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A NEW SPECIES OF MITES OF THE GENUS *GECKOBIA* (PROSTIGMATA, PTERYGOSOMATIDAE), PARASITIC ON MEDIODACTYLUS KOTSCHYI (REPTILIA, GEKKOTA) FROM CRIMEA

M. Bertrand[1], O. Kukushkin[2], S. Pogrebnyak[3]

[1] *Université Montpellier, III UMR 5175 CEFE, Route de Mende, Montpellier, 34199 France*
E-mail: bertrand.michel@univ-montp3.fr
[2] *Karadagh Nature Reserve, 24, Nauki Street, Theodosia 98188, AR Crimea, Ukraine*
E-mail: vipera_kuk@pochta.ru
[3] *National Museum of Natural History, vul. B. Khmelnytskogo, 15, Kyiv, 01601 Ukraine*
E-mail: slava.pogrebnyak@gmail.com

A New Species of Mites of the Genus *Geckobia* (Prostigmata, Pterygosomatidae), Parasitic on *Mediodactylus kotschyi* (Reptilia, Gekkota) from Crimea. Bertrand M., Kukushkin O., Pogrebnyak S. — *Geckobia sharygini* Bertrand, Kukushkin et Pogrebnyak, sp. n., a parasite of gecko *Mediodactylus kotschyi danilewskii* (Strauch, 1887) collected from Crimea (Ukraine) is described. The new species differs from other species of the genus by the scutum with convex posterior edge and seven pairs of dorsal stout setae on scutum. Almost 89 % of mites were found on the ventral surface of lizard's body. Maximum observed parasite charge is 60 specimens for a synanthropic locality and 17 mites for a natural locations. With exception of the newborn lizards, the infestation slightly increased from spring to autumn. The improved key to Pterygosomatidae and some *Geckobia* is provided. Position of *G. sharygini* sp. n. and some related species in the genus *Geckobia* is discussed in connection with phylogeny, distribution and ecological peculiarities of the hosts.

Key words: Acari, Prostigmata, Pterygosomatidae, *Geckobia*, *Mediodactylus kotschyi danilewskii*, Gekkota, Crimea, Ukraine, host-parasite relationships.

Новый вид клещей рода *Geckobia* (Prostigmata, Pterygosomatidae), паразитирующих на *Mediodactylus kotschyi* (Reptilia, Gekkota) из Крыма. Бертран М., Кукушкин О., Погребняк С. — Описан новый вид клещей *Geckobia sharygini* Bertrand, Kukushkin et Pogrebnyak, sp. n., представители которого были собраны в Крыму на крымском гекконе — *Mediodactylus kotschyi danilewskii* (Strauch, 1887). Описаный вид отличается от известных представителей рода тем, что проподосомальный щит с выпуклым задним краем и несёт 7 пар щетинок. Клещи локализуются преимущественно на вентральных поверхностях тела хозяина — 89 % обнаруженных особей. Максимальная интенсивность инвазии достигает 60 клещей на ящерицу в синантропных популяциях и лишь 17 — в природных биотопах. Исключая свежеотродившихся особей, экстенсивность заражения слабо повышается от весны к осени. Приведены доработанные определительные таблицы для родов семейства Pterygosomatidae и для некоторых видов рода *Geckobia*. Обсуждается положение *G. sharygini* sp. n. и ряда близких видов в системе рода в связи с филогенией, распространением и экологическими особенностями хозяев.

Ключевые слова: Acari, Prostigmata, Pterygosomatidae, *Geckobia*, *Mediodactylus kotschyi danilewskii*, Gekkota, Крым, Украина, паразито-хозяинные отношения.

Introduction

The family Pterygosomatidae (Acari, Prostigmata, Raphignathoidea) is a homogenous group of mites, with two highly specialized largest genera: *Geckobia* Mégnin, 1878 parasitic on Gekkota (Reptilia, Squamata) and *Pterygosoma* Peters, 1848 parasitic on Iguania (Reptilia, Squamata). Most of the *Geckobia* species have followed their host, the diurnal and/or nocturnal gekkotans, when they colonized new territories (Martinez et al., 2003). Despite the fact of wide distribution of the East Mediterranean species *Mediodactylus kotschyi* (Steindachner, 1870) (syn.: *Cyrtopodion kotschyi*), or species complex (Kasapidis et al., 2005), until now the only species of *Geckobia* was described from *M. kotschyi* — *G. parvulum* Bertrand, Paperna et Finkelman, 2000 (from *M. k. orientalis* Stepanek, 1934; locus typicus — Mount Hermon of Anti-Lebanon mountain range, Middle East). So, mites of the genus *Geckobia* can be thought a priori differentiated on a distinct old group of reptiles and also tend to stenoxeny, a consequence of the intimate interactions with the host. In this context, the study of the different species linked to some host acknowledges in:

