

Hemidactylus flaviviridis Rüppell, 1835 (Sauria: Gekkonidae) an invasive gecko in Assam

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Abstract. *Hemidactylus flaviviridis* is a widespread gecko in northern India, but appears to have recently been introduced into Assam through anthropogenic means. A distributional summary of this species in India is provided along with a preliminary assessment of its distribution in Guwahati city. *Hemidactylus flaviviridis* is currently restricted to commercial areas of Guwahati, chiefly those associated with the transport and sale of good. We hypothesise that this species has entered Assam along the primary transport routes of goods from areas of western India. Preliminary results suggest that the larger *Hemidactylus flaviviridis* may have deleterious effects on its native congeners, but the situation requires further monitoring.

Keywords: *Hemidactylus flaviviridis*, introduced gecko, Assam, negative effect, distribution, India.

Introduction

The genus *Hemidactylus* Oken, 1817, is a widespread group of geckos, distributed throughout much of the Old World tropics and subtropics as well as in the Mediterranean region and in the Americas (Giri & Bauer 2008). Some species of *Hemidactylus* have undergone natural and anthropogenic long distance dispersal, followed by colonization of new areas (Kluge 1969, Vanzolini 1978, Carranza et al. 2000, Vences et al. 2004) and a number of them are among the most human commensal of all lizards (Lever 2003, Meshaka et al. 2004). Human related translocations have resulted in some of these invasive lizards having an almost cosmopolitan distribution in tropical and warm temperate regions (Vences et al. 2004, Carranza & Arnold 2006).

Among the most widespread of *Hemidactylus* species are *H. garnotii* and *H. frenatus*, which are native to tropical Asia, but have also colonised and become naturalised in many parts of the world (Lever 2003, Kraus 2009). *H. mabouia*, an African species is now established in South America (Rivas et al. 2005), North America (Townsend & Krysko 2003), and on islands of the Indian Ocean (Vences et al. 2004), while *H. turcicus*, a Mediterranean gecko has also become established in a number of locations in the South eastern and mid-Atlantic United States (Meshaka et al. 2006, Sattler et al. 2007).

In some areas, recently introduced *Hemidactylus* species have been documented to have locally displaced native or long-established geckos (Dame & Petren 2006, Rivas et al. 2005). Townsend and Krysko (2003) reported on the interactions of two species of introduced *Hemidactylus*, *H. garnotii* and *H. turcicus*, in Florida, where the former, more recently-arrived, species has been replacing the longer-established *H. turcicus* in many areas. Likewise, Rivas et al. (2005) documented the range expansion of *H. mabouia* in Venezuela and stated that the species could very well cause the decline or even the disappearance of some native lizards, particularly other geckos. The demonstrated ability of invasive *Hemidactylus* species to displace or extirpate native or established geckos suggests that the arrival and naturalisation of such species anywhere in the world should be carefully documented and its effects on the local gecko fauna monitored.

Currently, the genus *Hemidactylus* has approximately 100 representative species worldwide (Uetz 2009). In India, this genus is represented by up to 26 species (Giri & Bauer 2008, Giri et al. 2009, Bauer et al. 2010). Seven of these, namely *H. frenatus* (Schlegel, 1836), *H. brookii* (Gray, 1845), *H. bowringii* (Gray, 1845), *H. garnotii* (Duméril & Bibron, 1836), *H. platyurus* (Schneider, 1792), *Hemidactylus flaviviridis* (Rüppell, 1835), and *H. karenorum* (Theobald, 1868), have been reported from North-eastern India (Ahmed et al. 2009). However, the presence of the last of these species has been ques-

tioned by Mahony and Zug (2007) and specimens reported as *H. bowringii* are almost certainly correctly attributable to *H. aquilonius* (Purkayastha et al. 2010). Although Ahmed et al. (2009) reported *H. flaviviridis* from Assam, no mention was made regarding specific localities. Previous work on this species in India had reported that Bengal was at the extreme eastern edge of the range (see Smith, 1935). Recently Purkayastha & Das (2009) provided specific locality records of this lizard from Guwahati, Assam (see Fig. 3). In this paper we present further data on the distribution of *Hemidactylus flaviviridis* in India and its status as an introduced species in Guwahati city, Assam. We also provide a preliminary assessment of the effect of *H. flaviviridis* on the local populations of *Hemidactylus* spp..

