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# A NEW SPECIES OF *CYRTOPODION* (GEKKONIDAE: GEKKONINAE) FROM PAKISTAN

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ABSTRACT: A new species of bent-toed gecko, *Cyrtopodion brachykolon* is described from a series of specimens collected in 1991 from Manshera and lower Swat districts, Northwest Frontier Province, Pakistan. Specimens were examined for 45 morphological characters and measurements. *Cyrtopodion brachykolon* is distinguished from the morphologically similar species, *Cyrtopodion walli* (Ingoldby 1922), by the former's relatively shorter limbs, smaller dorsal tubercles relative to the surrounding granular scales, indistinct longitudinal rows of enlarged dorsal tubercles, and fewer number of transverse color bands. Another morphologically similar species, *Alsophylax* (*Altiphylax*) *tokobajvi* Eremschenko and Szczerbak 1984, can be separated from this new species by its larger supranasal scales and less angularly bent or straight digits. We also provide a brief review of the taxonomic history of the bent-toed geckos of Pakistan, herein assigned to *Cyrtopodion* (*s. l.*).

*Key words:* *Alsophylax* (*Altiphylax*) *tokobajvi*; *Cyrtopodion brachykolon*; *Cyrtopodion walli*; Gecko; Lizard; New species; Taxonomy

PAKISTAN has an extremely diverse gecko fauna (41 recognized species and subspecies, excluding *Eublepharis macularius* (Blyth 1854) (Khan, 2004, 2006; this paper). The country's varied habitats and climatic zones are directly associated with the virtually unparalleled altitudinal range (0–4730 m above mean sea level) found within its borders. Its complex geography is brought about by the continuing collision of the Deccan and Eurasian plates. Smith et al. (1994) place the land collision in the northeast Deccan Plate at about 30 mya, while submarine contact would have been much earlier (65 mya; Klootwijk et al., 1992). The uplifting of the Tibetan Plateau began in the east about 40 mya (Treloar and Coward, 1991), followed by the orogeny of the western mountain ranges such as the Karakoram and Hindu Kush. The formation of these ranges, as well as smaller, yet zoogeographically different mountain systems (i.e., Sulaiman, Kirthar, and Pir Pangal), has presumably facilitated the diversification of geckos through vicariant events, although incontrovertible evidence of these events is so far lacking.

This diverse gecko fauna remains poorly understood despite recent contributions (Khan, 1993, 1994, 2001, 2003*a*, *b*, 2004, 2006; Mertens, 1969; Minton, 1966). It is clear from these studies and our own examination of museum specimens that phylogenetic relationships among various gekkonid species groups in Pakistan, as well as throughout southwestern and central Asia, remain unresolved because of a lack of understanding regarding critical aspects of the morphologic variation within these groups. This is particularly true for those with nondilated digits, such as *Alsophylax*, *Bunopus*, and *Cyrtopodion* (*s. l.*), etc. Continua appear to exist with virtually every morphological character that has been utilized to differentiate these genera and others in this region. Clearly, comparisons of pholidosis, habitus, etc., will not provide the resolution necessary to differentiate these groups. Basic characters of the skeleton and musculature have not been examined for most of these species and the modern collection and analysis of biochemical data have only recently begun (Macey et al., 2000).

A brief discussion of the Pakistan gecko fauna and its taxonomic complexities is presented to provide an adequate explanation regarding the assignment of the species

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described in this paper. Numbers of species listed under each genus below refer only to those reported from Pakistan. Within the Pakistan gekkonines, only *Hemidactylus* Cuvier 1820 ($n = 7$ species), *Ptyodactylus homolepis* Blanford 1875, and *Teratolepis fasciata* (Blyth 1854), have dilated digits. All others ($n = 32$ species and subspecies) have nondilated and clawed digits.

*Teratoscincus* Strauch 1863 ($n = 3$ species and subspecies), referred to by some authors as distinct at the subfamily level (Teratoscincinae; Kluge, 1987:40) can be readily separated from all other Pakistan geckos by its unique suite of morphologic characters, most notably its large, plate-like scales.

*Alsophylax* (*s. s.*) Fitzinger 1843 and *Bunopus* Blanford 1874 were confused in early literature (see Szczerbak and Golubev, 1996:7–8 for discussion). These taxa may be generally separated by the flat and enlarged nasal scales, nonsegmented tail, straight digits, and smooth subdigital lamellae of the former. *Bunopus* has smaller nasal scales, slightly angular digits, subdigitals with pectinate anterior margins, and spinose lateral digital scales. *Alsophylax* (*Altiphylax*) Eremschenko and Szczerbak 1984 was erected for *Alsophylax tokobaejvi* (the first mention of this patronymic is misspelled in the description; see Kluge, 2001:2), which has a weakly segmented tail, slightly angular digits, and smooth subdigitals. *Alsophylax* (*Altiphylax*) *boehmei* Szczerbak 1991, described from extreme northeastern Pakistan, was later placed in the synonymy of *Cyrtopodion stoliczkai* (Steindachner 1867) (Auffenberg et al., 2004). As currently defined, *Alsophylax* does not occur in Pakistan, but is widely distributed from Kazakhstan eastward through central Asia to China and Mongolia (Szczerbak and Golubev, 1996:55–86).

*Bunopus*, represented in Pakistan by *B. tuberculatus* Blanford 1874, is relatively easily separated from other Pakistan geckos by the presence of pectinate, subdigital lamellae and spinose lateral digital scales. *Bunopus tuberculatus* is widespread and occurs from the Middle East eastward through southern Pakistan (Anderson, 1999). *Crossobamon* Boettger 1888 also has serrate or pectinate subdigital lamellae, but its lateral digital scales form a distinct fringe, and are not spinose, as in *Bunopus*. The three species of Pakistan *Crossobamon* (*C. lumsdeni* Boulenger 1887, *C. maynardi* Smith 1933, and *C. orientalis* Blanford 1876) were formerly assigned to *Stenodactylus* Fitzinger 1826, a group with weakly to moderately fringed digits (webbed in *S. arabicus*), lacking enlarged transverse subdigital lamellae, and differing from other gekkonines in osteology. The validity of *C. lumsdeni* is in question (see Anderson, 1999; Khan, 2006). *Stenodactylus* occurs from northern Africa, the Middle East and eastward to southeastern Iran (Anderson, 1999; Arnold, 1980; Kluge, 1967), while *Crossobamon* is distributed from Kazakhstan east to Turkmenistan and south to Iran and Pakistan (Anderson, 1999:146).

The Pakistan geckos placed in *Tropiocolotes* Peters 1880 (two species and one subspecies) by Khan (2006:151–153), are easily recognized by their lack of enlarged dorsal tubercles and relatively small body size (<40 mm SVL). Eleven other species with similar pholidosis, etc., ranging from northern Africa eastward to southern Pakistan, have been variously assigned to *Tropiocolotes*, *Microgecko* Nikolsky 1907, and *Asiocolotes* Golubev 1984. The nomenclatural history of *Tropiocolotes* is complex (see Anderson, 1999:191 and Szczerbak and Golubev, 1996:8–9 for discussions). Szczerbak and Golubev (1996:98–123) list *Tropiocolotes* occurring in Pakistan as *T.* (*Asiocolotes*) *depressus* (Minton and Anderson 1965), *T.* (*Microgecko*) *p. persicus* (Nikolsky 1903) and *M. p. euphorbiacola* (Minton et al. 1970). Kluge (2001) follows this general arrangement, but recognizes *Tropiocolotes*, *Microgecko*, and *Asiocolotes* at the generic level. Khan (2006) does not allocate subgenera.

