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# THREE NEW SPECIES OF *Ptyodactylus* (REPTILIA; SQUAMATA; PHYLLODACTYLIDAE) FROM THE MIDDLE EAST

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Three new species of *Ptyodactylus* from the Middle East are described. First preliminary data on mtDNA phylogeny of *Ptyodactylus* is presented.

**Keywords:** fan-footed gecko; *Ptyodactylus*; Gekkonidae; new species; Oman; Jordan; mtDNA phylogeny.

## INTRODUCTION

Genus *Ptyodactylus* was described by Goldfuss in 1820 (Leviton et. al., 1992) and recently it belongs to the Phyllodactylidae family, together with other 9 genera and 128 gecko species, distributed in Old and New World.

*Ptyodactylus* is very uniform and monophyletic, nevertheless many taxa were described within this genus (Barbour, 1914; Boutan, 1893; Tornier, 1901; Peracca, 1894; and others). Recently only six species: *Pt. guttatus* Heyden, 1827; *Pt. hasselquistii* (Donndorf, 1798); *Pt. homolepis* Blanford, 1876; *Pt. puiseuxi* Boutan, 1893; *Pt. ragazzii* Anderson, 1898; *Pt. oudrii* Lataste, 1880 are considered as valid.

Typical character of *Ptyodactylus* — digits dilated with two diverging series of lamellae terminally, somewhat like a fan (Fig. 1).

*Ptyodactylus* is a widely distributed group, with a range reflecting long history of diversification and divergence of this genus. *Ptyodactylus* distributed from northern Africa (in the south as far as Cameroon), to Pakistan in the east and to Syria in the north. There are also some findings of *Pt. guttatus* in the Cyprus (Werner, 1994), but probably it is human introduction. The only *Ptyodactylus* in Pakistan is *Pt. homolepis*, until now it is known only by few type specimens in Calcutta collection (holotype ZSIC 5620) and Berlin collection (ZMB) (Bauer and Günther, 1991; De Lisle et al., 2013).

*Ptyodactylus hasselquistii* (Donndorff, 1798) is a slender species with elongated head with elongated rostral part. Maximal body length is 98 mm. Extremities and digits are relatively short and thin, 110 – 170 scales around midbody. Tail is long and thin, longer than body. Color pattern is very variable in different populations, usually light pink, gray. Color pattern is important diagnostic character of this species, it consists of clear regular dark transversal bands on the dorsum and tail. Head often with reddish tint with whitish patches, that covers also part of dorsum. There are two subspecies in *Pt. hasselquistii*: nominative (type territory — Cairo, Egypt) and *Pt. h. kramerii* Werner, 1994 (type territory Lebanon). *Pt. hasselquistii* is a night species, but often active also during the day time in the refuges, and in cold weather.

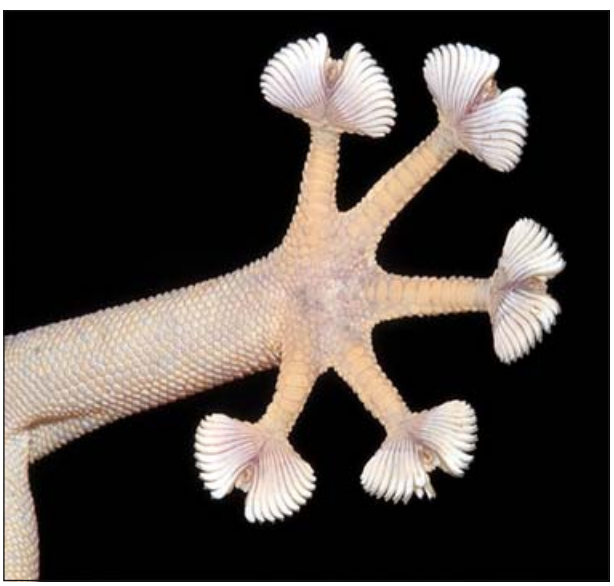

**Fig. 1.** Subdigital lamellae of *Pt. hasselquistii*.

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Frankenberg (1978) consider this as a night living form. Vocalization is a series of loud clicks. *Pt. hasselquistiii* distributed in northern Sudan, in Egypt (east of Nile), southern Israel and Jordan and in Arabia. In Egypt and Israel it is restricted to the Sudanian phytogeographic zones. Inhabit different biotopes. In the Nile River valley and on the Red Sea coast, it lives near to human, prefer lowland anthropogenic landscape. In southern Sinai and Eastern Desert it lives on the boulders, vertical walls, and in caves. Often abundant especially near to water and vegetation (Baha El Din, 2006).

*Ptyodactylus guttatus* Heyden, 1827 also slender species with medium body size (max SVL 87 mm). Head is relatively wide and high; snout is moderately long and wide. Extremities and digits are relatively long and thick, 118 – 151 scales around midbody. Tail long, shorter than body. Color is very variable, usually light gray gravel. Color pattern formed by large whitish patches, along the dorsal middle line together with dark patches, that on the tail appears as light and dark transversal bands. Head pattern is not contrast, formed by several dark and light patches and strokes of irregular shape.

This species permanently observed in the open places during the day time. In the winter time it often seen while basking near to refuge. Frankenberg (1978) consider this as "day and night" activity. Vocalization is a series of loud clicks. Probably it became more day active in sympathry with *P. hasselquistii*.

*Pt. guttatus* distributed in north-western Egypt, to the north as far as southern Syria, and in Jordan. Inhabits mountain and hilly areas in the Arabian Peninsula and in the Middle East. Lives on vertical slopes, rocks etc. (Baha El Din, 2006).

*Ptyodactylus puiseuxi* Boutan, 1893 — medium sized gecko. Coloration from light to dark brown or gray with numerous white and black patches on the dorsal side. Head is big and triangle. There are several white bands on the tail. Max SVL 78 mm, tail shorter than body.

This species lives in the Middle East, in Saudi Arabia, Jordan Iraq, Israel, Lebanon, and Syria. Usually night active species, normally appear after dark, but can be seen during day time in the shady places.

There is sexual dimorphism in all species of *Ptyodactylus* — males larger than females, robust with relatively larger head and extremities. These morphometric sexual differences clearly distinguished in *Pt. guttatus* and less in *Pt. puiseuxi*. Sexual dichromatism is described for these species: females are lighter colored and patches are less contrast than in males (Werner, 1993).

Morphological variations clearly appear between species than within distinct species. *Pt. puiseuxi* (northern Israel) and *Pt. guttatus* (central Israel) are parapatric species. *Pt. guttatus* (central Israel) and *Pt. hasselquistii* (southern Israel) are more likely parapatric species, but sympatrical in the north-eastern Sinai. In some areas one species replaces another (Werner, 1993).

## MATERIAL AND METHODS

Original material and specimens from herpetological collections of ZMMU (Moscow, Russia) and ZISP (St. Petersburg, Russia) were used for this work. In total about 150 specimens of *Ptyodactylus* were studied.

