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A new species of *Microgecko* Nikolsky, 1907 (Squamata: Gekkonidae) from Pakistan

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Abstract

Members of the dwarf geckos of the genus *Microgecko* Nikolsky, 1907 are distributed from western Iran to northwestern India, with seven currently recognized species. Three taxa have been reported from Pakistan, *M. depressus*, *M. persicus persicus* and *M. p. euphorbiacola*. The former is the only endemic species restricted to Pakistan. Herein, we describe a new species, *Microgecko tanishpaensis* **sp. nov.**, on the basis of four specimens collected from the remote area of the Toba Kakar Range in northwestern Balochistan. The type locality lies in an isolated valley in mountainous terrain known for the occurrence of other endemic reptile species, including geckos. *Microgecko tanishpaensis* **sp. nov.** is differentiated from the morphologically similar species *M. depressus* by possessing larger size, five scales bordering the nostril, internasals (supranasals) scales in contact with nostril, two large pairs of postmentals, higher numbers of interorbitals (27–30), scales around midbody (76–84), ventral scales from the postmental to vent (144–156) and scales along dorsal midline from axilla to groin (75–86). A morphological comparison of *M. tanishpaensis* **sp. nov.** with other species of the genus and an updated identification key for the genus *Microgecko* are presented.

Key words: endemism, morphology, *Microgecko tanishpaensis* **sp. nov**., Palearctic region, northwestern Balochistan, Torghar Mountains

Introduction

Currently, 41 gecko species from the family Gekkonidae are known to be native to Pakistan, including twenty-one endemic species (Masroor 2012). The smallest are species of the genus *Microgecko* Nikolsky, 1907, characterized by a vertical pupil, body scales, including subdigital lamellae on fingers and toes, smooth, supranasal scales significantly larger than other nasal scales and always contacting nostrils; one or two pairs of postsupranasal scales well-developed; dorsal scales distinctly smaller than ventrals and no enlarged subcaudal plates nor precloacal pores (Szczerbak & Golubev 1996). The members of the genus are distributed from western Iran to northwestern India and comprise seven species (Minton & Anderson 1965; Leviton & Anderson 1972; Szczerbak & Golubev 1996; Rastegar-Pouyani *et al.* 2008; Agarwal 2009; Bauer *et al.* 2013; Šmíd *et al.* 2014; Gholamifard *et al.* 2016, 2019; Torki 2020). Based on recent phylogenetic and osteological studies, the genus *Microgecko* is reckoned to be a monophyletic group, distinct from the genus *Tropiocolotes* Peters, by Bauer *et al.* (1913) and Pyron *et al.* (2013). Apart from the osteological differences of having the second ceratobranchial and fused nasals, members of the genus *Microgecko* are differentiated morphologically from *Tropiocolotes* by having smooth subdigital lamellae in comparison to carinated subdigital lamellae in the latter (with exception of *T. nattereri*). Furthermore, body scales in *Microgecko* are small and numerous as compared to members of *Tropiocolotes* (Guibé 1966; Kluge 1983).

In Pakistan, three taxa of the genus *Microgecko* have been reported: *M. depressus* (Minton & Anderson, 1965), *M. persicus persicus* (Nikolsky, 1903) and *M. persicus euphorbiacola* (Minton, Anderson & Anderson, 1970). Min-

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ton and Anderson (1965) described *Microgecko* (*Tropiocolotes*) *depressus* based on the collection of two specimens. Three additional specimens of this taxon were collected from the Chiltan Mountains near the Mastung District, Balochistan, ca. 50 km southwards from the type locality (Minton *et al.* 1970). In the present paper, we describe a new species of *Microgecko* from a remote valley in the Torghar Mountains, providing a diagnosis, comparison with congeners and an identification key.

Materials and methods

During fieldwork conducted in 2017 and 2018 in the Torghar Conservancy, Killa Saifulla District, Balochistan, we collected four specimens of geckos resembling *Microgecko* spp. Detailed morphological examination of the specimens was carried out to ascertain their identity. We compared our specimens with all other species of *Microgecko* and their original descriptions as well as other relevant publications containing morphological data regarding these geckos (Minton *et al.* 1970; Leviton & Anderson 1972; Szczerbak & Golubev 1996; Anderson 1999; Agarwal 2009; Rajabizadeh *et al.* 2010; Karamiani *et al.* 2013; Gholamifard *et al.* 2016, 2019; Torki 2020).

Forty mensural and meristic characters were taken from each of the studied specimens following Minton *et al.* (1970), Krause *et al.* (2013) and Gholamifard *et al.* (2016). Scale counts were taken using a stereomicroscope, while measurements were obtained using a digital caliper to the closest 0.01 mm. Measurements of arms, legs and head as well as scale counts beneath the toes were principally taken on the right side of the animal (from the left side only if the animal was damaged on the right).

Mensural characters: eye diameter (horizontally, ED), ear length (EL), head length (from tip of snout to anterior edge of tympanum, HL), head height (measured behind eyes, HH), head width (at the widest point of head, HW), distance anterior eye margin to tip of the snout (ES), distance posterior eye margin to ear (EE), mental width (MW), mental height (MH), rostral width (RW), rostral height (RH), snout-vent length (SVL), tail length (TL), length of upper arm (AL), length of forearm (FL), length of thigh (UL), length of shank (SL), distance between forelimb and hind limb insertion (DFH).

Meristic characters: number of postmental pairs (PMP), number of scales separating the first pair of postmentals (at the apex of mental, SSPM), number of scales separating the second postmental pair from infralabials (SPMI), number of interorbital scales including ciliary scales on the ridge above the eyes (IOS), number of scales on interorbital bone (SIO), number of supralabial scales (SL), supralabials anterior to eye (SLAE), number of infralabial scales (IL), number of gular scales (G), number of scales bordering the nostril (SBN), number of scales separating the internasals (supranasals) (SSIN), number of scales separating the postinternasals (postsupranasals) (SSPIN), dorsal scales across body dorsum (DS), number of dorsal scales in midline between axilla to groin (AGS), number of ventral scales from behind the postmentals (at the apex of mental) to level of vent (GVA), ventral scales across midbelly (VAB), number of enlarged scales anterior to vent midway between insertion of limbs (SMI), precloacal pores (PP), number of subdigital lamellae under the first toe (SDL 1st), number of subdigital lamellae under the third toe (SDL 3rd), number of subdigital lamellae under the fourth toe (SDL 4th), number of subdigital lamellae under the fourth finger (SDLF 4th).

