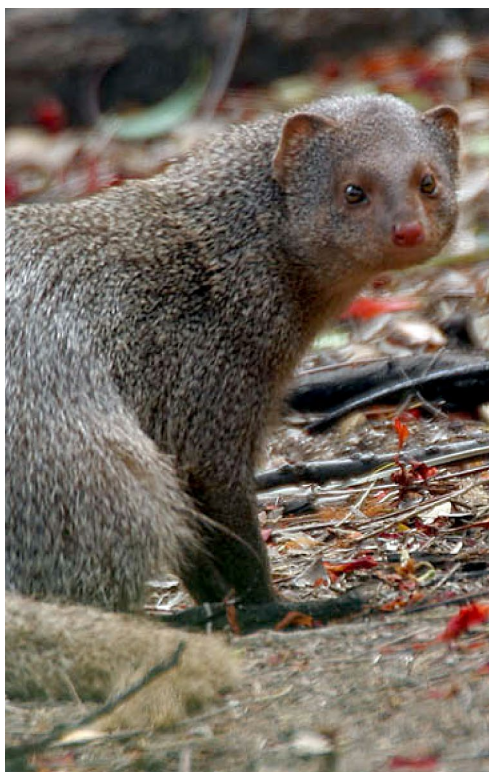


Indian mongoose

Herpestes javanicus



Steve Csurhes and Paul Fisher

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Front cover: *Herpestes javanicus* (Indian Mongoose)

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Summary

The Indian mongoose (*Herpestes javanicus*) is native to parts of Saudi Arabia, Iran, Asia and Malaysia. It is a small predatory mammal capable of surviving in a variety of habitats including deserts, forests, agricultural areas and urban areas.

The Indian mongoose was introduced to control pest rodents in sugar cane crops in many countries including islands in the Caribbean, Pacific and Indian oceans, as well as mainland South America and Europe (mainly in the late 1800s early 1900s). Unfortunately, it also preys on a large range of wildlife, other than rodents, and has caused a number of bird species to become threatened or extinct.

In response to a rat plague, a species of mongoose, believed to have been the Indian mongoose, was introduced into parts of northern Queensland in 1884 (the exact species involved is not clear). Fortunately, the mongoose failed to naturalise.

While the Indian mongoose is currently absent from Queensland (and Australia), this risk assessment presents evidence that it has the potential to become a major pest in Queensland, if it was ever released. The species has five important attributes that are considered to confer pest potential: (1) it is well adapted to climates experienced in Queensland (“climate-match”): (2) it is well adapted to a range of natural habitats that exist in Queensland: (3) it has a very broad, opportunistic diet: (4) it has an extensive natural distribution: and (5) it has a proven track-record of forming naturalised (pest) populations elsewhere, with serious consequences for local wildlife populations. Climate-match, a broad natural range, and a history as a pest elsewhere are perhaps the most reliable predictors of invasion success.

The Indian mongoose is listed among 100 of the “World’s Worst” invaders by the IUCN.

While the risk of import and release is considered to be low, the potential impact of naturalisation is considered to be substantial.

Taxonomy

Taxon identity: *Herpestes javanicus* (É Geoffroy Saint-Hilaire, 1818)

Common names:

Indian Mongoose, Small Indian Mongoose and Javan Mongoose

H. javanicus represents one of 10 species of *Herpestes*. The genus is just one of the genera within the mongoose family Herpestidae. Mongoose are related to civets and cats as part of the sub-order Feliformia, meaning “cat-like” carnivores.

H. javanicus comprises multiple sub-species, including:

- *Herpestes javanicus auropunctatus* (Hodgson 1836)
- *Herpestes javanicus exilis* (Gervais 1841)
- *Herpestes javanicus javanicus* (É Geoffroy Saint-Hilaire 1818)
- *Herpestes javanicus orientalis* (Sody 1936)
- *Herpestes javanicus pallipes* (Blyth 1845)
- *Herpestes javanicus palustris* (Ghose 1965)
- *Herpestes javanicus peninsulae* (Schwarz 1910)
- *Herpestes javanicus perakensis* (Kloss 1917)
- *Herpestes javanicus rafflesii* (Anderson 1875)
- *Herpestes javanicus rubrifrons* (JA Allen 1909)
- *Herpestes javanicus siamensis* (Kloss 1917)
- *Herpestes javanicus tjerapai* (Sody 1949)

The taxonomy of *H. javanicus* is unclear and often debated. The species is also known under a synonym *Herpestes auropunctatus* (Hodgson 1836).