**Morphological analysis.** For morphological analysis following characters were used (in mm): snout vent length (SVL, from the tip of the snout to the cloaca), tail length (L.cd., from cloaca to tail tip), head length (HeadL, from occipital pit to snout tip), head width (HeadW, at the point of greatest width), head height (HeadH, at the point of greatest height), width of the frontal bone (FrontW, least width between eye-sockets), space between front side of eye-socket to snout tip SnEye, eye horizontal diameter OrbD, greatest ear diameter EarL, space between hind edge of eye-socket to the ear EyeEar, body length between fore and hind limbs TrunkL, humerus length (LS, from shoulder articulation to elbow flexion), forearm length (ForeaL, from elbow flexion to the intercarpal articulation), femur length (FemurL, from femur-pelvis articulation to knee articulation), shank length (CrusL, from knee articulation to intertarsal articulation), 4$^{th}$ finger length (LD4A, claw not included), 4$^{th}$ toe length (LD4P, claw not included). Pholidosis characters: number of transversal scales rows on belly V, number of scales along ventral body side SLB (from mental scale to cloaca), number of subdigital lamellae on 4$^{th}$ finger LF4, number of subdigital lamellae on 4$^{th}$ toe LT4, number of rays forming 4$^{th}$ finger disk Fan4A, number of rays forming 4$^{th}$ toe disk Fan4P, number of supralabial scales SL, number of infralabials IL, number of cloacal tubercles at the tail base TubA, number of transversal rows of enlarged tubercles on the dorsum TubL, number of longitudinal rows of enlarged tubercles on the dorsum TubW.

Following indexes were used: SVL/HeadL, body length to head length ratio; HeadL/HeadW, head length to head width ratio; LS/ForeaL, forearm length to humerus length ratio; CrusL/FemurL, femur length to shank length ratio; SVL/FemurL, body length to shank length ratio; SVL/ForeaL, body length to forearm length ratio; SVL/LD4A, body length to 4$^{th}$ finger length ratio; SVL/LD4P, body length to 4$^{th}$ toe length ratio.

Statistical processing of the data was conducted using Statistica 6.0. Position of specimens in the space of canonical variables was determined using the canonical

discriminant analysis. Samples with the number of specimens more than 6 ($n > 6$) were used as grouping variables. Significance of size characteristics was tested also using Mann – Whitney test for independent variables.

**Museum abbreviations:** ZISP, Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia; ZMMU, Zoological Museum, Moscow State University, Moscow, Russia.

**Molecular analysis.** We obtained 417 base pair (bp) 5′ segment of the cytochrome oxidase subunit I (COI) gene for the 22 specimens of *Ptyodactylus* from Oman, Jordan, Israel, Egypt, and Cameroon.

Total DNA was extracted from the finger preserved in 96% ethanol following a salt extraction method (Miller et al. 1988). The fragment of COI gene was amplified with the primers VF1d and VR1 (Ivanova et al., 2006). Amplification was conducted in 20 μl of the reaction mixture containing 1 μl of DNA (50 – 100 ng), 15 pmol of each primers, 0.25 mM of each dNTP, 2 mM $MgCl_2$, 10× PCR buffer (0.01 M Tris-HCl, 0.05 M KCl, and 0.1% Triton X-100; pH 9.0), 0.2 U/μl of Taq polymerase (Helicon, United States). Cycling conditions: initial denaturation at 94°C for 4 min, followed by 30 cycles of 30-seq denaturation at 94°C, 35 seq annealing at 50°C and 50-seq elongation at 72°C, and the thermocycling program ended with a final elongation step at 72°C for 5 min. PCR products were purified using a Qiaquick PCR purification kit (Qiagen). The sequencing was carried out on ABI 3130 automated DNA analyzer (Applied Biosystems) using the manufacturer's protocols in both directions. Sequences were aligned using the Clustal W algorithm (Thompson et al., 1994) in BIOEDIT 7.0. 5.3 (Hall, 1999).

The maximum-likelihood criteria (ML) tree reconstruction and bootstrapping were performed using Treefinder (Jobb, 2008). To choose among the best model of molecular evolution we used AIC (Akaike, 1974) criterion in Treefinder. Bootstrap analysis employed 1000 replicates. For the COI the model chosen was HKY (GI:5) (Jobb, 2008). Genetic distances were creating in MEGA 5.10 (Tamura et al., 2011).

To root the tree we used sequence of *Cyrtopodion scabrum*.

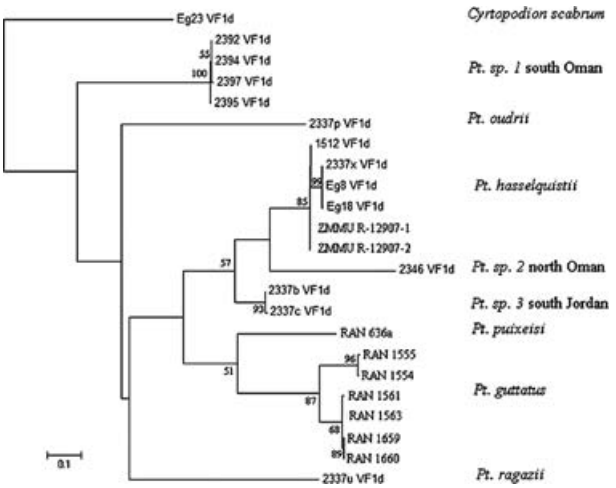


**Fig. 2.** Phylogenetic relationships of *Ptyodactylus* based on mtDNA sequences (COI) by the maximum-likelihood analysis. Values represent bootstrap replicates.

## RESULTS

**Molecular analysis.** A total of 18 haplotypes were identified among the 22 *Ptyodactylus* specimens. Of the 417 bp sequenced 164 sites were variable and 142 parsimony informative.

The ML reconstruction of phylogenetic relationships between the specimens is shown in Fig. 2. *Ptyodactylus* haplotypes formed eight groups with high bootstrap supports: four sequences of *Ptyodactylus* sp. 1 (2392, 2394, 2395, 2397) from Oman (Dhofar, Ayun); one of *Pt. oudrii* (2337p); six of *Pt. hasselquistii* (1512, 2337x, Eg8, Eg18, ZMMU R-12907-1, ZMMU R-12907-2) from Egypt and Jordan; two of *Ptyodactylus* sp. 3 (2337b,

**TABLE 1.** The Level of Genetic Divergence (*p*-distance, %) in the COI among *Ptyodactylus*

| | *Pt. hasselquistii* | *Pt. ragazii* | *Ptyodactylus* sp. 3 | *Ptyodactylus* sp. 1 | *Ptyodactylus* sp. 2 | *Pt. oudrii* | *C. scabrum* | *Pt. guttatus* |
|---|---|---|---|---|---|---|---|---|
| *Pt. ragazii* | 19.3 | | | | | | | |
| *Ptyodactylus* sp. 3 | 13.3 | 21.6 | | | | | | |
| *Ptyodactylus* sp. 1 | 19.8 | 21.2 | 20.9 | | | | | |
| *Ptyodactylus* sp. 2 | 15.8 | 23.3 | 17.7 | 20.7 | | | | |
| *Pt. oudrii* | 21.0 | 19.9 | 21.1 | 19.9 | 22.5 | | | |
| *C. scabrum* | 19.3 | 22.0 | 21.1 | 21.0 | 22.8 | 20.9 | | |
| *Pt. guttatus* | 19.7 | 20.3 | 19.3 | 22.4 | 21.7 | 21.3 | 24.5 | |
| *Pt. puiseuxi* | 19.8 | 20.9 | 18.5 | 23.3 | 21.6 | 21.8 | 20.9 | 19.0 |

**Fig. 3.** Holotype of *Pt. dhofarensis* sp. nov. in life.


**Fig. 4.** Map showing the type territories of described species: 1, Dhofar region, south Oman; 2, Nizwa region, north Oman; 3, Al Mudawarrah vicinity, south Jordan.

2337c) from Jordan (Mudawwarah); six of *Pt. guttatus* (RAN1555, RAN1554, RAN1561, RAN1563, RAN1659, RAN1660) from Jordan; one of *Pt. ragazii* (2337u) from Cameroon; one of *Pt. puiseuxi* (RAN636a) from Israel and one of *Ptyodactylus* sp. 2 (2346) from Oman (Ed-Dahilya, Wadi Ghul).