The remaining Pakistan geckos with nondilated digits include the genera *Agamura* Blanford 1874, *Rhinogekko* de Witte 1973, and *Cyrtopodion* (*s. l.*) Fitzinger 1843 (all as defined by Anderson, 1999). These species have angular digital articulations of varying degrees. We agree with Anderson (1999:127) that *Agamura* is monotypic (*A. persica* Duméril 1856), distinct from *Rhinogekko* in a number of characteristics, including a dark peritoneum, unique basal constriction of the tail, and lacking mental shields. Khan (2006)

also treats these as separate genera. *Rhinogekko* (2 species in Pakistan, *R. femoralis* (Smith 1933) and *R. misonnei* de Witte 1973) can be further characterized by its series of greatly enlarged subfemoral scales and prominently swollen or tube-like scales surrounding the nostrils. Szczerbak and Golubev (1996:12, 203–211) and Kluge (2001:2) treat *Rhinogekko* as a synonym of *Agamura*, and include the Iranian species *A. gastropholis* Werner 1917, while Anderson (1999:156–158) assigns the later to *Cyrtopodion*.

*Cyrtopodion* (*s.l.*) (as defined by Anderson, 1999) represents the most diverse and taxonomically perplexing gekkotan group in Pakistan. Nineteen species (Khan, 2004, 2006; this paper) are included in this artificial assemblage of geckos, having similar heterogeneous dorsal pholodosis, phalangeal articulation, and subdigital scalation. The current phylogenetic arrangement is inadequate and not based on plesiomorphic characters. Because homoplasious similarities in pedal morphology are well-known in geckos (see Bauer and Russell, 1991; Russell, 1979), we use *Cyrtopodion* in its broadest sense in the description presented herein (also see Discussion for genera recently described by Khan (2003*b*), an arrangement we find premature). The characters utilized to differentiate this new species best fall within the wide range of variation seen in *Cyrtopodion* (*s. l.*), rather than any other generic group presently recognized in southern and southwest Asia.

## Materials and Methods

Herpetological collections were made in Pakistan during the 1980s–1990s by Walter Auffenberg and the Zoological Survey Department of Pakistan. A series ($n = 14$) of unusual looking geckos, comprised of all size classes from hatchlings to adults, was collected from Manshera and lower Swat districts, Northwest Frontier Province, Pakistan, and subsequently deposited in the Florida Museum of Natural History, University of Florida. These geckos were examined for 45 morphological characters and measurements (Tables 1–2), and compared to all other geckos with similar morphology (i.e., those with small, round dorsal tubercles, and blunt caudal tubercles on indistinctly segmented

Table 1.—Morphological characters and measurements used for geckos from Pakistan. See text for certain character descriptions.

| No. | Character description |
|---|---|
| 1 | Number of post-nasals |
| 2 | Number of medial scales between post-nasals |
| 3 | Number of supralabials |
| 4 | Number of infralabials |
| 5 | Number of interorbitals |
| 6 | Number of scales surrounding dorsal tubercle (randomly counted 5 tubercles) |
| 7 | Number of scales between postmentals and cloaca |
| 8 | Number subdigital lamellae on fourth toe |
| 9 | Number of pairs of postmentals |
| 10 | Number of whorls on anterior one-third of tail |
| 11 | Number of large, lateral tubercles on each tail whorl |
| 12 | Number of color bands on head, nape, body, and tail |
| 13 | Number of scales between eye and ear (left side only) |
| 14 | Number of longitudinal rows of tubercles |
| 15 | Number of transverse rows of ventral scales at midbody |
| 16 | Number of subdigital lamellae on first toe |
| 17 | Presence (+) and number of cloacal spurs |
| 18 | Number of scale rows per tail whorl (max. 8 whorls counted) |
| 19 | Number of subdigital lamallae on fourth finger |
| 20 | First pair of postmentals in contact (+) or not in contact (−) |
| 21 | Scales on top of head relatively homogeneous in size (+) or not homogeneous in size (−) |
| 22 | Dorsal tubercles present (+) or absent (−) |
| 23 | Mental triangular (+) or not triangular (−) |
| 24 | Tail whorls distinct (+) or indistinct (−) |
| 25 | Presence (+) and number of preanal pores |
| 26 | Color pattern of dorsum banded (+) or not banded (−) |
| 27 | Color band from nostril through eye to nape present (+) or absent (−) |
| 28 | Femoral spines present (+) or absent (−) |
| 29 | Presence (+) and number of femoral pores |
| 30 | Enlarged tubercles on limbs present (+) or absent (−) |
| 31 | Roundish dorsal tubercles present (+) or absent (−) |
| 32 | Dorsal tubercle sculpture rounded (+) or not rounded (−) |
| 33 | Medial subcaudals in series (+) or not in series (−) |
| 34 | Distal scale row of tail whorl enlarged (+) or not enlarged (−) |
| 35 | Tail dorso-ventrally compressed (+) or not compressed (−) |
| 36 | Presence (+) and number of enlarged femoral scales |
| 37 | Snout–vent length (SVL) |
| 38 | Tail length |
| 39 | Head length |
| 40 | Head width |
| 41 | Head height |
| 42 | Nostril-eye distance |
| 43 | Eye–ear distance |
| 44 | Eye diameter |
| 45 | Ear diameter |

TABLE 2.—Measurements and scale counts for *Cyrtopodion brachykolon* from Pakistan. See text and Table 1 for character descriptions. * = holotype.

| Specimen | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UF 81188 | 3/3 | 1 | 9/8 | 7/7 | 17 | 7–8 | 137 | 19/19 | 3/3 | NA | 3 | 1/1/5/NA | 19 | 10 | 30 | 11/11 | +/2/2 | 8 | 18/19 | + | + |
| UF 81312 | 3/3 | 2 | 9/10 | 8/8 | 19 | 7–8 | 142 | 20/20 | 3/3 | NA | 3 | 1/1/4/NA | 19 | 10 | 34 | 11/11 | +/2/2 | 8 | 18/NA | − | + |
| UF 81313 | 3/3 | 2 | 8/8 | 7/8 | 20 | 7–8 | 155 | 20/20 | 3/3 | 7 | 3 | 1/1/4/11 | 19 | 10 | 34 | 9/10 | +/2/2 | 9 | 18/18 | − | + |
| UF 81316 | 3/3 | 1 | 8/9 | 7/7 | 18 | 7–8 | 147 | 20/21 | 3/3 | 8 | 3 | 1/1/5/12 | 19 | 10 | 32 | 10/11 | +/3/3 | 8 | 18/18 | − | + |
| UF 81317 | 3/3 | 2 | 8/10 | 7/7 | 20 | 7–8 | 142 | 20/20 | 3/3 | 8 | 3 | 1/1/4/12 | 20 | 10 | 32 | 11/11 | +/2/2 | 8 | 18/19 | + | + |
| UF 81318 | 3/3 | 2 | 8/9 | 7/7 | 21 | 7–9 | 155 | 19/21 | 3/3 | 8 | 4 | 1/1/5/12 | 22 | 10 | 34 | 11/11 | +/2/2 | 8–9 | 18/18 | + | + |
| UF 81319 | 3/3 | 2 | 10/7 | 7/7 | 20 | 7–8 | 143 | 21/21 | 3/3 | 7 | 3 | 1/1/5/11 | 21 | 10 | 34 | 11/11 | +/2/2 | 8 | 18/18 | + | + |
| UF 81320 | 3/3 | 2 | 9/9 | 7/7 | 21 | 8 | 153 | 21/21 | 3/3 | 7 | 4 | 1/1/4/10 | 19 | 10 | 30 | 9/9 | +/2/2 | 8 | 18/18 | + | + |
| UF 81321 | 3/3 | 2 | 9/9 | 7/7 | 20 | 7–9 | 155 | 20/21 | 3/3 | 7 | 3 | 1/1/5/NA | 19 | 10 | 32 | 11/11 | +/2/2 | 8–9 | 18/18 | + | + |
| UF 81322* | 3/3 | 2 | 10/9 | 8/8 | 20 | 7–8 | 151 | 21/21 | 3/3 | 7 | 3 | 1/1/4/12 | 19 | 10 | 34 | 11/11 | +/2/2 | 8–9 | 18/18 | + | + |
| UF 81323 | 3/3 | 2 | 9/9 | 7/7 | 20 | 8 | 150 | 21/21 | 3/3 | 7 | 3 | 1/1/4/NA | 19 | 10 | 32 | 11/11 | +/2/2 | 8–9 | 17/17 | + | + |
| UF 81324 | 3/3 | 2 | 10/9 | 8/7 | 18 | 7–8 | 143 | 21/21 | 3/3 | 8 | 3 | 1/1/4/10 | 19 | 10 | 34 | 10/10 | +/2/2 | 8 | 19/19 | − | + |
| UF 81325 | 3/3 | 1 | 9/10 | 8/8 | 21 | 7–8 | 158 | 21/21 | 3/3 | 8 | 3 | 1/1/5/13 | 20 | 10 | 34 | 11/11 | +/2/2 | 8–9 | 17/17 | + | + |
| UF 82078 | NA | NA | NA | NA | NA | NA | 149 | 21/21 | 3/3 | 7 | NA | 1/1/4/NA | NA | 10 | 30 | 11/11 | NA | NA | NA | + | + |