revealing new hypothesizes on where and how did the interactions with the host established, especially when the different parasite species share apomorphic characters (Bertrand, 2002);

bringing arguments on the duration of the host-parasite relationships, that could be ancient due to the gekkotan lineages having emerged on the Secondary Era (Borsuk-Białynicka, 1990);

explaining how emerged the actual diversity of the genus *Geckobia* throughout the vagaries in the host's distribution: when both host and parasite diversities are known, when isolated and endemic population or species persisted, or because the ancestral host speciated, or/and because host switch happened.

Constraints in the geckobian life cycle. The genus *Geckobia* is commonly found on geckonid lizards. This genus is considered as highly specialized, contrarily to the more primitive genera (essentially *Hirstiella* Berlese, 1920 and *Pimeliaphilus* Trägerdh, 1904). Mites of the genus *Geckobia* are generally stenoxenic parasites, collected mostly on a single or few host species. Except for the early life moments (the first days of larval stage), these mites remain fixed by the mouthparts on the host gecko, even during moulting. Chelicerae and feeding tube drill the host's epithelium, and the mite sucks host blood and lymph through the stylostome (Bauer et al., 1990). There is just the first free stage — the hexapod larva that needs to find the adequate host before moulting. Then, the mite stays fixed under or between the reptile's scales, during the successive moultings that alternate active and inactive stages. The active feeding stages, deutonymph and adult are sheltered in the still fixed exuvia of protonymphal and tritonymphal ghosts (these two stages are calyptostasic). The heteromorphic and sexually mature male is considered as a paedogenetic deutonymph. It is obvious that the loss of mobility is favored a closer association with the most adequate host.

The hosts of Gekkota may be widely distributed, like invasive species *Hemidactylus frenatus* Duméril et Bibron, 1836, or *H. mabouia* Moreau de Jonnès, 1818, (Squamata, Gekkonidae). Such distribution eases the expansion of the parasites. Some *Geckobia* mites may be as widespread as their host (Bertrand, Ineich, 1989; Martinez et al., 2003). Some of these hosts are nowadays considered invasive, active in colonizing homologous habitats all over the world. However, many other geckos remained in a restricted distribution, and show a load of ectoparasites, inherited of past, or that may be captured from neighbour species (Bertrand et al., 2008).

The host species, Kotschy's gecko, *Mediodactylus kotschyi* (Steindachner, 1870) is a small lizard widespread in the Eastern Mediterranea. Its range distribution is extended from Italy and Malta in the west to the southern parts of Trans-Caucasus and Iraq in the east, and from Jordan in the south to Serbia and Crimean Peninsula in the north (Beutler, Gruber, 1977; Szczerbak, Golubev, 1986). Crimean location is a northernmost relict populated by *Mediodactylus kotschyi danilewskii* (Straush, 1887) subspecies, no more than 680 m up from the Black Sea coastline, in natural habitats (rocky juniper-oak, juniper-pistachio and pine light forests) and synanthropic zones (Szczerbak, 1966; Baran, Gruber, 1982; Sharygin, 1977; Kukushkin, 2004, 2009; Kukushkin, Sharygin, 2005). As for today, *M. k. danilewskii* is not Crimean endemic, it also dwells the Eastern Balkans (Eastern Bulgaria, extreme north-east of Greece, Turkish Thrace), North-Western and Central Anatolia (Baran, Gruber, 1982; Szczerbak, Golubev, 1986; Rössler, 2000).

A misidentified citation of mites. The infestation of Kotschy's gecko in Crimea has been mentioned previously as by some "Pterigosomidae" mites of Trombidiformes (Szczerbak, 1960, 1966). Unfortunately, later some other mess was added by herpetologists. The original references of the parasite of mediodactylid are about attacks by "larvae of "*Geckobiella* sp." or "*Geckobiella* sp. (*geckoides*?)" (Sharygin, 1976, 1977; Kukushkin, 2005 a). Actually, the genus *Geckobiella* Hirst 1917 is, as far we know, a parasite of American iguanid lizards whereas the genus *Geckobia* is present in Southern Europe around the West Mediterranean Basin on the Mediterranean geckos.

