCZ 3487, 8199, Puttalam: AMNH 74270; Warakapola, 500 feet: AMNH 74258; Western Province: AMNH 74259; WHT461, 14.0 mm, Koskulana (near Panapola, alt. 460 m); WHT1165, 24.1 mm, Kottawa (Galle, alt. 60 m); WHT1168, 22.2 mm, Kodagoda (Imaduwa, Galle), alt. 45 m; WHT1293, 19.6 mm, Katubedda (Moratuwa), alt. 5 m.

Philautus nasutus
Figures 173-176

Ixalus nasutus Günther, 1868: Proceedings of the Zoological Society of London, 1868: 484 (type: BMNH 68.3.14.34, from "Ceylon").

Diagnosis. Similar to *Philautus temporalis*, but easily distinguished by the presence of a small calcar on its heel (absent in *P. temporalis*).

Figure 173. *Philautus nasutus*, 28.0 mm SVL, female, WHT 1177.

Figure 174. *Philautus nasutus*, 20.9 mm SVL, male, WHT 1177.

Description. A small *Philautus*; snout-vent length of mature males 19.0-22.8 mm, gravid females 22.0-29.5 mm. Head longer than broad. Snout sharply pointed. Nostril nearer to tip of snout than to eye. Canthus rostralis distinct, angular. Loreal region slightly concave. A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed teeth. Tympanum distinct,

Figure 175. *Philautus nasutus*, USNM 67969, dorsal aspect.

Figure 176. *Philautus nasutus*, USNM 68014, dorsal aspect.

vertically oval, its horizontal diameter 30.8-54.8% diameter of eye. Supratympanic fold prominent. Fingers not webbed. First finger slightly shorter than second, third finger longest. Two palmar tubercles. Tips of digits with well developed disks with prominent circum-marginal grooves. Both edges of digits with cutaneous fringes. Both fingers and toes with supernumerary tu-

Figure 177. Distribution in Sri Lanka of *Philautus nasutus*.

bercles. Disks on second, third and fourth fingers larger. Subarticular tubercles rounded or oval, conical or blunt. Toes webbed, webbing to distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on inner side and disk or between disk and distal subarticular tubercle on outer side of second toe; to penultimate subarticular tubercle on inner side and disk or distal subarticular tubercle or between them on outer side of third toe; to penultimate subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle on inner side and distal subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle on outer side of fourth toe; and disk on inner side of fifth toe. Relative length of toes 1<2<3<5<4. A small calcar on heel. Inner metatarsal tubercle oval, outer absent. Dorsum slightly tubercular. Upper eyelid with a small conical tubercle. Adults with a very thin median dermal ridge from tip of snout to vent, and from parietal to mid-dorsal area. A denticulated fringe along the back of the forearm and tarsus. Chin smooth or finely granular. Belly and hinder sides of thighs granular. Males with external vocal sacs and velvety nuptial pads on base of first finger.

Colour. In life (Figs. 173-174), dorsal colour chestnut brown to pale brown; loreal and temporal regions black; hinder side of thighs dark brown; ventral side white with dark brown pigments. Dorsal colour (in alcohol) brown or grey (Fig. 175); black patch laterally on both sides from snout to base of forelimbs; limbs with dark brown cross bars; some specimens with a narrow, white vertebral band (Fig. 176); venter white with brown spots.

Comments. Morphologically, *Philautus nasutus* is similar to *P. temporalis*; the former species differs in its more pointed snout, smaller tympanum, slightly tuberculated dorsum, narrow head, and distinct colouration. Kirtisinghe (1957) confused *Philautus nasutus* with *Polypedates nasutus* (= *Polypedates longinasus*),

and his illustration and description of *Philautus nasutus* is based on specimens of *Polypedates longinasus* which has an extremely pointed snout and a distinct calcar.

Distribution. Wet zone up to 1375 m elevation (Fig. 177) (all the specimens collected were found on the ground, in leaf litter, in wet, shaded forest areas). Species endemic to Sri Lanka.

Etymology. *Nasutus*, Latin, = large-nosed.

Material examined

No specific locality: USNM 68014, USNM 67969, BMNH 1874.4.29.537-540; Bogawantalawa: UMMZ 61066(11); Central Province: AMNH 74216; Pundaluoya: MCZ 3787; WHT1141, 25.3 mm, Mederipitiya (near Deniyaya); alt. 365 m; WHT1149, 6 ex., 18.2-27.5 mm, WHT1177, 10 ex., 18.7-28.0 mm, Koskulana (near Panapola, alt. 460 m); WHT1148, 20 ex., 15.8-29.0 mm, Watugala (near Deniyaya), alt. 600 m.

Philautus temporalis
Figures 178-182

Ixalus temporalis Günther, 1864: 434 (syntypes: BMNH 1947.2.6.8; 1947.2.6.10-11, from "Ceylon"). Type species of *Pseudophilautus* Laurent, 1943: Bulletin du Musée Royal d'Histoire Naturelle de Belgique, 19(5): 2.

Diagnosis. See diagnosis of *Philautus nasutus*.

Description. A small *Philautus*: snout-vent length of mature males 20.0-22.3 mm, gravid females 22.8-27.7 mm. Head longer than broad. Snout pointed. Narial nearer to tip of snout than to eye. Canthus rostralis angular. Loreal region oblique and concave. A small symphysial knob on anterior edge of

Figure 178. *Philautus temporalis*, 19.3 mm SVL, WHT 1125.

Figure 179. *Philautus temporalis*, NHMB 7220, (a) dorsal aspect, (b) ventral aspect.

mandible. Upper jaw with fine-pointed teeth. Tympanum distinct, oval (horizontally), about 34.3% diameter of eye. Supratympanic fold present. Fingers free or rudimentary webbing between them. First finger slightly shorter than second, third finger longest. Two palmar tubercles. Tips of digits with well developed disks with prominent circum-marginal grooves. Both edges of digits with cutaneous fringes. Disks on second, third and fourth fingers larger. Subarticular tubercles rounded or oval. Toes webbed, no webbing between

Figure 180. *Philautus temporalis*, NHMB 7293, dorsal aspect.

Figure 181. *Philautus temporalis*, NHMB 1295, dorsal aspect.

Figure 182. *Philautus temporalis*, NHMB 7291, dorsal aspect.

Figure 183. Distribution in Sri Lanka of *Philautus temporalis*.

first and second, and second and third toes; and to between distal subarticular tubercle and penultimate subarticular tubercle on outer side of third toe; to antepenultimate subarticular tubercle on inner side and between penultimate subarticular tubercle and antepenultimate subarticular tubercle on outer sides of fourth toe; and distal subarticular tubercle on inner side of fifth toe. Relative length of toes 1<2<3<5<4 or 1>2>5>3>4. Inner metatarsal tubercle oval, outer absent. Dorsum smooth; venter granular. Males with internal vocal sac.

Colour. In life (Fig. 178), dorsum and limbs yellowish brown. Laterally and ventrally ash with black spots. A yellow midvertebral line present. A dark brown band from eye through the tympanum to base of forelimbs. Loreal region brown. Dorsal colour in alcohol variable (Fig. 179a); brown or, greyish-olive above. Interorbital bar black; with or without mid-vertebral bands (narrow or wide: Figs. 180-182). White triangular spot on canthus rostralis. Venter white with brown spots on throat (Fig. 179b). Limbs with brownish cross bars.

Comments. Boulenger (1890) treated *Philautus temporalis* as a junior synonym of *P. leucorhinus*. However, Ahl (1931) and Laurent (1943) considered *P. temporalis* as distinct and Laurent (*op. cit.*), on the basis of osteological characters, erected a new genus, *Pseudophilautus*, for *Philautus temporalis*. Kirtisinghe(1957) overlooked *Pseudophilautus* and like Boulenger (1890), considered *Philautus temporalis* to be a junior synonym of *Philautus leucorhinus*.

Distribution. Restricted to the wet zone. Found in leaf litter in shaded forests of the wet zone in the elevation range of approximately 150-1850 m (Fig. 183). Species endemic to Sri Lanka.

Etymology. Temporalis, Latin, a reference to the temporal region of the frog, which has a dark stripe.

Material examined
No specific locality: BMNH 1856.7.9.5, 1973.3042. Nuwara-Eliya: NHMB 1220-22, 1283-97, 1302-1309, 7220, 2770, 7291, 7293; WHT1125, 19.3 mm, Adam's Peak, alt. 1850 m.

Philautus variabilis
Figures 184-188

Ixalus variabilis Günther, 1858 (publ. 1859): 74 (type: BMNH, from "Ceylon").

Diagnosis. See diagnosis of *Philautus femoralis*.

Description. A small *Philautus:* snout-vent length of mature males 16.6-28.5 mm, gravid females 30.0-31.5 mm. Head length greater than or equal to its width. Snout obtusely pointed. Nostril nearer to tip of snout than to eye. Canthus rostralis obtuse. Loreal region flat or concave. A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed teeth. Tympanum distinct, rounded, horizontally oval or vertically oval, 22.6-41.9% diameter of eye. Supratympanic fold prominent. Fingers rudimentarily webbed. First finger slightly shorter than second, third finger longest. Two palmar tubercles. Tips of digits with well developed disks with prominent circum-marginal grooves. Disk on fourth toe and on first finger smaller. Both edges of digits with cutaneous fringes. Both fingers and toes with supernumerary tubercles. Subarticular tubercles rounded or oval, conical or blunt (WHT102, Gammaduwa: conical subarticular tubercles; WHT440, Horton Plains: with blunt subarticular tubercles; WHT1144, Kanneliya: with conical subarticular tubercles). Toes webbed, webbing to distal subarticular tubercle on outer side of first toe (or very rudimentary webbing between first and second toes); to distal subarticular tubercle on inner side and distal subarticular tubercle or between disk and distal subarticular tubercle on outer side of second toe (or very rudimentary webbing between second and third toes); to penultimate subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle on inner side and distal subarticular tubercle or between

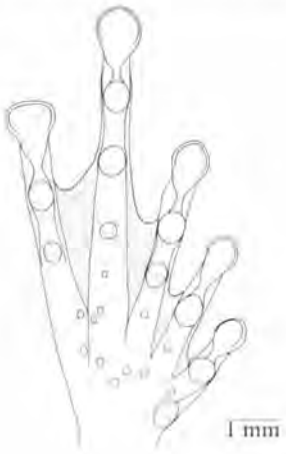

Figure 184. *Philautus variabilis*, 18.7 mm SVL, WHT 272, ventral aspect of right foot.

Figure 185. *Philautus variabilis*, 18.7 mm SVL, WHT 272 (photo: SL).

Figure 186. *Philautus variabilis*, 18.0 mm SVL, WHT 1315.

disk and distal subarticular tubercle on outer side of third toe; to penultimate subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle (or rarely on distal subarticular or between penultimate subarticular tubercle and antepenultimate subarticular tubercle) on inner side and penultimate subarticular tubercle on outer sides of fourth toe; and distal subarticular tubercle or between disk and distal subarticular tubercle on inner

Figure 187. *Philautus variabilis*, 21.0 mm SVL, WHT 729 (photo: SL).

Figure 188. *Philautus variabilis*, 27.4 mm SVL, WHT 1317.

side of fifth toe (Fig. 184). Inner metatarsal tubercle oval, outer absent. Some specimens with small, white-tipped tubercles on dorsum, hinder sides of thighs, around the vent, on both limbs and around the tympanum; a very thin dermal ridge on dorsum from tip of snout to vent. Dorsum smooth; venter granular. Males with more prominent white-tipped tubercles, an external vocal sac and a well-developed, velvety nuptial pad on the base of first finger.

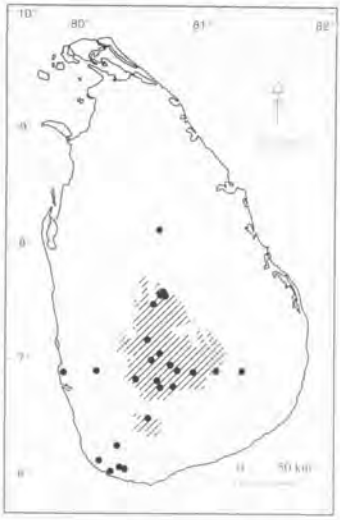

Figure 189. Distribution in Sri Lanka of *Philautus variabilis*.

Colour. In life light, dark or reddish brown, sometimes pale green (Figs. 185-188); flank with or without white patches; few white spots on both lips. Loreal region dark brown; some specimens with a yellowish mid-vertebral line; chin and chest with brown spots. Limbs with or without cross-bars; some mature males with golden forelimbs. Dorsal colour (in alcohol) variable; dorsum ranges from light tan to dark brown, with or without a brown, inverted "V" pattern; some specimens with small brown spots on dorsum and an interorbital band; hind limbs sometimes with cross bars.

Comments. *Philautus variabilis* is represented by a variety of colour morphs in Sri Lanka. Kirtisinghe (1957) confused *P. femoralis* with *P. variabilis* and considered the former to be a junior synonym of the latter. Boulenger (1891) reported (from a single specimen) *Ixalus signatus* (Boulenger, 1882) in Sri Lanka (type locality Malabar—now Kerala—India). His identification was evidently based on the fact that a conical papilla was present on the middle of the tongue. Shreve (1940) described *P. eximius* as having a conical papilla on the tongue, but no *Philautus* from Sri Lanka has been reported to possess such a lingual papilla except for Boulenger's record of *P. signatus* and the types of *P. eximius* (four of the smaller paratypes of which lack this papilla). The only other Sri Lankan rhacophorids that possesses a conical papilla on the tongue are species of *Rhacophorus*, though some of the juveniles of these species lack the papilla. The systematic value of this character is unclear, and we have not been able to examine the specimen from Sri Lanka which was identified as *P. signatus* by Boulenger (1891). We suspect this could be a *Rhacophorus* or another specimen of *P. eximius* with a conical lingual papilla.