Materials and Methods

In documenting the established range of *Hemidactylus flaviviridis* in India, we relied on literature as well as records of vouchered specimens obtained from online museum databases, chiefly through Herpnet (<http://www.herpnet.org/>) and The Combined Index to Herpetology Collections at the California Academy of Sciences ([http://researcharchive.calacademy.org/research/herpetology/Comb_Coll_Index/](http://research.calacademy.org/redirect?url=http://researcharchive.calacademy.org/research/herpetology/Comb_Coll_Index/)). The institutional codes used are AMNH: American Museum of Natural History, New York; CAS: California Academy of Sciences, San Francisco; FLMNH: Florida Museum of Natural History, Gainesville; KUH: The University of Kansas, Natural History Museum and Biodiversity Research Center, Lawrence; MCZ: Museum of Comparative Zoology, Cambridge, Massachusetts; MNHG: Muséum d'Histoire Naturelle, Genève; MNHN: Muséum national d'Histoire naturelle, Paris; UAZ: University of Arizona, Tucson.

In order to estimate local distribution and abundance of *Hemidactylus* in Guwahati, Visual Encounter Surveys (Crump and Scott, 1994) using time-constrained randomised walks (Lambert, 1984) were performed. Equal effort was given to the surveys, each of which covered a distance of 1000 sq. m. Each survey was carried out within the first two hours of darkness in the months of May and June, 2009. A steady speed was maintained for each survey. A total of three surveys of two hours duration each were conducted in each of the areas with a total of twelve man hours spent on the entire survey. Some lizards were captured and identified and then released whereas others were identified from a distance.

The study area was divided into two major zones – commercial and non-commercial as per the divisions established by the GMC (Guwahati Municipal Corporation). Most of the buildings, warehouses and godowns in the commercial areas that we surveyed were RCC (concrete) structures. However, the houses in the non-

commercial zones were a mixture of concrete buildings as well as tin roofed houses. Non commercial zone also included recreational parks with few trees and vegetation to forest fringes areas. We surveyed four areas in the commercial and five areas in the non-commercial zone. The areas in the commercial zone were FB1: Fancy bazaar Galla patti; FB2: Fancy bazaar Jail Road; CB: Christian basti and GCK: Gorchuk. The areas in the non-commercial zone were PNB1: Nehru Park; PNB2: Sukreswar Park; PNB3: Dighalipukhuri, Zoo: Assam State Zoo cum Botanical Garden, and Kam: Kamakhya temple area (Fig. 3). Representative voucher specimens were collected, preserved in 10% formaldehyde solution, and deposited in Arya Vidyapeeth College Museum.

Results

Hemidactylus flaviviridis was first described from “die Insel Massaua und die benachbarte Küstenlandschaft” [Massawa Island and neighboring coastal countryside, Eritrea] (Rüppel, 1835), at the far southwestern extreme of the species distribution (Sindaco and Jeremčenko, 2008). One year later, Duméril and Bibron (1836) described *H. coctaei* from Bengal and until Anderson (1896) synonymized the two names, this name was in standard use for Indian populations (e.g. Günther 1864, Theobald 1868, 1876, Boulenger 1890), although two other names based on Indian material, *Boltalia sublaevis* (Gray, 1842) and *Hemidactylus bengaliensis* (Anderson, 1871), are also in the synonymy of *H. flaviviridis*. The global distribution of the species as currently understood includes coastal and near-coastal areas around the Red Sea, Persian Gulf, and Arabian Sea, as well as parts of Pakistan, Nepal, India, and Bangladesh (Schleich & Kästle 2002, Sindaco & Jeremčenko 2008).