| Specimen | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UF 81188 | + | + | − | + | + | + | − | − | − | + | + | + | − | + | − | 46.6 | NA | 12.2 | 9.3 | 5.1 | 3.7 | 4.0 | 2.8 | 1.1 |
| UF 81312 | + | + | − | + | + | + | − | − | − | + | + | + | − | + | − | 50.4 | NA | 14.0 | 10.3 | 5.9 | 5.0 | 5.3 | 2.6 | 0.9 |
| UF 81313 | + | + | − | + | + | + | − | − | − | + | + | + | − | + | − | 37.0 | 44.0 | 10.6 | 7.8 | 4.4 | 3.4 | 3.4 | 2.0 | 0.6 |
| UF 81316 | + | + | − | + | + | + | − | − | − | + | + | + | − | + | − | 40.0 | 50.2 | 11.5 | 8.2 | 4.5 | 3.5 | 3.5 | 2.3 | 0.6 |
| UF 81317 | + | + | − | − | + | + | − | − | − | + | + | + | − | + | − | 35.4 | 44.8 | 10.2 | 7.4 | 3.8 | 3.0 | 3.2 | 2.3 | 0.8 |
| UF 81318 | + | + | − | + | + | + | − | − | − | + | + | + | − | + | − | 37.4 | 47.7 | 10.6 | 7.7 | 4.3 | 3.3 | 3.4 | 2.1 | 0.5 |
| UF 81319 | + | + | − | − | + | + | − | − | − | + | + | + | − | + | − | 32.0 | 39.8 | 9.8 | 7.2 | 3.9 | 3.0 | 3.4 | 2.2 | 0.5 |
| UF 81320 | + | + | − | − | + | + | − | − | − | + | + | + | − | + | − | 35.4 | 45.6 | 10.7 | 7.7 | 4.1 | 3.0 | 3.0 | 2.0 | 0.6 |
| UF 81321 | + | + | − | + | + | + | − | − | − | + | + | + | − | + | − | 48.8 | NA | 13.6 | 10.0 | 5.2 | 3.4 | 3.4 | 2.4 | 0.7 |
| UF 81322* | + | + | − | − | + | + | − | − | − | + | + | + | − | + | − | 50.6 | 60.2 | 13.0 | 10.1 | 5.3 | 4.5 | 4.5 | 2.9 | 0.9 |
| UF 81323 | + | + | − | − | + | + | − | − | − | + | + | + | − | + | − | 51.2 | NA | 13.3 | 9.6 | 5.3 | 4.4 | 4.4 | 2.7 | 0.9 |
| UF 81324 | + | + | − | + | + | + | − | − | − | + | + | + | − | + | − | 29.2 | 34.7 | 8.9 | 6.1 | 3.6 | 2.5 | 2.5 | 2.1 | 0.5 |
| UF 81325 | + | + | − | + | + | + | − | − | − | + | + | + | − | + | − | 34.7 | 43.3 | 10.0 | 7.3 | 3.9 | 2.8 | 3.0 | 2.2 | 0.7 |
| UF 82078 | + | + | − | NA | + | + | − | − | − | + | + | + | − | + | − | 21.1 | NA | 7.5 | 4.7 | 2.5 | NA | NA | 1.3 | NA |

caudal whorls) recorded from southern and central Asia, either by direct examination of museum specimens (see Appendix) or by descriptions available in the literature (Anderson, 1999; Auffenberg et al., 2004; Khan, 2004, 2006; Smith, 1935; Szczerbak and Golubev, 1986, 1996; see Results). Although many of these counts and measurements are standard, clarification of certain characters are provided. Only original (i.e., non-regenerated) tails were measured. The left side is given first for scale counts taken on both sides of the specimen. Character 6 was obtained by counting the scales surrounding five randomly selected enlarged dorsal tubercles. Character 12 lists the number of color bands in the following order: on the occipital region, nape, body (from forelimbs to sacrum), and tail. Character 13 lists the left side only for the number of scales between the eye and ear. The number of longitudinal rows of enlarged dorsal tubercles (Character 14) and transverse rows of ventral scales (Character 15) were counted at mid-body. Limb lengths were determined for four adult specimens by pressing the straightened limb to a steel ruler; manus, pes, and digits were not included.

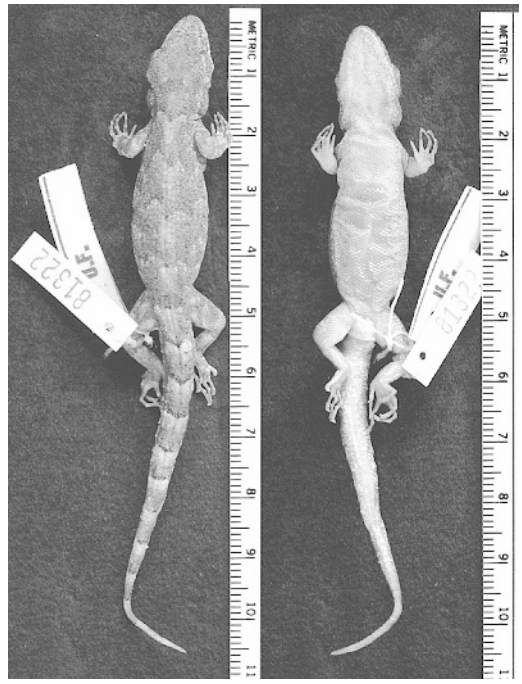

FIG. 1.—Hotoype of *Cyrtopodion brachykolon* (UF 81322). Dorsal (A) and ventral (B) views.