Kirtisinghe(1957) considered the specimens of *P. signatus* to be *P. variabilis*, and he reported *P. eximius* to be conspecific with *P. variabilis*. All of the morphological characters of the types of *P. eximius* agree with the diagnostic characters of *P. variabilis*. We concur with Kirtisinghe's identification of the speci-

men *P. signatus* reported from Sri Lanka by Boulenger, and his synonymy of *P. eximius* with *P. variabilis*.

Distribution. The range extends throughout the wet zone up to 2135 m altitude and wet pockets of the dry zone (Monaragala, Ritigala) (Fig. 189).

Etymology. *Variabilis*, Latin, = changeable.

Material examined

No specific locality: BMNH 53.3.30.23, 68.3.17.31; Bogawantalawa, Central Province: MCZ 12895, 15019, UMMZ 6107 (2); Gammaduwa: BMNH 1955.1.10.58-59; Nuwara-Eliya: NHMB 1227-32; WHT102, 11 ex., 15.5-27.5 mm, Mousakanda-Gammaduwa, alt. 915 m; WHT440, 25.5 mm, WHT1140, 20.8 mm, 15.2 mm, Nagrak Division, Nonpareil Estate (adjoining Horton Plains, alt. 2135 m); WHT1143, 4 ex., 16.2-22.9 mm, Namunukula, Gonakelle (Palagolla, alt. 1370 m); WHT1144, 6 ex., 12.7-20.9 mm, WHT1156, 6 ex., 15.3-20.6 mm, WHT1157, 22.0 mm, WHT1158, 11 ex., 11.6-22.1 mm, WHT1152, 2 ex., 14.9-19.6 mm, Kanneliya (Galle, alt. 150 m); WHT1138, 22.1 mm, near Devonford Estate (between Bogawantalawa and Balangoda, alt. 1525 m); WHT1139, 22.7 mm, WHT1164, 2 ex., 19.7-27.6 mm, Hakgala (near Nuwara Eliya), alt. 1830 m; WHT641, 22.5 mm, Weralugahamulla (Rakwana), alt. 305 m; WHT729, 21.0 mm, Kumaradola Group (Moneragala, alt. 305 m); 01145, 19.5 mm, WHT1146, 18.5 mm, Rumassala (Galle, alt. 5 m); WHT1147, 21.0 mm, Hapugala (Galle), alt. 15 m; WHT1159, 19.2 mm, WHT1160, 4 ex., 10.9-18.8 mm, Wakwella (Galle, alt. 30 m); WHT1150, 6 ex., 13.3-19.4 mm, WHT1153, 18 ex., 10.7-21.0 mm, Ramboda, alt. 1310 m; WHT1151, 22.4 mm, Kodagoda, Imaduwa, alt, 45 m; WHT1102, 2 ex., 18.2-25.1 mm, Belipola Estate, Mirahawatta, alt. 850 m; WHT272, 2 ex., 18.1-18.7 mm, Gampola, alt. 485 m; WHT1155, 23.6 mm, Panagula (between Tunmodera and Puwakpitiya), alt. 275 m; WHT1162, 18.3 mm, Adam's Peak, alt. 1850 m; WHT433, 2 ex., 18.0-18.2 mm, Ritigala, alt. 460 m; WHT96, 4 ex., 22.2-23.7 mm, Laggala (Knuckles), alt. 1220 m; WHT1163, 2 ex., 16.7-22.1 mm, Matale, alt. 335 m; WHT1315, 18.0 mm, Nugegoda (near Colombo), alt. 4 m; WHT1312, 18.1 mm, 1801, Kolapatna (near Kotmale), alt. 1220 m; WHT 1317, 27.4 mm, Ilukkumbura (near Laggala), 600 m.

Philautus stictomerus

Figure 190

Ixalus stictomerus Günther, 1875, Proceedings of the Zoological Society of London, 1875: 575-576 (holotype: BM 1947.2.8.54, from "Ceylon").

Original description of the species (Günther, 1875)—

"Snout of moderate length, rather pointed, with distinct canthus rostralis. Tongue without free pointed papilla in the middle. Tympanum very small, distinct. Skin smooth. The length of the body is less than the distance between vent and metatarsal tubercle; a cutaneous fold along the tarsus, commencing from the single small metatarsal tubercle; fingers with rudimentary web; toes of moderate length, half-webbed. Disks moderately developed. Olive-coloured, with indistinct symmetrical markings on the back, an interocular cross bar being darkest. A dark streak along the canthus rostralis is continued over the tympanum. Femur with three very indistinct cross bars above, its anterior and posterior sides being blackish minutely marbled with white. Lower parts whitish.

Figure 190. *Philautus stictomerus*, BMNH 1947.2.8.54 (holotype), dorsal aspect.

Figure 191. Distribution in Sri Lanka of *Philautus stictomerus*.

"A single specimen was obtained by Lieut. Col. Beddome in Ceylon; it is 34 millims. long, the length of the hind leg being 48 millims."

Comments. We have not had an opportunity of examining the holotype (but see photograph at Fig. 190). Kirtisinghe (1957), without giving reasons, considered *Philautus stictomerus* to be a junior synonym of *Rhacophorus microtympanum*. However, the absence of vomerine teeth suggests that it is in fact a *Philautus*.

Distribution. The only specimen with detailed collection data is BMNH 1973.3108-3109, from "1000-1200 ft., Kanneliya forest, Udugama (Fig. 191).

Etymology. *Sticto*, Greek, = spotted, punctured; *merus*, Latin, = pure, genuine.

Material examined
Holotype: BMNH 1947.2.8.54 (female), BMNH 1874.4.29.529-530, from "Ceylon"; BMNH 1973. 3040-3041, from "Ceylon"; BMNH 1973.3108-3109, from "1000-1200 ft., Kanneliya forest, Udugama, Ceylon.

Philautus eximius
Figures 192-195

Philautus eximius Shreve, 1940: Proceedings of the Biological Society of Washington, 53: 105-108 (holotype: MCZ 20879; paratypes: MCZ 20880-84; all from "Queenwood Estate, Dimbulla, 5000 feet, Ceylon", 26,1-35.5 mm SVL.

Diagnosis. Distinguished from all other Sri Lankan *Philautus* by the presence of a conical papilla on the middle of the tongue.

Description (based on two specimens, WHT1166, 30.5 mm and WHT1167, 19.8 mm). Snout-vent length 19.8-30.5 mm. Head longer than broad. Snout bluntly pointed. Narial nearer to tip of snout than to eye. Canthus rostralis indistinct. Loreal region oblique and concave. A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed teeth. Tympanum distinct horizontally oval, about 29.4-30.2% diameter of eye. Supratympanic fold present, prominent. Fingers with rudimentary webbing between them; first finger shorter than second, third finger longest. Two palmar tubercles. Tips of digits with well developed disks with prominent circum-marginal grooves;

Figure 192. *Philautus eximius*, MCZ 20879 (holotype), dorsal aspect.

Figure 193. *Philautus eximius*, MCZ 20881 (paratype), dorsal aspect.

Figure 194. *Philautus eximius*, MCZ 20883 (paratype), dorsal aspect.

disks on third and fourth fingers larger and oval in shape; and disks on first and second fingers and all toes with rounded disks. Both edges of digits with cutaneous fringes. Both fingers and toes with supernumerary tubercles. Subarticular tubercles rounded or oval, conical. Toes webbed, webbing to disk on outer side of first toe; to between disk and distal subarticular tubercle on

Figure 195. *Philautus eximius*, 27.6 mm SVL, WHT 253.

Figure 196. Distribution in Sri Lanka of *Philautus eximius*.

inner side and disk on outer side of second toe; to distal subarticular tubercle on inner side and disk on outer side of third toe; to distal subarticular tubercle on inner side and between disk and distal subarticular tubercle on outer sides of fourth toe; and disk on inner side of fifth toe. Relative length of toes 1<2<3<5<4. Inner metatarsal tubercle oval, outer absent. Dorsum tuberculated or smooth. Around the gape with one or two prominent tubercles. Very thin dermal ridge on dorsum from tip of the snout to vent. Chin and chest smoothly granular and abdomen roughly granular. Both limbs with tubercles. Vent surrounded by prominent tubercles.

Colour. (In alcohol), dorsally brown; a black interorbital bar present (Figs. 192-194). "W" shape marking on the dorsum. Venter light brown. Limbs with dark cross bars. Colour in life see figure 195.

Comments. The only other species of *Philautus* known to have a conical papilla on the tongue is *Philautus signatus* Boulenger, 1891 (see comments under *P. variabilis*).

Distribution. Only three specimens have been collected recently, from Ramboda (1310 m), Koskulana (460 m) and Adam's Peak (1850 m) (Fig. 196). It was found on the ground in wet areas. Species endemic to Sri Lanka.

Etymology. *Eximius*, Latin, = uncommon, extraordinary.

Material examined

Dimbula, Queenwood Estate, 5,000 ft: MCZ 20879 (holotype), MCZ 20880-84 (paratypes). WHT1166, 30.5 mm, Ramboda, alt. 1310 m; WHT1 167, 19.8 mm, Adam's Peak, alt. 1850 m; WHT 253, 27.6 mm, Koskulana (near Panapola), 460m.

Polypedates Tschudi, 1838 (type species *Hyla leucomystax* Gravenhorst, 1829, by subsequent designation of Fitzinger, 1843). About 20 species in Sri Lanka, India and eastwards to Indonesian islands and China. Four species recorded from Sri Lanka; only one of which (*P. maculatus*) is also found in India, the other three (*P. cruciger*, *P. eques*, and *P. longinasus*) being endemic to the island. Wolf (1936) and De Silva (1955a) considered *P. eques* to be a subspecies of *Rhacophorus cruciger* (= *P. cruciger*); and *P. maculatus* to be a subspecies of *R. leucomystax* (= *P. leucomystax*). Further, Kirtisinghe (1957) placed *P. nasutus* (= *P. longinasus*) in the synonymy of *R. cruciger eques*. None of these workers provided reasons for these synonymies and here we recognise all four taxa as distinct species.

Polypedates cruciger
Figures 197-200

Polypedates cruciger Blyth, 1852 (publ. 1953): in Kelaart, 1852 (Appendix): 48 (type: not traced, from "Ceylon").

Diagnosis. Similar to *P. maculatus* but distinguished by its co-ossified skull (Fig. 197) (vs. skull without co-ossification in *P. maculatus*, Fig. 212).

Description. Snout-vent length of mature males 50.0-59.8 mm, gravid females 72.0-90.0 mm. Head length greater than or equal to head width. Snout bluntly pointed, projecting beyond lower jaw. Narial opening in a groove, nearer to tip of snout than to eye. Canthus rostralis angular. Loreal region oblique and concave. A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed teeth; two series of oblique vomerine teeth between choanae, close to inner anterior edge of choanae (Fig. 198). Skull with a bony parieto-squamosal arch. Skin coossified on fronto-parietal and squamosal bones (Fig.

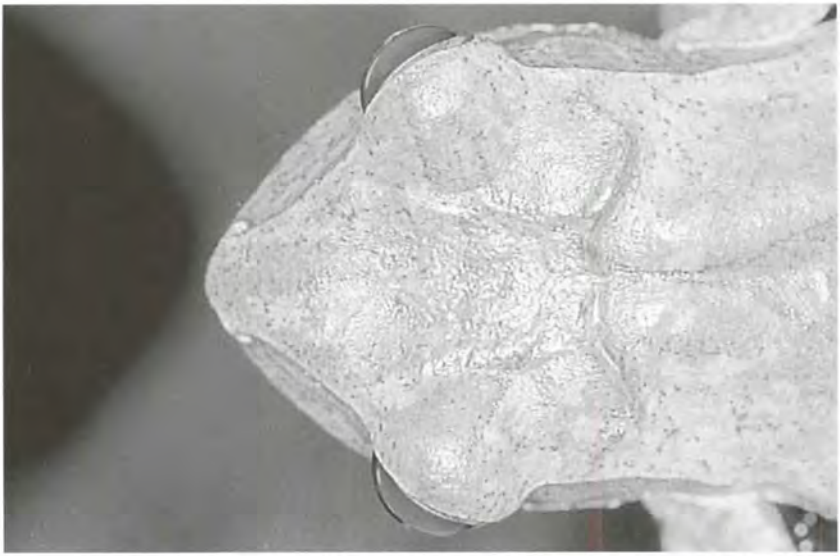

Figure 197. *Polypedates cruciger*, 84.8 mm SVL, WHT 1210, dorsal aspect of head.