In India the earliest locality records of *H. flaviviridis* were from Bengal and Bombay (Duméril & Bibron 1836, Günther 1864). Theobald (1876) gave its distribution, as *H. coctaei* [sic], as “Orissa, Bengal, North-Western Provinces, The Panjab, Sikkim, Khasi hill, Kachar, Birmah, Bombay (Duméril & Bibron 1836), Pinang (Cantor 1847), but not hitherto recorded from Southern India or Ceylon.” However, it is likely that his concept of this species was composite, so that not all of these localities actually apply to specimens today referable to *H. flaviviridis*. Boulenger (1885, 1890) likewise continued to include erroneous eastern localities in his accounts of the species. Smith (1935), however, opined that the native range of *Hemidactylus flaviviridis* in India was restricted to northern India and that it did not occur east of Bengal. Ti-

kader and Sharma (1992) and Sharma (2002) considered the species distributed across the whole of India, but widespread only north of about 20°N. They did not indicate the species' presence in either Nepal or Bangladesh. However, it is now known to occur in western and southwestern Bangladesh (Chakma 2009) and in Nepal (Kästle 2002). Within India the occurrence of *H. flaviviridis* in most northern states has been reported in the literature (e.g. Ahmed & Dasgupta 1992, Hussain & Ray 1995, Husain 1997, Sharma 2000, Dasgupta & Raha 2004) and is likewise supported by museum vouchers (Fig. 2); (e.g. Rajasthan [UAZ 55089], Punjab [AMNH R 39373, AMNH R 39379–80], Maharashtra [FLMNH 20103, FLMNH 20120–21, MNHN 0.6594, MHNG 2032.071–073], Haryana [MCZ R3153], Delhi [FLMNH 19996–98, FLMNH 20102], Uttar Pradesh [FLMNH 61466, MNHN 1990.828831], Bihar [CAS 94138], Orissa [KUH, 193682], Bengal [MNHN 0.6595], Madhya Pradesh [CAS 94145, MNHN 1990.1522]). Indeed, the only vouchered record from southern India is one with the vague locality "Cote de Malabar" [coastal Karnataka or Kerala]. (MNHN 0.2310). Records to the east of West Bengal and adjacent parts of Bangladesh (e.g. those of Theobald 1876 and Boulenger 1885, 1890) have not been verified by extensive field work in Myanmar (Zug et al. 2007) and in Northeast India, prior to 2009 the species has only been listed as "likely to occur" in Tripura (Sanyal et al. 2002).

These records suggest that *Hemidactylus flaviviridis* in India is more-or-less continuously distributed from Gujarat, Punjab and Rajasthan in the northwest, to Madhya Pradesh in the south and Bengal in the east. The first vouchered records from Assam, and Northeast India in general were those of Ahmed et al. (2009) and Purkayastha & Das (2009), and these mark the easternmost extent of the species range (see Fig. 2). Both because the species has only recently been confirmed from the region, and because it is apparently restricted to the greater Guwahati urban area, we believe that the species has only recently colonised Assam.

We found *H. flaviviridis* only in the commercial areas of Guwahati (see Fig. 3). The localities where *H. flaviviridis* was found were essentially places where goods were received and dispatched nationwide. We found them occupying concrete walls of the godowns or warehouses where these goods were stored. We did not encounter this species in areas of human habitation except those located immediately adjacent to commercial areas.

H. frenatus and *H. brookii* were found in both commercial and non-commercial zones, *H. cf. aquilonius* was found mostly in and around human settlements and in parks (non-commercial), and *Hemidactylus platyurus* was found strictly in the forest fringe (non-commercial) areas. The other geckos encountered during the surveys were *Cnemaspis assamensis* (Das & Sengupta 2000) and *Gekko gecko* (Linnaeus 1758).

Hemidactylus frenatus and a very small number of *H. brookii* were found syntopically with *H. flaviviridis* in commercial areas (Fig. 4 & 5). The encounter rate for *H. frenatus* was significantly lower in the areas also occupied by *H. flaviviridis* (see Fig. 1).