The distribution map of all the species and subspecies of *Microgecko* (Fig. 1) including *M. tanishpaensis* **sp. nov.** from northwestern Balochistan was prepared using QGIS (2020). Locality information of the holotype was taken from descriptive papers and others as follow: *M. depressus* (AMNH 93003 from Kach [Ziarat District], on the abandoned rail line between Ziarat and Quetta, Balochistan, 30.46° N 67.34° E, 1,981 m; Minton *et al*. 1965); *M. h. helenae* (ZISP 10242.1, Alchorschir in Arabistano" [Alkhorshid , Khuzestan Province, Iran], 31.54º N 49.86º E, 666 m; Ananjeva *et al*. 2020); *M. h. fasciatus* (ZSM 500/66 (501/68), Sorkheh Dizeh ("Dize") [also noted as "Sorkh-e-Dize"], 125 km west of Kermanshah, on road to Qasr-e Shirin (on road to Baghdad in original description), Kermanshah Province, Iran, 34.39º N 46.05º E, 1,180 m; Gholamifard *et al*. 2015); *M. chabaharensis* (SUHC 1273, Rasoul Abad village, between Chabahar and Konarak, Chabahar County, Sistan and Baluchestan Province, southeastern Iran, 25.46º N 60.49º E, 27 m; Gholamifard *et al*., 2016); *M. laki* (ZFMK 102764, on the western slope of the Zagros mountains, Howmeyan region, Kohdasht, Lorestan Province, western Zagros Mountains, western Iran, 33.78º N 47.55º E, 1,500 m; Torki 2000); *M. latifi* (CAS 134365, Southern Zagros mountains bordering the great interior desert basin, Kerman (Kirman), Kerman Province, Iran, 30.30º N 57.11º E,1,760 m; Leviton & Anderson 1972); *M. p. persicus* (ZISP 10005, "Vikus Degak in terra Dizak, Persia orientalis" Degak [Dehak], Dizak, Iran, 28.96º N 61.20º E, 1,364 m; Rajabizadeh *et al*. 2010); *M. p. euphorbiacola* (CAS 93939, Lower Pab Hills, Hab

Chowki, Las Bela District, Balochistan, Pakistan, 25.04º N 66.80º E, 100 m; Minton *et al*. 1970) and *M. p. bakhtiari* (CAS 86408, Between Masjed-Soleiman and Sar-i-Gach, Khuzestan Province, Iran, 31.78° N 49.50° E, 412 m; Minton *et al*. 1970); *M. varaviensis* (RUZM GT.11.57, Varavi Mountain, Varavi District, Mohr County, southwest Fars Province, southern Iran, 27.50° N 53.11° E, 1,340 m; Gholamifard *et al*. 2019).

Acronyms for the above mentioned repositories of holotypes are as follow: AMNH: American Museum of Natural History, New York, USA; ZISP (formerly ZIL): Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; ZFMK: Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany; SUHC: Sabzevar University Herpetological Collection, Sabzevar, Iran; CAS: California Academy of Sciences, San Francisco, USA; RUZM: Razi University Zoological Museum, Kermanshah, Iran; ZSM: Zoologische Staatssammlung München, Germany; RSM: Royal Scottish Museum, Edinburgh, United Kingdom; UMMZ: University of Michigan Museum of Zoology, Ann Arbor, USA.

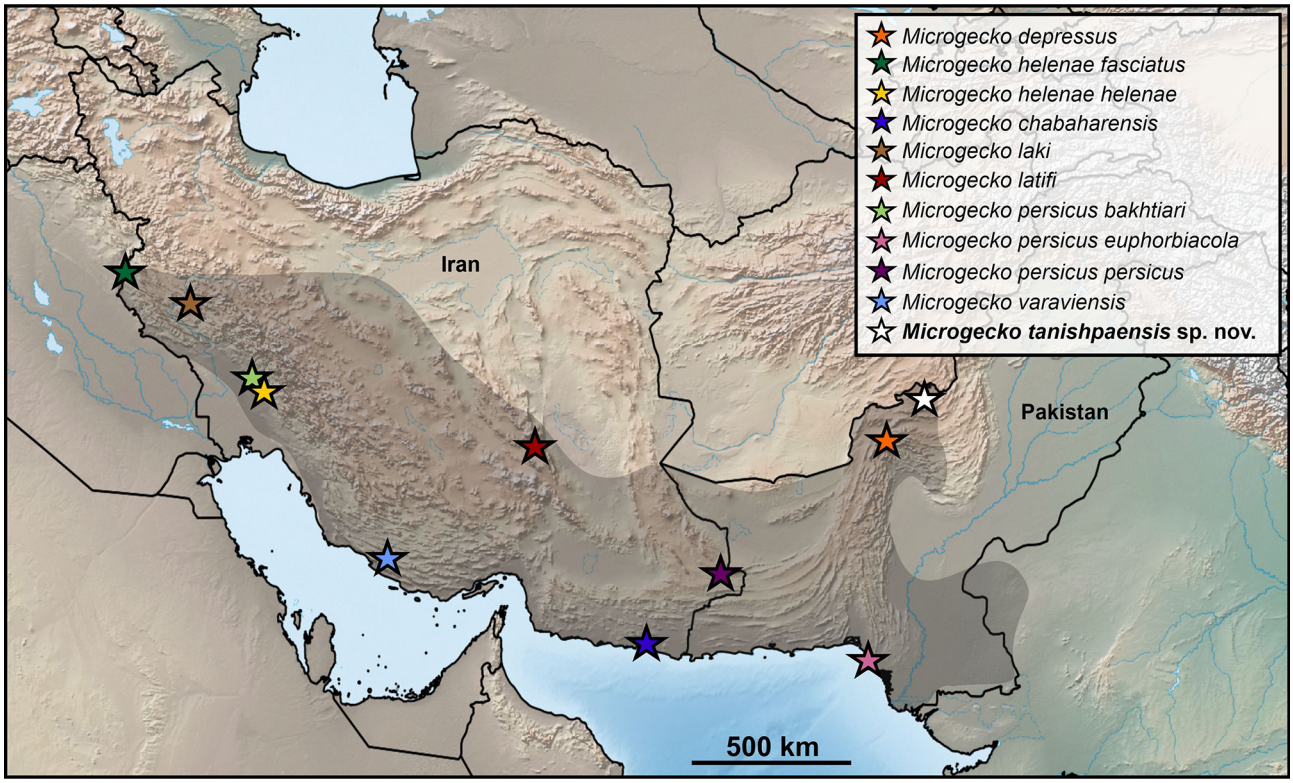

FIGURE 1. Type localities of all known species and subspecies of Microgecko including *Microgecko tanishpaensis* **sp. nov.** The distribution range of the genus is highlighted in light black.

Results

Reptilia: Squamata
Family Gekkonidae
Genus *Microgecko* Nikolsky, 1907

***Microgecko tanishpaensis* sp. nov.**
Figs. 2–4, Tab. 1
Recommended vernacular name: Tanishpa's dwarf gecko
Pashto name: داتانشپالتکه

Holotype. Pakistan Museum of Natural History (PMNH) 4023, an adult female, collected from Tanishpa, Torghar, Killa Saifullah district, Balochistan, Pakistan (31.19º N, 68.47º E), elevation 2378 m a.s.l., 3 September, 2018, leg. Ibad-ur-Rehman (Figs. 2, 4A,E, 5A,B).

Paratypes. All the paratypes were collected from the same locality as the holotype. PMNH 3695 is adult male,

27 March, 2017, leg. Muazzam Ali Khan. PMNH 4024, adult male and PMNH 4025, a subadult, 27 August, 2018, leg. Iqbal Sher (Figs. 3, 4 B–D,F, 5C,D).

Diagnosis. A large *Microgecko* (to at least 43.8 mm SVL) characterized by flattened head, body and tail, five scales bordering the nostril, internasal (supranasal) scales in contact with nostril and separated from each other, two pairs of postmentals, 76–84 scales around midbody, 144–156 ventral scales from the postmental to vent, 75–86 scales along dorsal midline from axilla to groin and six precloacal pores in adult male.