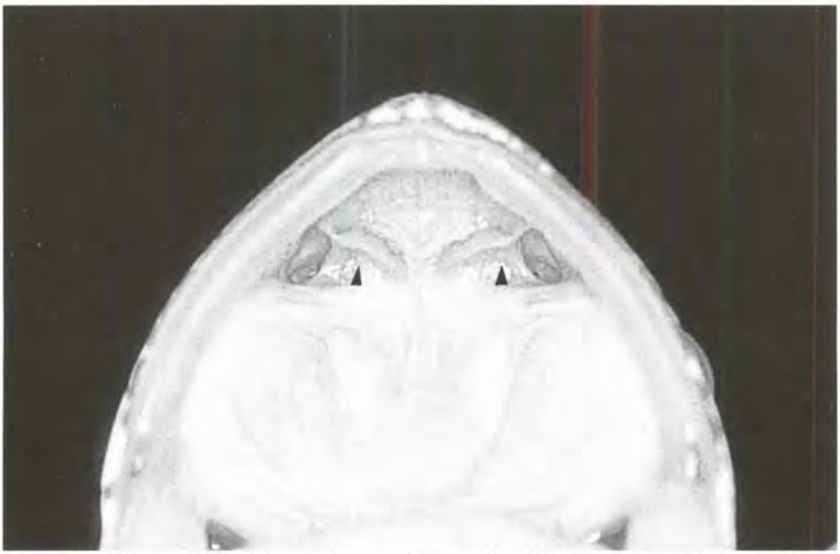

Figure 198. *Polypedates cruciger*, 84.8 mm SVL, WHT 1210, ventral aspect of palate (arrow indicates vomerine teeth).

197). Tympanum large, distinct, rounded or horizontally oval, diameter 53.7-67.8% of eye diameter. Supratympanic fold present. Fingers with rudimentary webbing between them, first finger slightly shorter than second, third finger longest. Two or three palmar tubercles. Tips of digits with well-developed disks; prominent circum-marginal grooves present. Both edges of digits

Figure 199. *Polypedates cruciger*, 53.1 mm SVL, WHT 242 (photo: SL).

with cutaneous fringes. Disks on second, third and fourth fingers larger. Subarticular tubercles rounded or oval. Toes webbed, webbing to disk or between disk and distal subarticular tubercle on outer side of first toe; to disk or between disk and distal subarticular tubercle on inner side and disk on outer side of second toe; to distal subarticular tubercle on inner side and disk on outer side of third toe; to distal subarticular tubercle (rarely on disk) on both inner and outer sides of fourth toe; and disk or between disk and distal subarticular tubercle on inner side of fifth toe. Relative length of toes, 1<2<3=5<4 or 1<2<3<5<4. A small oval inner metatarsal tubercle, laterally compressed, outer metatarsal tubercle absent; and supernumerary tubercles on toes. Dorsum, chin and chest smooth; belly and underside of thigh granular. Some mature male specimens with white-tipped tubercles on dorsum and thigh. Male with well developed, velvety nuptial pad on base of first finger.

Colour. In life, greenish-brown, dark brown (Fig. 199) or yellowish orange (Fig. 200). Dorsum with dark brown hourglass-shaped markings extending from mid-level of eyes to mid-dorsum; rest of dorsum with or without irregular dark brown pigmented patches. Some specimens with dark brown irregular patches on dorsum with whitish background and no hourglass-shaped markings; loreal and temporal regions black; a white line on upper lip from behind level of eye and extending to base of forelimbs. A row of yellowish-white granules along outer edge of forearm and fourth finger; groin with or without black and white speckles; venter white; black or dark brown bars on limbs; back of thigh uniformly brown with dark brown spots.

Comments. *Polypedates cruciger* has been confused with *P. leucomystax* (Gravenhorst, 1829) (type locality: Java) and *P. maculatus* (Boulenger, 1889;

Figure 200. *Polypedates cruciger*, not preserved, from Sri Lanka (photo: ID).

Wolf, 1936). Boulenger's (1889) study of the variation in the cranial osteology of *P. maculatus* suggested the derivation of *P. cruciger* from *P. maculatus*. Nevill (1888) pointed out morphological differences and similarities between *P. leucomystax* and *P. cruciger*. *Polypedates cruciger* possesses a coossified skull like that of *P. leucomystax*, and possibly based on this character, Wolf (1936) considered *P. cruciger* to be a subspecies of *P. leucomystax*. However, *P. leucomystax* has not been recorded from Sri Lanka. Further, Matsui et al. (1986) showed that *P. leucomystax* may or may not possess a coossified skull even within the same locality.

Kirtisinghe (1957) considered *P. eques* to be a subspecies of *P. cruciger*. The only character shared by both which might have led to this conclusion is the presence of an hourglass-shaped marking on the dorsum. However, this character is variable, and some specimens lack the marking altogether. The frog also changes body colour when exposed to varying intensities of light (De Silva, 1958a).

Morgan-Davies (1958) described the reproduction and metamorphosis of *Polypedates cruciger*. He made an extensive life-history study of the species in the field and laboratory. Like most *Polypedates*, *P. cruciger* lays eggs in a foam nest; clutch size varies from 240 to 300, eggs with an average diameter of 2.0 mm. The eggs are unpigmented. Both Kirtisinghe (1957) and Morgan-Davies (1958) described tadpoles.

Distribution. Occurs throughout Sri Lanka in both the dry and wet zone up to 1525 m (Fig. 201). It is entirely an arboreal species, found in human-occupied habitats and wet forests, in loose barks etc. Individuals appear to be territorial and often frequent the same haunt. Species endemic to Sri Lanka.

Etymology. *Cruciger*, Latin, = across, criss-crossed.

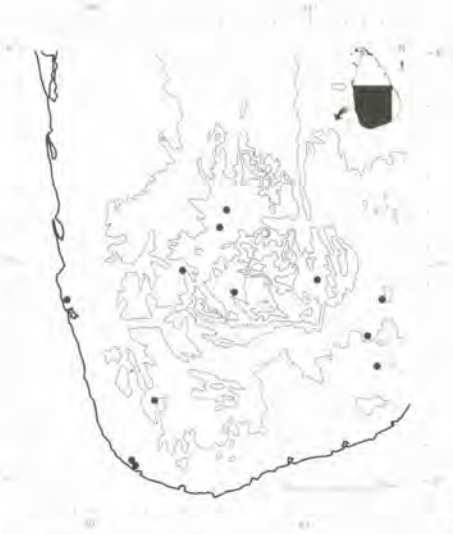

Figure 201. Distribution in Sri Lanka of *Polypedates cruciger*.

Material examined

No specific locality: CAS 85280, CAS-SU 2647, NHMB 1170-73, 7642-43, USNM 19231, 57782; Dimbula, Queenwood Estate, 5000 feet: MCZ 20870-72; Gampola, Central Province: CM 67687, 67984; Peradeniya: NHMB 1168-69; Hali-Ela, Uva Province: CM 67582; WHT970, 76.2 mm, WHT1091, 62.5 mm, WHT1092, 81.0 mm, WHT1095, 78.7 mm, WHT1099, 53.4 mm, Navinna (Galle, alt. 15 m); WHT1093, 75.6 mm, Galge (between Kataragama and Buttala, alt. 90 m); WHT1094, 71.6 mm, Konketiya (between Kataragama and Buttala, alt. 185 m); WHT202, 3 ex., 52.0-63.7 mm, Lihinigala-Yattapatha (Moragala near Agalawatta, alt. 150 m); WHT242, 53.1 mm, Parawalatenna (Kitulgala, alt. 150 m); WHT1090, 71.7 mm, Monaragala, alt. 150 m; WHT1247, 2 ex., 52.3-56.1 mm, Kohuwala (near Colombo), alt. 15 m, WHT1210, 84.8 mm, Hapugala (Galle), alt. 15 m.

Polypedates eques

Figures 202-205

Polypedates eques Günther, 1858 (publ. 1859): 80, pl.6, fig. B (syntypes: BMNH 54.3.21; 58.6.15.9-12, from "Ceylon").

Diagnosis. Similar to *P. longinasus* but easily distinguished by the moderately elongate and pointed snout (Fig. 202) (vs. extremely elongate and pointed snout in *P. longinasus* (Fig. 207)).

Description. Snout-vent length of mature males 32.0-42.0 mm, gravid females 62.0-71.0 mm. Head longer than wide. Snout pointed, triangular when viewed dorsally. Narial opening nearer to tip of snout than to eye. Canthus rostralis angular. Loreal region concave. A small symphysial knob on anterior edge of mandible. Two distinct series of oblique vomerine teeth between choanae, close to inner anterior edge of choanae. Upper jaw with fine-pointed teeth. Tympanum rounded or vertically oval, 48.1-60.0% of eye. Supratympanic fold present. Fingers slightly webbed. Three distinct palmar tubercles. First finger subequal

Figure 202. *Polypedates eques*, 71.0 mm SVL, WHT 968, lateral aspect of head.

to second, third finger longest. A glandular fold along forearm and on tarsus to tip of first toe. Tips of digits with well developed disks with prominent circum-marginal grooves. Both edges of digits with cutaneous fringes. Disks on second, third and fourth fingers larger. Subarticular tubercles rounded or oval. Toes webbed, webbing to disk or distal subarticular tubercle or between disk and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle or between disk and distal subarticular tubercle on inner side and disk on outer side of second toe; to distal or penultimate subarticular tubercle or between distal and penultimate subarticular tubercle on inner side and disk or distal subarticular tubercle on outer side of third toe; to distal or penultimate subarticular tubercle or between penultimate and distal subarticular tubercle on inner sides and distal subarticular tubercle on outer side of fourth toe; and disk on inner side of fifth toe. Relative length of toes 1<2<3<5<4. Inner metatarsal tubercle distinct. A narrow glandular fold along tarsus and outer edge of fifth toe. calcar present. Dorsum smooth; venter granular; vent surrounded by yellowish-white rounded tubercles; hinder side of thighs with tubercles. Male with well developed, velvety nuptial pad on base of first and second fingers and internal vocal sacs.

Colour In life, dorsum greyish-brown to orangish-yellow (Fig. 203) to reddish-brown (Fig. 204). Loreal region reddish orange. Tip of snout dark brown. Tibia and calcar reddish-orange. An hourglass-shaped marking on dorsum.

In alcohol, dorsum grey or reddish orange (Fig. 205), with variable markings; most specimens with a hourglass-shaped brown marking from middle of eye to mid-dorsum, rest of body spotted brown; some specimens without characteristic hourglass-shaped marking and with scattered dark brown patches on dorsum; venter white; some specimens with brown spots on throat

Figure 203. *Polypedates eques*, 41.1 mm SVL, WHT 1010.

Figure 204. *Polypedates eques*, WHT 1217, 33.7 mm SVL.

and on limbs; belly distinctly cross barred; vent surrounded by distinctly rounded tubercles. Limbs cross barred; inner side of thighs mottled.

Comments. Morphologically, *P. eques* is similar to *P. cruciger* and *P. longinasus*: each has hourglass-shaped markings on the dorsum and a slender habitus. This led Kirtisinghe (1957) to consider *P. eques* to be a subspecies of *P. cruciger*. However, the characteristic coossified skull and the bony parietal-squamosal

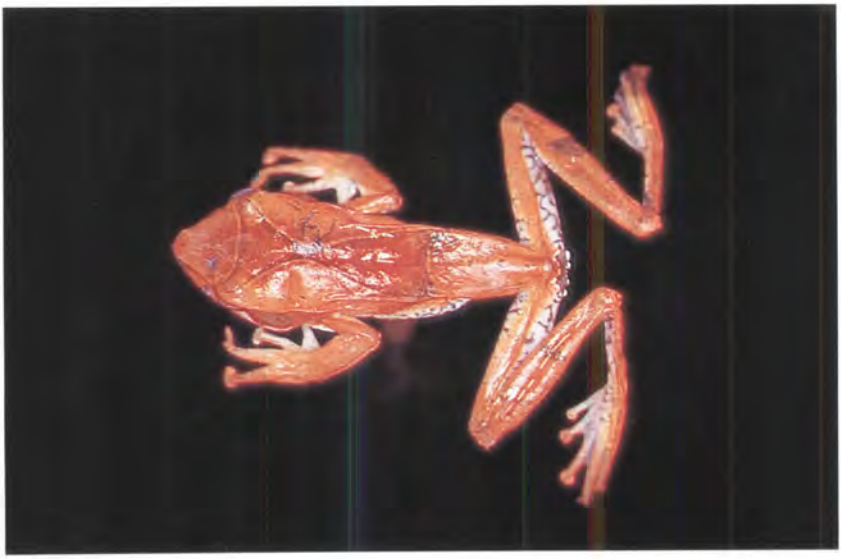

Figure 205. *Polypedates eques*, WHT 1313, 59.2 mm SVL.

Figure 206. Distribution in Sri Lanka of *Polypedates eques*.

arch of *P. cruciger* are lacking in *P. eques*. Senanayake (1969) described the morphological differences between *P. eques* and *P. nasutus* (= *P. longinasus*), which he considered to be conspecific with *P. eques*. *Polypedates eques* can be easily distinguished from *P. longinasus*: the former has a more elongate snout that terminates in a pointed dermal flap.

Distribution. *Polypedates eques* was recorded from the higher regions of the central hills (up to 2135 m alt.) and eastern Sinharaja (Fig. 206). Species endemic to Sri Lanka.

Etymology. *Eques*, Latin, = horseman, horse rider.