Discussion

The fact that *Hemidactylus flaviviridis* was encountered only in the commercial zone of the city, coupled with the fact that its previously reported native range does not extend to Northeast India, lead us to believe that it has been introduced into Assam via anthropogenic agency.

The commercial areas occupied by *H. flaviviridis* were full of godowns and warehouses where produce, particularly cereals (rice), legumes and vegetables (potatoes and onions only) from other places in India are stocked and distributed. For example rice is received from Punjab and Bengal, onions from Maharashtra (Nasik and Mumbai) and Gujarat (Bhavnagar), and potatoes from Bengal (Kolkata, Alipurduar) and Bihar (Patna). Consignments from Punjab are routed via Delhi and usually take about 12–15 days to reach Guwahati, those from Maharashtra take 6–7 days by road, and those from Bengal require about 2–3 days. Legumes take the route from Bareilly via Delhi to Guwahati by rail transport and take a long time in transit (pers. comm. local produce stockists).

Many of the areas from which the goods were obtained, such as Punjab, Delhi, Bihar, Gujarat, Maharashtra and Bengal are within the native range of *H. flaviviridis* (e.g. Smith 1935, Sharma 2002). We believe that these well-established goods routes have provided a mechanism for the introduction of *H. flaviviridis* into Northeast India. Kästle (2002) earlier suggested a similar explanation for the presence of this species in parts of Nepal.

However, the ability of an introduced species to become invasive is yet another aspect. The sig-

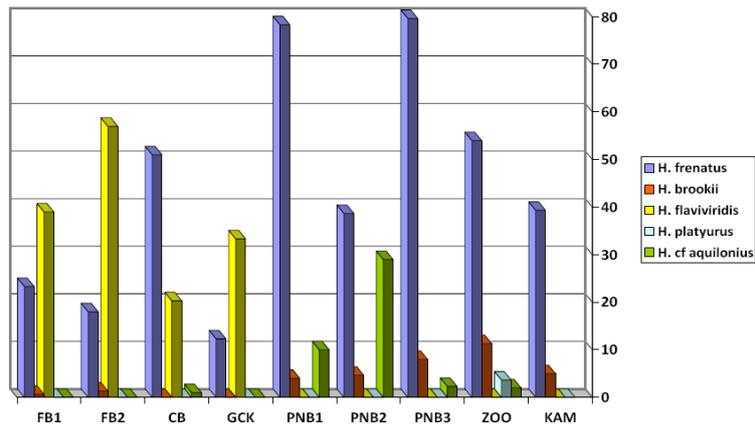


Figure 1. Graph showing number of individuals of *Hemidactylus* sp. per unit time in the different study sites. (Study site abbreviations as in text). [Abbreviations: FB1- Fancy bazaar Galla patti, FB2- fancy bazaar, Jail road, CB- Christian basti, GCK- Gorchuk, PNB1- Nehru Park, PNB2- Sukreswar Park, PNB3- Dighalipukhuri, Zoo- Assam State Zoo cum Botanical Garden, Kam- Kamakhya temple area)].