Description and biology

H. javanicus is a small, slender mongoose with short legs. It has an elongated head with a pointed muzzle and small ears. *H. javanicus* has five toes with retractable claws and a robust tapered tail. Body length ranges from 50–67 cm with the male larger than the female (the latter is 54–67 cm). Body weight ranges from 305–662 grams (Roy 2006). The body is covered with short hair which is pale to dark brown with golden flecks (Figure 1). The underside of the body is slightly lighter in colour.



Figure 1. Indian mongoose (*Herpestes javanicus*) Photo; Wikimedia Commons—reproduced under the terms of GNU Free Documentation License.

Diet

H. javanicus is carnivorous but has a varied and opportunistic diet. Depending on habitat and food availability its diet can include a range of small mammals, birds, reptiles, invertebrates and plant matter. Some populations are largely insectivorous while others consume a diet largely consisting of fruit for part of the year (Hays & Conant 2007).

Reproduction

H. javanicus can breed up to two to three times each year, with breeding being most frequent when food is abundant. Average litter size is two to three young. Females become sexually mature at 10 months of age and males at four months (de Magalhaes & Costa 2009).

Preferred habitat

H. javanicus can survive in a range of habitats including, agricultural land, coastal areas, desert, natural forests, planted forests, rangeland, grassland, riparian zones, ruderal/disturbed habitat, urban and wetland areas. However, it is perhaps best adapted to dry (arid and semi-arid) habitats. Climatically, it is best suited to tropical zones, but marginal habitat includes subtropical areas.

Predators and diseases

H. javanicus has very few natural predators. They sometimes suffer lethal wounds when trying to subdue and consume some of the larger cobra species.

Parasites include fleas, ticks, helminths and nematodes (Web 1980). Cat fleas can carry murine typhus fever, a risk to human health. *H. javanicus* is also a vector for rabies and the bacterial disease 'Leptospirosis' (commonly known as 'Weil's disease'). Leptospirosis has a number of symptoms in humans, but in extreme cases can lead to renal and liver failure.

Origin and distribution

H. javanicus has an extensive native range across Saudi Arabia, Iran, Iraq, Afghanistan, Pakistan, India (south to Sind on the west and Orissa on the east), Nepal, Bangladesh, Burma, Thailand, Malaysia, Laos, Vietnam, and southern China including Hainan Island. In addition, *H. javanicus* has an extensive naturalised range across a number of continents including many islands.

Table 1.

Countries or regions with naturalised populations of *Herpestes javanicus* (Indian Mongoose) (from Roy 2006).

Country or region	Year introduced
British Virgin Islands	
- Beef Island	1910
- Tortola	-
- Jost Van Dyke	-
US Virgin Islands	
- Buck Island	1910
- St Croix	1884
- St John	-
- St Thomas	-
- Lovango	-
- Water Island	-
Antigua, Barbados	1877
Jamaica	1872
Trinidad	1870
Hispaniola	1895
St Vincent	-
St Lucia	-
St Kitts and Nevis	1884
Cuba	1866
Puerto Rico	1887
- Vieques (including)	-
Grenada	1882

Country or region	Year introduced
French Islands	
- French Guiana	-
- Guadeloupe	-
- La Desirade	-
- Marie- Galante	-
- Martinique	-
- Suriname	1900
St Martin	1888
Guyana	-
Hawai'i	1883
- Maui	
- Moloka'i	
- O'ahu	
USA	Unknown
Japan	1910
- Okinawa	
- Amami	
Fiji	1883
- Viti Levu	
- Vanua Levu	
Croatia	1910
Tanzania	
- Mafia Island	-
Mauritius	-