Material examined

No specific locality: CAS 85281-82, CAS-SU 2648, MCZ 1982, 2372, 10156-57, NHMB 1194-1214, RMNH 1961; Bogawantalawa: UMMZ 61078; Horton Plains, Central Province: AMNH 74202; Kandapola, 6500 feet, Central Province: AMNH 23734-35, MCZ 10184-85, NHMB 1146-65, 3079, 5639; WHT1087, 8 ex., 16.5-38.7 mm, Hakgala (near Nuwara Eliya), alt. 1830 m; WHT968, 71.0 mm, WHT1010, 2 ex., 39.6-41.1 mm, Nagrak Division, Nonpareil Estate (adjoining Horton Plains, alt. 2135 m); NMSL ARH 3 (a), 9 ex., 33.1-38.3 mm, Lindula alt. 1265 m; WHT1238, 5 ex., 31.0-34.3 mm, Haputale, alt. 1525 m; WHT1313, 59.2 mm, Pattipola, alt. 1890 m; WHT 1217, 33.7 mm, Morningside (near Rakwana), alt. 1060 m.

Polypedates longinasus
Figures 207-208

Rhacophorus longinasus Ahl, 1931: Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin, 1931: 44-45 (type: BMNH 68.5.13.16, from "Southern Ceylon").

Diagnosis. See diagnosis of *P. eques*.

Description. Snout-vent length of mature males 41.0-47.0 mm, gravid females 57.0-60.0 mm. Head longer than broad. Snout extremely pointed, 47.2-50.9% of head length (Fig. 207). Nostril nearer to tip of snout than to eye. Canthus rostralis angular. Loreal region grooved. Snout and narial openings project beyond margin of lower jaw. A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed teeth and two series of distinct, oblique vomerine teeth between choanae; choanae elliptical. Tympanum rounded,

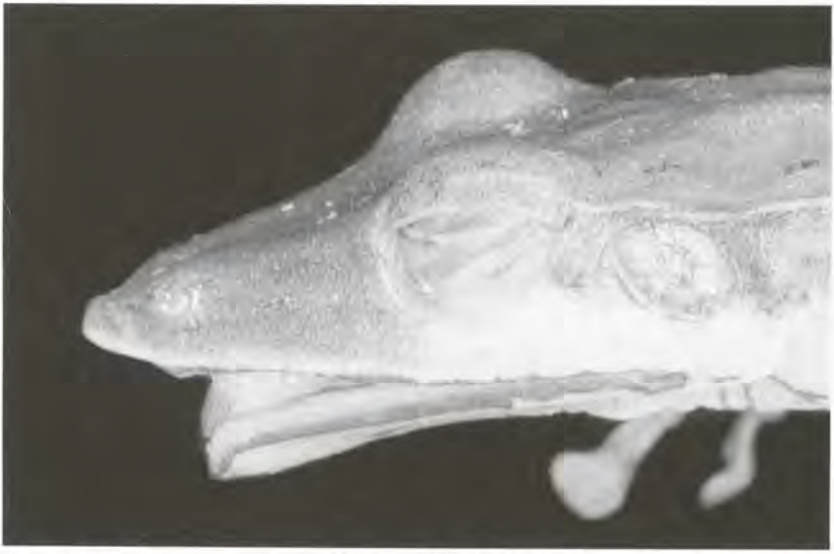

Figure 207. *Polypedates longinasus*, 55.2 mm SVL, WHT 778, lateral aspect of head.

Figure 208. *Polypedates longinasus*, not preserved, Sinharaja Forest, Sri Lanka (photo: RP).

vertically or horizontally oval, its horizontal diameter 43.2 to 51.4% of eye diameter. A supratympanic glandular fold present. Fingers free, first finger slightly shorter than second, third finger longest. Two palmar tubercles. Tips of digits with large, grooved disks; disks triangular. Subarticular tubercles rounded, oval and conical. Both fingers and toes with supernumerary tubercles. Narrow glandular fold along forearm and tarsus. Toes webbed, webbing to between disk and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on inner side and between disk and distal subarticular tubercle on outer side of second toe; to between distal subarticular tubercle and penultimate subarticular tubercle on inner side and between disk and distal subarticular tubercle on outer side of third toe; to penultimate subarticular tubercle on inner side and between distal subarticular tubercle and penultimate subarticular tubercle or distal subarticular tubercle on outer side of fourth toe; and disk or between disk and distal subarticular tubercle on inner side of fifth toe. Relative length of toes, 1<2<3<5<4. Inner metatarsal tubercle distinct, oval; outer metatarsal tubercle absent. Dorsum, chin and chest smooth; belly finely granular. Lower side of thigh with white tubercles; a series of four to six large, rounded, conical white tubercles below vent. Males with internal vocal sac and a nuptial pad on base of first finger.

Colour. In life, dorsum reddish-brown to dark brown; a bright red band from tip of snout to middle of flank (Fig. 208). Laterally dark brown. Lips yellow or white. Limbs light to dark brown and cross-barred. Calcar orange; venter white or pale yellow.

In alcohol, dorsum greenish-olive to grey; with or without a hourglass-shaped marking extending from mid-level of eye to mid-dorsum; some speci-

Figure 209. Distribution in Sri Lanka of *Polypedates longinasus*.

mens with irregular dark brown patches on dorsum. Scattered dark brown patches and very thin reddish lines on dorsum of some specimens, and fine black median line between hourglass-shaped markings; chocolate black band from tympanum to flanks; whitish-yellow band from below eye to groin; series of longitudinal rows of small, black spots above dorsolateral fold in some specimens; venter yellow; lower lip black; a pink-to red-coloured calcar.

Comments. Günther (1868) described this species as *Polypedates nasutus*, but Ahl (1927) provided the replacement name, *P. longinasus*, because *P. nasutus* was preoccupied in *Polypedates* by *Ixalus nasutus* Günther, 1868. Kirtisinghe (1957) and Senanayake (1969) neglected Ahl's (1927) replacement name, and maintained *P. nasutus*. Moreover, Kirtisinghe (1957) confused *P. nasutus* (= *P. longinasus*) with *Philautus nasutus* and his descriptions and illustrations of *Philautus nasutus* are actually those of *Polypedates longinasus*. Wolf (1936) considered *Polypedates nasutus* (= *Polypedates longinasus*) to be a junior synonym of *Rhacophorus eques* (= *Polypedates eques*). Similarly, Kirtisinghe (1957) considered *R. eques* (= *Polypedates eques*) a subspecies of *R. cruciger* (= *Polypedates cruciger*) and maintained *R. nasutus* (= *Polypedates longinasus*) as a junior synonym of *R. cruciger eques* (= *Polypedates eques*).

Senanayake (1969) reviewed the status of *Rhacophorus nasutus* (= *Polypedates longinasus*) and provided characters to differentiate *Polypedates longinasus* from *P. eques*. Morphologically, *P. longinasus* is similar to *P. eques* owing to their hourglass-shaped markings, but the former can be distinguished by its more pointed snout that terminates in a pointed dermal flap. Senanayake (1969) provided ecological, geographical, and systematic data for *P. longinasus*.

Description of larval stages and reproduction discussed by Fernando & Dayawansa (1995).

Distribution. Recorded from mid-hill to upper montane region of the central massif (150-1300 m alt., see Fig. 209). Species endemic to Sri Lanka.

Etymology. *Longi*, Latin, = long, elongate; *nasus*, Latin, = nose.

Material examined

Harasbedda, Central Province: CM 67790; Kanneliya, 1500 feet: BMNH 1967.547-548; Lower Matale, 1200 feet: AMNH 78927; WHT778, 55.2 mm, Parawalatenna (Kitulgala, alt. 150 m); WHT1176, 2 ex., 44.0-58.6 mm, Koskulana (near Panapola, alt. 460 m).

Polypedates maculatus

Figures 210-212

Hyla maculata Gray, 1834: pl. LXXXII, fig. 1. (no type material; locality India by implication).

Rhacophorus (Rhacophorus) maculatus biscutiger (Peters, 1871), Monatsberichte der Preussischen Akademie der Wissenschaften zu Berlin, 1871: 649 (holotype: ZMB; type locality: Rambodde, Ceylon).

Diagnosis. See diagnosis of *P. cruciger*.

Description. Snout-vent length of mature males 34.5-45.7 mm, gravid females 43.5-70.0 mm. Head longer than broad or equal (rarely broader than long). Snout bluntly pointed. Narial nearer to tip of snout than to eye. Canthus rostralis angular. Loreal region oblique and concave. A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed teeth and two series of distinct, oblique vomerine teeth between choanae, close to inner anterior edge of choanae. Small individuals and juveniles with a posterior frontal-parietal arch; large specimens with a thickened frontal-parietal process. Tympanum distinct, rounded or horizontally oval, 47.6-73.1% diameter of eye. Supratympanic fold present, prominent. Fingers with rudimentary webbing between them; first finger slightly shorter than second, third finger longest. Two palmar tubercles. Tips of digits with well-developed disks with prominent circum-marginal grooves. Both edges of digits with cutaneous fringes. Both fingers and toes with supernumerary tubercles. Disks on second, third and fourth fingers larger. Subarticular tubercles rounded or oval, conical. Toes webbed, webbing to disk or between disk and distal subarticular tubercle (rarely on distal subarticular tubercle) on outer side of first toe; to distal subarticular tubercle on inner side and disk or between disk and distal subarticular tubercle on outer side of second toe; to distal subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle on inner side and disk or between disk and distal subarticular tubercle on outer side of third toe; to distal or penultimate subarticular tubercle or between distal and penultimate subarticular tubercle on inner side and distal subarticular tubercle on outer sides of fourth toe; and disk or between disk and distal subarticular tubercle on inner side of fifth toe. Relative length of toes, 1<2<3<5<4. Inner metatarsal tubercle oval, outer absent. Dorsum smooth,

Figure 210. *Polypedates maculatus*, 42.3 SVL, WHT 974 (photo: SL).

Figure 211. *Polypedates maculatus*, not preserved, Bengal, India (photo: KD).

chin and chest smoothly granular, venter and underside of thigh granular. Males with internal vocal sac and nuptial pad at base of first finger.

Colour. In life (Fig. 210), dorsum olivaceous to chestnut, sometimes brownish-yellow or grey with scattered dark spots; loreal and temporal regions dark

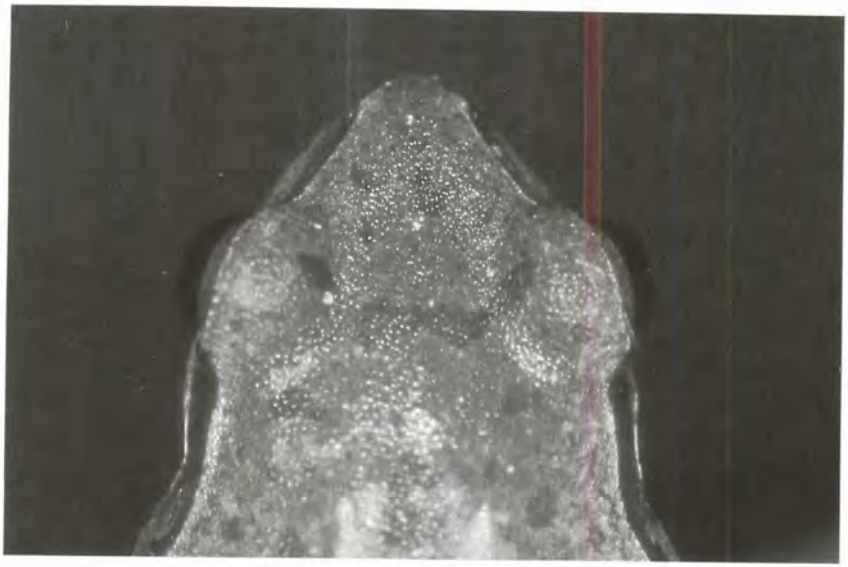

Figure 212. *Polypedates maculatus*, 40.5 mm SVL, WHT 1248, dorsal aspect of head.

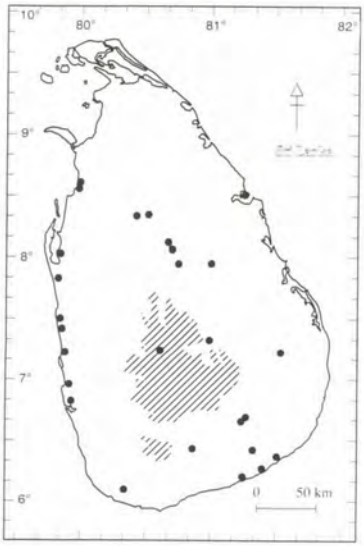

Figure 213. Distribution in Sri Lanka of *Polypedates maculatus*.

brown or black; limbs with dark cross-bars. Dorsal colour in alcohol variable; with brown or grey background and scattered black spots; a "W" shaped interorbital marking; loreal and temporal region black; limbs with black bars; inner side of thigh speckled with black and white; venter white.

Comments. *Polypedates maculatus* is the most widely distributed rhacophorid in Sri Lanka. Morphologically, this species is similar to *P. leucomystax* from India and south-east Asia and to *P. cruciger* from Sri Lanka. Boulenger (1889) provided characters to distinguish these three species and suggested that *P. cruciger* evolved from *P. maculatus*. Most specimens of *P. maculatus* from India (Fig. 211) and Sri Lanka have an extension of the frontal-parietal connected to the squamosal by a ligament. In some of the large adults, this ligament is thickened, but there is no sign of coossification (Fig. 212). Wolf (1936), Kirtisinghe (1957) and De Silva (1958a) considered *P. maculatus* to be subspecies of *P. leucomystax* (Gravenhorst, 1829) (type locality Java) although the latter has not been recorded from Sri Lanka. Peters (1871) recognised the Sri Lankan population of *Polypedates maculatus* as a distinct species *(Polypedates biscutiger)*. Dubois (1986) however considered the Sri Lankan population to be a subspecies of *P. maculatus*. Dubois noted the following distinguishing characters of *P. m. biscutiger*: dorsal pattern with few spots, not a triangular pattern as reported by Kirtisinghe (1957); nuptial pad on the second finger of the males absent; head relatively larger than in *P. m. maculatus*; and tibia relatively longer than in *P. m. maculatus*.