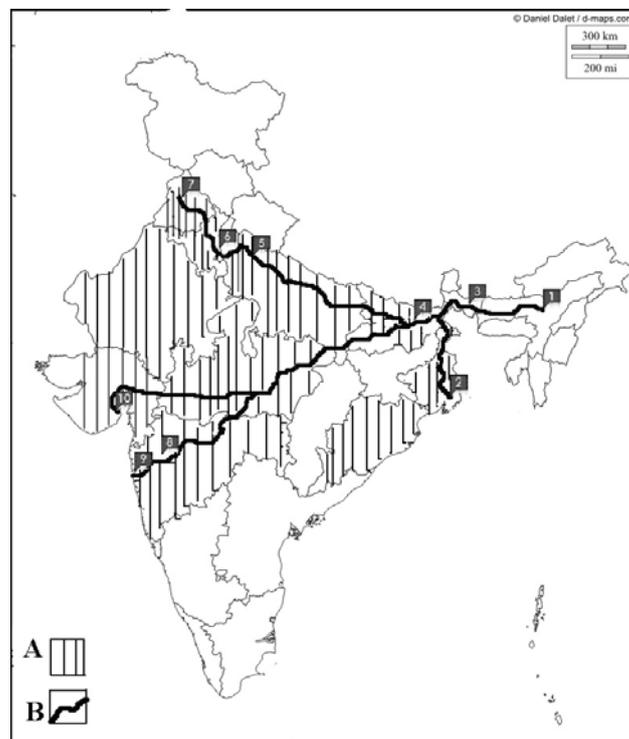


Figure 2. Map showing distribution of *H. flaviviridis* in India [1: Guwahati (Assam), 2: Kolkata (West Bengal), 3: Alipurduwar (West Bengal), 4: Patna (Bihar), 5: Bareilly (Uttar Pradesh), 6: Delhi (Delhi), 7: Jalandhar (Punjab), 8: Nasik (Maharashtra), 9: Mumbai (Maharashtra), 10: Bhavnagar (Gujarat); A: Species range in India, B: Possible routes of entry of *H. flaviviridis* into Assam, based on known produce “transport routes”].

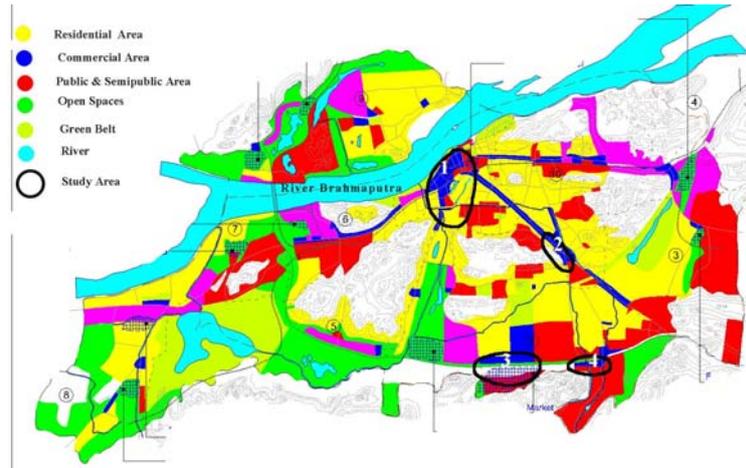


Figure 3. A map showing the distribution of *H. flaviviridis* in Guwahati [1: Fancy Bazar ($26^{\circ}10'58.72''N$, $91^{\circ}44'35.24''E$); 2: Christian Basti ($26^{\circ}9'18.62''N$, $91^{\circ}46'47.92''E$); 3: Gorchuk ($26^{\circ}6'42.36''N$, $91^{\circ}45'26.57''E$); 4: Beltola ($26^{\circ}6'44.47''N$, $91^{\circ}47'52.24''E$)].



Figure 4. A group of *Hemidactylus flaviviridis* seen on the wall of an Indian Oil Petrol Station in a commercial area (Gorchuk) of Guwahati.



Figure 5. *Hemidactylus flaviviridis* in a commercial area (Gorchuk) of Guwahati.

nificantly lower encounter rate for *H. frenatus* in comparison to *H. flaviviridis* in the commercial areas to that of areas devoid of *H. flaviviridis* suggests that *H. flaviviridis* has a negative impact on the local *H. frenatus*. The pattern of invasion and possible colonisation of *H. flaviviridis* is similar to that of the *H. frenatus* in Brisbane, Australia where it was seen to have a negative effect on the two native species, *Gehyra dubia* and *Oedura robusta*, occupying the same anthropogenic niche in urban, suburban, rural and bushland habitats in Greater Brisbane (Newberry & Jones 2007). Invasive geckos often tend to have a negative impact on the local gecko population owing to several reasons one of which may be resource utilisation as seen in the case of *H. frenatus*, in the Pacific region, where it was seen to reduce resource availability for *L. lugubris*, thus causing a negative impact (Petren & Case 1996). The reasons for the apparent rarity of *H. frenatus* in the commercial areas occupied by *H. flaviviridis* need further investigation. However, it is possible that *H. flaviviridis*, being larger in size compared to sympatric *Hemidactylus* in the study area, reduces the resources available for its native congeners. Further monitoring will be required to determine if *H. flaviviridis* will expand out of the limited areas it currently occupies in Guwahati and also to assess the nature of its ecological interactions with native geckos.