A new species of mites of the genus *Geckobia* collected from the Crimean geckos is described in this paper.

Material and methods

Material available for this study was collected in the following locations: sample 09042301, Ukraine, Crimea, Sevastopol, ancient town Chersonesos Taurica, ruins of the citadel, 44°36'33.65" N, 33°29'43.28" E, April 23, 2009, 23 females 1 deutonymph in 12 slides; sample 09042401, Ukraine, Crimea, Sevastopol Territory, surroundings of Balaklava, unnamed rocky peak between the mountain Asketi and pass Kamara-Bogaz, about 300–350 m a. s. l., rocky juniper-oak light forest, 44°29'22.03" N, 33°38'0.15" E, April 24, 2009, 6 females 2 deutonymphs in 4 slides (Kukushkin).

In 5 localities of 3 geografic points of Crimean Southern coast (ancient town Chersonesos Taurica, Cape Ayu-Dagh, mountain-volcanic massive Kara-Dagh) 266 geckos were inspected for infestation; 176 animals with 1267 specimens of parasitic mites were found. Type series specimens are deposited in Collection of Arthropoda, Muséum d'Histoire naturelle de Paris (MHNP) and the acarological collection of National Museum of Natural History, Kyiv, Ukraine (MNHK).

Specimens were collected and preserved in ethanol. Host gecko is *Mediodactylus kotschyi danilewskii* (Straush, 1887). Some mites were cleared in lactic acid, and dissection of mouthparts and legs were done. Microscop Wild Leitz T 20 EB. Measurements were made on pictures taken with calibrated Motic T camera or micrometer, drawings with camera lucida. Measurements are given in micrometers (μm). Nomenclature of tarsal setae following Jack (1964) and Bertrand et al. (1999).

Geckobia sharygini Bertrand, Kukushkin et Pogrebnyak, **sp. n.** (fig. 1–18)

Type material. Holotype ♀, sample 09042301, Ukraine, Crimea, Sevastopol, ancient town Chersonesos Taurica ruins (MHNP). Paratypes: 9 ♀ from sample 09042301, 4 ♀ from sample 09042401 (MHNP); 13 ♀, 1 deutonymph from sample 09042301, 2 ♀, 2 deutonymphs from sample 09042401 (MNHK). No males were found.

Description

Female. Body roughly triangular in shape, red colored, relatively small in size. Length and width of animals preserved in ethanol: 330–350 × 490–510. Specimens cleared and mounted are larger — 370–370 × 530–550. Soft cuticle, covered by dense and numerous setae on the dorsum and on the posterior margins of the body.

Dorsum (fig. 1–3). Dorsal cuticle with fine striation, densely covered by numerous serrated setae increasing in length towards posterior end of the body. Ornamentation of the body varies from "lineate" to "undulate" according to the definition from Evans (1992). The scutum is roughly divided medially in two fields by the longitudinally orientated cuticle ripples without setae (fig. 2); scutum globally semicircular in shape, longer than wide, not reaching slightly concave anterior edge of the body. Seven pairs of stout scutal setae; little rounded ocular lens (9–10) situated on each side of scutum, close to ocular seta (15–18) and surrounded by three stout setae inserted on small protrusions (24–28, 27–34, 24–27). Three other stout setae (23–29) complete scutal setation. Posterior edges of scutum surrounded by transverse rows of ripples with short plumose setae (10–16 long). Lateral setae arranged in 6 files symmetrically on each side of the body, varying in length from 14–16 (near the ocular lens) to 17–20 above third and fourth pairs of legs. Posterad, the dorsal caudal setae are at least 3 times longer (53–66) than last dorsal. The preanal setae longest (74–75). Genital setae shorter (40–57) than preanal.

Venter (fig. 5, 7, 8). Epimeral plates. Coxae developed (fig 7), gathered in two groups with setation from I to IV: 4 (2, 2) — 5 (3, 2). Anterior epimeral plate (coxae I, II) with 2 thin and long setae on coxa I (25–28, 35–40), supplemented with robust seta of proper epimerite (16–19); one robust paraxial stout seta (29–32) and slender plumose one distally (15–18) on coxa II. Posterior epimeral plate (coxae III, IV) with four large robust stout epimeral setae (29–32) and plumose one distally (22–24) on coxa III slightly anterior to junction between fourth and third coxae. Anterior and posterior epimeral plates well separated by striated cuticle bearing five robust brush-like ended setae (16–22).