Distribution. Widely distributed in Sri Lanka up to 460 m (Fig. 213). It is found also in human-modified habitats, and like *P. cruciger* is found in houses. Individuals appear to be territorial and return to the same haunt during the day.

Etymology. *Maculatus*, Latin, = spotted.

Material examined

No specific locality: BMNH 1953.1.3.46, CAS 16922-24, FMNH 125374, MCZ 10158, NHMB 2625; Inginiyagala: CM 83547-48; Karadikkuli, Northern Province: CM 67891; Madampe: CM 67789; Marawilla, Southern Province: CM 67889; Marichcchukkaddi, Northern Province: CM 67890, 67892-93; Peradeniya: NHMB 1063-67; Puttalam, Westernn Province: AMNH 74272-73; Trincomalee: FMNH 125373, 125375-76, 125378-79; Yala, Southern Province: AMNH 74295, 74297; WHT971, 57.5 mm, WHT974, 42.3 mm, Palatupana (Kirinda), alt. 5 m; WHT965, 38.8 mm, Mahiyangana, alt. 90 m; WHT972, 39.5 mm, Palugaswewa (railway station), alt. 130 m; WHT973, 58.3 mm, Piliyandala, alt. 12 m; WHT969, 52.9 mm, Ritigala, alt. 200 m; WHT1080, 3 ex., 30.4-52.2 mm, WHT1081, 51.7 mm, WHT1085, 48.0 mm, Konketiya (between Kataragama and Buttala, alt. 185 m); WHT618, 2 ex., 38.6-41.2 mm, Weligatta (Bundala, alt. 5 m); WHT1082, 45.3 mm, Kataragama, alt. 44 m; WHT1083, 53.4 mm, Buttala, alt. 160 m; WHT1084, 66.7 mm, Mundel (near Puttalam, alt. 2 m); WHT1086, 42.3 mm, Modera, alt. 4 m; WHT1088, 3 ex., 36.7-46.7 mm, Anuradhapura, alt. 90 m; WHT1089, 3 ex., 41.5-45.7 mm, Udawalawe, alt. 100 m; WHT1098, 38.6 mm, Kottawa (Galle, alt. 60 m); WHT1248, 3 ex., 36.5-40.5 mm, Sigiriya, alt. 175 m; WHT1300, 26.5 mm, Negambo, alt, 2 m; WHT1301, 46.6 mm, Polonnaruwa, alt. 55 m.

Rhacophorus Kuhl and van Hasselt, 1822 (type species *Rhacophorus moschatus* Kuhl and van Hasselt, 1822, by monotypy). Over 50 species distributed from Sri Lanka and India through China to Japan and the Philippines. All five nominal species of *Rhacophorus* reported from Sri Lanka were referred to *R. microtympanum* by Wolf, 1936 and Kirtisinghe, 1957.

Rhacophorus cavirostris
Figures 214-217

Polypedates cavirostris Günther, 1868: 486, pl. 39, fig. 1 (holotype: BMNH 1868.3.17.32, from "Ceylon").

Ixalus fimbriatus Günther, 1872: Annals and Magazine of Natural History, (4)9: 67.87 (holotype: BMNH.1871.12.14.38, from "Ceylon").

Diagnosis. *Rhacophorus cavirostris* is distinguished from all other Sri Lankan rhacophorids except *Theloderma schmarda* by its tuberculated dorsum and distinctly tuberculated fringes on the posterior margin of lower arm and tarsus. It differs from *T. schmarda* in the presence of vomerine teeth (absent in *T. schmarda*).

Description. Snout-vent length of mature males 25.5-30.8 mm, gravid females 35.0-45.5 mm. Head longer than broad or width subequal to length. Snout short and blunt. Narial opening nearer to tip of snout than to eye, nasal capsuls prominent and elevated. Canthus rostralis distinct angular. Loreal region deeply concave. Two, short series of oblique vomerine teeth between choanae, close to inner front edge of choanae. Dorsal surface of tongue with or without tubercles. Tympanum distinct, round or vertically oval, 37.0-43.3% diameter of eye. Supratympanic fold prominent. Fingers with rudimentary webbing between them; first finger shorter than second, third finger longest, relative length of fingers 1<2<4<3. Outer edge of lower arm and fourth finger with prominent tuberculated cutaneous fringe. Two palmar tubercles, the inner one larger than the outer. Tips of digits with well developed disks with prominent circum-marginal grooves. Both edges of digits with cutaneous fringes. Fingers and palm with supernumerary tubercles. Subarticular tubercles distinct, rounded or oval, conical; prominent on fingers. Toes webbed, webbing to disk on outer side of first toe; to distal subarticular tubercle on inner side and disk on outer side of second toe; to distal subarticular tubercle on inner side and

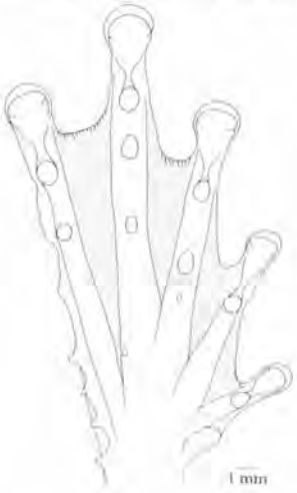

Figure 214. *Rhacophorus cavirostris*, 43.5 mm SVL, NMSL ARH 8(a), ventral aspect of right foot.

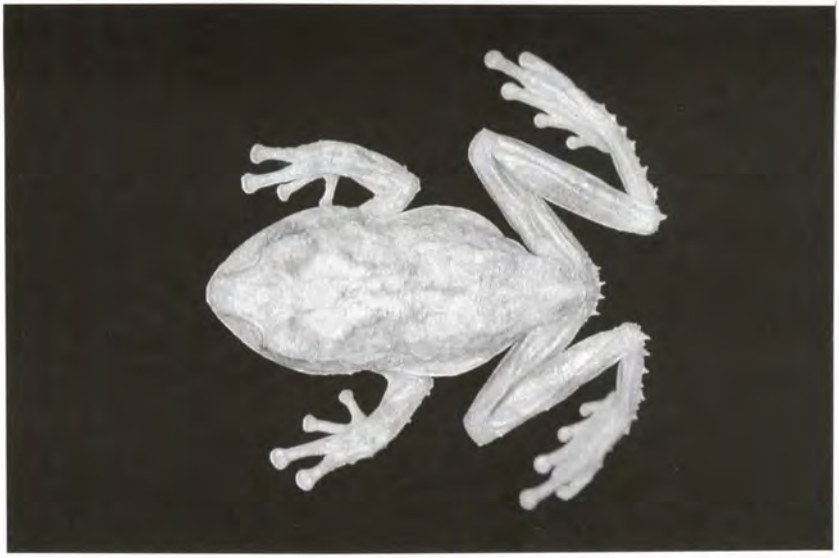

Figure 215. *Rhacophorus cavirostris*, 43.5 mm SVL, NMSL ARH 8 (a), dorsal aspect.

Figure 216. *Rhacophorus cavirostris*, 45.2 mm SVL, WHT1294.

disk on outer side of third toe; to distal subarticular tubercle on both inner and outer sides of fourth toe; and disk on inner side of fifth toe (Fig. 214). Relative length of toes 1<2<5<3<4 or 1<2<3=5<4. Outer edge of fifth toe and tarsi with prominent tuberculated fringe (Fig. 215). Inner metatarsal tubercle laterally compressed, oval outer absent. Dorsum with numerous small tubercles. Gular

Figure 217. *Rhacophorus cavirostris*, BMNH 1868.3.17.32 (holotype), dorsal aspect.

Figure 218. Distribution in Sri Lanka of *Rhacophorus cavirostris*.

smooth or smoothly granular, venter and underside of thighs granular. Area below vent and hindside of thighs with numerous spinous tubercles.

Colour. In life (Fig. 216), dorsum dark brown with unequal yellowish or light brown blotches. In alcohol, dorsum reddish-olive, marbled with black on sides. Ventrum whitish. Throat with brown spots. Limbs with indistinct black cross bands (Fig. 217).

Comments. Wolf (1936), Kirtisinghe (1957) and Liu & Hu (1961) considered *R. cavirostris*, to be junior synonym of *R. microtympanum* (which Liu & Hu (*op.*

cit.) transferred to *Philautus*), but *R. cavirostris* can be distinguished from all other Sri Lankan Rhacophoridae by the presence of conical fringes on the posterior margins of the hand and tarsus, and spinous tubercles below the vent. Liu & Hu (1961)

Distribution. This appears to be a canopy species (which probably explains why it is infrequently collected). The only specimens available to us were collected from Hiniduma (150 m alt.) and Haycock (660 m alt.), Galle District, southwestern Sri Lanka (Fig. 218). Species endemic to Sri Lanka.

Etymology. *Cavi*, Latin, = hollowed, caved; *rostris*, Latin, pertaining to the snout or muzzle.

Material examined

No specific locality: BMNH 1868.3.17.32 (holotype), 1871.12.14.33; Hiniduma: BMNH 1975.850; Ratnapura: BMNH 1955.1.10.51; NMSL ARH 8 (a), 2 ex,m 43.5-33.6 mm, Hiniduma (Galle), alt. 150 m; WHT1294, 45.2 mm, Haycock (Hiniduma), alt. 660 m.

Rhacophorus fergusonianus
Figure 219-223

Rhacophorus fergusonianus Ahl, 1927: Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin, 1927: 44 (holotype: BMNH 1876.3.21.34, from "Ceylon").

Diagnosis. *Rhacophorus fergusonianus* is similar to *R. microtympanum* but is distinguished from that species by its webbing on the outer side of the fourth toe: fourth toe webbing to distal subarticular tubercle on outer side (vs. to penultimate subarticular tubercle on outer side in *R. microtympanum*).

Description. Snout-vent length of mature males 30.0-37.3 mm, gravid females 33.5-48.3 mm. Head width greater than or equal to its length (rarely less). Snout short and subtriangular. Narial opening nearer to tip of snout than to eye.

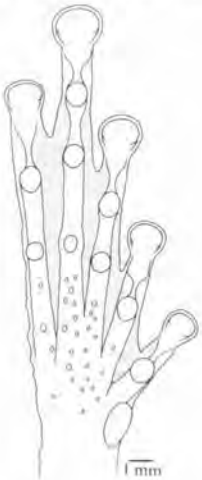

Figure 219. *Rhacophorus fergusonianus*, 46.2 mm SVL, WHT 734, ventral aspect of right foot.

Figure 220. *Rhacophorus fergusonianus*, not preserved, Gampola, Sri Lanka, (photo: ID).

Canthus rostralis distinct. Loreal region oblique and concave. A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed teeth and two small series of vomerine teeth between and close to anteromedial edge of choanae. Tympanum distinct, round, about 26.9-39.3% diameter of eye. Supratympanic fold present, prominent. Fingers with rudimentary webbing between them; first finger slightly shorter than second, third finger longest. Two palmar tubercles. Tips of digits with well-developed disks with prominent circum-marginal grooves; disks on third and fourth fingers larger and oval in shape; first and second fingers and all toes with rounded disks. Both edges of digits with cutaneous fringes; but cutaneous fringes on outer edge of fourth finger and fifth toe very prominent. Both fingers and toes with supernumerary tubercles. Subarticular tubercles rounded or oval, conical. Toes webbed, webbing to distal subarticular tubercle or between disk and distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle (or rudimentary webbing only) on inner side and distal subarticular tubercle or between disk and distal subarticular tubercle (or rarely to disk) on outer side of second toe; to distal subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle (or rarely to penultimate subarticular tubercle) on inner side and distal subarticular tubercle or between disk and distal subarticular tubercle (or rarely to disk) on outer side of third toe; to distal subarticular tubercle or between distal subarticular tubercle and penultimate subarticular tubercle (or rarely to penultimate subarticular tubercle) on inner side and distal subarticular tubercle on outer sides of fourth toe; and between disk and distal subarticular tubercle (or rarely to disk) on inner side of fifth toe (Fig. 219). Relative length of toes 1<2<3<5<4. Inner metatarsal tubercle oval, outer absent. Dorsum smooth or finely granular, venter

Figure 221. *Rhacophorus fergusonianus*, 35.0 mm SVL, WHT 101, Mousakanda, Gammaduwa (Knuckles), Sri Lanka.

Figure 222. *Rhacophorus fergusonianus*, 46.2 mm SVL, WHT 734.

and underside of thigh granular. Both limbs with tubercles. Males with internal vocal sac and nuptial pad at base of first finger.

Colour. In life, dorsum yellow (Fig. 220), yellowish-brown (Fig. 221) or dark brown (Fig. 222), with irregular dark brown patches. Venter pale yellow or brown. Throat and chest with or without fine brown spots. Some specimens

Figure 223. *Rhacophorus fergusonianus*, BMNH 1876.3.21.34 (holotype), dorsal aspect.