*Ptyodactylus* sp. 1 from Oman (Dhofar, Ayun) is a sister taxon to all other *Ptyodactylus* species. Position of *Pt. oudrii* and *Pt. ragazii* is not clear. *Pt. hasselquistii* is polyphyletic taxon, with *Ptyodactylus* sp. 3 from Jordan (Mudawwarah) sister to *Ptyodactylus* sp. 2 Oman (Ed-Dahilya, Wadi Ghul) and *Pt. hasselquistii* from Jordan and Egypt. *Pt. puiseuxi* is a sister taxon to *Pt. guttatus* species complex.

Genetic divergence between *Ptyodactylus* species is very high — about 20% (*p*-distance) for *Pt. hasselquistii*, *Pt. ragazii*, *Pt. puiseuxi*, *Pt. guttatus*, and *Pt. oudrii* (Table 1). *Ptyodactylus* sp. 1, *Ptyodactylus* sp. 2, *Ptyodactylus* sp. 3 closer to *Pt. hasselquistii* and differ from it by 20, 16, and 13%, respectively. The level of genetic divergence among *Ptyodactylus* sp. 2 and *Ptyodactylus* sp. 1 is 21%, among *Ptyodactylus* sp. 2 and *Ptyodactylus* sp. 3 is 18%, among *Ptyodactylus* sp. 3 and *Ptyodactylus* sp. 1 is 21%. Similar genetic divergence was found between populations of *Cyrtopodion kotschyi* (Kasapidis et. al., 2005), however the authors did not make any taxonomic conclusions.

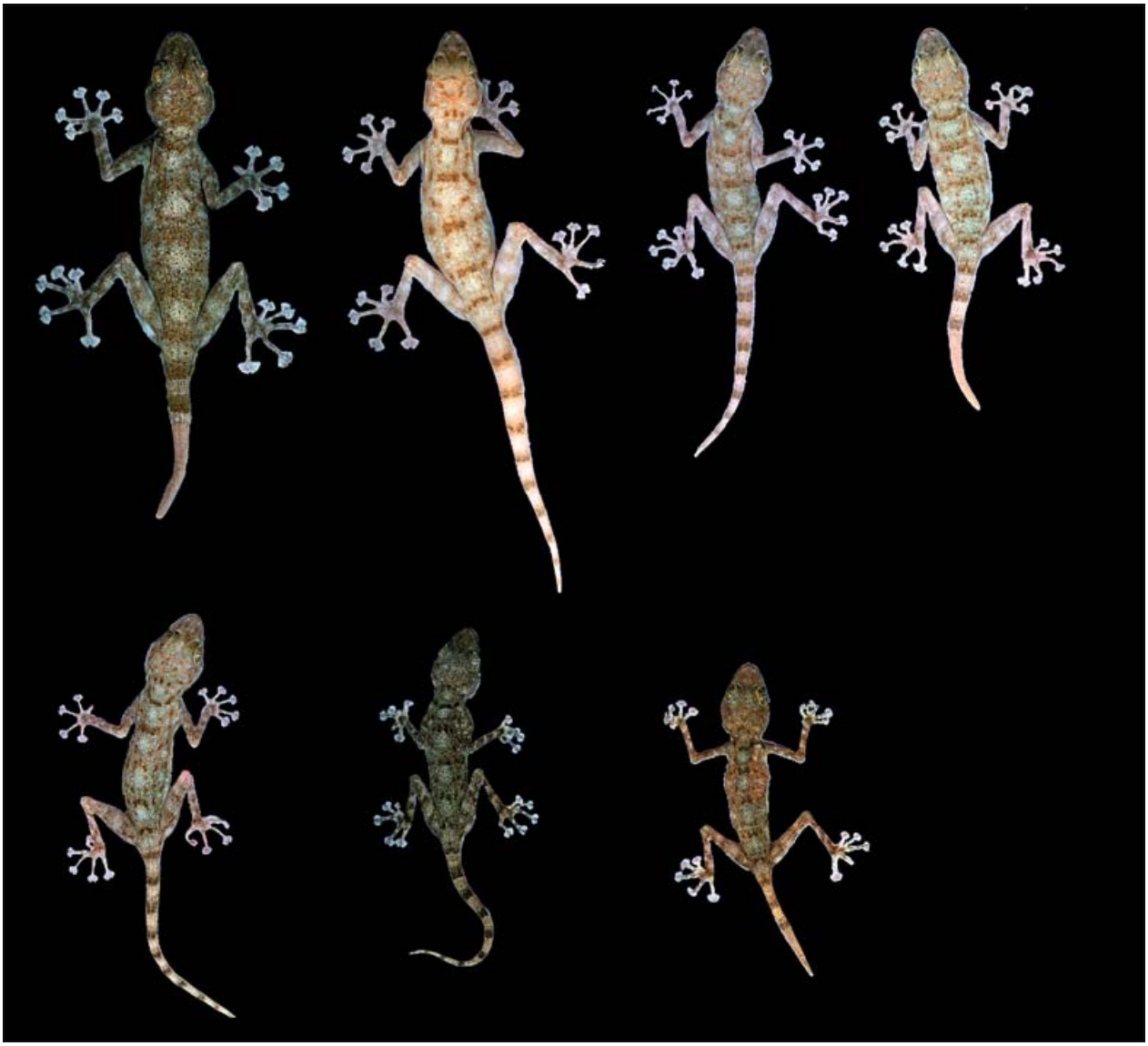

**Fig. 5.** Type series of *Ptyodactylus dhofarensis* sp. nov.

Based on these molecular differences together with good morphological characters we describe herein three new species of *Ptyodactylus* from the Middle East.

***Ptyodactylus dhofarensis* sp. nov.**

**Holotype.** ZISP 26947 (Fig. 3). Sultanate Oman, Dhofar region, Wadi Auyn, 17°14′ N 53°53′ E, *h* = 678 m a.s.l. Leg. 28.02.2013 by R. Nazarov and J. Stenicka (Fig. 4).

**Paratypes.** Four females and two males ZISP 26948 – 26953 (Fig. 5). All specimens with the same data as holotype.*

**Diagnosis.** One of the largest species of the *Ptyodactylus* with the male body length about 95 mm. Tail length equal to the body length. Head is wide, rostral part rounded and not elongate. Enlarged tubercles on the back are small, 3 – 4 times larger than surrounding scales, rounded shape, slightly keeled. Enlarged scales on the head developed only in the occipital area and on its sides. No enlarged tubercles on dorsal parts of fore- and

* Some type specimens will be transferred to ZMMU herpetological collection.