## RESULTS

Although many of the morphological characters examined in this study overlap with those known for other southwestern and central Asian geckos, the new species described herein has dorsal and caudal scale morphologies most similar to *Cyrtopodion walli* (Ingoldby 1922) from the southern Chitral District in western Pakistan. *Cyrtopodion walli* has distinct longitudinal rows of enlarged dorsal tubercles, which are larger relative to the surrounding granular scales. The new species is easily separated from *C. walli* by its larger supranasals, relatively shorter limbs, and fewer number of transverse color bands. *Cyrtopodion baturensis* (Khan and Baig 1992) and *C. stoliczkai* (Steindachner 1867) from northern Pakistan have similar caudal tubercle features, but have distinctly segmented tails with laterally expanded lobes, while the tail of the new species is round in cross section and indistinctly segmented. The Tian-shan pygmy gecko, *Alsophylax* (*Altiphylax*) *tokobajvi*, is similar in overall morphology, but has relatively longer limbs and straight to slightly angularly bent digits. These data suggest that the new species is on a distinct evolutionary lineage.

## SYSTEMATIC ACCOUNT

### Cyrtopodion **brachykolon** *sp. nov.*

Short-limbed Bent-toed Gecko

*Holotype*.—UF 81322 (Figs. 1–2, Table 2), female, collected by H. Rehman on 28 May 1991, 3.0 km W Marghazar, Swat District, Northwest Frontier Province, Pakistan (34° 37′ N, 72° 20′ E), 1700 m elevation (Fig. 3). This adult female was used as the holotype because males in the type series listed below lack tails, have tails that are in the process of being regenerated, and/or are juveniles.

*Paratypes*.—UF 81312–13, 81316–21, 81323–25, same data as holotype; UF 81188, collected by H. Rehman on 21 May 1991, 1981 m elevation, Batrasi Gali, Manshera District, Northwest Frontier Province, Pakistan (34° 25′ N, 73° 20′ E) (Fig. 3, Table 2).

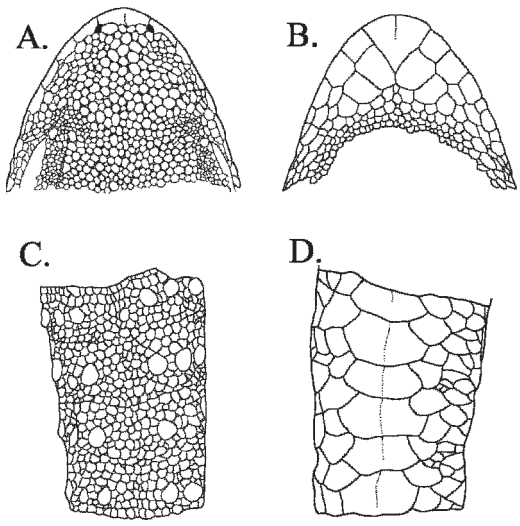


FIG. 2.—Holotype of *Cyrtopodion brachykolon* (UF 81322). Dorsal (A) and ventral (B) views of head; and dorsal (C) and ventral (D) views of tail about one head length from cloaca.

*Diagnosis*.—*Cyrtopodion brachykolon* is distinguished by its distinctly short limbs, stout body and large head; two postnasal scales (three in *C. walli*), 10 indistinct longitudinal rows of enlarged dorsal tubercles surrounded by rosettes of 7–9 small granular scales (10–12 distinct rows of enlarged dorsal tubercles each surrounded by 8–12 scales in *C. walli*); 137–158 ventral scales from first pair of postmentals to cloaca (143–182 in *C. walli*); 17–19 subdigital lamellae on fourth finger, 9–11 on first toe, and 19–21 on fourth toe (16–22, 11–14, and 22–28, respectively, in *C. walli*). *Cyrtopodion brachykolon* is superficially similar to *C. stoliczkai* and *C. baturensis* in its dorso-lateral caudal tubercles, but the later two species have distinctly segmented tails which are also laterally expanded or lobed. Additionally, the new species can be separated from *Alsophylax tokobajvi*, which has 91–109 ventral scales between the first pair of postmentals and cloaca, 20–27 subdigital lamellae on the fourth toe, and straight to slightly bent digits (see Szczerbak and Golubev, 1986, 1996).

*Description of holotype*.—The holotype is similar to paratypes in morphology and coloration unless otherwise noted; adult female with 50.6 mm snout–vent length (SVL); 60.2 mm tail length (TL); SVL/TL = 0.840; head length (HL)/SVL = 0.256; head width

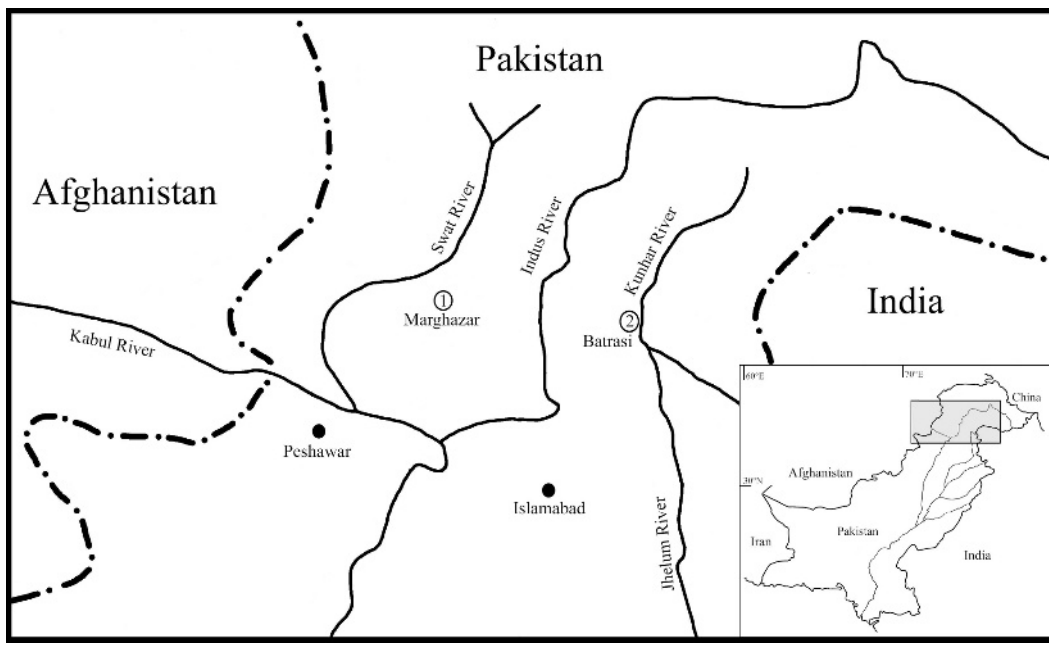


FIG. 3.—Collection sites of *Cyrtopodion brachykolon* in Northwest Frontier Province, Pakistan. (1) holotype locality, 3.0 km W Marghazar, Swat District (34° 37′ N, 72° 20′ E); (2) Batrasi Gali, Manshera District (34° 25′ N, 73° 20′ E).

(HW)/HL = 0.776; head height (HH)/HW = 0.524; eye diameter (EYD)/eye–nostril (E–N) = 0.644; ear diameter (EAD)/EYD = 0.310; one supranasal and two subequal postnasals; two medial scales separating supranasals; nine and 10 supralabials, eight infralabials; 20 interorbitals; 19 scales between eye and ear; 7–8 scales surrounding each dorsal tubercle; first pair of postmentals in contact with short suture; 151 scales between postmentals and cloaca; 34 transverse rows of ventrals at mid-body; 11 subdigital lamellae on first toe; 21 subdigital lamellae on the fourth toe; preanal pores absent, series of enlarged preanal scales nonpitted; seven whorls on anterior one-third of tail; 8–9 scale rows per tail whorl; three large, blunt dorso-lateral tubercles on each tail whorl; one series of transversely enlarged subcaudals; dark dorsal crossbands include one on occipital area, one on nape, four on body, and 12 on tail.