History as a pest elsewhere

H. javanicus is a major pest in many locations across the world and is listed among 100 of the “World’s Worst” invaders by the IUCN (Roy 2006). Wild populations pose a serious threat to native wildlife and several bird species have been pushed towards extinction. Its impact on native wildlife has been most severe on small islands, where local birds have evolved in the absence of mammalian predators. The barred-wing rail (*Nesoclopeus poecilopterus*), in Fiji, and the Hispaniola racer (*Alsophis melanichnus*) are two species that are believed to have been pushed to extinction as a result of predation by *H. javanicus*. A third species, the Jamaica petrel (*Pterodroma caribbaea*), is critically endangered. *H. javanicus* has been implicated in the decline of a number of other bird species. On the US Virgin Islands, *H. javanicus* is a major predator of hawksbill turtle (*Eretmochelys imbricate*) eggs. The breeding success of this turtle can be improved significantly if *H. javanicus* is trapped and removed (Roy 2006).

Current status in Australia and Queensland

A species of mongoose, believed to have been *H. javanicus*, was introduced into parts of northern Queensland in 1884 in response to a rat plague (the exact species involved is not clear). Fortunately, the mongoose failed to naturalise.

There are historical reports of hundreds of Indian mongoose being released near the Murray River and in other areas of New South Wales. Again, these introductions failed to result in naturalisation (Long 2003).

Pest potential in Queensland

H. javanicus has five important attributes that are considered to confer pest potential: (1) it is well adapted to tropical (and to a lesser degree subtropical) climates experienced in Queensland; (2) it is well adapted to a range of natural habitats that exist in Queensland; (3) it has a broad (generalist) and opportunistic diet; (4) it has an extensive natural distribution; and (5) it has a proven track-record of forming naturalised (pest) populations elsewhere. Climate-match, a broad natural range and a history as a pest elsewhere are perhaps the most reliable predictors of invasion success (for a full review of attributes that confer invasion success see Hayes and Barry 2008).

Climate match

Since climate is a primary factor that determines a species’ distribution, the climate-modelling software ‘CLIMATCH’ (Bureau of Rural Sciences, Australia) was used to predict the area of Australia where climate is suitable for *H. javanicus* (Figure 2). Such modelling suggests that tropical areas of northern Australia, including large areas of northern Queensland, are suitable.