Description of holotype. An adult female with a regenerated tail (Fig. 2A,B); neck distinct; scales of top and sides of head slightly elevated, juxtaposed, smooth, somewhat irregular in size, those of loreal region larger than those on upper sides of head and occiput (Fig. 2C), 30 across head in interorbital area counting the ciliary scales, 6 scales exclusively on interorbital bone; rostral pentagonal, wider than high with distinct median furrow, its width slightly less than twice its height; nostril between rostral, first supralabial and three nasals, area behind the nasals depressed; infranasal in contact with first supralabial; internasals (supranasals) differentiated from the surrounding scales, in contact with nostrils, separated from each other by a scale; post-supranasals smaller than internasals, separated by a pair of scales; pupil vertical, edges serrate; ear opening smaller than pupil; 11 supralabials, the first 6 anterior to eye, 7th supralabial in contact with granules surrounding the eyes, the rest below the orbit small, the last one barely differentiated from the adjacent scales (Fig. 4A); 8 infralabials, decreasing in size posteriorly; scales on snout almost equal, larger than those on back of head; mental somewhat triangular, with round rear edge; one pair of well-developed postmentals, a smaller second pair could be differentiated, the first pair separated in midline by mental as well as by four gular scales; first pair of postmentals about half the size of mental, in contact with first infralabial; the second, smaller postmental pair less than half the size of the first pair, not in contact with infralabials (Figs. 2D, 5B); 72 gulars, flat, juxtaposed, hexagonal to polygonal, smaller than dorsals, ventral and upper head scales, not uniform in size, those on throat region are larger and subimbricate.

Scales on dorsum somewhat rhomboid to irregular in shape, smooth, subimbricate, 50 across middorsum, smaller than ventrals, 78 in midline between axilla and groin, laterals little smaller than middorsals; ventrals smooth, imbricate, rhomboid, those on abdominal region are larger than those on throat, 32 across midbelly, 156 from behind the apex of mental to anterior margin of cloaca; scales of limbs and tail subimbricate, arranged more or less in rows or annuli, those on limbs similar to dorsals; adpressed forelimb reaches between eyes and snout, adpressed hindlimbs not reaching to axilla; digits angularly bent between three distal phalanges and proximal portion of the digits; subdigital lamellae under fingers and toes smooth, keel-like structures between ultimate and antepenultimate phalanges appeared as a result of desiccation of this specimen (Fig. 4E); 14 subdigital lamellae on 4th finger, 12 under 1st toe, 17 under 3rd toe and 19 under 4th toe, terminal portion of toes compressed; the regenerated tail covered above and below by smooth, rhomboid, flat, slightly imbricate scales, distinctly larger than those of dorsum and about equal in size to the ventrals, arranged in regular transverse series; precloacal region slightly damaged, six enlarged scales anterior to vent midway between insertion of limbs; tail length 35 mm, of which more than 90% is regenerated.

Measurements of holotype. Snout-vent length 43.8 mm, tail length 35.0 mm (regenerated tail), head length from tip of snout to the anterior edge of ear 11.3 mm, head width 8.0 mm, head height 3.0 mm, forelimb length 11.0 mm, hindlimb length 14.8 mm, trunk length 20.7 mm (see Table 3 for detailed measurements and meristic counts).

Coloration. Live specimens have saffron yellow color above, ventral surfaces dusty to cream; a chocolate-colored band from snout through eye, ears and meeting with a nuchal band; a short brownish bar on occiput; three transverse bands on dorsum between axilla and groin, the interspace between them about more than two times the width of narrow bands, another fairly small brownish spot midway between insertion of hindlimbs. Body coloration and pattern of the three paratypes (Fig. 3: PMNH 3695, 4024 & 4025) almost exactly as the holotype.

Description of paratypes: The paratypes do not differ significantly from the holotype in coloration and pattern except as follows: PMNH 3695, an adult male with a regenerated tail, a desiccated and slightly damaged specimen with six well-developed precloacal pores in three-space-three configuration, separated by a scale (Fig. 3C, 4C), 10 supralabials, three scales separating the first pair of postmentals; PMNH 4024 is an adult male having six large precloacal scales bearing pits in a continuous series (Fig. 3A, 4B,D), a single scale separating the supranasals, the first pair of posmentals marginally separated by a single scale, the second pair of postmentals about half the size of the first pair, in contact with first supralabials (Figs. 5C); PMNH 4025 is a subadult with a complete original tail, a single scale separating the supranasals, the second pair of postmentals about half the size of the first pair, five crossbars on tail, width of crossbars less than half the width of the interspaces. Detailed data including metric, meristic and qualitative characters of holotype and paratypes is provided in Table 1.

Etymology: The species is named after the region where the holotype was collected: Tanishpa village in the valley of the same name, Torghar Mts., Killa Saifulla District, Balochistan Province, Pakistan, by adding the Latin "-ensis" meaning 'from' or 'belonging to'.

Habitat and ecology: The type locality, Tanishpa, is a small village situated in the Torghar Mountains (meaning "Black Mountains") in the Toba Kakar Range, a southern offshoot of the Himalayas, ca. 60 km from the border with Afghanistan (Fig. 1). The Torghar Mountains are very rugged semi-arid sandstone ridges with an average elevation of 2400 m and is approximately 90 km long and vary from 15 to 30 km in width. This region is characterized by having dry temperate ecology, with sparse vegetation (Fig. 6). The climate of the area is dry, with cold winters (an average mean temperature of 4°C) and warm summers (an average mean temperature 26 °C). Heavy snow often falls in winter and violent thunderstorms and dust storms occur in summer. The area receives very little precipitation with a recorded annual total between 180 mm and 270 mm (Planning and Development Department of Government of Balochistan, 2011). Occasional drought cycles are experienced which severely affect the flora and fauna of the region (Raja 2000). Shrub-steppe plant communities dominate the semi-desert landscape of the Torghar Hills. Bunchgrasses, forbs, *Ephedra* sp., *Artemisia* sp., and other shrubs occur on the upland slopes. *Cargana ambigua* and *Tamarix* sp. grows in low lying areas and streambeds where water is available. Trees are scarce, yet wild olive (*Olea europea cuspidata*), juniper (*Juniperus excels*), wild pistachio (*Pistacia khinjuk*), almond (*Prunus brahuica*) and ash (*Fraxinus xanthoxyloides*) are scattered across the lower slopes, and orchards are cultivated where water is sufficiently available. Overgrazing of the valleys has led to the establishment of xerophytic scrub vegetation dominated by *Acacia, Artemisia, Haloxylon,* and *Rosa* species (Frisina *et al.* 1998, 2002). Mammals including *Capra falconeri megaceros*, *Ovis orientalis cycloceros, Canis lupus, Otocolobus manul, Felis silvestris ornata*, *Hyaena hyaena*, *Vulpes vulpes, Martes foina*, and number of small species, such as *Ochotona rufescens* and *Ellobius fuscocapillus* and over 78 bird species have been reported from the area. The area is rich in reptiles, including the endemic taxa *Laudakia melanura nasiri* and *Cyrtopodion rhodocauda*. Other recorded species recorded in the vicinity of the type locality were: *Testudo horsfieldii*, *Cyrtopodion watsoni*, *Hemidactylus persicus*, *Phrynocephalus scutellatus, Ablepharus pannonicus*, *Eremias persica*, *Laudakia microlepis*, *Trapelus agilis, Platyceps rhodorachis*, *Psammophis schokari, Ptyas mucosa, Macrovipera lebetina obtusa*, and *Pseudocerastes persicus* (Woodford *et al.* 2004).