*Variation*.—Medium-sized geckos (SVL of largest adult examined = 51.2 mm ($n$ = 14); tail slightly longer than body (longest TL = 60.2 mm); SVL/TL (mean = 0.808 ± standard deviation [SD] = 0.025, $n$ = 9); hind limb moderate, extending to axilla, forelimb short, extending to near nostril; body and head somewhat dorso-ventrally compressed. Head moderate (HL/SVL, mean = 0.288 ± 0.024, HW/HL, mean = 0.723 ± 0.035, HH/HW, mean = 0.545 ± 0.021; snout equal to or a little longer than distance between eye and ear. Eye large (EYD/E–N, mean = 0.686 ± 0.089; ear rounded to ovate, small, EAD/EYD, mean = 0.300 ± 0.049.

Nostril bordered by rostral, first supralabial, an enlarged supranasal and two subequal postnasals; the first supralabial with a dorsad flange bordering the nostril providing a false impression of a fourth postnasal; one to two medial scales between postnasals. Dorsal head scales generally homogeneous in size and shape, slightly larger on snout; 17–21 interorbital scales; loreals often with small projections on posterior one-third of eye; rostral partially cleft; eight to 10 supralabials, seven to eight infralabials. Mental triangular; three pairs of postmentals, decreasing in size posteriorly, first pair in contact (50%) or separated by one scale (50%), if in contact, suture short or in a point contact, third pair often only slightly enlarged and separated from infralabials by a series of relatively smaller scales. Dorsum of body and limbs with small roundish, beaded to flat scales intermixed with larger, roundish tubercles; tubercles surrounded by rosettes of seven to nine small scales, two to three times larger than granular scales, smooth, flat to rounded, sometimes indistinctly keeled, slightly conical laterally, arranged in 10 indistinct longitudinal rows. Lateral fold indistinct, often absent. Venter with roundish, slightly imbricate scales, 30–34 across middle of belly; 137–158 from postmentals to cloaca. Enlarged scales in preanal region present; males with four distinct preanal pores situated in short chevron; medial scales with pores separated by zero or one smaller scale; females without distinct pores, but enlarged preanal scales may be nonpitted or distinctly or indistinctly pitted. Femoral pores and spines absent. Cloacal spurs present, blunt, two to three per side. Limbs short, particularly forelimbs, forelimb (FL)/SVL, mean = 0.205 ± 0.01, hindlimb (HL)/SVL, mean = 0.325 ± 0.01, $n$ = 4. Digits without lateral projections; toes moderate in length, angularly bent; fingers short, indistinctly bent, subdigital lamellae well-developed, nearly as broad as digit, but not expanded, 17–19 on fourth finger, 9–11 on first toe, 19–21 on fourth toe. Tail dorso-ventrally compressed in anterior two-thirds, more cylindrical posterior one-third; anterior half with distinct dorsal medial groove; anterior half of tail not distinctly segmented, lacking swollen and lobed areas laterally; seven to eight indistinct whorls in anterior third of tail; each segment in anterior half with one enlarged dorso-lateral tubercle and two to three enlarged, bluntly conical lateral tubercles per side, medial tubercles largest; tubercles reduced in size and number (two) distally, indistinct or absent on posterior one-third; eight to nine rows of scales per whorl, terminal row not enlarged, squared-off posteriorly, not acuminate or keeled; one series of transversely enlarged subcaudals, five to six times larger than adjacent scales; regenerated tail without segments and lobes, uniformly covered in small, flat scales.

Dorsum ground color light to medium gray with six to seven irregular transverse darker

gray bands, with even darker posterior margins, one in occipital area, one at nape, and 4–5 on body; 10–13 dark bands on tail; limbs with short grayish bars; grayish-brown band from nostril through eye; top of head irregularly mottled; labials with dark speckles; venter light colored occasionally with dark speckles laterally.

*Etymology*.—The Greek *brachys-* (short) and Greek *kolon* (limb) (neuter) is used to form the composite noun *brachykolon* (short limb), which is applied in apposition to the generic name.

*Distribution*.—*Cyrtopodion brachykolon* is presently known only from localities in the Manshera and lower Swat districts, Northwest Frontier Province, Pakistan (Fig. 3). However, this species is expected to occur in intervening areas with suitable habitat and may also occur in similar situations in eastern Afghanistan and northwestern India.

*Habitat*.—The region of Pakistan where *Cyrtopodion brachykolon* has been collected is known as the Himalayan Foothills Subprovince (Auffenberg, 1997), an area characterized by north-south trending mountain ranges of moderate (250–2700 m) elevations that separate the valleys of the Swat, Indus, and Jhelum rivers. This region forms a transitional zone between the semi-arid plains and the higher Himalaya, Karakoram, and Hindu Kush ranges to the north. This area is typified by Chir Pine (*Pinus roxburghii*) forests and grasslands, heavily modified and impacted by human activity. *Cyrtopodion brachykolon* utilizes the widespread surficial limestone and slate in this region as refugia.

The series of *Cyrtopodion brachykolon* was collected under rocks along stone walls in Chir Pine forests at elevations from 1200–1981 m. Although this species was collected under loose rocks along stone walls used for agriculture and retaining walls, it was not encountered in nearby human dwellings.

*Reproduction*.—One female (UF 81316, 51.2 mm SVL) collected 28 May 1991 is gravid with two developing eggs that are visible through its semi-transparent abdomen.

## Discussion

The diagnostic ratios of limb length to SVL (see variation above) for *Cyrtopodion brachykolon* may be indicative of its ground-dwelling habits. Climbing bent-toed geckos, or at least those known to be adept in jumping, have relatively longer limbs. For example, the limbs of the following three gecko species are decidedly longer (relative to SVL) than *Cyrtopodion brachykolon* as indicated by their mean FL/SVL and HL/SVL ratios, respectively: 0.279 ± 0.04 and 0.422 ± 0.07 for *Cyrtopodion baturensis*, 0.245 ± 0.01 and 0.340 ± 0.01 for *C. stoliczkai*, and 0.285 ± 0.02 and 0.360 ± 0.02 for *C. walli* ($n = 4$ for each species; see Appendix).

The observed morphological similarities between *Cyrtopodion brachykolon, C. walli*, and *Alsophylax tokobajvi* do not necessarily suggest close phylogenetic position. Variation of southern and central Asian geckos is poorly understood, particularly at supraspecific levels. Generic assignment of Asiatic bent-toed geckos continues to be difficult and many of those taxa found in the Himalayas and southwestern Asian deserts prove especially problematic (Russell and Bauer, 2002). In order to elucidate the untidy nomenclatural history as well as further justify our generic assignment of *C. brachykolon*, we provide a brief review of the most comprehensive phylogenetic arrangements of *Cyrtopodion* (*s. l.*) presented by earlier workers (Table 3).

Kluge (1985) presented a detailed account of the various usages of the names *Gonydactylus, Goniodactylus*, and *Gonyodactylus* (also see Underwood, 1954:474). Kluge (2001:6, 29) listed these genera as *nomen nudum* and synonyms of either *Cyrtodactylus* Gray 1827 or *Stenodactylus*. Species described in *Gonydactylus* Kuhl and van Hasselt 1822 (see Darevsky et al., 1997; Schleich and Kästle, 1998) were most recently reassigned to *Cyrtodactylus* (Kluge, 2001:7) and *Siwaligekko* (Khan, 2003*b*:3).