**TABLE 2.** Measurements and Pholidosis Characters of the Type Specimens of *Pt. dhofarensis* sp. nov.

| Character | Holotype | Paratypes | | | | | |
|---|---|---|---|---|---|---|---|
| | ZISP 26947 | ZISP 26948 | ZISP 26949 | ZISP 26950 | ZISP 26951 | ZISP 26952 | ZISP 26953 |
| Sex | m | f2 | m3 | f4 | f5 | m6 | f7 |
| SVL | 94.8 | 82.4 | 62 | 60.4 | 55.0 | 61.5 | 55.3 |
| TailL | 50* | 80 | 40* | 62 | 57 | 60 | 35* |
| HeadL | 25.1 | 23.5 | 18.6 | 18.5 | 17.0 | 18.2 | 16.1 |
| HeadW | 18.5 | 15.2 | 11.8 | 12.3 | 11.5 | 12.2 | 11.0 |
| HeadH | 11.6 | 9.5 | 7.8 | 8.0 | 7.2 | 7.4 | 6.8 |
| FrontW | 4.2 | 2.7 | 1.8 | 1.8 | 1.7 | 2.0 | 1.8 |
| SnEye | 10.0 | 9.2 | 6.0 | 7.0 | 6.5 | 6.8 | 6.0 |
| OrbD | 6.2 | 5.1 | 4.4 | 4.4 | 4.3 | 4.4 | 4.1 |
| EarL | 4.3 | 3.2 | 3.7 | 3.8 | 2.5 | 2.6 | 1.7 |
| EyeEar | 7.6 | 6.0 | 4.8 | 5.2 | 4.0 | 5.2 | 4.2 |
| TrunkL | 41.3 | 35.6 | 28.5 | 27.1 | 23.8 | 29 | 25.6 |
| LS | 18.4 | 14.8 | 12.5 | 13.0 | 10.7 | 13.1 | 12.9 |
| ForeaL | 16.3 | 14.2 | 11.7 | 11.2 | 10.3 | 12.0 | 11.5 |
| FemurL | 23.6 | 20.0 | 17.4 | 17.3 | 15.6 | 17.5 | 15.6 |
| CrusL | 19.0 | 16.0 | 13.8 | 13.6 | 11.8 | 13.5 | 11.2 |
| LD4A | 7.8 | 7.8 | 4.6 | 5.0 | 4.8 | 5.5 | 4.4 |
| LD4P | 9.0 | 9.0 | 5.1 | 6.1 | 6.0 | 6.2 | 5.1 |
| V | 46 | 50 | 46 | 49 | 47 | 44 | 52 |
| SLB | 209 | 210 | 192 | 189 | 211 | 198 | 204 |
| LF4 | 9 | 9 | 10 | 10 | 10 | 10 | 10 |
| LT4 | 14 | 11 | 13 | 12 | 12 | 11 | 12 |
| Fan4A | 11 + 11 | 10 + 10 | 11 + 11 | 10 + 10 | 11 + 11 | 11 + 11 | 11 + 11 |
| Fan4P | 11 + 11 | 11 + 11 | 11 + 11 | 10 + 10 | 11 + 11 | 11 + 11 | 11 + 11 |
| TubA | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| SL | 14 | 11 | 12 | 12 | 12 | 12 | 12 |
| IL | 12 | 11 | 11 | 12 | 11 | 12 | 11 |
| TubL | 35 | 36 | 36 | 34 | 34 | 36 | 35 |
| TubW | 12 | 12 | 14 | 12 | 12 | 12 | 12 |

hindlimbs. Tail segments almost not developed and can be distinguished only in its first third.

General coloration of the dorsal parts from light gray to beige or dark gray. Dorsal pattern with five transversal dark bands. Bands can be wide and can join on the body sides, making 4 – 5 rounded light patches in between. Other dorsal pattern, typical for females, with a narrow contrast dark bands, with distinguished rounded light patches along the middorsal line. Head dorsal pattern almost not developed. Ventral body coloration is white. There are 10 – 12 narrow dark transversal bands on the tail, with usually larger intervals between them. Different variations of the pattern in the type series are shown on Fig. 5.

**Description of the holotype.** Adult male ZISP 26947, SVL: 94.8 mm, TL: 50 mm (regenerated).

Head relatively short (SVL/HeadL = 3.77), wide (HeadL/HeadW = 1.35) and not flattened (HeadL/HeadH = 2.16). Rostral part short (HeadL/SnEye 2.51). Dorsal side covered by small rounded homogenous scales, smooth enlarged tubercles developed only in the occipital area and head sides.

Eye is large (HeadL/OrbD = 4.04); pupil saw-edged; supraciliaries relatively large and increase in size to the front side of the eye-socket. External eye large, oval-shaped (HeadL/EarL = 5.83); space between front edge of ear to hind edge of eye-socket bigger than eye diameter (OrbD/EyeEar = 0.81).

Width of the rostral scale (3.4 mm) considerable bigger than its height (2.7 mm). Edge of rostral scale with three peaks, two of them bordered with nostril, and third is between nostrils in scale center.

Two supranasals separated by two small scales; rostral scale in contact with first supralabials, two supranasals and scales between them; nostrils distinguishable swelled and bordered by supranasal, rostral, and first supralabial scales and by two enlarged postnasals.


**Fig. 6.** Head morphology of *Ptyodactylus* species; a, *Pt. ragazzii*; b, *Pt. hasselquistii*; c, *Pt. orlovi* sp. nov.; d, *Pt. ananjevae* sp. nov.; e, *Pt. dhofarensis* sp. nov.; f, *Pt. guttatus*; g, *Pt. puiseuxi*; h, *Pt. oudrii*; i, *Pt. homolepis*.

Mental scale considerable elongate and separate first pair of postmentals. Height of mental scale (3.7 mm) considerable bigger than its width (1.6 mm); three pairs of enlarged postmentals. 13 supralabials, 12 infralabials from the right side, 12 supralabials and 12 infralabials from the left.

Body rounded and elongate (SVL/TrunkL = 2.29), ventrolateral fold not well developed but the border between ventral and lateral sides of the body clearly distinguished by different shape of scales (ventrals about 1.5 times larger than laterals). Dorsal side of the body covered by small granulated scales, with flattened rounded enlarged slightly keeled tubercles among them (about 6 – 8 times bigger, than surrounding scales). These tubercles formed 12 longitudinal irregular rows.

Ventral scales relatively small and flat, V 46 scales, SLB 209 scales; gular area covered by small smooth homogenous scales.

Femoral and preanal pores absent.

Fore- and hindlimbs long (SVL/ForeaL = 5.81; SVL/CrusL = 4.98); fingers and toes long, with 9 subdigital lamellae on 4$^{th}$ finger and 14 lamellae on 4$^{th}$ toe.

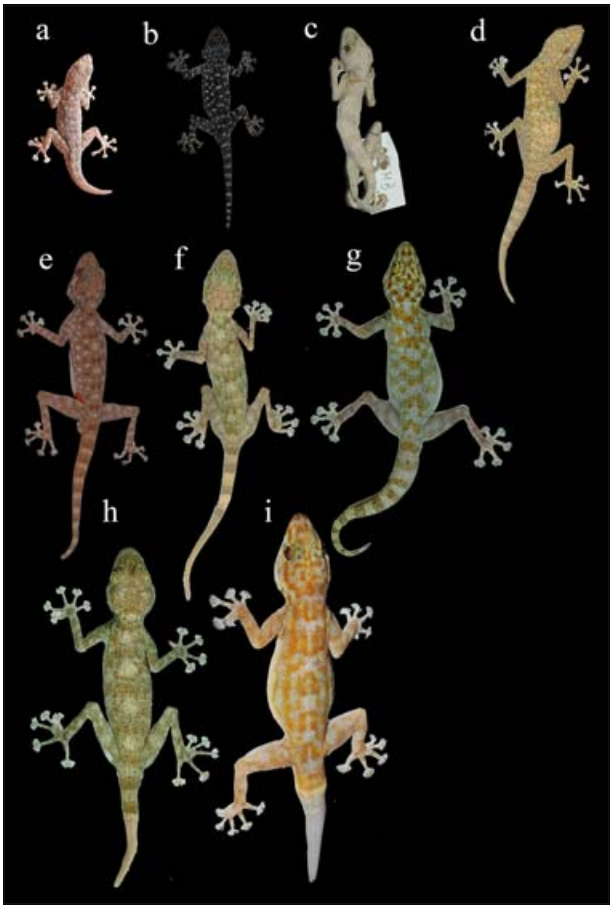


**Fig. 7.** Dorsal view of all *Ptyodactylus* species: a, *Pt. oudrii*; b, *Pt. puiseuxi*; c, *Pt. homolepis*; d, *Pt. ananjevae* sp. nov.; e, *Pt. guttatus*; f, *Pt. orlovi* sp. nov.; g, *Pt. hasselquistii*; h, *Pt. dhofarensis* sp. nov.; i, *Pt. ragazzii*.