Figure 224. Distribution in Sri Lanka of *Rhacophorus fergusonianus*.

with two dark brown bands between eyes and two "W" shape patches on dorsum; limbs with cross bars (Fig. 223).

Comments. Ahl (1927) confused *Ixalus* (= *Philautus*) with *Rhacophorus* and provided the replacement name, *R. fergusonianus* for *R. fergusonii* Boulenger, 1882, which was preoccupied in *Philautus* by *Ixalus fergusonii* Günther, 1876. Wolf (1936) and Kirtisinghe (1957) considered *R. fergusonii* to be a junior synonym of *R. microtympanum*. *Rhacophorus fergusonianus* is morphologically similar to *R. macropus*, but it can be distinguished from *R. macropus* by having reduced webbing on the toes.

Distribution. This rocky-stream dwelling or arboreal species was recorded mainly from rain forests up to elevations of about 915-1710 m (Fig. 224). This species is more abundant in the Knuckles hills, but has also been recorded from the central hills. It was observed mainly on wet boulders in streams and rough tree barks. Species endemic to Sri Lanka.

Etymology. The species name is an eponym honouring William Ferguson (1820-1887), a British botanist and herpetologist who lived in Sri Lanka.

Material examined

No specific locality: BMNH 1876.3.21.34 (holotype); Belihul Oya: BMNH 1931.2.1.8-10; Koslanda: BMNH 1972.1893; Madulsima: BMNH 1908.7.2.3-7; Peradeniya: NHMB 1175-76; WHT734, 46.2 mm, Berragalla, alt. 1220 m; WHT94, 5 ex., 31.0-48.3 mm, Laggala (Knuckles), alt. 1220 m; WHT101, 12 ex., 23.9-45.7 mm, Mousakanda-Gammaduwa (Knuckles, alt. 915 m).

Rhacophorus macropus

Figures 225-233

Ixalus macropus Günther, 1868: Proceedings of the Zoological Society of London, 1868: 484, pl.39, fig. 4 (holotype BMNH 1864.7.11.24, from "South Ceylon").

Ixalus sarasinorum Müller, 1887: Verhandlungen der Naturforschenden Gesellschaft in Basel, 1887: 256-257, pl. 1., fig.1 (lectotype: NHMB 1218; paralectotypes: NHMB 1217-18; from "Peradeniya," Sri Lanka). New synonymy.

Polypedates nanus Günther, 1868: 485, pl.39, fig.3 (syntypes: BMNH 1868.5.13.3(4), from "S. Ceylon").

Diagnosis. *Rhacophorus macropus* is distinguished from all other Sri Lankan *Rhacophorus* except *R. reticulatus* by the presence of a conical papilla on the middle of the tongue, Fig. 225 (vs. a pointed papilla in *R. reticulatus*, Fig. 245).

Description. Snout-vent length of mature males 24.5-29.5 mm, gravid females 30.5-41.8 mm. Head longer than broad. Snout short and rounded. Narial opening nearer to tip of snout than to eye. Canthus rostralis angular. Loreal region

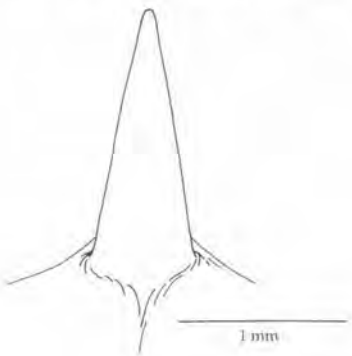

Figure 225. *Rhacophorus macropus*, 37.0 mm SVL, WHT 90: frontal aspect of lingual papilla.

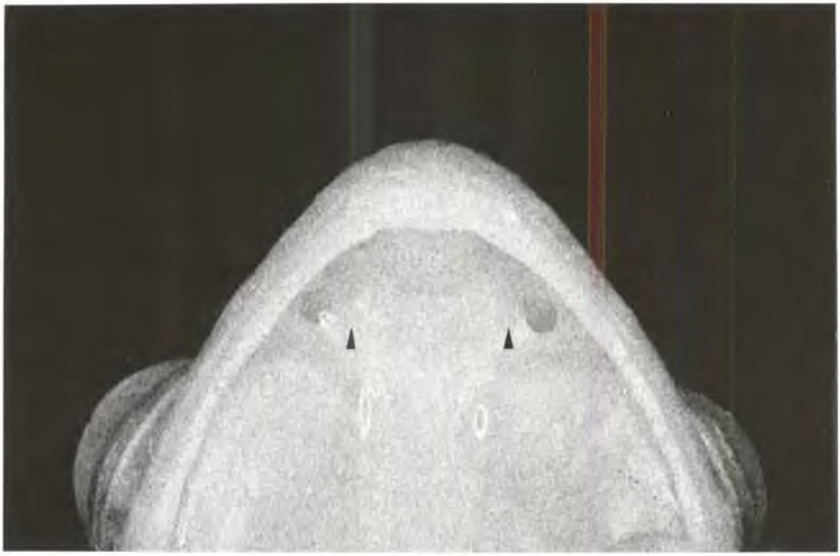

Figure 226. *Rhacophorus macropus*, 37.0 mm SVL, WHT 90: ventral aspect of palate (arrow indicates vomerine teeth).

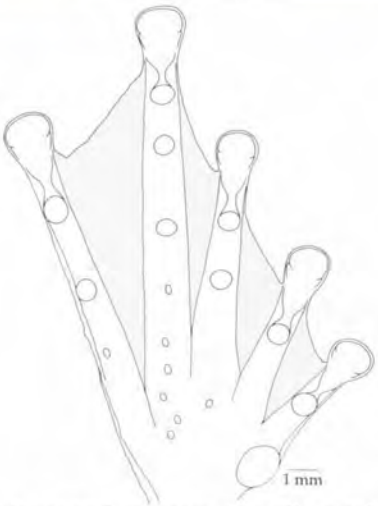

Figure 227. *Rhacophorus macropus*, 37.0 mm SVL, WHT 90: ventral aspect of right foot.

oblique and concave. A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed teeth; two small series of indistinct vomerine teeth (Fig. 226). A distinct conical papilla on middle of tongue. Tympanum distinct, rounded or vertically oval, about 18.4-26.0% diameter of eye. A prominent supratympanic fold present. Fingers with rudimentary webbing between them; first finger slightly shorter than second, third finger longest; a prominent cutaneous fringe on outer edge of fourth finger. Two palmar tubercles. Tips of digits with well developed disks with prominent circum-marginal grooves, disks on third and fourth fingers larger and oval in shape; and disks on first and second fingers and all toes with rounded disks. Both edges of digits with

Figure 228. *Rhacophorus macropus*, 37.0 mm SVL, WHT 90, Laggala, Sri Lanka.

Figure 229. *Rhacophorus macropus*, not preserved, Loolcondera, Sri Lanka.

cutaneous fringes. Both fingers and toes with supernumerary tubercles. Subarticular tubercles rounded or slightly oval. Toes webbed, webbing to disk on outer side of first toe; to disk or distal subarticular tubercle on inner side and disk on outer side of second toe; to disk or distal subarticular tubercle on inner side and disk on outer side of third toe; to disk or distal subarticular

Figure 230. *Rhacophorus macropus*, BMNH 1973.30.77, Bogowantalawa, Sri Lanka, dorsal aspect.

Figure 231. *Rhacophorus macropus*, BMNH 1973.30.81, Bogowantalawa, Sri Lanka, dorsal aspect.

tubercle on both inner and outer sides of fourth toe; and disk on inner side of fifth toe (Fig. 227); a prominent cutaneous fringe on outer edge of fifth toe. Relative length of toes 1<2<3<5<4. Inner metatarsal tubercle oval, outer absent. Dorsum smooth or with small white-tipped tubercles. Around the gape

Figure 232. *Rhacophorus macropus,* MCZ 20873, Queenwood, Dimbula, Sri Lanka, dorsal aspect.

Figure 233. *Micrixalus sarasinorum,* NHMB 1217 (lectotype), dorsal aspect.

with one or three very prominent tubercles. Chin and chest smoothly granular and abdomen roughly granular. Both limbs with tubercles. Males with nuptial pad at base of first finger and more prominent tubercular dorsum.

Colour. In life, dorsum brown with dark brown patches; dorsal tubercles white (Fig. 228-229). Interorbital with a dark bar or triangle. Two "W" shaped dark

Figure 234. Distribution in Sri Lanka of *Rhacophorus macropus*.

brown patches on dorsum behind eyes (Fig. 230). Some specimens with narrow vertebral bands from tip of snout to vent (Fig. 231). A single specimen with a light patch on the head (Fig. 232). Limbs cross-barred. Throat with brown spots. White spots laterally on both sides of head, below eyes and posteriorly on both sides of body at base of thigh. Ventrum yellowish-white.

Comments. *Rhacophorus macropus* is morphologically similar to *R. microtympanum* and *R. fergusonii*, but distinguished from both by its fully-webbed toes and distinctive colouration. Müller(1887) described *Ixalus sarasinorum* (Fig. 233) from Peradeniya, subsequently placed in *Micrixalus* by Boulenger (1888); except for the original description, no other information is available on this species. Kirtisinghe(1957) was doubtful about the presence of this species in Sri Lanka and suspected that the report of *Micrixalus* in Sri Lanka was erroneous.

Examination of the lectotype (NHMB 1217) and a paralectotype (NHMB 1218) of *Ixalus sarasinorum* did not assist in definitively assigning this species to either *Micrixalus* or *Rhacophorus*. Both *Micrixalus* and all Sri Lankan *Philautus* lack vomerine teeth. The types of *Micrixalus sarasinorum* also lack vomerine teeth. Histological preparation of the finger tip of the paratype revealed the presence of an intercalary cartilage before the last phalangeal bone, indicating that these specimens belong to the Rhacophoridae. Both types of *M. sarasinorum* possess a conical papilla on the middle of the tongue, a character which also is found in some Sri Lankan *Rhacophorus* and the types of *Philautus eximius*(= *Philautus variabilis*). Morphologically, the types of *M. sarasinorum* closely resemble specimens of *Rhacophorus macropus*; all specimens of *R. macropus* possess completely webbed toes, a smooth dorsum, suborbital spots and spots posteriorly on both sides of the body at the base of thigh. The snout-vent length of the lectotype is 22.6 mm and of the paralectotype 14.2 mm, suggesting that

both specimens are juveniles. Based on these observations, *M. sarasinorum* is considered conspecific with *R. macropus*.

Distribution. This species is distributed in the Knuckes and central hill regions of Sri Lanka, up to an elevation of 1710 m (Fig. 234). Found under leaf litter and on wet boulders. Species endemic to Sri Lanka.

Etymology. The species name is coined from the Greek root *macro* (= large) and the suffix *pous* or *pus* (= foot).

Material examined

No specific locality: BMNH 1868.5.13.3(4) (types of *Polypedates nanus*), 1973.3116; Dimbula, Queenwood Estate, 5000 feet: MCZ 20873-74; Gammaduwa, 3000 ft.: BMNH 1973.3103, Gingathena, 4000 ft.: BMNH 1973.3091; Laxapana: BMNH 1973.3064, 1973.3065-66, 1973.3069; Nuwara-Eliya: AMNH 74210-11, BMNH 1973.3090; Bogowantalawa, 5000-5200 feet: BMNH 1973.30.74-82; Rattota, Gammaduwa, 3000-4000 ft.: BMNH 1973.3098-99, 1974.3094; South Sri Lanka: BMNH 1864.7.11.24 (holotype); NHMB 1217, (lectotype of *Ixalus sarasinorum*); WHT90, 10 ex., 22.0-37.0 mm, Laggala (Knuckles), alt. 1220 m.

Rhacophorus microtympanum

Figures 235-242

Polypedates microtympanum Günther, 1858: 77, pl. 6, Fig. A (syntypes: BMNH, from "Ceylon").

Rhacophorus dimbullae Shreve, 1940: Proceedings of the Biological Society of Washington, 53: 105-108 (holotype: MCZ 70878, from "Queenwood Estate, Dimbulla, 5000 feet, Ceylon") (Fig. 235).

Rhacophorus zimmeri Ahl, 1927: Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin, 1927: 41-42 (type: ZMB, not examined, from "Point de Galle," Sri Lanka).

Rhacophorus pleurotaenia Boulenger, 1904: Journal of the Bombay Natural History Society, 15: 430 (holotype: BM 1947.2.7.64, from Kandy, Sri Lanka) (Fig. 236).

Diagnosis. See diagnosis of *Rhacophorus fergusonianus*.

Description. Snout-vent length of mature males 30.0-36.5 mm, gravid females 43.0-50.5 mm. Head broader than long in adults and equal or longer than broad in subadults. Snout rounded. Narial opening nearer to tip of snout than to eye or in middle. Canthus rostralis distinct, angular. Loreal region slightly concave, oblique. A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed teeth and two small series of distinct, oblique vomerine teeth between choanae, close to inner front edge of choanae. Tympanum distinct, round or vertically oval, about 28.9-40.0% diameter of eye. A prominent supratympanic fold present. Fingers with rudimentary webbing between them; first finger slightly shorter than second, third finger longest. Two palmar tubercles. Tips of digits with well developed disks with prominent circum-marginal grooves, disks on third and fourth fingers larger and oval in shape; and

Figure 235. *Rhacophorus dimbullae,*MCZ 70878 (holotype), dorsal aspect.