Algorithm: Closest Standard Score

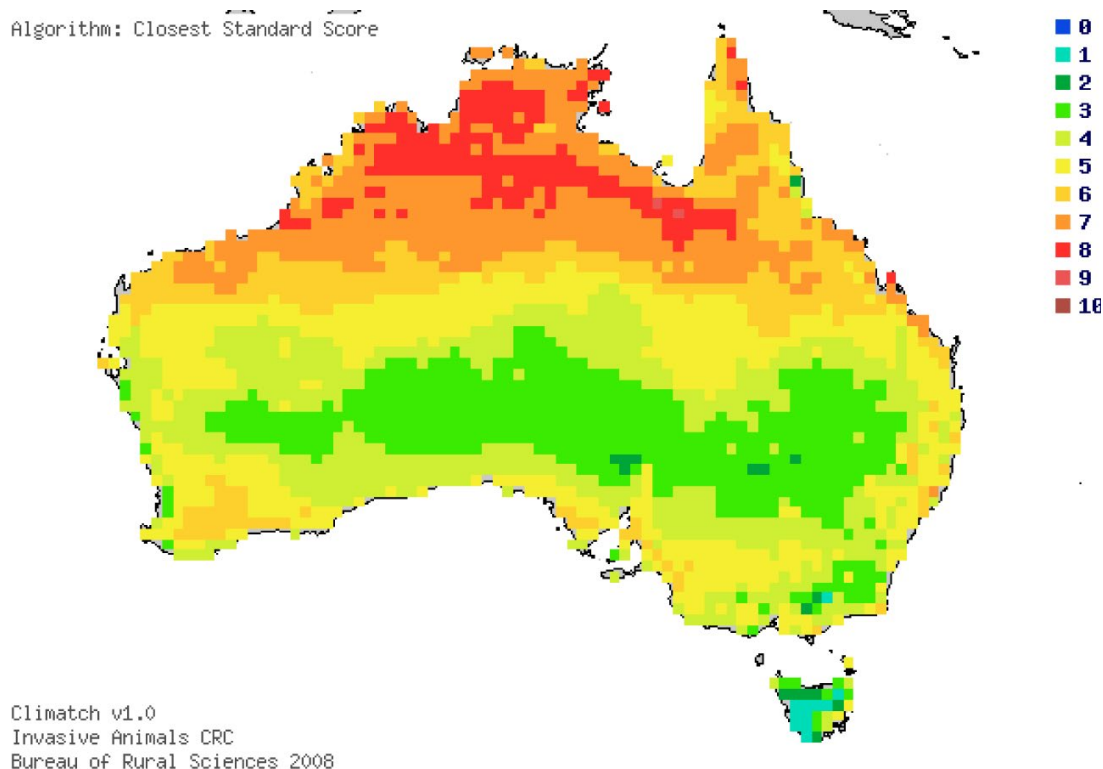


Figure 2. Potential distribution of *Herpestes javanicus* in Australia (red and orange areas indicate where climate is most suitable for the species; yellow and green are less suitable and blue is unsuitable).

Habitat match

Across its native and naturalised ranges, *H. javanicus* survives in a very diverse range of habitats including desert, tropical savannah (open woodland and shrubland), forest, agricultural areas, coastal areas and urban areas. Comparable habitats exist over substantial areas of Queensland. Habitats most at risk are perhaps arid and semi-arid rangelands and deserts in tropical North Queensland.

Broad natural geographic range

H. javanicus has an extensive native range across Saudi Arabia, India, Pakistan, China, and Malaysia, with a similarly extensive naturalised range (Caribbean, Pacific islands and Europe). An extensive range tends to reflect a species' ecological "flexibility" (i.e. ability to opportunistically adapt to dynamic environmental conditions).

Generalist diet

H. javanicus has an opportunistic diet tending to feed on whatever prey items are abundant at any point in time. A broad, opportunistic diet is a common feature of invasive pests (eg. feral cat, European fox and feral dog). It seems reasonable to predict *H. javanicus* would have little difficulty finding suitable prey items in Queensland, if it naturalised.

Numerical risk analysis

A numerical risk assessment for *H. javanicus* considers the species to pose a ‘serious establishment risk’ to Australia and an ‘extreme pest threat’ to Australia (see appendix).

Control

A number of control methods have been applied, but are principally focused on the use traps or poisons. Traps are commonly used to reduce mongoose populations over relatively small areas. However, trapping needs to be on-going since populations quickly recover if trapping ceases (Hays & Conant 2007). Predator-proof fences have been proposed as a control method on Mauritius, but are expensive (Roy et al. 2002).

The poison Diphacinone has been used in Hawai’i (Hays & Conant 2007), but its use needs to consider the potential for non-target damage. The use of integrated management practices for large, extensive mongoose populations are often necessary, since any reduction of mongoose numbers can lead to increases in feral cat and rat populations, posing on-going threats to native wildlife (Roy et al. 2002).

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Appendix

Using the Bomford (2008) risk assessment system (7 factor analysis), the Indian Mongoose (*Herpestes javanicus*) was ranked as an 'extreme' threat species in Queensland.