Tail regenerated (TailL = 50 mm), tail segments slightly developed and distinguished only in first third of tail. Ventral part of tail light without pattern, covered by small uniform scales.

**Etymology.** Named after the place where new species found — Dhofar, Oman.

**Distribution.** Species known only from the type territory. Probably inhabits also bordering areas of Yemen.

**Morphological comparisons.** Head shape and dorsal body side pattern of a new species similar with those in *Pt. guttatus* (Fig. 6), from which its differ by bigger body size (*Pt. dhofarensis* sp. nov. max SVL 94.8 mm, *Pt. guttatus* max SVL 87 mm), by smaller ventral scales (*Pt. dhofarensis* sp. nov. SLB 189 – 211, *Pt. guttatus* SLB 118 – 151), and by position of enlarged scales, that in *Pt. guttatus* cover the dorsal side of head and extremities, while in *Pt. dhofarensis* sp. nov. they cover only lateral parts of the head and absent on extremities. In *Pt. guttatus* tail segments well developed and marked by two rows of enlarged tubercles on the upper side of the tail. In *Pt. dhofarensis* sp. nov. there is no enlarged tubercles on the tail, tail segments not developed. Dark transversal tail bands in *Pt. dhofarensis* sp. nov. relatively narrow and space between them bigger than bands width, while in *Pt. guttatus* tail bands are wide and space between them about 1.5 – 2 times smaller than bands width.

*Pt. dhofarensis* sp. nov. differs from *Pt. hasselquistii* by the head shape and proportion (in *Pt. hasselquistii* head relatively narrow with elongated rostral part), by smaller ventral scales (*Pt. dhofarensis* sp. nov. SLB 189 – 211, *Pt. hasselquistii* SLB 110 – 170), by coloration and pattern (warm colors in *Pt. hasselquistii* — from light brown to rich-red, while in *Pt. dhofarensis* sp. nov. colors vary from light gray with beige tint to dark gray). Dorsal pattern coloration differences are shown on Fig. 7. Head pattern in *Pt. hasselquistii* very well developed in contrast with *Pt. dhofarensis* sp. nov..

*Pt. dhofarensis* sp. nov. differs from *Pt. puiseuxi* by larger size and dorsal pattern details. Males of *Pt. puiseuxi* usually very dark colored (almost black background), with rounded light contrast (almost white) not arranged patches, in females pattern is less contrast; there are 10 – 12 wide tail dark bands, space between them 2 – 3 times smaller than bands width; enlarged rounded tubercles cover whole occipital area of the head, dorsal side of extremities and formed well developed segments on the tail.

*Pt. dhofarensis* sp. nov. differs from *Pt. oudrii* by significantly larger size (*Pt. oudrii* max SVL 60 mm, *Pt. dhofarensis* sp. nov. max SVL 94.8 mm). Large triangle rounded keeled tubercles cover whole dorsal body side in *Pt. oudrii*, including extremities and tail, in contrast with *Pt. dhofarensis* sp. nov. that do not have it on extremities and tail. In *Pt. oudrii* tail segmented, in contrast with *Pt. dhofarensis* sp. nov.

*Pt. dhofarensis* sp. nov. differs from *Pt. ragazzii* by coloration and dorsal side body pattern, there are brick-red tint in *Pt. ragazzii* coloration (Fig. 7). Bigger number of ventral scales (*Pt. dhofarensis* sp. nov. SLB 189 – 211, *Pt. ragazzii* SLB 104 – 145). There are enlarged tubercles on the dorsal side of thigh in *Pt. ragazzii*, that usually absent in *Pt. dhofarensis* sp. nov.

*Pt. dhofarensis* sp. nov. differs from *Pt. homolepis* in larger size, enlarged dorsal tubercles, that absent in *Pt. homolepis*, and pattern of dorsal coloration that in *Pt. homolepis* formed by five wide dark M-shaped bands.

### *Ptyodactylus orlovi* sp. nov.

**Holotype.** Adult female ZISP 26954. Sultanate Oman, Ad Dakhiliyah region, Wadi Tanuf 23°04′ N

**Fig. 8.** General view of *Pt. orlovi* sp. nov.

57°09′ E, *h* = 827 m a.s.l., Leg. 25.02.2013 by R. Nazarov and J. Stenicka (Fig. 4).

**Paratypes.** Female ZISP 26955 (No. 4) with the same data as holotype. Female ZISP 26956 (No. 1) from Sultanate Oman, Ad Dakhiliyah region, Wadi Ghul. 23°09′ N 57°12′ E, *h* = 847 m a.s.l., Leg. 25.02.2013 by R. Nazarov and J. Stenicka. Two male ZISP 26957 – 26958 (Nos. 3 and 5) from 25 km NW from Nizwa city, old fort in Alfeequin village — Al Manah. 22°47′ N 53°35′ E, *h* = 416 m a.s.l., Leg. 25.02.2013 by R. Nazarov and J. Stenicka; two male and one female ZISP 26959 – 26961 from North Oman (Figs. 8 and 9).*

**Diagnosis.** Medium-sized gecko, with maximum body length about 84 mm, tail a little shorter than body. Head narrow with elongated rostral part. Enlarged tubercles on the dorsum are small, 4 – 6 times bigger than surrounding scales, rounded shape slightly keeled. Dorsal head side covered by small homogenous scales, with enlarged rounded tubercles between them. There are no enlarged tubercles on the dorsal side of extremities. Tail segments not developed.

General color of dorsal body side is gray. There are 5 – 6 dark, not wide, horseshoe-shaped transversal bands on the back, with lighter rounded patches between them. Small rounded light patches irregularly cover side of the body. There is dark horseshoe-shaped band on the head sides beginning from the hind edge of eye-socket above ears to the occipital area. This band can be fragmented, especially well developed in young specimens.

Dorsal head pattern with some separated dark patches of irregular shape, with lighter rounded dots between them. There are 8 – 11 transversal dark bands on the tail, with spaces between them about same width or little bigger. Ventral body side white. Different types of coloration shown in Fig. 9.

**Description of the holotype.** Adult female ZISP 26954, SVL = 83.5 mm, TailL = 82 mm. SVL/HeadL = 3.84, head relatively not wide (HeadL/HeadW = 1.4) and high (HeadL/HeadH = 2.46). Rostral part elongated and not wide, HeadL/SnEye = 2.49. Dorsal head side cov-

* Some type specimens will be transferred to ZMMU herpetological collection.