Venter setation. Body covered by short and stout setae (15–17) in 3–4 rows and scale-like setae (24–28 × 22–25) on greatest part of the ventral surface except anterior half of ventral surface, from posterior end of infracapitulum forward to level of fourth coxae backward. These scale-like setae almost symmetrical, similar to lime leaves. More peripheral setae gradually changing shape to more elongated on body posterior margins, from leaf-like setae (from 33–41 to 43–49) to typically caudal serrated setae (55–64). Scale-like setae superimposing each other, covering ventral surface in at least two coats.

Anogenital area (fig. 6, 7). Genital and anal openings close to each other and covered by pair of common folds. Genital opening in terminal position and visible on both sides of body. Ventrally, genital aperture closed hermetically by thickened tubercles playing role of opercula, striation of cuticle of both sides closely corresponding. These lips resolving in two blades overlapping each other posterad at the body end. Each thickened lip with terminal serrate seta (28–36). Genital flaps with 10–12 long serrated setae (42–58) surround thickened lips. Two robust aggenital setae (64–70, 65–74) near frontal (dorsal) part of genital flaps. Anal opening posterior to genital one, on dorsal side. Anal flaps with 3 pairs of long serrated setae (62–65, 55–58, 29–31).

Gnathosoma (fig. 2, 16, 17, 18). Infracapitulum subquadrangular in shape (fig. 16) with pair of setae (gnathobasal setae) as long as or slightly longer than palp (*ca.* 60 μm long). The infracapitulum laterally strengthened by podocephalic canal (salivary ductus)