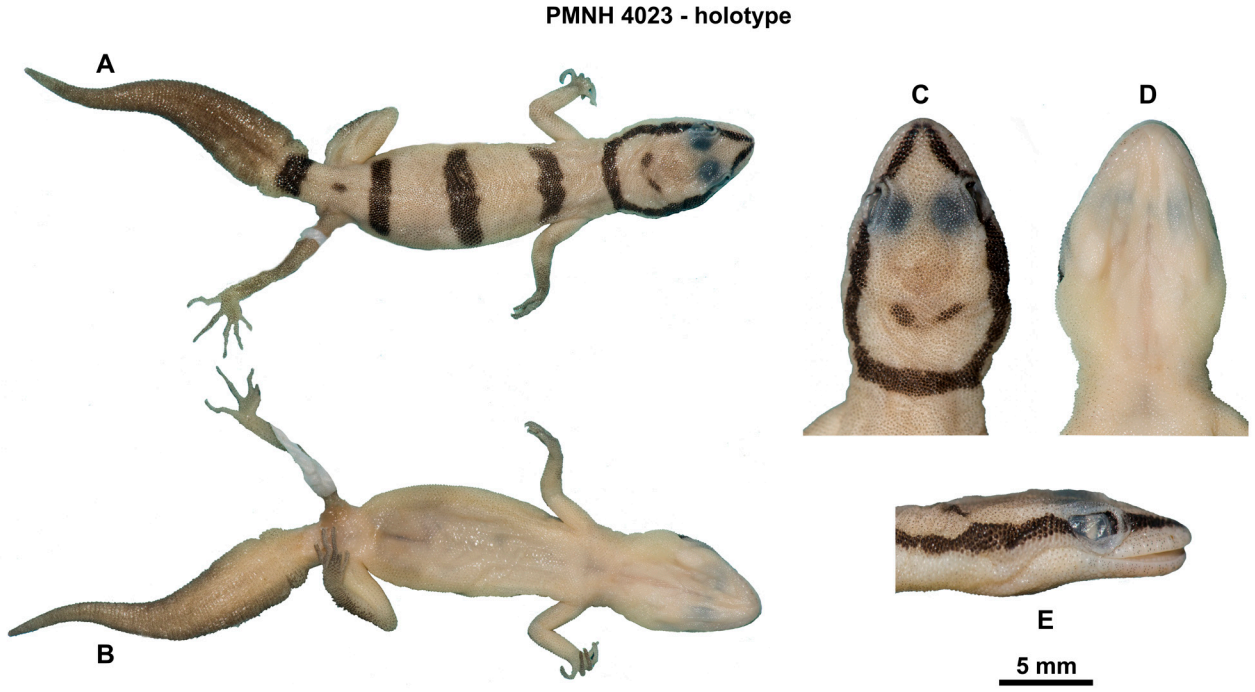

FIGURE 2. Views of (A) body dorsum (B) body venter (C) head dorsal (D) head ventral (E) head lateral of the holotype of *Microgecko tanishpaensis* **sp. nov**. exhibiting pattern of three dorsal crossbars between forelimb and hindlimb insertion.

TABLE 1. Mensural and meristic data of the type series of *Microgecko tanishpaensis* **sp. nov.** For abbreviation of characters see Material and methods (rt = regenerated tail, tb = tail broken, F = female, M = male, SA = subadult).

PMNH	4023	3695	4024	4025
Sex	F	M	M	SA
Mensural data				
SVL	43.8	38.0	36.5	22.5
TL	35.0 (rt)	31.0 (rt)	tb	20.4
HL	11.3	11.0	8.0	5.5
HW	8.0	7.3	6.4	3.4
HH	3.0	2.4	2.7	2.0
ES	4.5	4.1	3.4	2.0
ED	1.5	1.4	1.3	0.8
EL	0.6	1.0	0.5	0.4
EE	3.2	3.2	2.7	1.5
DFH	20.7	19.3	16.0	10.2
MW	1.4	1.2	1.1	0.5
MH	1.5	1.4	1.2	0.6
RW	1.4	1.4	1.1	0.7
RH	0.9	0.7	0.7	0.4
AL	5.5	5.6	5.2	2.9
FL	5.5	5.4	4.4	2.7
UL	7.8	7.5	7.1	3.9
SL	7.0	7.3	6.2	3.3
Meristic data				
SL	11	10	10	10
IL	8	8	8	8
PMP	2	2	2	2
SSPM	3	4	1	1
SPMI	1	0	0	0
IOS	30	28	27	28
SIO	6	6	6	6
SLAE	6	6	6	6
G	72	64	66	68
SBN	5	5	5	5
SSIN	1	1	1	2
SSPIN	2	2	1	1
DS	50	48	48	48
AGS	78	75	76	86
GVA	156	148	144	155
VAB	32	30	28	36
SMI	6	6	6	6
PP	-	6	6	-
SDL 1st	12	10	12	11
SDL 3rd	17	16	16	16
SDL 4th	19	17	17	18
SDLF 4th	14	14	13	12

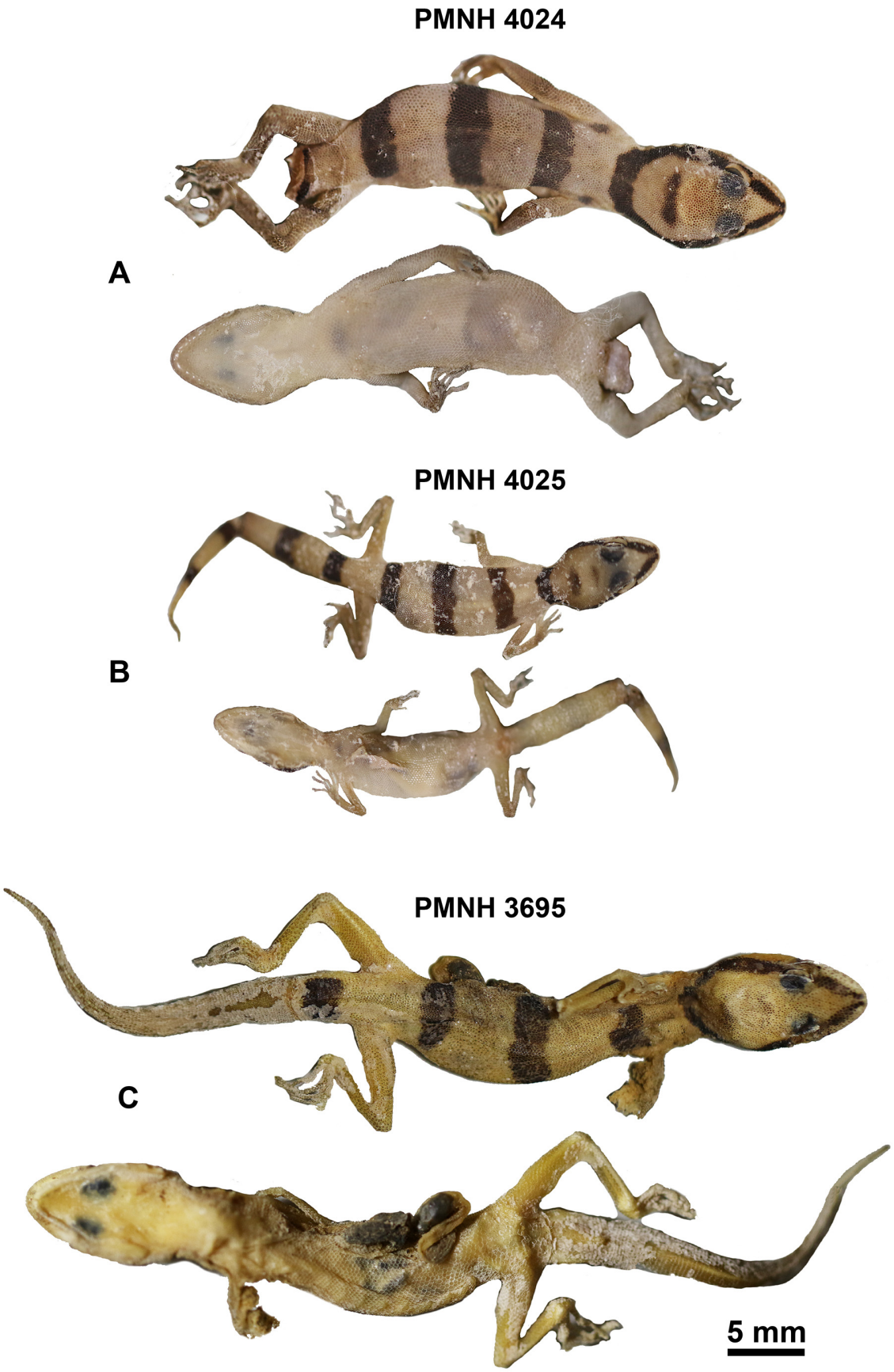

FIGURE 3. Dorsal and ventral body views of *Microgecko tanishpaensis* **sp. nov.** paratypes (A) PMNH 4024 (B) PMNH 4025 (C) PMNH 3695.