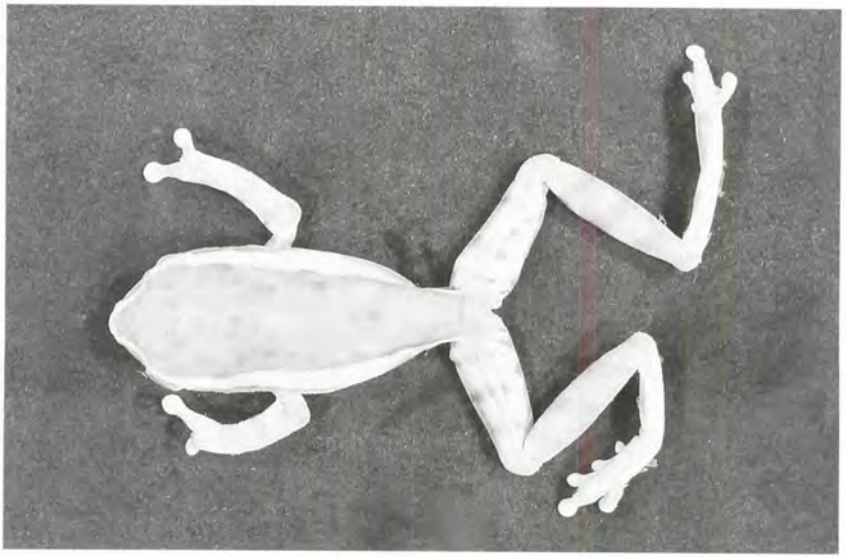

Figure 236. *Rhacophorus pleurotaenia,* BMNH 1947.2.7.64 (holotype), dorsal aspect.

disks on first and second fingers and all toes with rounded disks. Both edges of digits with cutaneous fringes. Both fingers and toes with supernumerary tubercles. Subarticular tubercles distinctly rounded or slightly oval. Toes webbed, webbing distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle or rudimentary webbing on inner side and distal

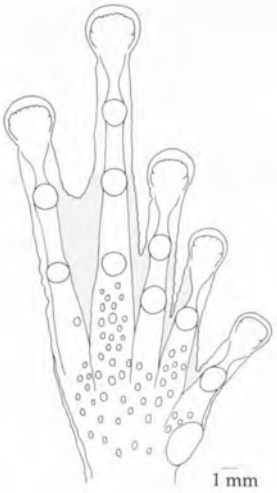

Figure 237. *Rhacophorus microtympanum*, 46.2 mm SVL, WHT 438, ventral aspect of right foot.

subarticular tubercle on outer side of second toe; to penultimate subarticular tubercle on inner side and distal subarticular tubercle on outer side of third toe; to penultimate subarticular tubercle on both inner and outer sides of fourth toe; and distal subarticular tubercle on inner side of fifth toe (Fig. 237). Relative length of toes 1<2<3<5<4. Inner metatarsal tubercle oval, outer absent. Dorsum smooth, small rounded tubercles in some specimens but middle of dorsum always smooth. Chin and chest smoothly granular, abdomen and underside of thighs roughly granular.

Figure 238. *Rhacophorus microtympanum*, 46.2 mm SVL, WHT 438.

Figure 239. *Rhacophorus microtympanum,* RMNH 6516, dorsal aspect.

Figure 240. *Rhacophorus microtympanum,* NHMB 1083, dorsal aspect.

Colour. In life (Fig. 238), dorsal colour pattern variable, grey or brown above. Some specimens with irregular black spots on dorsum; dark brown interorbital bar present (Figs. 239, 240) or absent (Figs. 241a, 242). A lateral, curved stripe on both sides of back. Loreal and temporal regions dark brown; dorsal tubercles white; limbs cross-barred. Throat with (241b) or without brown spots. Ventrum yellowish-white.

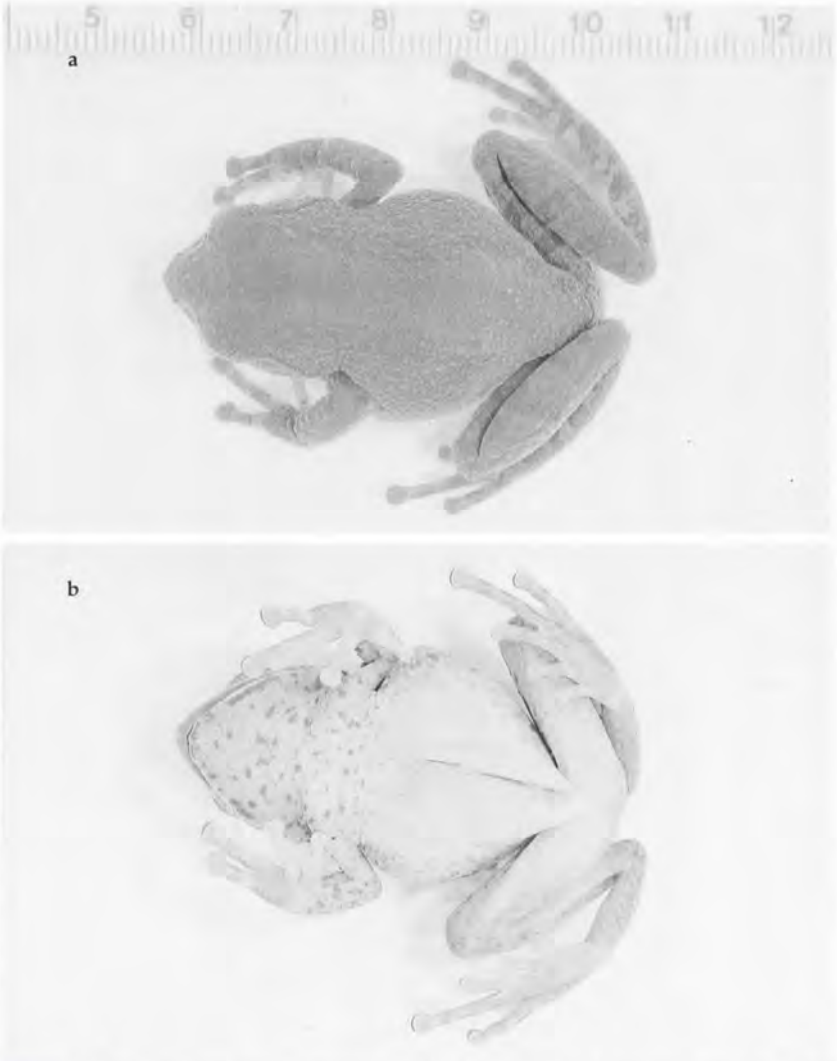

Figure 241. *Rhacophorus microtympanum*, BMNH 1973.30.51, Laxapana, Sri Lanka, (a) dorsal aspect, (b) ventral aspect.

Comments. Wolf (1936) considered *R. microtympanum* to be polymorphic, but the descriptions of *R. microtympanum* given by him are based on specimens of several species of *Rhacophorus* from Sri Lanka.

There are four reports (Günther, 1876; Ferguson; 1876; Kirtisinghe, 1946b, 1957) on the eggs and tadpoles of *Rhacophorus* from Sri Lanka. Günther (1876) reported 20 eggs attached to the abdomen of a female *Rhacophorus* which he considered to be *R. reticulatus*. Kirtisinghe (1946b) collected 12 eggs from loose

Figure 242. *Rhacophorus microtympanum*, USNM 67905, dorsal aspect.

Figure 243. Distribution in Sri Lanka of *Rhacophorus microtympanum*.

soil, and reported their size to be 60.0 mm in diameter. He obtained tadpoles from some of the eggs, and later identified the metamorphs to be *R. reticulatus*. Furthermore, he reported that the species has direct development on land with the entire development taking place within the jelly covering. Kirtisinghe's (1957) description of the eggs and tadpoles of *R. microtympanum* is based on his observations of 1946, when he considered the froglets to be *R. reticulatus*. Neither Günther (1876) nor Kirtisinghe(1946b) obtained eggs directly from the females of *R. reticulatus*; both reported on eggs found separately. Thus, it is

difficult to ascertain the species assignment of the eggs of *Rhacophorus* described by either author.

We examined two gravid females of *Rhacophorus microtympanum* with snout-vent lengths of 40.2 and 48.5 mm, containing 52 and 48 eggs, respectively. The ova had diameters of 2.5-3.0 mm and were embedded in jelly coverings, 5.0-5.5 mm in diameter.

Distribution. This species is distributed in the central hills, Knuckles and the southern wet forests of Sri Lanka (Fig. 243) up to 2135 m. Arboreal. Species endemic to Sri Lanka.

Etymology. *Micro*, Greek, = small; *tympanum*, Latin, = drum (a reference to the tympanum of the ear).

Material examined

No specific locality: BMNH 1933.9.10.19, 53.3.30.17-18, 53.3.30.2425, CAS 85283, NHMB 1111-1113, 3080, RMNH 1757(5), 6516(3), UMMZ 64326, USNM 19218, USNM 67905; Horton Plains, 6900 ft., Central Province: AMNH 24203-206; Nuwara-Eliya, Central Province: AMNH 74224, 23774, BMNH 1931.2.1.3-5, 68.9.8.1-3, MCZ 2809, NHMB 1072-1110, 1310-1311; Pattipola, 6200 ft.: MCZ 28098; Laxapana: BMNH 1973.30.51; Pundaluoya, 4000 ft.: BMNH 1905.3.25.124-127; Dimbula, Queenwood Estate, 5000 ft.: MCZ 70878 (holotype of *Rhacophorus dimbullae*); Rattota, Ravelston Estate, Gammaduwa: BMNH 1973.3092; *Rhacophorus pleurotaenia*, BMNH 1947.2.7.64 (holotype);WHT438, 10 ex., 24.0-49.4 mm, WHT966, 25.3 mm, Nagrak Division, Nonpareil Estate (adjoining Horton Plains, alt. 2135 m).

Rhacophorus reticulatus
Figures 244-248

Polypedates reticulatus Günther, 1864: 431, pl. 26, fig. F (holotype: BMNH 1854.3.21.1, from "Ceylon").

Diagnosis. See diagnosis of *Rhacophorus macropus*.

Description. Snout-vent length 31.6-58.5 mm. Head longer broader than broad. Snout short and obtuse (Fig. 244). Narial opening nearer to tip of snout than to eye. Canthus rostralis distinct. Loreal region concave. A small, pointed papilla on middle of tongue (see Fig. 245). A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed teeth and two distinctly elevated vomerine teeth, slightly away from choanae. Tympanum small, distinct, horizontally oval, about 30.4% diameter of eye. Supratympanic fold present. Fingers with rudimentary webbing between them. First finger slightly shorter than second, third finger longest. Two palmar tubercles. Fingers with supernumerary tubercles. Tips of digits with well developed disks with prominent circum-marginal grooves. Subarticular tubercles rounded or oval, slightly conical. Toes webbed, webbing to disk on outer side of first toe; to distal subarticular tubercle on inner side and disk on outer side of second toe; to distal subarticular tubercle on inner side and disk on outer side of third toe; to distal subarticular tubercle on inner side and between disk and distal subarticular tubercle on outer side of fourth toe; and disk on inner side of fifth toe (Fig. 246). Relative length of toes 1<2<5<3<4. Both edges of toes with cutaneous fringes. Inner

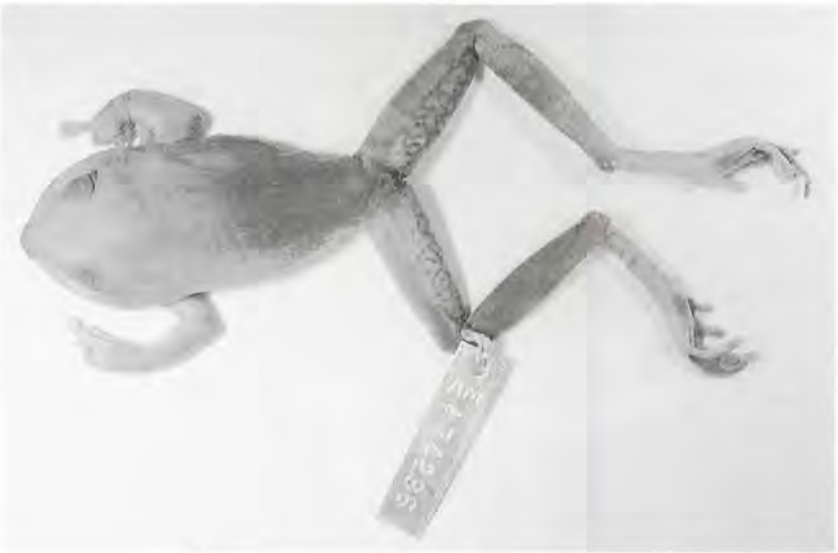

Figure 244. *Rhacophorus reticulatus*, AMNH 74296, dorsal aspect.

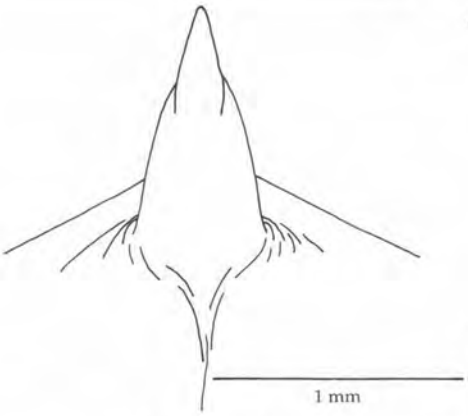

Figure 245. *Rhacophorus reticulatus*, 31.6 mm SVL, WHT 1121: frontal aspect of lingual papilla.

metatarsal tubercle oval, outer absent. Head dorsally smoothly granular; entire dorsum smooth. Inner side of tarsi with larger tubercles. Throat and underside of thighs smooth. Venter granular.