Species		<i>Herpestes javanicus</i> (Indian Mongoose)
Date of assessment		
Literature search type and date		See references
Factor	Score	
A1. Risk to people from individual escapees (0–2)	1	Indian Mongoose pose a low risk of harm to people.
A2. Risk to public safety from individual captive animals (0–2)	0	Indian Mongoose pose no risk to public safety.
Stage A. Public Safety Risk Rank = Sum of A 1 to 2. (0–4)	1	Moderately dangerous
B1. Climate Match (1–6)	4	high climate match in Australia. CMS = 1001. (Bureau of Rural Sciences 2006).
B2. Exotic population Established Overseas (0–4)	4	Indian Mongoose have established in multiples regions.
B3. Overseas Range Size (0–2)	1	Overseas range size of less than 70 million square kilometres (approximation).
B4. Taxonomic Class (0–1)	1	Mammal
B5. Diet (0–1)	1	Generalist predator
B6. Habitat (0–1)	1	Can survive and breed in human-disturbed habitats (including grazing and agricultural lands).
B7. Migratory (0–1)	1	Non-migratory or facultative migrant in its native range
B. Probability escaped or released individuals will establish a free-living population = Sum of B 1 to 7. (1–16)	13	Serious Establishment Risk
C1. Taxonomic group (0–4)	2	Order Carnivora
C2. Overseas range size including current and past 1000 years, natural and introduced range (0–2)	2	Extensive range
C3. Diet and feeding (0–3)	2	a carnivore but can consume plat matter
C4. Competition with native fauna for tree hollows (0–2)	2	uses tree hollows
C5. Overseas environmental pest status (0–3)	3	Major environmental pest overseas

C6. Climate match to areas with susceptible native species or communities (0–5)	3	The species has 1–9 grid squares within the highest two climate match classes, and/or has 10–29 grid squares within the highest four climate match classes, that overlap the distribution of any susceptible native species or ecological communities
C7. Overseas primary production pest status (0–3)	0	Not a pest of primary production in any country or region.
C8. Climate match to susceptible primary production (0–5)	1	Total commodity damage score 6.5 (see Table 1).
C9. Spread disease (1–2)	2	Yes (eg. rabies, leptospirosis)
C10. Harm to property (0–3)	0	No harm to property
C11. Harm to people (0–5)	1	Very low risk = 1.
C. Probability an exotic species would become a pest (for birds, mammals, reptiles and amphibians) = Sum of C 1 to 11. (1–37)	18	Serious Pest Score Risk
A. Risk to public safety posed by captive or released individuals		
A = 0 = not dangerous; A = 1 = moderately dangerous; A ≥ 2 = highly dangerous	1	Moderately dangerous (can carry dangerous diseases and inflict bite)
B. Risk of establishing a wild population		
For birds and mammals: B < 6 = low establishment risk; B = 7–11 = moderate establishment risk; B = 12–13 = serious establishment risk; B > 14 = extreme establishment risk	13	Serious establishment risk
For reptiles and amphibians: B < 3 = low establishment risk; B = 3–4 = moderate establishment risk; B = 5–6 = high establishment risk; B > 6 = extreme establishment risk		
C. Risk of becoming a pest following establishment		
C < 9 = low pest risk; C = 9–14 = moderate pest risk; C = 15–19 = serious pest risk; C > 19 = extreme pest risk	18	Serious pest risk
VPC Threat Category		Extreme

Table 1. Calculating Total Commodity Damage Score

Industry	Commodity Value Index¹ (CVI)	Potential Commodity Impact Score (PCIS, 0–3)	Climate Match to Commodity Score (CMCS, 0–5)	Commodity Damage Score (CDS, columns 2 x 3 x 4)
Cattle (includes dairy and beef)	11	0	Not estimated	0
Timber (includes native and plantation forests)	10	0	Not estimated	0
Cereal grain (includes wheat, barley sorghum etc)	8	0	Not estimated	0
Sheep (includes wool and sheep meat)	5	0	Not estimated	0
Fruit (includes wine grapes)	4	0	Not estimated	0
Vegetables	3	0	Not estimated	0
Poultry and eggs	2	3	Not estimated	6
Aquaculture (includes coastal mariculture)	2	0	Not estimated	0
Oilseeds (includes canola, sunflower etc)	1	0	Not estimated	0
Grain legumes (includes soybeans)	1	0	Not estimated	0
Sugarcane	1	0	Not estimated	0
Cotton	1	0	Not estimated	0
Other crops and horticulture (includes nuts, tobacco and flowers)	1	0	Not estimated	0
Pigs	1	0	Not estimated	0
Other livestock (includes goats, deer, camels, rabbits)	0.5	1	Not estimated	0.5
Bees (includes honey, beeswax and pollination)	0.5	0	Not estimated	0
Total Commodity Damage Score (TCDS)	—	—	—	6.5