All specimens were collected soon after dusk at about 20h00, suggesting that the species is possibly nocturnal as other species of the genus *Microgecko*. Specimens were caught away from the human settlements in open landscape along the dry streambed on large sandstones in the months of March and September revealing that the species activities may at least extend over this period. Such large sandstones are used by these geckos as shelter against adverse environmental conditions during periods of inactivity or hibernation. During collection, the specimens moved on the ground or climbed with great agility. Collection of only four specimens during 40 days of survey in 2017 and 2018 suggests that this is a rare, or at least rarely encountered, species. The type locality is characterized by herbaceous cover and occasional shrubs and wild olive trees.

Comparison with other species of *Microgecko*: *Microgecko tanishpaensis* **sp. nov.** superficially resembles *M. depressus* but differs from it in the following characters: larger size, five scales in contact with nostril including first supralabial, rostral and three nasals (*versus* four in *M. depressus* including first supralabial, rostral and two nasals; Fig. 5A), supranasals and postsupranasals differentiated from the surrounding scales (*versus* not differentiated); supranasal in contact with nostril (*versus* not in contact; Fig. 5A), separated from each other by a scale (*versus* in contact), rostral pentagonal (*versus* quadarangular), six supralabials anterior to eye, the rest below the orbit but separated from the eye by granules (*versus* 4 to 5), 10–11 supralabials (*versus* 8–10), 144–156 GVA (*versus* 129–139), 76–84 scales around midbody (*versus* 74–76), two pairs of postmentals (*versus* absent or one small pair; Fig. 5B), three dark brown transverse bands on the back (*versus* 3–5), five transverse bands on tail (*versus* 6) and six precloacal pores in males (*versus* 2–5).

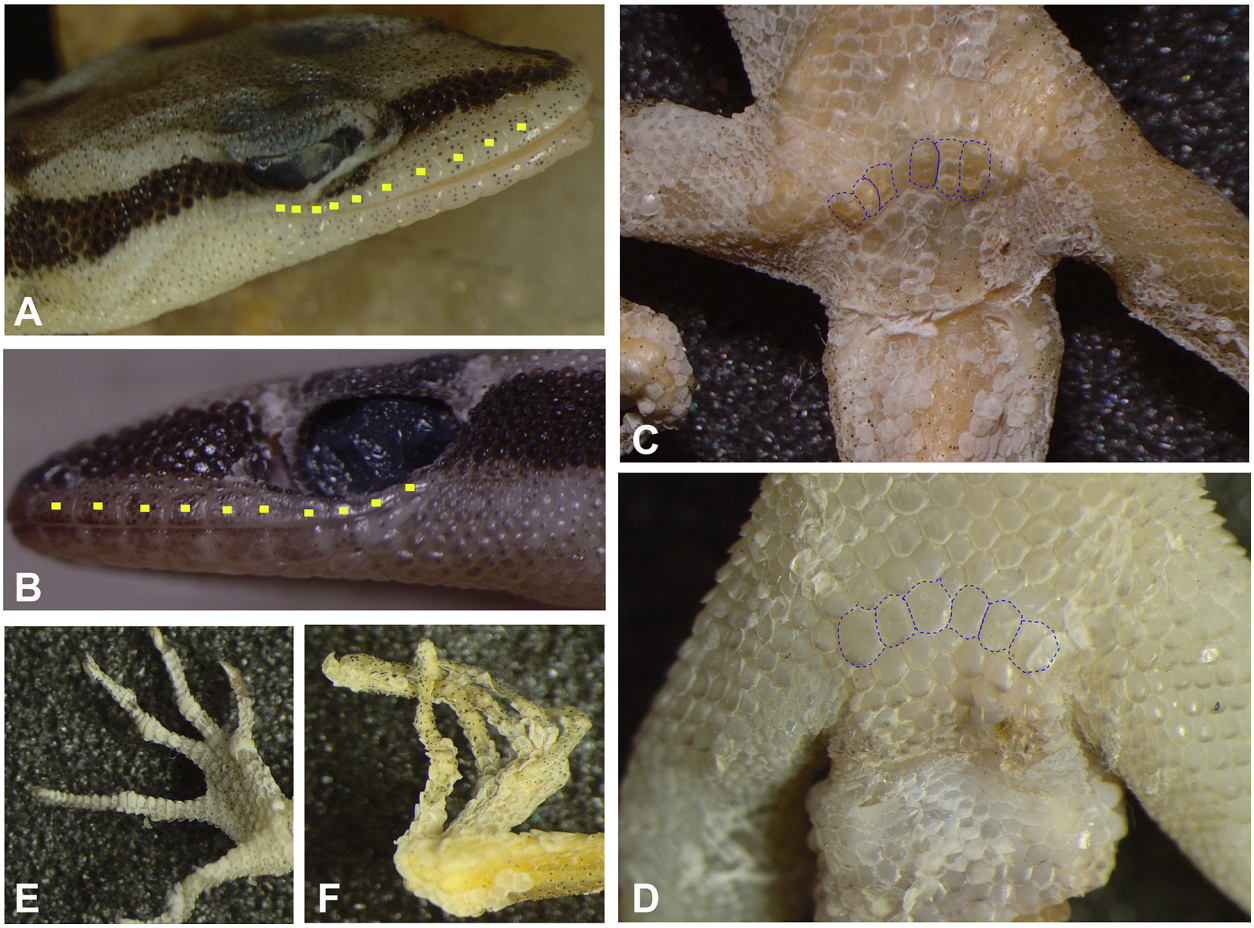

FIGURE 4. *Microgecko tanishpaensis* **sp. nov.** a) Lateral view of right side of head of holotype PMNH 4023 of showing 11 supralabials, the first six anterior to eye, the rest separated from eye by granules, (B) six well-developed enlarged precloacal pores in male paratype PMNH 3695, pores separated by a single scale, (C) lateral view of left side head of paratype PMNH 4024 showing 10 supralabials, the first six anterior to eye, the rest separated from eye by granules, (D) six enlarged pitted scales in male paratype PMNH 4024, (E) subdigital lamellae on right side of fourth toe of holotype PMNH 4023 exhibiting keels between ultimate and antepenultimate phalanges due to desiccation, (F) subdigital lamellae on right side of fourth toe of paratype PMNH 4024 exhibiting keeled structures between ultimate and antepenultimate phalanges.