Early workers (i.e., Annandale, 1913; Smith, 1935) assigned naked- or bent-toed geckos to *Gymnodactylus* Spix 1825, a polyphyletic assemblage of geckos with angular digits and a heterogeneous dorsal pholidosis. Based on material in the Indian Museum, Annandale (1913) presented the first taxonomic scheme of the assemblage, which he divided into 5 groups. **Group I:** Small ground geckos; stout form; regular, longitudinal dorsal

TABLE 3.—Generic assignments of selected gecko species from 1913 to 2006, source is indicated in column headings. Numerals indicate Group Number (see text for definitions); when present, second set of abbreviations = assigned subgenus, i.e., GyCd = *Gymnodactylus* (*Crytodactylus*); Ag = *Agamura*; Al = *Altigekko*; Cp = *Cyrtopodion*; Ge = *Geckoella*; Go = *Gonydactylus*; Gy = *Gymnodactylus*; In = *Indogekko*; Md = *Mediodactylus*; Si = *Siwaligekko*; Te = *Tenuidactylus*; Th = Tibeto-Himalayan Group; — = not listed; ‡ = given as synonym of *walli*; * = likely based on specimens of *montiumsalsorum*; ° = listed as species *incertae*, later described as *mintoni*; † = listed as a synonym of *stoliczkai*.

| Species | Annandale (1913) | Smith (1935) | Underwood (1954) | Wermuth (1965) | Minton (1966) | Mertens (1969) | Kluge (1991) | Kluge (1993) | Das (1994) | Szczerbak and Golubev (1996) | Kluge (2001) | Khan (2003b) | Khan (2006) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *agamuroides* Nikolsky 1900 | — | — | — | GyCd | Ag | Ag | Cp | Cp | Cp | TeCp | Cp | Cp | Cp |
| *angularis* Smith 1921 | — | Gy2 | Cd | GyCd | — | — | Go | Cd | — | — | Cd | — | Cd |
| *battalensis* Khan 1993 | — | — | — | — | — | — | — | — | Te | — | Cd | Si | Si |
| *baturensis* Khan and Baig 1992 | — | — | — | — | — | — | — | Te | Te | TeTh | Te | Al | Al |
| *brevipalmatus* Smith 1923 | — | Gy3 | Cd | GyCd | — | — | Go | Cd | — | — | Cd | — | — |
| *brevipes* Blanford 1874 | Gy1 | — | — | GyCd | — | — | Md | Md | — | — | Cp | — | — |
| *chitralensis* Smith 1935 | — | Gy2 | — | GyCd | Cd | GyCd | Go | Cd‡ | Go | TeTh | Cd | — | Md‡ |
| *collegalensis* Beddome 1870 | — | Gy4 | — | GyCd | — | — | Ge | Ge | Ge | — | Ge | Si | Cd |
| *condorensis* Smith 1921 | — | Gy2 | Cd | GyCd | — | — | Go | Cd | — | — | Cd | — | Cd |
| *consobrinoides* Annandale 1905 | Gy5 | Gy2 | — | GyCd | — | — | Go | Cd | — | — | Cd | — | Cd |
| *dattanensis* Khan 1980 | — | — | — | — | — | — | Go | Cd | Go | TeTh | Cd | Si | Si |
| *deccanensis* Günther 1864 | Gy4 | Gy6 | — | GyCd | — | — | Ge | Ge | Ge | — | Ge | Si | Cd |
| *elongatum* Blanford 1875 | Gy1 | — | Cd | GyCd | — | — | Cp | Cp | — | TeCp | Cp | — | — |
| *fasciolatus* Blyth 1861 | Gy5 | Gy2 | — | GyCd | — | — | Go | Cd | Go | TeTh | Cd | Si | — |
| *feae* Boulenger 1893 | Gy5 | Gy2 | — | GyCd | — | — | Go | Cd | — | — | Cd | — | — |
| *fedtschenkoi* Strauch 1887 | — | Gy1 | Cd | GyCd | Cd* | GyCd* | Te | Te | Cp | TeTe | Te | Cp | — |
| *fortmunroi* Khan 1993 | — | — | — | — | — | — | — | — | Te | — | Te | In | In |
| *fraenatus* Günthe, 1864 | Gy5 | Gy2 | Cd | GyCd | — | — | Go | Cd | Go | — | Cd | — | Cd |
| *gubernatoris* Annandale 1913 | Gy3 | Gy2 | — | GyCd | — | — | Go | Cd | Go | — | Cd | — | — |
| *himalayanus* Duda and Sahi 1978 | — | — | — | — | — | — | Go | Cd | Go | TeTh | Cd | Si | Si |
| *indusoani* Khan 1988 | — | — | — | — | — | — | Go | Te | Te | — | Te | In | In |
| *intermedius* Smith 1917 | — | Gy2 | Cd | GyCd | — | — | Go | Cd | — | — | Cd | — | Cd |
| *irregularis* Smith 1921 | — | Gy2 | Cd | GyCd | — | — | Go | Cd | — | — | Cd | — | Cd |
| *jeyporensis* Beddome 1878 | Gy4 | Gy6 | — | GyCd | — | — | Ge | Ge | Ge | — | Ge | Si | Cd |
| *kachhensis* Stoliczka 1872 | Gy1 | Gy1 | Cd | GyCd | Cd | GyCd | Cp | Cp | Cp | TeCp | Cp | Cp | Cp |
| *khasiensis* Jerdon 1870 | Gy3 | Gy2 | Cd | GyCd | — | — | Go | Cd | Go | — | Cd | — | Cd |
| *kohsulaimanai* Khan 1991 | — | — | — | — | — | — | — | Te | Te | — | Te | Cp | Cp |
| *lawderanus* Stoliczka 1871 | Gy2? | Gy5 | Cd | GyCd | — | — | Go | Cd | Go | TeTh | Cd | Si | — |
| *malcolmsmithi* Constable 1949 | — | — | Cd | GyCd | — | — | Go | Cd | Go | — | Cd | — | — |
| *mansarulus* Duda and Sahi 1978 | — | — | — | — | — | — | Go | Cd | Go | — | Cd | — | — |
| *mintoni* Golubev and Szczerbak 1981 | — | — | — | — | — | GyCd° | Go | Cd | Go | TeTh | Cd | Si | Si |
| *montiumsalsorum* Annandale 1913 | Gy1 | Gy1 | — | GyCd | Cd | GyCd | Cp | Te | Te | TeCp | Te | Cp | Cp |
| *nebulosa* Beddome 1870 | Gy4 | Gy4 | Cd | GyCd | — | — | Ge | Ge | Ge | — | Ge | Si | Cd |
| *oldhami* Theobald 1876 | Gy4 | Gy2 | Cd | GyCd | — | — | Go | Cd | — | — | Cd | — | Cd |
| *peguensis* Boulenger 1893 | Gy5 | Gy2 | Cd | GyCd | — | — | Go | Cd | — | — | Cd | — | Cd |
| *potoharensis* Khan 2001 | — | — | — | — | — | — | — | — | — | — | — | Cp | Cp |
| *pulchellus* Gray 1827 | Gy5 | Gy2 | Cd | GyCd | — | — | Go | Cd | Go | — | Cd | Cd | Cd |
| *rhodocaudus* Baig 1998 | — | — | — | — | — | — | — | — | — | — | Te | In | In |
| *rohtasfortai* Khan and Tasnim 1990 | — | — | — | — | — | — | Go | Te | Te | — | Te | In | In |
| *rubidus* Blyth 1861 | Gy3 | Gy2 | Cd | GyCd | — | — | Go | Cd | Go | — | Cd | — | Cd |
| *scabrum* Heyden 1827 | Gy1 | Gy1 | Cd | GyCd | Cd | GyCd | Cp | Cp | Cp | TeCp | Cp | Cp | Cp |
| *stoliczkai* Steindachner 1867 | Gy2 | Gy5 | Cd | GyCd | Cd | GyCd | Go | Cd | Go | TeTh | Te | Al | Al |
| *triedra* Günther 1864 | Gy4 | Gy4 | Cd | GyCd | — | — | Ge | Ge | Ge | — | Ge | Si | Cd |