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References

- Ahmed, M.F., Das, A., Dutta, S.K. (2009): Amphibians and Reptiles of Northeast India, A Photographic Guide. Aranyak, Guwahati. xiv + 170 pp.
- Ahmed, S., Dasgupta, G. (1992): Reptilia. In: Director, Zoological Survey of India (ed.), Fauna of West Bengal. Part 2: 1-65. Zoological Survey of India, Calcutta.
- Anderson, J. (1896): A Contribution to the Herpetology of Arabia, with a Preliminary List of the Reptiles and Batrachians of Egypt. R.H. Porter, London. 124 pp.
- Bauer, A.M., Jackman, T.R., Greenbaum, E., Giri, V., de Silva, A. (2010): South Asia supports a major endemic radiation of *Hemidactylus* geckos. *Molecular Phylogenetics and Evolution* 57: 343-352.
- Boulenger, G.A. (1885): Catalogue of the lizards in the British Museum (Natural History). Vol. 2, 2nd ed., London, xiii+497 pp.
- Boulenger, G.A. (1890): The Fauna of British India, Including Ceylon and Burma. Reptilia and Batrachia. Taylor & Francis, London, xviii + 541 pp.
- Cantor, T.E. (1847): Catalogue of reptiles inhabiting the Malayan Peninsula and Islands. *Journal of Asiatic Society, Bengal, Calcutta* 16 (2): 607-656, 897-952, 1026-1078.
- Carranza, S., Arnold, E.N., Mateo, J.A., López-Jurado, L.F. (2000): Long-distance colonization and radiation in gekkonid lizards, *Tarentola* (Reptilia: Gekkonidae), revealed by mitochondrial DNA sequences. *Proceedings of the Royal Society of London B* 267: 637-649.
- Carranza, S., Arnold, E.N. (2006): Systematics, biogeography, and evolution of *Hemidactylus* geckos (Reptilia: Gekkonidae) elucidated using mitochondrial DNA sequences. *Molecular Phylogenetics and Evolution* 38: 531-545.
- Chakma, S. (2009): *Hemidactylus flaviviridis*. In: Kabir, S.M.H., Ahmad, M., Ahmed, A.T.A., Rahman, A.K.A., Ahmed, Z.U., Begum, Z.N.T., Hassan, M.A., Khondker, M. (eds), *Encyclopedia of Flora and Fauna of Bangladesh*, Vol. 25, Amphibians and Reptiles. Asiatic Society of Bangladesh, Dhaka. xviii + 204 pp.
- Crump, M.L., Scott Jr., N.J. (1994): Visual encounter surveys. pp. 84-92. In: Heyer, W.R., Donnelly, M.A., McDiarmid, R.W., Hayek, L.C., Foster, M.S. (eds), *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians*. Smithsonian Institution Press, Washington, D.C.