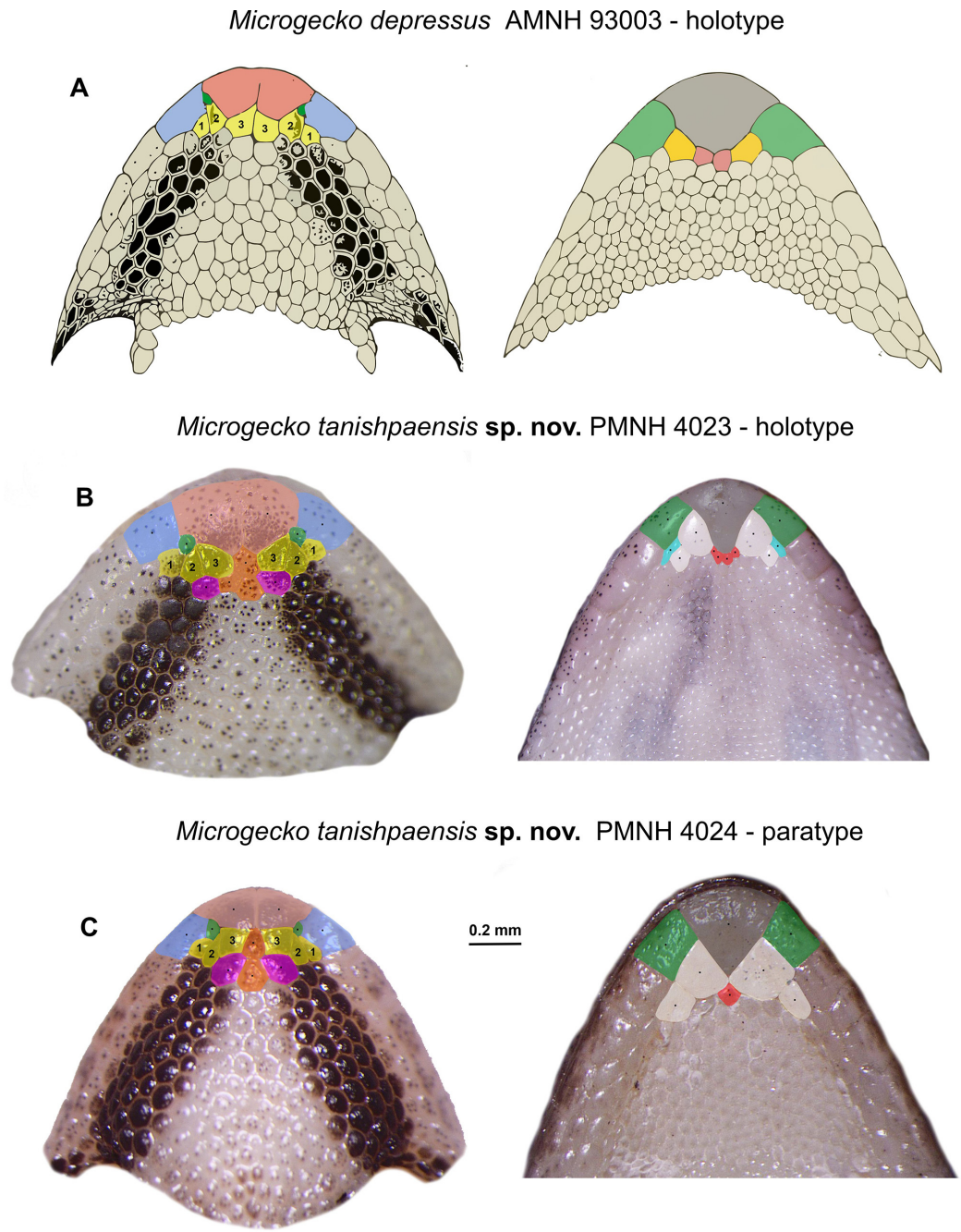

FIGURE 5. Details of anterior head scalation: (A) dorsal (left) and ventral (right) view of head of holotype (AMNH 93003) of *Microgecko depressus* reproduced from Minton *et al.* (1970: 347); internasal and postinternasal not differentiated from adjacent scales, internasals in contact with each other and separated from the nostril, three scales border the nostril on both sides, note a single very small pair of postmentals separated by two scales, (B) dorsal (left) and ventral (right) view of head of holotype (PMNH 4023) of *Microgecko tanishpaensis* **sp. nov.**; the internasals (also known as supranasals) shown by yellow square 3 and postsupranasals are large, differentiated from adjacent scales, supranasals separated from each other by a scale and in contact with nostril of their sides, 5 scales border nostril, two pairs of postmental shields, the first pair larger, separated from each other by 4 gular scales, the second pair about less than half of the first pair, (C) dorsal (left) and ventral (right) view of head of paratype 4024; size and pattern of scales same as that of holotype PMNH 4023, two pairs of postmentals, the first pair barely in contact, the second pair almost about half the size of first pair. Light red = rostral, blue = first supralabial, bright yellow = nasals, green = nostril, pink = postsupranasal, orange = scales separating internasal (supranasal) and postsupranasal scales, white = postmentals, green = infralabials, grey = mental, cyan square = scale separating first pair of postmental from the infralabial.

Microgecko h. helenae Nikolsky and *M. h. fasciatus* Schmidtler & Schmidtler, both very distantly distributed in Iran, can be easily differentiated from *M. tanishpaensis* **sp. nov.** by the following combination of characters: 5–8 supralabials (*versus* 10–11), three supralabials reach the front edge of orbit (*versus* 6), one pair of postmentals (*versus* 2), supranasals and postsupranasals in contact or partly separated (*versus* always separated in *M. tanishpaensis* **sp. nov.**), 11–15 subdigital lamellae on 4th toe (*versus* 17–19), 101–126 GVA (*versus* 144–156), 60–75 scales across midbody (*versus* 76–84), none or 5–7 dorsal crossbars on back edged with white color in the rear (*versus* 3 crossbars with no white edges) and none or 7–12 crossbars on tail (*versus* 5).

Except for *M. persicus bakhtiari* Minton, Anderson & Anderson, the other two subspecies of Persian dwarf gecko *M. persicus* differ from *M. tanishpaensis* **sp. nov.** in having a dorsal color pattern of crossbars with posterior white margins. From the nominate subspecies *M. p. persicus* (Nikolsky), our new species can be distinguished by the following set of characters: 10–11 supralabials (*versus* 7–10), 27–30 interorbital scales (*versus* 16–22), 17–19 subdigital lamellae on 4th toe (*versus* 13–16), 144–156 GVA (*versus* 117–130), 3 crossbars with no white edges (*versus* none or 5 dorsal crossbars on back edged posteriorly with white) and 5 crossbars on tail (*versus* 8–9). From *M. p. bakhtiari*, our new species *M. tanishpaensis* can be differentiated as follows: 27–30 interorbital scales (*versus* 18–22), 17–19 subdigital lamellae on 4th toe (*versus* 12–16), 75–86 AGS (*versus* 57–71), 144–156 GVA (*versus* 113), 3 crossbars on back (*versus* 4–5), width of crossbars on back and tail less than half of interspaces (*versus* width of dorsal and caudal crossbars more than the width of interspaces), 5 crossbars on tail (*versus* 9–10). The eastern subspecies *M. p. euphorbiacola* Minton, Anderson & Anderson, can be distinguished from *M. tanishpaensis* **sp. nov**. by the following characters: first pair of postmentals mainly separated (*versus* the first pair of postmentals in broad contact), 27–30 interorbital scales (*versus* 15–20), 17–19 subdigital lamellae on 4th toe (*versus* 11–16), 144–156 GVA (*versus* 111–130), 76–84 scales across midbody (*versus* 66–77), 75–86 AGS (*versus* 62–76), 3 dorsal crossbars on back (*versus* 4–5), width of dorsal crossbars less than half of interspaces (*versus* more than half or equal to width of interspaces) and 5 crossbars on tail (*versus* 6–8).