TABLE 3—Continued.

| Species | Annandale (1913) | Smith (1935) | Underwood (1954) | Wermuth (1965) | Minton (1966) | Mertens (1969) | Kluge (1991) | Kluge (1993) | Das (1994) | Szczerbak and Golubev (1996) | Kluge (2001) | Khan (2003b) | Khan (2006) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *variegatus* Blyth 1859 | Gy5 | Gy2 | — | GyCd | — | — | Go | Cd | — | — | Cd | — | — |
| *walli* Ingoldby 1922 | — | Gy5† | — | GyCd† | Cd† | GyCd† | Go† | Cd | Go | TeTh† | Te | Md | Md |
| *watsoni* Murray 1892 | — | Gy1 | — | GyCd | Cd | — | Cp | Cp | Cp | TeCp | Cp | Cp | Cp |

series of large, keeled tubercles; and cylindrical or subcylindrical tail. Content: *Gymnodactylus brevipes* Blanford 1874, *G. elongatum* Blanford 1875, *G. kachhense* Stoliczka 1872, *G. montiumsalsorum* Annandale 1913, and *G. scabrum* Heyden 1827 (type). **Group II:** Medium-sized geckos with a comparatively smooth dorsum; and tails laterally expanded. Content: *Gymnodactylus stoliczkai* Steindachner 1867 (type). *Gymnodactylus lawderanus* Stoliczka 1871 was provisionally included here. **Group III:** Slender, arboreal geckos; dorsal scales minute with scattered enlarged tubercles; and no enlarged subcaudals. Content: *Gymnodactylus gubernatoris* Annandale 1913; *G. khasiensis* Jerdon 1870 (with synonym *G. himalayicus* Annandale 1906); *G. rubidus* Blyth 1861 (type). **Group IV:** Stout, arboreal geckos, varying dorsal pholidosis; and tail short, without enlarged subcaudals. Content: *Gymnodactylus deccanensis* Günther 1864 (with synonym *G. albofasciatus* Boulenger 1885), *G. jeyporensis* Beddome 1878, *G. nebulosa* Beddome 1870 (type), *G. oldhami* Theobald 1876, and *G. triedra* Günther 1864. **Group V:** Similar to Group III, but consisting of larger geckos with intense coloration; and enlarged transverse subcaudals present. Content: *Gymnodactylus consobrinoides* Annandale 1905; *G. fasciolatus* Blyth 1861; *G. feae* Boulenger 1893; *G. fraenatus* Günther 1864, *G. peguensis* Boulenger 1893, *G. pulchellus* Gray 1827 (type); and *G. variegatus* Blyth 1859.

Smith (1935) presented a similar taxonomic scheme based on species occurring in Colonial India (all species included in *Gymnodactylus*). **Group I:** Corresponds closely with Annandale's Group 1 (type = *G. scabrum*), but he excludes the extralimital *G. elongatum* and includes *G. fedtschenkoi* Strauch 1887, likely because of the confusion with *G. montiumsalsorum*. **Group II:** Large species, often intensely colored in various color patterns; and dorsal scales granular with enlarged, keeled tubercles; elongate toes, cylindrical tail; embraces both groups III and V of Annandale; *G. pulchellus* (type) in addition to *G. angularis* Smith 1921, *G. chiltralensis* Smith 1935, *G. condorensis* Smith 1921, *G. intermedius* Smith 1917, *G. irregularis* Smith 1921, and *G. oldhami* (from Group IV of Annandale). **Group III:** Monotypic offshoot of Group II; webbed toes and lateral caudal extensions. (*G. brevipalmatus* Smith 1923). **Group IV:** Smaller, stout species; brightly colored; short toes; and dorsal pholidosis of small granular scales with larger, keeled tubercles; tail short; a subset of Annandale's Group IV, including *G. nebulosa* (type), *G. triedra*, and *G. collegalensis* Beddome 1870. **Group V:** Medium-sized geckos with inconspicuous color patterns; and varied dorsal pholidosis; toes long; tail short and swollen basally; the same as Annandale's Group II, except that the assignment of *G. lawderanus* with *G. stoliczkai* (type) is no longer provisional. **Group VI:** Moderately large species with conspicuous coloration; dorsal scales much larger than ventrals; tail cylindrical; barely swollen basally; a subset of Annandale's Group IV, including *G. deccanensis* (type) (with synonym *G. albofasciatus*) and *G. jeyporensis*.

Underwoood (1954) restricted *Gymnodactylus* to a small group of New World geckos and resurrected and redefined *Cyrtodactylus* (type species, *Cyrtodactylus pulchella*) for the diverse Old World bent-toed geckos.

Szczerbak and Golubev (1984) erected *Tenuidactylus*, type species *Gymnodactylus caspius* Eichwald 1831, to distinguish the bent–toed geckos of Europe and the Middle East eastward through central Asia from the southern Asian *Cyrtodactylus*. *Tenuidactylus* was further divided into three subgenera:

*Tenuidactylus* (*s.s.*), *Mediodactylus* Szczerbak and Golubev 1977 (type species *Gymnodactylus kotschyi* Steindachner 1870), and *Mesodactylus* Szczerbak and Golubev 1984 (type species *Gymnodactylus kachhense*). Kluge (1985:98) determined that *Mesodactylus* was unavailable. In their treatment of much of the gecko fauna of the former Soviet Union and the surrounding regions, Szczerbak and Golubev (1986, 1996; the later being a translation of the original into English, with numerous notes and corrections) utilized *Tenuidactylus*, dividing it into three subgenera, *Tenuidactylus* (*s.s.*), *Mediodactylus* and *Cyrtopodion*. Kluge (1985:98) further demonstrated that *Tenuidactylus* is a junior subjective synonym of *Cyrtopodion*, type species *Stenodactylus scabrum*. Hence, the non*Cyrtodactylus* group of bent-toed geckos was comprised of the genus *Cyrtopodion*, with three subgenera *Cyrtopodion* (*s. s.*), *Mediodactylus* and *Tenuidactylus* (see Anderson (1999:149–150). Kluge (2001) affords all three full genus ranking. Khan (2003*b*:4–5) relegates *Tenuidactylus* to the synonymy of *Cyrtopodion*, stating that the former was based on the presence of preanal and femoral pores in a continual series, which is a variable character in Eurasian bent-toed geckos. Khan (2004, 2006) follows this arrangement. Khan (2003*b*:5) treats *Mediodactylus* as a subgenus, presumably of *Cyrtopodion*, though it is not clearly stated, while Khan (2004:194; 2006:142–143) lists it as a genus.

A few Pakistani and Indian species that could not be assigned to a subgenus under the taxonomic scheme proposed by Szczerbak and Golubev (1986, 1996) were allocated to the Tibeto-Himalayan group of *Tenuidactylus*, an artificial assemblage of geckos with characters somewhat transitional between typical *Cyrtodactylus* (from the east) and the Palearctic species. This group included *Tenuidactylus chitralensis, T. kirmanensis, T. mintoni, T. stoliczkai*, and *T. tibetanus. Tenuidactylus dattanensis, T. fasciolatus, T. lawderanus*, and *T. himalayanus* were provisionally included, although Szczerbak and Golubev (1996:197, footnote) were unable to examine specimens.