**TABLE 3.** Measurements and Pholidosis Characters of Type Specimens of *Pt. orlovi* sp. nov.

| Character | Holotype | Paratypes | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Wadi Tanuf ZISP 26954 | Wadi Ghul ZISP 26956 | Manah ZISP 26957 | Wadi Tanuf ZISP 26955 | North Oman ZISP26958 | North Oman ZISP 26959 | North Oman ZISP 26960 | North Oman ZISP 26961 |
| Sex | f2 | f1 | m3 | f4 | m5 | f6 | m7 | m8 |
| SVL | 83.5 | 78.6 | 81 | 76.7 | 71.2 | 71.1 | 64.2 | 68.4 |
| TailL | 82 | 72* | 62* | 68* | 64* | 57* | 65.0 | 67 |
| HeadL | 21.7 | 22.4 | 22.4 | 20.3 | 19.6 | 20.6 | 17.6 | 19.4 |
| HeadW | 15.5 | 14.8 | 14.5 | 14.0 | 13.4 | 13.2 | 12.4 | 11.6 |
| HeadH | 8.8 | 8.2 | 8.7 | 8.2 | 8.0 | 8.2 | 7.4 | 7.3 |
| FrontW | 2.4 | 2.3 | 2.7 | 2.2 | 2.0 | 2.1 | 1.8 | 2.0 |
| SnEye | 8.7 | 8.7 | 9.0 | 8.8 | 7.6 | 7.7 | 7.2 | 7.2 |
| OrbD | 4.9 | 5.1 | 4.8 | 4.8 | 4.2 | 4.2 | 4.0 | 4.2 |
| EarL | 3.5 | 3.3 | 3.3 | 3.4 | 2.8 | 3.0 | 2.8 | 2.4 |
| EyeEar | 6.2 | 5.8 | 5.5 | 4.8 | 4.9 | 5.1 | 4.3 | 4.5 |
| TrunkL | 38.4 | 42.2 | 35.5 | 38.4 | 36.0 | 34.0 | 31.7 | 30.5 |
| LS | 16.8 | 16.2 | 15.8 | 16.8 | 14.8 | 15.4 | 12.4 | 13.2 |
| ForeaL | 15.0 | 14.1 | 14.0 | 13.2 | 11.7 | 12.0 | 11.0 | 11.4 |
| FemurL | 21.2 | 21.1 | 19.8 | 21.3 | 18.6 | 18.5 | 17.6 | 17.8 |
| CrusL | 17.2 | 17.1 | 16.7 | 17.0 | 14.4 | 14.1 | 13.6 | 13.7 |
| LD4A | 6.2 | 6.1 | 5.7 | 5.7 | 5.7 | 6.2 | 5.2 | 5.0 |
| LD4P | 7.8 | 7.8 | 6.2 | 7.1 | 6.7 | 7.0 | 5.4 | 6.2 |
| V | 64 | 57 | 58 | 56 | 58 | 53 | 54 | 50 |
| SLB | 212 | 218 | 206 | 231 | 216 | 204 | 208 | 216 |
| LF4 | 10 | 10 | 9 | 9 | 10 | 10 | 10 | 7 |
| LT4 | 11 | 12 | 12 | 12 | 11 | 10 | 10 | 10 |
| Fan4A | 10 + 10 | 10 + 10 | 11 + 11 | 10 + 10 | 10 + 10 | 10 + 10 | 10 + 10 | 9 + 9 |
| Fan4P | 10 + 10 | 10 + 10 | 11 + 11 | 10 + 10 | 10 + 10 | 10 + 10 | 10 + 10 | 10 + 10 |
| TubA | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 |
| SL | 15 | 16 | 14 | 16 | 14 | 13 | 14 | 13 |
| IL | 14 | 15 | 13 | 15 | 13 | 13 | 12 | 13 |
| TubL | 40 | 37 | 44 | 45 | 45 | 43 | 42 | 46 |
| TubW | 12 | 11 | 14 | 13 | 12 | 10 | 12 | 12 |

ered by small rounded homogenous scales, with smooth enlarged tubercles between them.

Eye of middle size (HeadL/OrbD = 4.42), pupil saw-edged. Supraciliaries relatively large and increase in size to the front edge of eye-socket, while from opposite side with elongated pointed edge (eyelash). External ear of oval shape relatively large (HeadL/EarL = 6.2). Space between front edge of ear to hind edge of eye-socket bigger than eye diameter (OrbD/EyeEar = 0.79).

Rostral scale width (3.2 mm) bigger than its height (2.5 mm). Edge of rostral scale with three peaks, two of them in contact with nostril, and third one in between of two nostrils in central part of scale. Central peak higher than lateral.

Two supranasals separated by one scale; rostral scale in contact with first supralabial, two supranasals and scales between them; nostrils distinguishable swelled and surrounded by supranasals, rostral scale, first supralabial and by two enlarged postnasals.

Mental scale distinguishable elongated and separate first pair of postmentals. Height of mental scale (3.3 mm) considerable bigger than its width (1.3 mm). Three pairs of enlarged postmentals. There are 15 supralabials and 14 intralabials from the right and left sides.

Body rounded (SVL/TrunkL = 2.17), ventrolateral fold not well developed, but the border between ventral and lateral body sides clearly distinguished by different size of scales (ventrals about 1.5 times bigger than laterals). Dorsal side of the body covered by small granulated scales, with flat rounded smooth enlarged tubercles between them (about 3 – 5 times bigger than surrounding scales). This tubercles forming 12 longitudinal irregular rows.

**Fig. 9.** The type series of *Pt. orlovi* sp. nov.

Ventral scales relatively small and flat, V= 64, SLB = 212; gular area covered by small homogenous smooth scales.

There are no femoral or preanal pores.

Fore- and hind limbs long, SVL/ForeaL = 5.56, SVL/CrusL = 4.85. There are 10 subdigital lamellae on the 4th finger and 11 on the 4th toe.

Tail length about equal to body length (TailL = 82 mm), tail segments almost not developed. Ventral part of the tail light without pattern, covered by small homogenous scales.

**Etymology.** Species named in honor of Nikolai Orlov, Zoological Institute, St. Petersburg (Russia) in recognition of his contribution to herpetological research in Asia.

Distribution. Species was found in several localities in Nizwa vicinity (Oman), it is likely that it is distributed in whole mountain massive in the north Oman and bordering UAE.

**Morphological comparisons.** *Pt. orlovi* sp. nov. is similar morphologically (head shape and ratio, and dorsal body pattern) with *Pt. hasselquistii* (Fig. 6) from which it differs by smaller ventral scales and their higher number (*Pt. orlovi* sp. nov. SLB 204 – 231, *Pt. hasselquistii* SLB 110 – 170), by pattern and coloration (in *Pt. hasselquistii* color pattern with warm tints from light brown to brick red, while in *Pt. orlovi* sp. nov. usually gray tint). Differences in dorsal body pattern are shown on Fig. 7. *Pt. hasselquistii* has very well developed contrast head pattern, in contrast *Pt. orlovi* sp. nov. head pattern usually is not contrast and formed by dark and light patches of irregular shape.

*Pt. orlovi* sp. nov. differs from *Pt. guttatus* in relatively narrow head with elongated rostral part, smaller ventral scales (*Pt. orlovi* sp. nov. SLB 204 – 231, *Pt. gut-*

**Fig. 10.** General view of *Pt. ananjevae* sp. nov.

*tatus* SLB 118 – 151). Enlarged scales in *Pt. guttatus* cover dorsal part of extremities, in contrast in *Pt. orlovi* sp. nov. they are absent on extremities. Tail segments in *Pt. guttatus* developed and marked by two rows of enlarged scales on the upper tail side, while in *Pt. orlovi* sp. nov. tail is not segmented. In *Pt. orlovi* sp. nov. width of the dark transversal tail bands about equal to the spaces between them, while in *Pt. guttatus* there are wide bands tail and spaces between them 1.5 – 2 times smaller than bands width.

*Pt. orlovi* sp. nov. differs from *Pt. puiseuxi* by larger size and details of dorsal body color pattern. Males of *Pt. puiseuxi* usually very dark colored (almost black background), with rounded light contrast (almost white) not arranged patches, in females pattern is less contrast. There are 10 – 12 wide tail dark bands, space between them 2 – 3 times smaller than bands width. Enlarged rounded tubercles cover whole occipital area of the head, dorsal side of extremities and formed well developed segments on the tail, in contrast in *Pt. orlovi* sp. nov. tail segments not developed.

*Pt. orlovi* sp. nov. differs from *Pt. oudrii* by considerable larger size (*Pt. orlovi* sp. nov. SVL 83.5 mm, *Pt. oudrii* max SVL 60 mm). Large triangle rounded keeled tubercles cover whole dorsal body side in *Pt. oudrii*, including extremities and tail, in contrast with *Pt. dhofarensis* sp. nov. that do not have it on extremities and tail. Tail segmented in contrast with *Pt. orlovi* sp. nov.