FIGURE 6. The habitat at the of type locality of *M. tanishpaensis* **sp. nov.**

Microgecko latifi Leviton & Anderson, known from its holotype, four unvouchered specimens (Anderson 1999) and two recently examined specimens (Torki 2020), can be recognized by having four scales bordering the nostril (*versus* 5 in *M. tanishpaensis* **sp. nov.**), no postmental scale pairs (*versus* 2 pairs), fewer supralabials (6–7 *versus*

10–11), infralabials (5 *versus* 8), interorbitals (16–19 *versus* 27–30), subdigital lamellae on 4th toe (13–14 *versus* 17–19), scales around midbody (72 *versus* 76–84) and GVA (120 *versus* 144–156).

The recently described *M. chabaharensis* Gholamifard, Rastegar-Pouyani, Rastegar-Pouyani, Khosravani, Yousefkhani & Oraei and *M. varaviensis* Gholamifard, Rastegar-Pouyani & Rastegar-Pouyani, can be distinguished from the *M. tanishpaensis* **sp. nov.** by exhibiting no dorsal transverse bar or having such bars indistinct. In *M. varaviensis*, the nostril is bordered by four scales and bears a single pair of postmentals, contrary to *M. tanishpaensis* **sp. nov.** which possesses five scales bordering nostril and two large pairs of postmentals. From *M. laki*, *M. tanishpaensis* **sp. nov.** can be distinguished by having 6 precloacal pores in males (*versus* none), nostrils separated from each other (*versus* in contact), two pairs of postmentals (*versus* one), dorsal dark crossbars without posterior white margins (*versus* white margins present) and higher numbers of supralabials, infralabials, interorbital scales, AGS and GVA. For additional comparison of *M. tanishpaensis* **sp. nov.** with its congeners, see Table 2.

Identification key to the species and subspecies of the genus *Microgecko*

Modified from Leviton & Anderson (1972); Szczerbak & Golubev (1996); Anderson (1999); Gholamifard *et al.* (2016, 2019); and Torki (2020).

1.	Precloacal pores in male present	2
-	Precloacal pores absent	3
2.	Internasals (supranasals) not differentiated from adjacent scales, not in contact with nostril; four scales border nostril; postmentals absent, or one small pair	*M. depressus*
-	Internasals (supranasals) differentiated from adjacent scales, in contact with nostril; five scales border nostril; two pairs of postmental shields, sometimes one large and the other smaller that can be differentiated from the surrounding gulars	*M. tanishpaensis* **sp. nov.**
3.	Postmental shields absent	*M. latifi*
-	Postmental shields present	4
4.	A single pair of postmentals	5
-	Two or three pairs of postmentals	8
5.	Black crossbars on tail bordered with white posteriorly	*M. laki*
-	Black crossbars on tail not bordered with white posteriorly	6
6.	Postmentals in contact or not; five distinct dark crossbars on dorsum with white posterior margins	*M. h. fasciatus*
-	Postmentals not in contact; dark crossbars of body indistinct or absent, sometimes two dorsolateral series of white spots	7
7.	Dark crossbars of body indistinct or absent; five scales border nostril; supranasal scales mostly in contact	*M. h. helenae*
-	No dorsal crossbars on body, with two light dorsolateral series of white spots; four scales border nostril; supranasal scales separated by two scales	*M. varaviensis*
8.	Two pairs of postmentals; dark dorsal crossbars on body and tail distinct	9
-	Three pairs of postmentals; dark dorsal crossbars on body absent	*M. chabaharensis*
9.	Dark dorsal crossbars of body and tail broader than interspaces	*M. persicus bakhtiari*
-	Dark dorsal crossbars of body and tail narrower than interspaces	10
10.	Dark dorsal crossbars less than half the width of interspaces	*M. p. persicus*
-	Dark dorsal crossbars as wide as or slightly narrower than interspaces	*M. p. euphorbiacola*

Discussion

A new species, the largest of dwarf gecko in genus *Microgecko* with a decided flattening of the head, body and tail, is hereby described. Although, our new species superficially resembles *M. depressus* in overall body coloration and dorsal pattern of crossbars, it is distributed in an isolated valley (the northernmost type locality of any Pakistani *Microgecko* at an aerial distance of about 150 km from the type locality of *M. depressus*; Fig. 1) and bears a set of unique morphological characters, distinguishing it from its congeners.

Minton and Anderson (1965) described *M. depressus* (formerly *Tropiocolotes depressus*) from two localities nearby Quetta, Balochistan. The holotype is a female measuring 27 mm in SVL and is housed at American Museum of Natural History as AMNH 93003. It was collected from Kach (a union council of the Ziarat District) on the abandoned rail line at an altitude of 1981m (6500 ft.). A single male paratype of *M. depressus*, measuring 29 mm in SVL, was collected near Kolpur (a union council of the Mastung District) at an altitude of 1860 m and deposited at the Royal Scottish Museum (RSM 1964.58.1). Szczerbak and Golubev (1996) examined the holotype, paratype and three additional specimens housed at the Senckenberg Museum Frankfurt, Germany and gave detailed morphologi-

TABLE 2. Comparison of metric and meristic characters between *Microgecko tanishpaensis* **sp. nov.** and all other taxa of the genus *Microgecko.* * data not available or lost; Sources: 1) Rajabizadeh *et al*. 2010; 2) Szczerbak & Golubev 1996; 3) Torki 2020; 4) Minton *et al*. 1970; 5) Karamiani *et al*. 2013; 6) Agarwal 2009; 7) Gholamifard *et al*. 2016; 8) Leviton & Anderson 1972; 9) Anderson 1999; 10) Gholamifard *et al*. 2019.

Species	*M. persicus persicus*			*M. p. bakhtiari*	*M. p. euphorbiacola*	*M. helenae helenae*	
Sources	1	2	3	4/5	2/6	7/3	2
SVL (in mm)	15.5–27.4	25.3–31.8	*	20.5–35.71	17.8–35.9	*	15.5–28.5
Number of specimens	6	3	3	1/4	58/2	9/25	60
Postmental pairs	1–3	2	2	2	Mainly 2, rarely 1 or 3	1	1
Supralabials	7–9	9–10	9	9–10	8–10	5–7/5–8	6–7
Infralabials	7–8	7–9	8	6–7	6–9	5–6/5–8	5–7
Interorbital scales	19–22	16–19	18–21	18–22	15–20	22–26	15–23
Subdigital lamellae on 4th toe	13–16	13–14	14	12/12–16	11–15/ 14–16	13–15	11–15
Scales bordering nostril	5	5	5	5	5	5	5
Scales around midbody	*	78	*	74/83–89	66–77	*	60–75
Ventral scales from behind the postmental to vent	117–126	130	*	113	111–130	109–122	101–122
Scales along dorsal midline from axilla to groin	*	82 (4)	79	71/57–68	62–76 (4)	75–82	65–84 (9)
Supranasals	Large, in contact or partly separated	Large, in contact or separated	Large, in contact	Large, separated	Large, in contact or separated	Large, in contact or separated	Large, in contact or separated
Postsupranasals	Large, in contact or separated	Large, in contact	Large, in contact	Large, separated	Large, mainly in contact	Large, separated	Large, mainly separated, rarely in contact
Contact of the first pair of postmentals	Narrow, wide	Separated, or in narrow contact	In contact	In contact, narrow suture	In contact, wider suture	Not in contact	Mainly separated, rarely in contact
Number of precloacal pores	-	-	-	-	-	-	-
Dorsal crossbars	0, and 5; less than half width of interspacing	5; less than half width of interspaces	0–5	4–5; broader than interspaces	4–5; more than half or equal to width of interspaces	1–6/0–5	5–7
Tail crossbars	8	9; narrower than interspaces (4)	>5	10; wider than interspaces 9–10 (5)	6–8; narrower than interspaces (4)	10–11; narrower than interspaces/ 0–12	10