- Dame, E.A., Petren, K. (2006): Behavioural mechanisms of invasion and displacement in Pacific island geckos (*Hemidactylus*). *Animal Behaviour* 71: 1165-1173.
- Dasgupta, G., Raha, S. (2004): Reptilia. pp. 143-179. In: Director, Zoological Survey of India (ed.), *Fauna of Bihar (Including Jharkhand)*. Part I, Zoological Survey of India, Kolkata.
- Duméril, A.M.C., Bibron, G. (1836): *Erpétologie Générale ou Histoire Naturelle Complète des Reptiles*. Vol. 4. Paris, Librairie Encyclopédique de Roret. ii + 571 pp., errata, 1 folding table, pls. 29-32, 34, 36, 38, 40-42, 50, 55.
- Giri, V.B., Bauer, A.M. (2008): A new ground-dwelling *Hemidactylus* (Squamata: Gekkonidae) from Maharashtra, with a key to the *Hemidactylus* of India. *Zootaxa* 1700: 21-34.
- Giri, V.B., Bauer, A.M., Vyas, R., Patil, S. (2009): A new species of rock-dwelling *Hemidactylus* (Squamata: Gekkonidae) from Gujarat, India. *Journal of Herpetology* 43: 385-393.
- Günther, A. (1864): *The Reptiles of British India*. Taylor & Francis, London. xxvii + 452 pp., 26 pls.
- Husain, A., Ray, P. (1995): Reptilia. pp. 159-167, pls. I-II. In: Director, Zoological Survey of India (ed.), *Fauna of Western Himalaya (U.P.)*. Himalayan Ecosystem Series: Part I. Zoological Survey of India, Calcutta.
- Husain, A. (1997): Reptilia. pp. 665-698. In: Director, Zoological Survey of India (ed.), *Fauna of Delhi*. Zoological Survey of India, Calcutta.
- Kästle, W. (2002): Family Gekkonidae (Geckos). pp. 674-722. In: Schleich, H.H., Kästle, W. (eds), *Amphibians and Reptiles of Nepal*. A. R. G. Gantner Verlag, Ruggell, Liechtenstein.
- Kluge, A.G. (1969): The evolution and geographical origin of the New World *Hemidactylus mabouia-brooki* complex (Gekkonidae, Sauria). *Miscellaneous Publications of the Museum of Zoology, University of Michigan* 138: 1-78.
- Kraus, F. (2009): *Alien Reptiles and Amphibians. A Scientific Compendium and Analysis*. Springer-Verlag, Dordrecht. xii + 564 pp (with CD-ROM).
- Lambert, M.R.K. (1984): Amphibians and reptiles. pp. 205-227. In: Cloudsley-Thompson, J.L. (eds), *Key environments: Sahara Desert*. Pergamon Press, London.
- Lever, C. (2003): *Naturalized Reptiles and Amphibians of the World*. Oxford University Press, Oxford. xx + 318 pp.

