

## **Species Richness and Endemism in Pakistan**

Species richness is only one measure of biological diversity but the use of this parameter to assess biodiversity is limited by the fact that many species, particularly insects, fungi and micro-organisms, remain to be identified. Little work has yet been done to evaluate other measures of biodiversity in Pakistan, including *taxonomic* and *functional* diversity, and the amount of genetic variability within species and their sub-divided populations. Because Pakistan is largely bounded by man-made borders and does not comprise an isolated entity in biogeographic terms, relatively few species are found only in Pakistan.

Thus, Pakistan has relatively low national rates of endemism for some species (about 7% for flowering plants and reptiles, and 3% for mammal) but higher for freshwater fish (15%).

However, the proportion of 'restricted range' species occurring in Pakistan is much higher, and for many of these species, Pakistan contains the bulk of the global population.

### **Mammals**

Up to 174 mammal species (including yet to be published information from PMNH) have been reported to occur in Pakistan. There are at least three endemic species & a number of endemic and near-endemic subspecies. Species belonging to the Palaearctic realm occur largely in the Himalayan and Balochistan uplands; those belonging to the Indo-Malayan realm occur primarily in the Indus plains including the Thar desert and Himalayan foothills. In addition, species with affinities to the Ethiopian region occur in the dry southwest and along the Makran coast and Thar desert of Pakistan.

### **Birds**

At least 668 species of birds have been recorded in Pakistan (**Table 1**), of which 375 are recorded as breeding (Roberts 1991, Z.B. Mirza, pers. comm.). A high percentage of Pakistan's bird fauna is migratory, with a huge invasion of Palaearctic winter visitors (over 30% of recorded species; Roberts 1991).

One third of Pakistan's bird species have Indo-Malayan affinities, and the remaining Palaearctic; of the latter, about one third are more specifically Sino-Himalayan in distribution (Roberts 1991). The Suleiman Range, Hindu Kush, and Himalaya in NWFP and Azad Kashmir comprise part of the Western Himalayan Endemic Bird Area; this is a global centre of bird endemism with 10 restricted range species in Pakistan. The Indus valley wetlands constitute a secondary area of endemism, with one restricted range species.

## **Reptiles and amphibians**

Over 177 species of reptiles are known in Pakistan, (Chelonia 14, Crocodylia 1, Sauria 90, Serpentes 65). Of these, 13 species are believed to be endemic (**Table 1**). As with other groups, these are a blend of Palaearctic, Indo-Malayan and Ethiopian forms. One genus, the monospecific *Teratolepsis*, is endemic, while another, *Eristicophis*, is nearendemic. The Chagai Desert is of particular interest for reptiles, with six species endemic to Pakistan and a further six species found only here and in bordering parts of Iran. Important populations of marine turtles nest on Pakistan's southern beaches. As Pakistan is a predominantly arid and semi-arid country, it is not surprising that only 22 species of amphibians have been recorded, of which 9 are endemic.

## **Fish**

Pakistan has 198 freshwater fish species, including introduced species. This fish fauna is predominantly south Asian, with some west Asian and high Asian elements. There are 29 endemic species. Also noteworthy are the 9 species of snow trout (sub-family Schizothoracinae) which occur in rivers of the northern mountains. Species richness is highest in the Indus river plains, the Kirthar Range and the Himalayan foothills, while the river systems of north-east Balochistan have the highest levels of endemism. Almost 800 species of fish have been recorded in Pakistan's coastal waters; however, no analysis of their population status and distributional range is available.

## **Invertebrates**

Known species of invertebrates represent only a small proportion of the actual number likely present in Pakistan. However, some taxa are better known than others, especially for marine invertebrates. Among the best known are also the Lepidoptera (butterflies), and at least two books on the butterflies of Pakistan are in preparation. The total number of butterfly species probably exceeds 400, with high rates of endemism in the Satyrids, Lycaenids and Pierids (PMNH data). Butterflies of high altitudes are largely either endemic or are derived from boreal fauna from the west. In the northern mountains alone, 80 species with many endemics, have been recorded (Hasan 1997). So far, more than 5000 species of insects have been identified in Pakistan including 1000 species of Heteroptera, 400 species of Lepidoptera, 110 species of Diptera, 49 species of Isoptera, 109 species of Polychaetes, over 700 marine molluscs, 100 species of land

snails, and 355 species of nematodes (see also section on Soil Biodiversity).