.....continued on the next page

TABLE 2. (Continued)

Species	*M. h. fasciatus*	*M. latifi*		*M. chabaharensis*	*M. varaviensis*	*M. laki*	*M. depressus*	*M. tanishpaensis* **sp. nov.**
Sources	7/3	8/9	3	7	10	3	2	Present study
SVL (in mm)	27.0 (9)	21.5-26.0	*	25.8–28.5	12.9–28.3	22.8–24.6	26.8–32.2	22.5–43.8
Number of specimens	24/9	5	2	3	15	2	5	4
Postmental pairs	1	0	0	3	1	1	Absent or 1–2 (very small)	2
Supralabials	6–7	6	7	8–9	6–7	6	8–10	10–11
Infralabials	5–7	5	5	8	5–6	5–6	6–8	8
Interorbital scales	22–30/21–25	16	17–19	25–30	20–25	25–27	16–20	27–30
Subdigital lamellae on 4th toe	13–15	14	13	13–14	12–15	12–13	16–18	17–19
Scales bordering nostril	5	4	4	5	4	4–5	4	5
Scales around mid-body	*	72 (2)	*	*	*	*	74–76	76–84
Ventral scales from behind the postmental to vent	111–126	120	*	124–133	101–114		129-139	144–156
Scales along dorsal midline from axilla to groin	82–96	75	77–81	85–86	56–71	65–78	65-73 (4)	75–86
Supranasals	Large, separated	Large, in contact	Large, in contact	Large, in contact	Large, separated	Large, in contact	Not differentiated from adjacent scales, in contact	Differentiated from adjacent scales, separated

.....continued on the next page

TABLE 2. (Continued)

Species	*M. h. fasciatus*	*M. latifi*		*M. chabaharensis*	*M. varaviensis*	*M. laki*	*M. depressus*	*M. tanishpaensis* **sp. nov.**
Postsupranasals	Large, separated	Large, separated	Large, separated	Large, in contact	Large, separated	Large, separated	Not present	Differentiated from adjacent scales, separated
Contact of the first pair of postmentals	In contact or separated	-	-	Wide or narrow	Not in contact	Not in contact	Not in contact	Mainly separated, rarely in contact
Number of precloacal pores	-	-	-	-	-	-	2–5	6
Dorsal crossbars	5; narrower than interspaces	A dark spot between shoulders, two others in front of hindlimbs	5	0	0	0–5	3–5; narrower than interspaces	3; less than half width of interspaces
Tail crossbars	7–9; narrower than interspaces	9; narrower than interspaces	7–9	*	9–11	5	6; narrower than interspaces	5; narrower than interspaces

cal data for the species. They, however, listed an erroneous elevation of the holotype locality of 2200 m. In defining *M. depressus*, Minton and Anderson (1965) and Szczerbak and Golubev (1996) mentioned four scales bordering the nostril including rostral, first supralabial, and two flat small nasal scales. Contrary to this, the illustration of the holotype AMNH 93003 (Fig. 5A and Fig. 7A, B in Mint*on et* al. 1970, p. 347) and that of paratype RSM 1964.58.1 (Szczerbak & Golubev 1996; Fig. 57d, p.122) reveal that the nostril is bordered by three scales including rostral, first supralabial and a small nasal scale. Furthermore, the supranasals are in contact and do not enter in the nostrils. The postmental are lacking in *M. depressus* or sometimes with one or two small postmentals, barely differentiated from the adjacent gulars.

In discussing relationships of dwarf geckos, Minton and Anderson (1965) mentioned three species groups within dwarf geckos of the genus *Tropiocolotes*. Their first species group included *tripolitanus* and its subspecies occurring in arid North Africa, the second species group comprised of *steudneri* and *nattereri* found in Egypt and the Middle East and the third species group, which they referred to *Microgecko*, included *T. helenae* and their newly described taxon *T. depressus*. Nevertheless, Minton and Anderson (1965) were reluctant to place their species into the widely used dwarf gecko genus *Tropiocolotes*. They found that *M. depressus* has morphological characters that overlap with their generic definitions of *Tropiocolotes* and *Microgecko*. For example, a definition character of the genus *Microgecko* states that supranasal and postsupranasal scales are larger than other nasal scales, and the former is always in contact with the nostril. This preceding character is altogether contrary to the condition of this character in *M. depressus*. Similarly, the genus *Microgecko* has members which have no enlarged subcaudals and precloacal pores in males. *Microgecko depressus* has, however, enlarged subcaudals only on last one-third of tail and 2–5 precloacal pores in males. Guibé (1965) also examined the types of *T. depressus* and concluded that they failed to fit his generic definitions of either *Tropiocolotes* or *Microgecko,* making the situation more complex. Following Sindaco & Jeremčenko (2008), Bauer *et al.* (2013) provisionally placed *depressus* in the genus *Microgecko*. Krause *et al.* (2013) examined morphological traits of 324 specimens including members of *Altiphylax*, *Microgecko* and *Tropiocolotes*, and found that *M. depressus* clustered with *Altiphylax levitoni* while the remaining *Microgecko* taxa formed a cluster on their own. For the reasons that *M. depressus* and *M. tanishpaensis* **sp. nov.** are the only known dwarf geckos that bear precloacal pores in males and exhibit flattened head, body and tail, we highly recommend to carry out further molecular research of *M. depressus* as well as our new species *M. tanishpaensis* to reconstruct phylogenetic relationships in the morphologically complex genus *Microgecko*.

The unique morphological features of our new species of *Microgecko* from Pakistan highlight several points regarding to the herpetofauna of Balochistan. Firstly, these large and less populated areas are herpetologically understudied. Pakistan harbors more than 200 extant species of reptiles, and this number is probably vastly underestimated when the number of species is compared with Iran or Afghanistan (Šmíd et al. 2014; Wagner *et al*. 2016; Jablonski *et al*. 2019). Understanding of reptile diversity in Pakistan increased significantly during the last two decades (Khan 2006; Masroor 2012), but most of the current knowledge was obtained only during 20th century (Minton 1966; Mertens 1969, 1970, 1971, 1974). Nevertheless, the knowledge of the Pakistani and especially Balochistani herpetofauna is still poor and we are probably only in the beginning of the integrative taxonomical research regarding to herpetofauna of Balochistan. Secondly, the topography and habitat complexity of Balochistan provides current, but mostly historical refugia that are biogeographically underexplored. Whereas we have certain knowledge to the historical processes in the Iranian plateau or Central Asiatic deserts and mountains that affected fauna during the Pliocene and Pleistocene times (Macey *et al.* 1998, 1999; Poyarkov *et al.* 2014; Solovyeva *et al.* 2018; Asadi *et al.* 2019; Dufresnes *et al.* 2019), studies regarding historical biogeography of the regions between the Palearctic and Oriental zones where Balochistan lies are very limited (Rastegar 2000; Rastegar & Nilson 2002; Yousefkhani *et al.* 2019). The Torghar Mountains may represent such a refugia with unique fauna that need to be explored for our overall understating of the species and genetic diversity in the division between the Middle East, south and Central Asia.

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