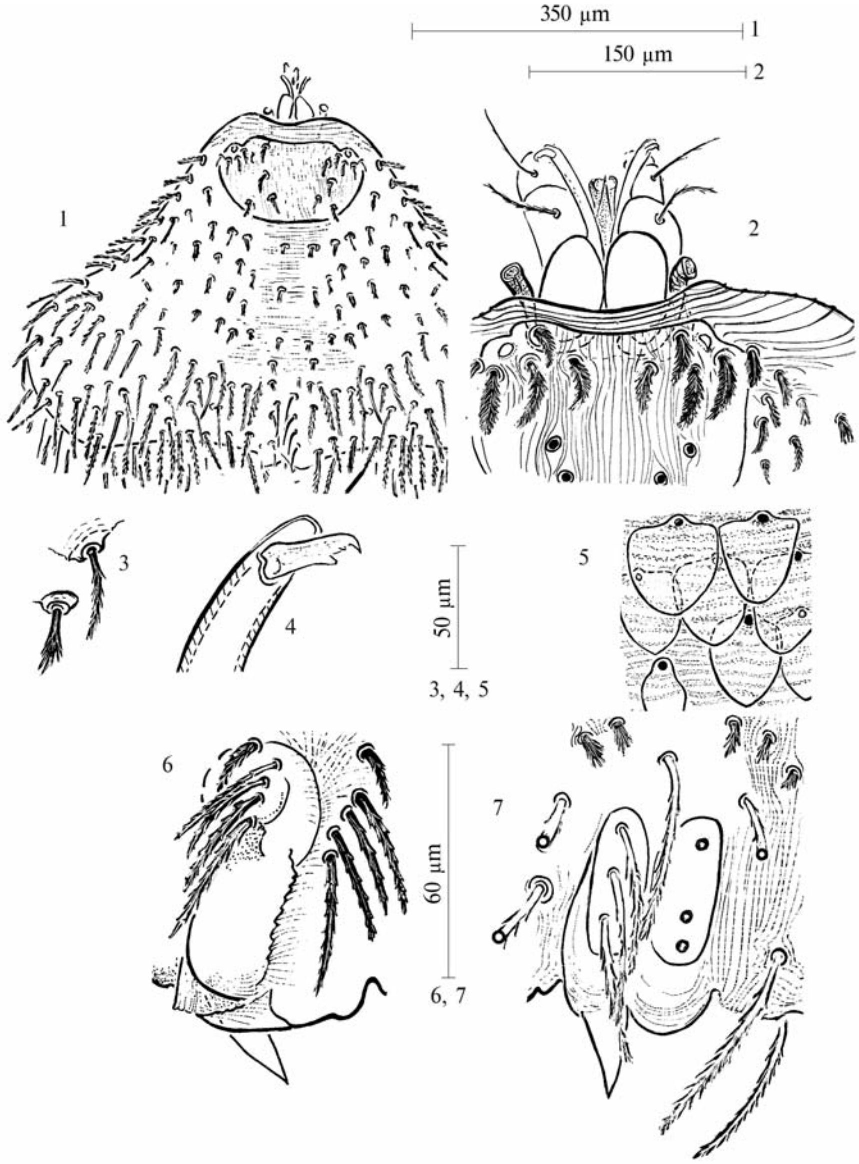

Fig. 1–7. *Geckobia sharygini* sp. n., ♀: 1 — dorsal view; 2 — anterior part of idiosoma; 3 — dorsolateral plumose and dorsal short "brush-like" setae; 4 — distal part of right chelicera, dorsal; 5 — ventral scale-like setae; 6–7 — ventral (6) and dorsal view (7) of anogenital area.

Рис. 1–7. *Geckobia sharygini* sp. n., ♀: 1 — дорсальная сторона тела; 2 — передняя часть идиосомы; 3 — перистые дорсолатеральнные и короткие дорсальные щетковидные щетинки; 4 — дистальная часть правой хелицеры, дорсально; 5 — вентральные чешуевидные щетинки; 6–7 — аногенитальная область с дорсальной (6) и вентральной стороны (7).

continued and plunging in two branches before first pair of coxae, and diverging in two branches. Palp (56–59), chelicera (93–94) and lips tube emerge, flanked by peritremes, with short tubes, directed upward (fig. 16–18).

Chelicera (90–100 µm long) in dorsal position. Proximal end (30–40) pear-shaped, continued by long branch ended in forked mobile digit. Terminal hook mobile, with 2 terminal little teeth between hook extremity and developed subterminal tooth, laterally oriented, and protected by short hood (fig. 4).

Palp (fig. 17, 18). Femora as wide (26–28) as chelicera body (26–27). Dorsal setae ciliate on palpfemur (36–42) and palpgenu (35–36). Palpal chaetotaxy: 1–1–2–4 + ω. Palptibial seta 14 long, two setae of palptarsus 24–28 long. Palptibial claw embedded and protected by developed cuticle fold. Three lips form tube shorter than chelicerae and palps.

Legs (fig. 8–14). Length of legs increasing from leg I to IV. Visible length of legs I–IV (without coxae and claws): 160–170, 167–180, 205–210, 235–240. Chaetotaxy: stout and robust ventrolateral seta on each trochanter, short (10–14) and brush-like ended setae on leg I, ciliate and relatively long setae on legs II–IV (20–21, 27–28, 28–29). Chaetotaxy from trochanter to tibia: (1–1–1–1) (3–2–2–2) (1–0–0–1) (5–5–5–5). Femora I, III, IV with feather-like seta (13–22, 23–25, 18–20) and slightly serrated macrochetae (47–58, 50–53, 42–50); only macrochetae (47–48) and one more simple seta on femur II. Dorsal macrochetae (41–42, 62–69) of tibiae I and IV situated behind lateral setae (paraxial and antiaxial), dorsal setae of tibia II and III situated in front of nearest lateral setae and moderate in length (27–36, 34–36). Tarsi I–II short (26–30), snub,