## **Plants**

About 5,700 species of flowering plants (Angiosperms) have been reported to date in the 'Flora of Pakistan native and introduced species. In a preliminary analysis of the flora of Pakistan, Ali and Qaiser (1986) found that the number of species per genus is much lower than the global average, indicating a high diversity at the generic level; and that the flora includes elements of six phytogeographic regions, being in order of importance: the Mediterranean, Saharo Sindian, Euro-Siberian, Irano-Turanian, Sino-Japanese, and Indian. The families with the largest numbers of species are the Compositae (649 species), Poaceae (597), Papilionaceae (439), Brassicaceae (250), and Cyperaceae (202). Among the lower plants, there are at least 189 pteridophytes (ferns and their allies), of which 153 are Sino- Himalayan elements and 36 Euro-Siberian.

Four monotypic genera of flowering plants (*Douepia*, *Suleimania*, *Spiroseris*, *Wendelboa*), and around 400 species (7.8%) are endemic to Pakistan (R. Rafiq, pers. comm.). Most endemics are Irano-Turanian and Sino-Japanese elements. Almost 80% of Pakistan's endemic flowering plants are confined to the northern and western mountains (Ali and Qaiser 1986). Here, two phytogeographic provinces can be distinguished: the Balochistan Province and the Western Himalayan Province. The Kashmir Himalayas in particular are identified as a global centre of plant diversity and endemism. Families with more than 20 recorded endemics are Papilionaceae (57 species), Composite (49), Umbelliferae (34), Poaceae (32) and Brassicaceae (20); 31 of the endemics belong to the genus *Astragalus*, the largest genus in Pakistan with about 134 species (R. Rafiq, pers. comm.). New endemics are still being discovered.

## **Soil Biodiversity and Microbes**

Soil biodiversity comprising populations of nematodes, annelids, snails and slugs, microarthropods, millipedes, centipedes, termites, and other micro-organisms such as algae, fungi, protozoan, and bacteria represents the largest group of living organisms. Estimates suggest that only 10% of the soil biodiversity and of other microbes has, so far, been studied and described. These organisms can be both extremely beneficial as well as damaging in different environments.

The fauna of plant parasitic nematodes in Pakistan includes 191 species belonging to 56 genera, 36 sub-families, 21 families, 9 super-families, 3 sub-orders, and 3 orders (Maqbool et al., 1992).

Plant parasitic nematodes are known to affect crop yields, quality

of the product produced and limited utilization of the nutrients. Burrowing, cyst, dagger, lance, reniform, root-knot, seedgull, sheath, and stunt nematodes are common in Pakistan and can cause 5-20% damage to host plants. Damages due to root rot disease produce a loss of up to 10-80% in different vegetable crops and fruit trees (Abdul Aziz Khan, pers. comm.).

In Pakistan, the information on soil biodiversity and microbes is very limited except for soilborne fungi and nematodes for which reliable and published research data are available (Mirza and Qureshi 1978; Ghaffar 1984). For root infecting fungi, Soilborne Diseases Research Centre, Department of Botany, University of Karachi, have identified more than 169 host plants. More than 4500 species of fungi (Naseem, pers. comm.) have been reported from Pakistan including: 24 genera and 68 species of *Ascomycetes*; 216 genera and 881 species of *Basidiomycetes*; 256 genera and 1321 species of *Deutromycetes*; and two genera and four species of *Myceliasterilia*. A total of 775 species of algae has also been reported.

According to the Greek philosopher Aristotles, earthworms are the soil builders and ecosystem engineers. They maintain and enhance soil fertility by way of adding nitrogen, phosphorus, potash, and magnesium and sodium to the soil. Not more than 20 species are known from Pakistan. Studies on their distribution and their relation with different ecosystems have not been attempted. A total of 50 termite species have so far been recorded from Pakistan