*Pt. orlovi* sp. nov. differs from *Pt. ragazzii* in coloration and color pattern of dorsal body side, there are brick-red tint in *Pt. ragazzii* coloration (Fig. 7). Smaller ventral scales (*Pt. orlovi* sp. nov. SLB 204 – 231, *Pt. ragazzii* SLB 104 – 145). There are enlarged tubercles on the dorsal side of thigh and first third of tail in *Pt. ragazzii*, that usually absent in *Pt. orlovi* sp. nov.

*Pt. orlovi* sp. nov. differs from *Pt. homolepis* in larger body size, head shape and ratio. In *Pt. homolepis* head relatively short, rostral part rounded and not elongated. There are enlarged dorsal tubercles in *Pt. orlovi* sp. nov. that absent in *Pt. homolepis*. Pattern of dorsal coloration in *Pt. homolepis* is formed by five wide dark M-shaped bands, in contrast in *Pt. orlovi* sp. nov. bands are relatively not width and horseshoe-shaped.

*Pt. orlovi* sp. nov. differs from *Pt. dhofarensis* sp. nov. in smaller body size, relatively narrow head with elongated rostral part, smaller ventral scales (*Pt. orlovi*

sp. nov. SLB 204 – 231, *Pt. dhofarensis* sp. nov. SLB 189 – 211). Enlarged tubercles in *Pt. orlovi* sp. nov. cover dorsal side of the head, in contrast in *Pt. dhofarensis* sp. nov. tubercles cover only the head sides.

### *Ptyodactylus ananjevae* sp. nov.

**Holotype.** Male ZISP 26962, southern Jordan, Al Mudawwarah vicinity, 29°20′ N 35°57′ E, Leg. 5 – 6.04.2012 by D. Melnikov (Fig. 4).

**Paratype.** Female ZISP 26963 (Figs. 10 and 11), the same data as holotype.*

**Diagnosis.** Medium-sized gecko, maximum body size about 80 mm, tail length slightly bigger or equal to the body length. Head narrow with elongated rostral part. Enlarged tubercles on the dorsum are rounded, triangle-shaped, 4 – 6 times larger that surrounding scales, with well developed keels. Enlarged rounded tubercles cover sides of the head in the occipital area. Enlarged tubercles well developed on the dorsal parts of proximities. Tail not segmented.

Ground color of dorsal body side from light beige to reddish tint.

Dorsal pattern formed by small reddish-brownish and light patches of irregular shape (Fig. 11). Larger rounded light patches are distinguished along the vertebra. Pattern of the dorsal side of the head formed by small rounded brick-red patches and light dots. There are 10 – 12 transversal dark wide bands on the tail, width of bands bigger than spaces between them. Ventral side of the tail is white.

**Description of the holotype.** Adult male ZISP 26962, SVL = 80 mm, tail regenerated TailL = 58 mm.

Head not wide, but elongated (SVL/HeadL = 3.96, HeadL/HeadW = 1.36), relatively not high (HeadL/HeadH = 2.49) with elongated and narrow rostral part (HeadL/SnEye = 2.46). Dorsal side of the head covered by rounded homogenous scales. Enlarged rounded tubercles cover only occipital area and sides of the head and absent in the parietal area.

Middle size eye (HeadL/OrbD = 4.59); pupil saw-edged, supraciliaries considerable large with well developed eyelash on the hind edge of the orbit. External ear of oval shape (HeadL/EarL = 6.73). Distance between front edge of the ear to the hind edge of orbit bigger than eye diameter (OrbD/EyeEar = 0.7).

Width of the rostral scale (2.9 mm) bigger than its high (1.8 mm). Two supranasals separated by one large scale; rostral scale in contact with first supralabial, two supranasals and scales between them; nostrils slightly swelled and surrounded by supranasal, rostral, first supralabial scales and two enlarged postnasals.

**Fig. 11.** The type series of *Pt. ananjevae* sp. nov.

Mental scale considerable elongated and separate first pair of the postmentals. High of the mental scale (2.7 mm) considerable bigger than its width (1.3 mm). Four postmental from the right side and three from the left. There are 13 supralabials and 12 infralabials.

Body rounded and elongated (SVL/TrunkL = 2.07), ventrolateral fold developed slightly but the border between ventral and lateral sides of the body distinguished by different scale size (ventral scales about 1.5 times bigger than lateral scales). Dorsal side of the body covered by small granular scales, between then are rounded triangle enlarged keeled tubercles (about 4 – 6 times larger than surrounded scales). These tubercles forming 12 longitudinal rows.

Ventral scales relatively small and flat, V = 52, SLB = 207; gular area covered by small homogenous smooth scales.

Femoral and preanal pores are absent.

Distal parts of proximities relatively short SVL/ForeaL = 6.25 and SVL/CrusL = 5.12. There are 8 subdigital lamellae on 4$^{th}$ finger and toe.

Length of regenerated tail is 58 mm, tail segments not developed. Lower side of the tail light without pattern, covered by small homogenous scales.

Description of coloration of this species is presented in the species diagnosis.

**Etymology.** Species named in honor of Natalia Ananjeva, Zoological Institute, St. Petersburg (Russia) in recognition of her contribution to study of Asian lizards.

* Some type specimens will be transferred to ZMMU herpetological collection.

**Distribution.** Known only from the type locality.

**Morphological comparisons.** New species is from "*hasselquistii*" species complex. Like other representatives of this complex it characterized by relatively narrow head with elongated rostral part (Fig. 6).

*Pt. ananjevae* sp. nov. differs from *Pt. hasselquistii* by smaller ventral scales (*Pt. ananjevae* sp. nov. SLB 203 – 207, *Pt. hasselquistii* SLB 110 – 170), coloration and pattern, in *Pt. hasselquistii* pattern of the dorsal side of body formed by dark or reddish-brownish bands, while in *Pt. ananjevae* sp. nov. pattern formed by small dark and light patches of irregular shape. Difference in the dorsal pattern of this two species is shown on Fig. 7. In *Pt. ananjevae* sp. nov., like in *Pt. hasselquistii*, there are well developed contrast pattern of the head, but in *Pt. ananjevae* sp. nov. this pattern formed by small dark and light dots.

*Pt. ananjevae* sp. nov. differs from *Pt. guttatus* by relatively narrow head with elongated rostral part, smaller ventral scales (*Pt. ananjevae* sp. nov. SLB 203 – 207, *Pt. guttatus* SLB 118 – 151). There are well developed tail segments in *Pt. guttatus* in contrast with *Pt. ananjevae* sp. nov. with not developed tail segments.

*Pt. ananjevae* sp. nov. differs from *Pt. puiseuxi* by larger size, body ratio (in *Pt. ananjevae* sp. nov. it is more elongated) and details of the dorsal body color pattern. Males of *Pt. puiseuxi* usually very dark colored (almost black background), with rounded light contrast (almost white) not arranged patches, in females pattern is less contrast. There are 10 – 12 wide tail dark bands, space between them 2 – 3 times smaller than bands width. Enlarged rounded tubercles cover whole occipital area of the head in contrast with *Pt. ananjevae* sp. nov. with no tubercles in the parietal area. In *Pt. puiseuxi* there are well developed segments on the tail, in contrast in *Pt. ananjevae* sp. nov. tail segments not developed.

*Pt. ananjevae* sp. nov. differs from *Pt. oudrii* by larger size (max SVL 60 vs. 80 mm for *Pt. ananjevae* sp. nov.). Enlarged rounded triangle keeled tubercles cover whole dorsal side of *Pt. oudrii*, including extremities and tail, in contrast in *Pt. ananjevae* sp. nov. they are absent in the parietal area of the head. Tail segmented, in contrast with *Pt. ananjevae* sp. nov.