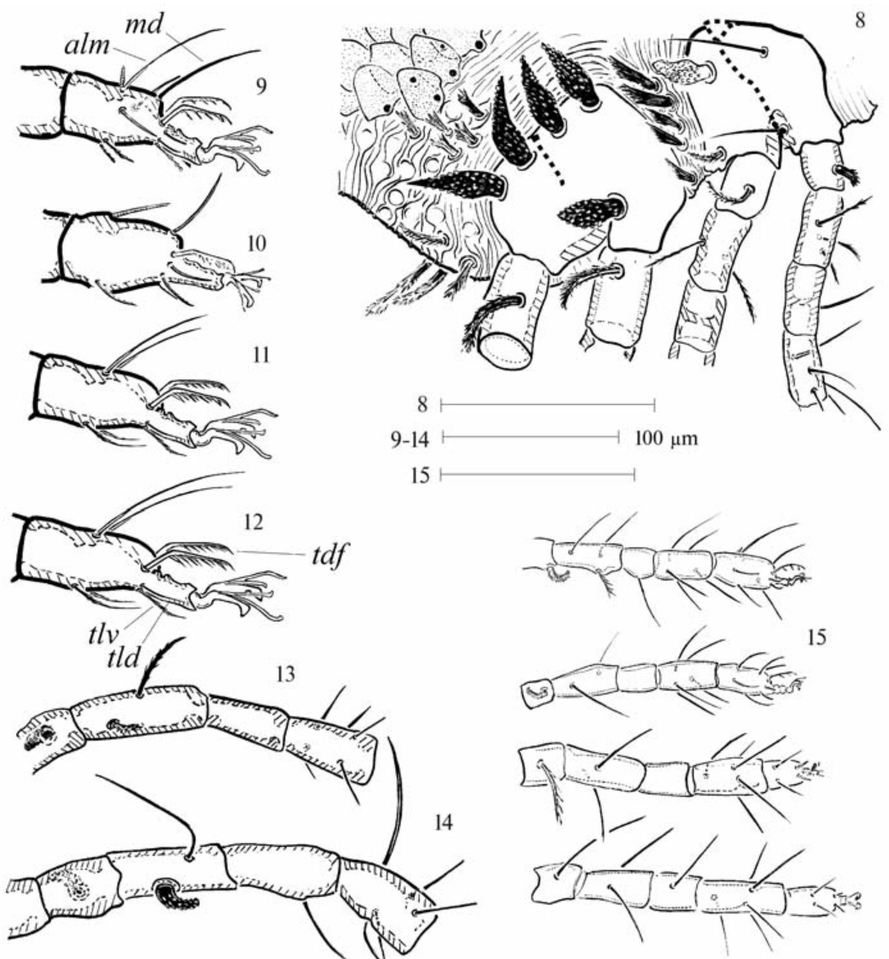

Fig. 8–15. *Geckobia sharygini* sp. n., ♀: 8 — ventral view and legs; 9 — tarsus I, antiaxial view; 10 — tarsus II antiaxial view; 11 — tarsus III antiaxial view; 12 — tarsus IV antiaxial view; 13 — trochanter, femur, genu and tibia. of leg IV, ventrolateral view; 14 — trochanter, femur, genu and tibia of leg III, ventrolateral view; deutonymph: 15 — legs I–IV.

Рис. 8–15. *Geckobia sharygini* sp. n., ♀: 8 — часть вентральной стороны и ноги; 9–12 — лапка I–IV соответственно; 13 — вертлуг, бедро, колено и голень ноги IV, вентролатеральная сторона; 14 — вертлуг, бедро, колено и голень ноги III, вентролатеральная сторона; дейтонимфа: 15 — ноги I–IV.