- Mahony, S., Zug, G.R. (2007): *Hemidactylus karenorum* (Squamata, Gekkonidae) – not in India? *Hamadryad* 32: 84-86.
- Meshaka Jr., W.E., Butterfield, B.P., Hauge, J.B. (2004): The Exotic Amphibians and Reptiles of Florida. Krieger Publishing Company, Malabar, Florida, x + 155 pp.
- Meshaka Jr., W.E., Marshall, W.E., Boundy, S.D.J., Williams, A.A. (2006): Status and geographic expansion of the Mediterranean gecko, *Hemidactylus turcicus*, in Louisiana: implications from the Southeastern United States. *Herpetological Conservation and Biology* 1(1): 45-50.
- Newberry, B., Jones, D.N. (2007): Presence of Asian House Gecko *Hemidactylus frenatus* across an urban gradient in Brisbane: influence of habitat and potential for impact on native gecko species. pp. 59-65. In: Lunney, D., Eby, P., Huthings, P., Burgin, S. (eds), Pest or Guest: The Zoology of Overabundance. Royal Zoological Society of New South Wales, Mosman, Australia.
- Petren, K., Case, J.T. (1996): An experimental demonstration of exploitation competition in an ongoing invasion. *Ecology* 77(1): 118-132.
- Purkayastha, J., Das, M. (2009): Geographic distribution: *Hemidactylus flaviviridis* (yellow-green house gecko). *Herpetological Review* 40: 451-452.
- Purkayastha, J., Das, M., Bauer, A.M., Sengupta, S., Dutta, S.K. (2010): Notes on the *Hemidactylus Bowringii* complex (Reptilia: Gekkonidae) in India, and a change to the national herpetofaunal list. *Hamadryad* 35(1): 20-27.
- Rivas, F.G., Ugueto, G., Rivero, R., Miralles, A. (2005): The Herpetofauna of Isla de Margarita, Venezuela: New Records and Comments. *Caribbean Journal of Science* 41(2): 346-351
- Rüppell, E. (1835): Neue Wirbelthiere zu der Fauna von Abbyssinien gehörig. Amphibien. In Commission bei Siegmund Schmerber, Frankfurt am Main. 18 pp, 6 pls.
- Sanyal, D.P., Dattagupta, B., Gayen, N.C. (2002): Reptilia. pp. 159-177. In: Alfred, J.R.B. (ed.), Fauna of Tripura. Vertebrates, Zoological Survey of India, Calcutta.
- Sattler, P., Lane, C., Harris, K. (2007): Status and distribution of the Mediterranean gecko (*Hemidactylus turcicus*) in Virginia. *Catesbeiana* 27.
- Schleich, H.H., Kästle, W. (2002): Amphibians and Reptiles of Nepal. Koeltz, Königstein, 1200 pp. [review in *Reptilia* 40: 87].
- Sharma, R.C. (2000): Reptilia. pp. 243-297. In: Alfred, J.R.B. (eds), Fauna of Gujarat (Part 1). Vertebrates. Zoological Survey of India, Calcutta.
- Sharma, R.C. (2002): Fauna of India, Reptilia, Vol. II, Sauria. Zoological Survey of India, Calcutta. xxv + 430 pp.
- Sindaco, R., Jeremčenko, V.K. (2008): The Reptiles of the Western Palearctic. 1. Annotated Checklist and Distributional Atlas of the Turtles, Crocodiles, Amphisbaenians and Lizards of Europe, North Africa, Middle East and Central Asia. Edizioni Belvedere, Latina, Italy. 579 pp.
- Smith, M.A. (1935): The Fauna of British India, Including Ceylon and Burma. Reptilia and Amphibia. Vol. II—Sauria. Taylor & Francis Ltd., London. xii + 445 pp., 2 maps, 1 pl.
- Theobald, W. (1868): Catalogue of Reptiles in the Museum of the Asiatic Society of Bengal. *Journal of the Asiatic Society of Bengal, Calcutta*, 37 (extra number 146): (2), i-vi, 7-88, i-iii, 4 pls.
- Theobald, W. (1876): Descriptive Catalogue of the Reptiles of British India. Thacker, Spink and Co., Calcutta. x + 238 + xxxviii + xiii pp.
- Tikader, B.K., Sharma, R.C. (1992): Handbook of Indian Lizards. Zoological Survey of India, Calcutta. xv + 250 pp., 42 pls.
- Townsend, J.H., Krysko, K.L. (2003): The distribution of *Hemidactylus* (Sauria:Gekkonidae) in northern peninsular Florida. *Florida Scientist*. 66: 204-208.
- Vanzolini, P.E. (1978): On South American *Hemidactylus* (Sauria, Gekkonidae). *Papéis Avulsos de Zoologia* 31(20): 307-343.
- Vences, M.S., Wanke, D.R.V., Branch, W.R., Glaw, F., Meyer, A. (2004): Natural colonization or introduction? Phylogeographical relationships and morphological differentiation of house geckos (*Hemidactylus*) from Madagascar. *Biological Journal of the Linnean Society* 83: 115-130.
- Uetz, P. (2009): The Reptile Database. <<http://www.reptile-database.org>>, accessed at 31.12.2009.
- Zug, G.R., Vindum, J.V., Koo, M.S. (2007): Burmese *Hemidactylus* (Reptilia, Squamata, Gekkonidae): taxonomic notes on tropical Asian *Hemidactylus*. *Proceedings of the California Academy of Sciences*, 4th Series 58: 387-405.