*Pt. ananjevae* sp. nov. differs from *Pt. ragazzii* by smaller size (max SVL 98 vs. max SVL 80 for *Pt. ananjevae* sp. nov.) and pattern of dorsal body side (in *Pt. ragazzii* usually brick-red transversal bands, that can join together forming reticulated pattern (Fig. 7), smaller ventral scales (SLB 203 – 207 vs. SLB 104 – 145 for *Pt. ragazzii*).

*Pt. ananjevae* sp. nov. differ from *Pt. homolepis* by larger size, head shape and ratio. In *Pt. homolepis* head relatively short, rostral part rounded and not elongated. There are enlarged tubercles in *Pt. ananjevae* sp. nov. that absent in *Pt. homolepis*. Pattern of dorsal coloration in *Pt. homolepis* formed by five wide dark M-shaped bands, in contrast in *Pt. ananjevae* sp. nov. pattern formed by small dark and light patches.

*Pt. ananjevae* sp. nov. differs from *Pt. dhofarensis* sp. nov. by smaller size (max SVL 94.8 vs. max SVL 80 mm for *Pt. ananjevae* sp. nov.). Relatively narrow head with elongated rostral part. Enlarged tubercles in *Pt. ananjevae* sp. nov. cover dorsal parts of thigh, in contrast in *Pt. dhofarensis* sp. nov. they not cover dorsal parts of proximities.

*Pt. ananjevae* sp. nov. differs from *Pt. orlovi* sp. nov. in smaller size and pattern of dorsal side of the body. In *Pt. orlovi* sp. nov. pattern formed by transversal horseshoe shaped bands, in contrast with *Pt. ananjevae* sp. nov. Dark bands on the tail in *Pt. ananjevae* sp. nov. are wide and spaces between bands smaller than bands,

**TABLE 4.** Measurements and Pholidosis Characters of Type Specimens of *Pt. ananjevae* sp. nov.

| Character | Holotype ZISP 26962 | Paratype ZISP 26963 |
|---|---|---|
| Sex | m | f |
| SVL | 80.0 | 76.4 |
| TailL | 58* | 30* |
| HeadL | 20.2 | 20.2 |
| HeadW | 14.8 | 15.0 |
| HeadH | 8.1 | 8.0 |
| FrontW | 2.6 | 2.2 |
| SnEye | 8.2 | 8.1 |
| OrbD | 4.4 | 4.2 |
| EarL | 3.0 | 3.0 |
| EyeEar | 6.2 | 5.8 |
| TrunkL | 38.6 | 32.5 |
| LS | 16.7 | 15.6 |
| ForeaL | 12.8 | 12.2 |
| FemurL | 22.4 | 19.5 |
| CrusL | 15.6 | 14.0 |
| LD4A | 5.7 | 6.0 |
| LD4P | 7.3 | 6.8 |
| V | 52 | 55 |
| SLB | 207 | 203 |
| LF4 | 8 | 9 |
| LT4 | 8 | 10 |
| FanA | 7 + 7 | 9 + 9 |
| FanP | 9 + 9 | 10 + 10 |
| TubA | 2 | 2 |
| SL | 13 | 13 |
| IL | 12 | 13 |
| TubL | 29 | 37 |
| TubW | 12 | 12 |

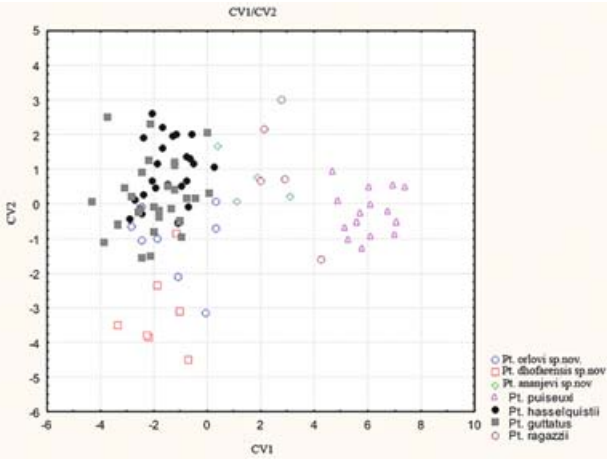


**Fig. 12.** Allocation a number of samples for seven species of *Ptyodactylus* are compared by 13 morphological characters (SVL, HeadL, HeadW, HeadH, FrontW, OrbD, EarL, LS, ForeaL, FemurL, CrusL, LD4A, LD4P) on the basis of discriminant analysis.

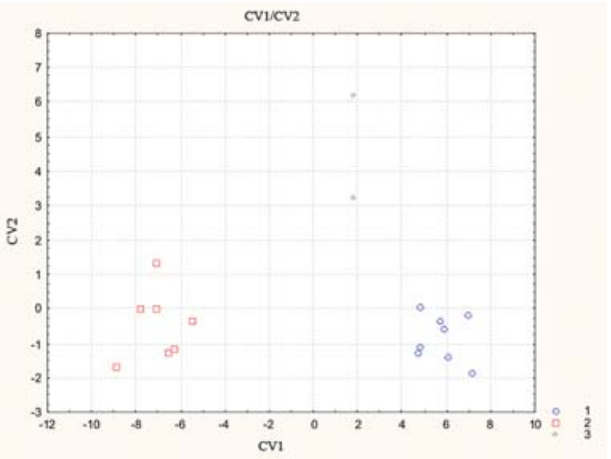


**Fig. 13.** Allocation a number of samples for three new *Ptyodactylus* species are compared by 9 morphometric characters (SVL/HeadL, HeadL/HeadW, HeadL/FrontW, LS/ForeaL, FemurL/CrusL, SVL/FemurL, SVL/ForeaL, SVL/LD4A, SVL/LD4P) on the basis of discriminant analysis.

while in *Pt. orlovi* sp. nov. spaces about the same width as bands.

Canonical discriminant analysis of the main morphological characters showed that the most distant are *Pt. puiseuxi* and *Pt. dhofarensis* sp. nov. while *Pt. guttatus* and *Pt. hasselquistii* not distinguished and combined in one group (Fig. 12). Probably this is due fragmental material used for analysis. Taking into account high polymorphism and mosaic distribution, it is better to compare morphological characters between populations but not between species. But for such analysis more material needed.

Canonical discriminant analysis of all morphological characters studied, showed that all three new species very distant and clearly distinguished (Fig. 13).

## DISCUSSION

Our results reveal high divergence and polymorphism within groups *Pt. guttatus*, *Pt. hasselquistii* and *Pt. ragazzii*, these species in fact represents species complexes. Genetic divergence of mtDNA between *Ptyodactylus* species is very high — 20% (*p*-distance) for *Pt. hasselquistii*, *Pt. ragazii*, *Pt. puiseuxi*, *Pt. guttatus*, and *Pt. oudrii*. The level of genetic divergence among described species also high (18 – 21%). Canonical discriminant analysis of morphological characters also showed clear difference between described species.

Our preliminary data on the morphological characters of the head ratios showed that *Ptyodactylus* can be well divided into two groups: "*hasselquistii*" and "*guttatus*." Representatives of the first group with relatively not wide head with elongated and pointed rostral part: *Pt. hasselquistii*, *Pt. ragazzii*, *Pt. ananjevae* sp. nov., and *Pt. orlovi* sp. nov. Representatives of the second group characterized by relatively wide head with short and rounded rostral part: *Pt. guttatus*, *Pt. homolepis*, *Pt. puiseuxi*, *Pt. oudrii*, and *Pt. dhofarensis* sp. nov. This corresponds well with our molecular data on phylogenetic relationships among *Ptyodactylus*.

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