Macey et al. (2000) determined the monophyly of *Cyrtopodion* (*C. caspius* (Eichwald 1831), *C. fedtschenkoi, C. longipes* (Nikolsky 1896), and *C. elongatum*), and *Mediodactylus* (*M. russowi* (Strauch 1887) and *M. spinicaudus* (Strauch 1887)) through comparisons of allozymic data. Kluge (2001:30) assigned these as *Tenuidactylus caspius, T. fedtschenkoi*, and *T. longipes*, and *Cyrtopodion elongatum*. Although Macey et al. (2000) retained the four taxa above in *Cyrtopodion*, it is interesting to note that *C. elongatum* groups separately and appears to be basal to the *Tenuidactylus caspius–fedtschenkoi-longipes* group. The significance of this sister-group relationship and its bearing on Pakistan *Cyrtopodion* and *Tenuidactylus* (sensu Kluge and others) remains unknown.

Although indisputable assignment of most species of Asian bent-toed geckos is not yet possible, particularly for numerous taxa occurring in southwestern Asia, the rearrangement as proposed by Szczerbak and Golubev (1984) (and revised by others) is much improved over earlier taxonomic schemes. Kluge (2001:7) lists seven species in *Cyrtopodion*, all occurring in Pakistan or contiguous areas: *C. agamuroides* Nikolsky 1900, *C. brevipes, C. elongatum, C. kachhense, C. kirmanense* Nikolsky 1900, *C. scabrum*, and *C. watsoni* Murray 1892. Kluge (2001:18–19) includes six species in *Mediodactylus* occurring in the Mediterranean region, Middle East and southwestern Asia (no Pakistan species): *M. amictopholis* Hoofien 1967, *M. heterocercus* Blanford 1874, *M. kotschyi, M. russowii, M. sagittifer* Nikolsky 1900, and *M. spinicaudus*. Khan (2003*b*:5) includes the Pakistan species *Gymnodactylus walli* and the Iranian *G. kirmanense* in the subgenus *Mediodactylus* with little comment, while Khan (2004:194) lists *G. walli* as the only Pakistan representative of the genus *Mediodactylus* (erroneously listed as *Indogekko walli*). Khan (2006:142–143) follows this same arrangement. Kluge (2001) assigns *G. walli* to the genus *Tenuidactylus*. Kluge (2001:30) lists 15 species under the genus *Tenuidactylus*: *T. baturensis, T. caspius, T. fedtschenkoi, T. fortmunroi* Khan 1993, *T. indusoani* Khan 1988, *T. kohsulaimanai* Khan 1991, *T. longipes, T. medogensis* Zhao and Li 1987, *T. montiumsalsorum, T. rhodocaudus* Baig 1998, *T. rohtasfortai* Khan and Tasnim 1990, *T.*

*stoliczkai, T. turcmenicus* Szczerbak 1978, *T. walli*, and *T. yarkandensis* Anderson 1872.

Khan (2003*b*) further divided some of the bent-toed geckos of Pakistan with the description of three new genera, *Altigekko, Indogekko*, and *Siwaligekko*. Khan (2003*b*) also recognizes *Cyrtopodion* (with *Tenuidactylus* as a synonym) to include the Pakistani and extralimital taxa *C. agamuroides, C. caspius, C. fedtschenkoi, C. kachhense, C. kohsulaimanai, C. montiumsalsorum, C. potoharensis* Khan 2001, *C. scabrum, C. turcmenicus*, and *C. watsoni. Cyrtodactylus* does not occur in Pakistan according to Khan (2003*b*:2–3), and is restricted to those species occurring from the temperate Himalayas eastward through southeastern Asia and some western Pacific islands. Khan (2003*b*:5) afforded the generally Mediterranean *Mediodactylus* full genus status, including those typical of the group as well as *M. walli* from western Pakistan and the Iranian *M. kirmanense*.

*Altigekko* (type species = *Tenuidactylus baturensis* Khan and Baig 1992) includes two currently recognized species, *A. baturensis* and *A. stoliczkai*, both occurring in the northern portions of FANA, Pakistan. Khan (2003*b*:2) also includes *A. boehmei* that was allocated to the synonymy of *A. stoliczkai*, and *A. yarkandensis* that is probably also a synonym of *stoliczkai* (Auffenberg et al, 2004). Khan erroneously lists *lawderanus* under *Altigekko* (M. S. Khan, personal communication; see *Siwaligekko*). Characteristics of the tail are diagnostic: segments laterally enlarged or lobed in fully adult individuals; caudal tubercles are rounded or slightly keeled, not acuminate; and subcaudals small, in several transverse series.

*Indogekko* (Sandstone Geckos) (type species = *Cyrtodactylus indusoani* Khan 1988) is comprised of *I. fortmunroi, I. indusoani, I. rohtasfortai, I. rhodocaudus* and *I. longipes* (with subspecies *longipes* (*s.s.*), *microlepis* (Lantz 1918), and *voraginosus* (Leviton and Anderson 1984)). *Indogekko longipes* is extralimital, occurring from Turkmenistan south through Afghanistan into northeastern Iran. In Pakistan, this group is confined to northern portions of Punjab and Balochistan provinces, and can be characterized by their long tails with enlarged and acuminate lateral tubercles that flare distally, and a single series of enlarged subcaudals.

*Siwaligecko* (type species = *Cyrtodactylus battalensis* Khan 1993) can be characterized by their short, round tails with indistinct segments; and subcaudals small in several transverse series per whorl. This group as defined, includes *S. battalensis, S. dattanensis, S. fasciolatus, S. himalayanus, S. lawderanus, S. markuscombaii* (Darevsky et al., 1997), *S. martinstollii* (Darevsky et al., 1997), *S. mintoni* (Golubev and Szczerbak 1981), *S. nepalensis* (Schleich and Kästle, 1998), and *S. tibetanus*. In Pakistan, *Siwaligecko* is confined to northern Punjab and southern Northwest Frontier provinces. Extralimital distribution includes the western Himalayas and Nepal.

We are reluctant to recognize the taxonomic arrangement presented by Khan (2003*b*, 2004, 2006). Although it is clearly steeped in morphologic similarity, we cannot agree that this classification implies phylogenetic relationships. *Cyrtopodion brachykolon* described in this paper cannot be comfortably assigned to any of the presently recognized genera or subgenera occurring in the region, except for *Cyrtopodion* (*s.l.*) (see Anderson, 1999). We fully expect that future analyses using additional morphological characters and their variation, as well as biochemical and genetic analyses, will result in generic reassignments of many Pakistani bent-toed geckos, including *Cyrtopodion brachykolon*.

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## Appendix

### *Specimens Examined*

*Cyrtopodion brachykolon.* Pakistan: Northwest Frontier Province: Manshera District: Batrasi Gali, PWD Rest House (UF 81188, 82078); Swat District: 3.0 km W Marghazar (UF 81312–13, 81316–25).

*Cyrtopodion baturensis.* Pakistan: Federally Administered Northern Areas (FANA): Gilgit Agency: Pasu (BMNH 1990.3, holotype; CAS 170529 and USNM 284136, paratypes); Hunza District: Dih (UF 79147).

*Cyrtopodion stoliczkai.* Pakistan: Federally Administered Northern Areas (FANA): Skardu District: near Skardu Airport, 10.0 km W Skardu (UF 81328, 81336, 81344, 81349).

*Cyrtopodion walli.* Pakistan: Northwest Frontier Province: Chitral District: Chitral, at Chitral Fort (UF 82309–10, 88017), Bermoghluscht, at Nasir Saiful Mulook Fort (UF 88024).