Colour. In life (Fig. 247), dorsally dark brown; a black interorbital bar; limbs with cross-bars (Fig. 248). Venter yellow. Dorsal colour (in alcohol) brown; some specimens with irregular dark brown patches or with a triangular patch on snout or with dark brown interorbital bar; belly whitish-yellow; limbs with distinct dark brown cross bands.

Comments. *Rhacophorus reticulatus* is morphologically similar to *R. macropus* and *R. fergusonianus*, but can be distinguished from them by having a distinctly broad head, rounded snout, smaller conical papilla on the tongue, distinct

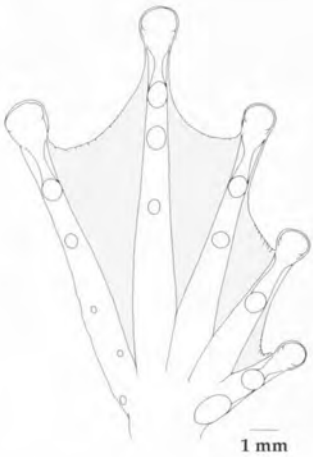

Figure 246. *Rhacophorus reticulatus*, 31.6 mm SVL, WHT 1121, ventral aspect of right foot.

canthus rostralis and the distinct colour pattern. Günther (1876), Ferguson (1876) and Kirtisinghe (1946b) reported on the reproductive strategies and tadpoles of this species, but their studies were not based on direct observations. Günther's (1876) description is based on eggs attached to the belly of a female which he identified as *R. reticulatus*. Kirtisinghe (1946b) obtained the eggs from the field and identified the metamorphs as *R. reticulatus*. Until further studies on the reproductive strategies of *R. reticulatus* can be done, the observations of Günther and Kirtisinghe remain uncertain.

Figure 247. *Rhacophorus reticulatus*, 31.6 mm SVL, WHT 1121, Moray Estate, Rajamally (near Mousakelle), Sri Lanka.

Figure 248. *Rhacophorus reticulatus*, BMNH 1854.3.21.1 (holotype), dorsal aspect.

Figure 249. Distribution in Sri Lanka of *Rhacophorus reticulatus*.

Distribution. We have collected only a single specimen, from Moray Estate, Mousakelle (1370 m). The species has also been recorded from the Knuckles hills and Yala (AMNH 74296) (spurious?), in the arid zone (rainfall < 1,500 mm per year) of southern Sri Lanka (Fig. 249). Our specimen was found during day, in wet leaf litter. Species endemic to Sri Lanka.

Etymology. *Reticulatus*, Latin, = net, net-like.

Material examined

No specific locality: BMNH 1854.3.21.1 (holotype), 1973.3136, MCZ 1324; Gammaduwa: BMNH 1973.3105-3107; Laxapana: BMNH 1973.3060; Pundaluoya, 4000 ft.: BMNH

1890.11.8.30; Yala, Southern Province: AMNH 74296; WHT1121, 31.6 mm, Moray Estate, Rajamally (near Mousakelle, alt. 1370 m).

Theloderma Tschudi, 1838 (type species *Theloderma leporosa* Tschudi, 1838, by monotypy). About eight species recognised from Indochina, southern China, Burma and Sumatra; absent from peninsular India. A single species in Sri Lanka, placed in *Philautus* by Kirtisinghe (1957), referred to *Theloderma* by Liem (1970).

Theloderma schmarda
Figures 250-252

Polypedates (?) schmarda Kelaart, Annals and Magazine of Natural History, 1854 (13): 407-408 (type: not traced, from "Adam's Peak," Sri Lanka).

Polypedates ? schmardanus Kelaart, 1855 (1856?): 22 (type: not known, from "Adam's Peak," Sri Lanka).

Note. The characteristic spinous tubercular body diagnostic of the genus *Theloderma* is present in *T. schmardanum*, the smallest Sri Lankan amphibian and possibly one of the rarest species; only 16 specimens are known.

Diagnosis. See diagnosis of *Rhacophorus cavirostris*.

Description. A small frog; snout-vent length of mature individuals 23.0 mm-25.6 mm. Head longer than broad. Snout pointed. Nostril nearer to tip of snout than to eye; nasal capsules prominent and elevated; internarial area concave. Canthus rostralis distinct, angular. Loreal region oblique, concave. A small symphysial knob on anterior edge of mandible. Upper jaw with fine-pointed

Figure 250. *Theloderma schmarda*, BMNH 1953.1.3.29, dorsal aspect.

Figure 251. *Theloderma schmarda,* 25.6 mm SVL, WHT 1120, Adam's Peak, Sri Lanka.

Figure 252. *Theloderma schmarda,* 18.7 mm SVL, WHT 1161, Adam's Peak, Sri Lanka.

teeth. Tympanum distinct, vertically oval, about 33.3-37.5% diameter of eye. Supratympanic fold present, prominent. Fingers with rudimentary webbing between them; first finger slightly shorter than second, third finger longest. Outside of fourth finger with fringe. Three palmar tubercles. Tips of digits with well developed disks with prominent circum-marginal grooves. Both fingers and toes with supernumerary tubercles. Subarticular tubercles rounded

Figure 253. Distribution in Sri Lanka of *Theloderma schmarda*.

or oval, conical. Toes webbed, webbing to distal subarticular tubercle on outer side of first toe; to distal subarticular tubercle on inner side and distal subarticular tubercle or between disk and distal subarticular tubercle on outer side of second toe; to penultimate subarticular tubercle on inner side and distal subarticular tubercle or between disk and distal subarticular tubercle on outer side of third toe; to penultimate subarticular tubercle or between penultimate subarticular and antepenultimate subarticular tubercle on inner side and between distal subarticular tubercle and penultimate subarticular tubercle or between penultimate subarticular and antepenultimate subarticular tubercle on outer side of fourth toe; and disk or between disk and distal subarticular tubercle (or rarely on distal subarticular tubercle) on inner side of fifth toe. Relative length of toes, 1<2<3<5<4. Both edges of toes with cutaneous fringes. Inner metatarsal tubercle oval, outer absent. Entire dorsum, eyelids, head and limbs with small and large conical warts (Figs. 250, 251); outer side of fourth finger and fifth toe with conical warts; a cutaneous calcar at joint of tibia and tarsus; upper and lower lips with a row of warts. Venter granular.

Colour. In life, dorsal colour light green (Fig. 251) to dark brown (Fig. 252); brown cross bands on inter-orbital area and limbs; loreal and temporal region dark brown; venter speckled with brown spots; tips of warts yellow.

In alcohol, deep brown; a dark brown cross-band between the eyes; dark brown dorsolateral bands; lips with brown and white spots; throat speckled with brown spots; loreal and temporal region dark brown.

Distribution. Recorded from the Central hills and Knuckles range, up to 2300 m. Found both on the ground and on bushes, and in the daytime, under loose stones in moist areas (Fig. 253). Species endemic to Sri Lanka.

Comment. Kelaart published descriptions of this species in at least two places: the *Annals and Magazine of Natural History*, 1854, vol. 13: 407; and vol. 2 of his

Prodromus faunae Zeylanicae, page 22. The former publication was in fact published only in 1854. Volume 2 of Kelaart's *Prodromus faunae Zeylanicae* however is nothing more than a collection of repaginated separates of already published work (R. Pethiyagoda, pers. comm.), and the article "Descriptions of new or little known species of reptiles.." was not published until 1855 at earliest, for it contained a reprint of an article already published in the *Journal of the Royal Asiatic Society (Ceylon Branch)* in 1855. O'Donoghue (1933) has argued that the separates printed by Kelaart (which form the contents of volume 2 of his *Prodromus*) were intended for private circulation only and do not constitute a valid publication. At the same time, Taylor (1947) doubted that the early volumes of the *Journal of the Royal Asiatic Society (Ceylon Branch)* was a valid publication for the purpose availability in terms of the International Code of Zoological Nomenclature, although he felt that volume 2 of *Prodromus* had been validly published. Regardless of the validlity of publication, the oldest published name is that in the *Annals and Magazine of Natural History* (1854), and that is *Theloderma schmarda*.

Etymology. The species name is an eponym honouring L.K. Schmarda, professor of zoology at Prague University, who collected this species on Adam's Peak (2243 m) during a visit to Sri Lanka, and drew Kelaart's attention to it.

Material examined

No specific locality: BMNH 1953.1.3.28-36, 71.12.14.27, 71.12.14.50, CAS 85284, MCZ 17713; Bogawantalawa. Central Province: USNM 67094; Gammaduwa: BMNH 1955.1.10.56; Nuwara-Eliya: NHMB 1239-40; WHT1120, 25.6 mm, WHT1161, 2 ex,m 18.7-13.9 mm, Adam's Peak, alt. 1850 m; WHT975, 17.1 mm, Kirigalpota, alt. 2300 m; WHT1278, 14.0 mm, Pidurutalagala (near Nuwara Eliya), alt. 2200 m.

APPENDIX

Atlas of unidentified species

A large number of specimens not referrable to any of the species described in this book were collected in the course of the WWF-WHT Amphibian Survey of Sri Lanka (1993-1996). Of these, a representative sample of 16 are figured in this appendix mainly in order to demonstrate that biodiversity in this group is in fact far higher than hitherto estimated. Formal description of these and other new amphibian species from Sri Lanka will take place in a systematic review now in preparation by K.M.-A. Note: the "diagnosis" given in each figure caption is not comprehensive and serves only as an indication.

Figure 254. *Bufo* cf. *kotagamai*, lacking parietal ridges: Sinharaja Forest (photo: Andreas Nöllert).

Figure 255. *Bufo* cf. *kelaartii*, but with a blunt snout (when viewed laterally) and with numerous white-tipped tubercles on the head and palm: Peak Wilderness.

Figure 256. *Philautus* cf. *femoralis,* differing in colour pattern and lacking femoral bars: Haputale.

Figure 257. *Philautus* cf. *variabilis,* diffrering in colour pattern: Ratnapura.

Figure 258. *Philautus* cf. *variabilis*, with dorsal ridges: Hiniduma.

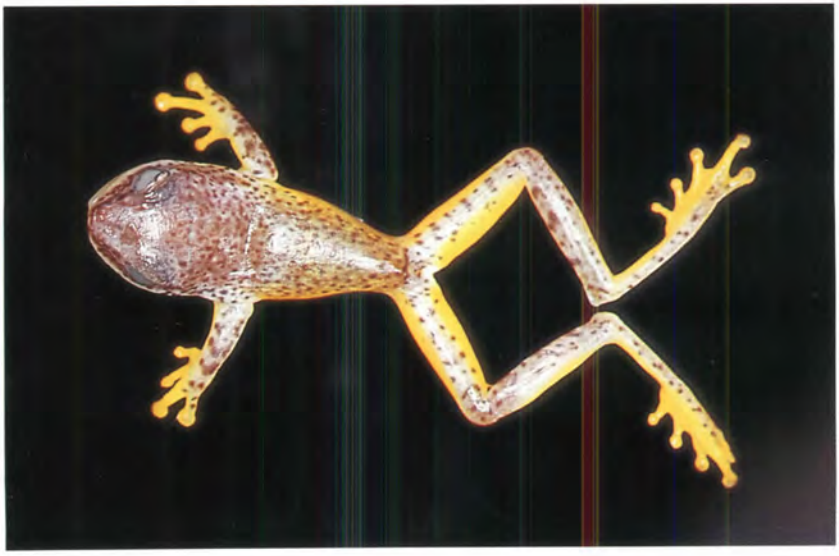

Figure 259. *Rhacophorus* sp., distinct from all Sri Lankan congeners: Galle.

Figure 260. *Rhacophorus* cf. *fergusonianus*, differing in disc shape and more heavily tuberculated dorsum: Kitulgala.

Figure 261. *Rhacophorus* cf. *cavirostris*, but with less webbing and different colours: Monaragala.

Figure 262. *Rhacophorus* sp., but with a shorter and more rounded snout than any of the Sri Lankan *Rhacophorus* species: Namunukula.

Figure 263. *Rhacophorus* sp., colour pattern distinct from other Sri Lankan *Rhacophorus* species: Eastern Sinharaja.

Figure 264. *Rhacophorus* cf. *fergusonii*, with different colour pattern and toe shape: Laggala.

Figure 265. *Rhacophorus* cf. *fergusonii*, with a different colour pattern and toe shape: Laggala.

Figure 266. *Rhacophorus* cf. *microtympanum*, witha pointed snout: Sinharaja.

Figure 267. *Rhacophorus* spp., differs from Sri Lankan congeners by markedly reduced webbing: Eastern Sinharaja.

Figure 268. *Rhacophorus* sp., differs from other Sri Lankan *Rhacophorus* by its colour pattern: Galle.

Figure 269. *Rhacophorus* cf. *microtympanum*, but differing in colour pattern and found only on rock faces: Kanneliya.

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INDEX

Montane habitats

Both amphibian species diversity and endemicity are highest in Sri Lanka's upper montane forests. The photograph on the opposite page shows the Peak Wilderness, which is dominated by Adam's Peak (2243 m) (background). The cloud forest of the Horton Plains National Park (*ca.* 2135 m) (following page) is another area to which several amphibian species are restricted.