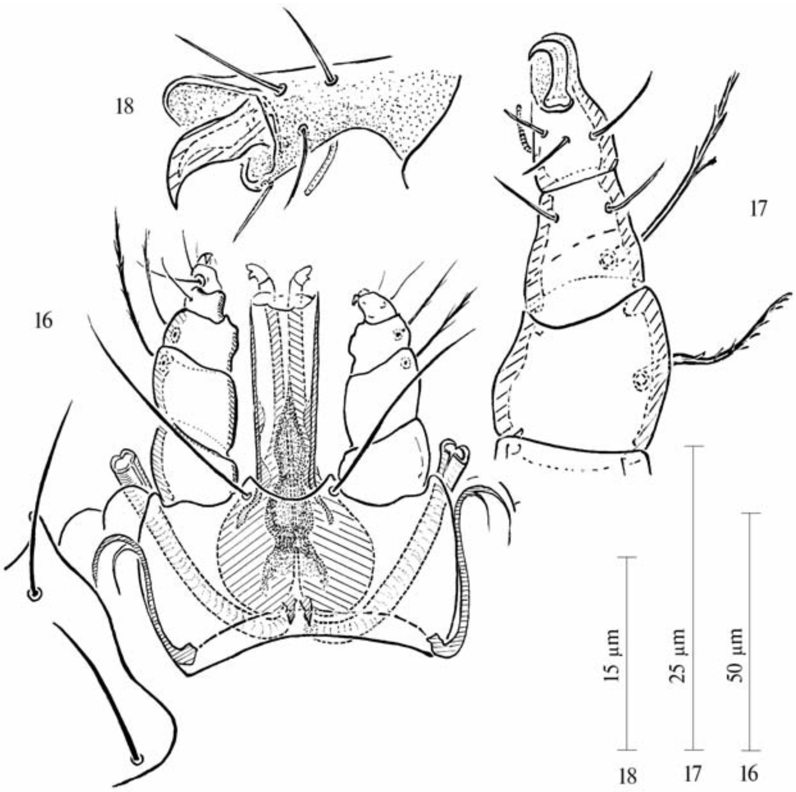

Fig. 16–18. *Geckobia sharygini* sp. n., ♀: 16 — gnathosoma ventrally; 17 — palp, ventral view; 18 — distal segment of the palp.

Рис. 16–18. *Geckobia sharygini* sp. n., ♀: 16 — вентральная сторона гнатосомы; 17 — пальпа, вид снизу; 18 — дистальный членик пальпы.

whereas tarsi III and IV slightly elongated (34–37, 40–42). Tarsus I with small solenidion (7–8) and companion seta *alm* (28–29). Tarsus I with typical setation for *Geckobia*: *alm, md*, (*bv*), (*td*), (*tld)*, (*tlv*), (*tdf*) (characteristic brush-like) + ω, only ventral setae ciliate. Tarsus II with only one dorsal long and large (8–11) solenidion. Tarsus II setation: (*bv*), (*td*), (*tld*), (*tlv)* (*tdf*) + ω, ventral setae slightly pilose. Tarsus III with two moderate long (24–28) dorsal setae and two moderate long (16–18) ventral setae. Tarsus III terminal setation with pairs of (*tdf*) and (*tlm) + (tlv)* (all terminal setae 24–25 µm in length). Tarsus IV with two moderate long (35–36) dorsal setae and two moderate long (17–18) ventral setae. Tarsus IV terminal setation with pairs of (*tdf*) and (*tlm) + (tlv)* (all terminal setae 20–21 long). Claws projected forward by elongated ends of tarsi. Tenent hairs present with flattened ends, two by unguis, external branch longest.

D e u t o n y m p h a l f e m a l e. Deutonymph not similar in shape to adult female, roundish or round-oval. Idiosoma length 225–260, width 205–260. Scutum medially divided into two parts by longitudinal striation, with 4 pairs of plumose setae (39–44). One postocular seta (42–48) and two lateral prodorsal setae plumose (40–48). Other dorsal setae more or less tomentose (27–35). Ventral anterior setae short and brush-like (11–20), medial, lateral and caudal tomentose (24–36). Leg chaetotaxy (fig. 15) (from trochanter to tibia): (1–1–1–1) (3–2–2–2) (1–0–0–1) (5–5–5–5) similar to that of female. Normal coxal chaetotaxy: 2–2–2–2. Coxal setae sometimes variable: doubled paraxial coxa II seta asymetrically, thinned antiaxial coxae IV setae and doubled paraxial coxa IV setae. Setae shorter than in adult female. Setae of coxa I thin and smooth (39–44) and of other three coxae short and brush-like (9–14). Trochanter setae I–IV

Table 1. Deutonymphal leg segments length
Таблица 1. Длина члеников ног дейтонимфы

leg	trochanter	femur	genu	tibia	tarsus
I	17–20	31–38	15–18	27–30	28
II	20–20	29–29	22–24	25–28	25
III	27–39	32	28	30	27
IV	27	38	28	40	36

long and ciliate (39–44). Femur I with 2 lateral slightly serrated and long setae (42–48, 30–34), and plumose latero-ventral one (24–26). Femora II–IV each with two long serrated setae (24–31, 42–48). Tibia I–IV with macrochaeta (41–48, 37–39, 33–40, 64–72). Deutonymph leg measurements as in table 1.

Male and larva: unknown.

Etymology. Species named in a honor of Dr. Sergei Sharygin, the herpetologist from Nikita Botanical Gardens (Yalta, Crimea, Ukraine), who brought significant contribution in the study of the Crimean Kotschy's gecko.

Differential diagnosis. This new species is most similar to *G. parvulum, G. loricata* Berlese 1892, *G. turkestana* Hirst 1925, and *G. squamaeum* Bertrand, Paperna et Finkelman, 2000 by the ventral scale-like setae. *G. sharygini* sp. n. differs by having seven pairs of dorsal stout setae on scutum (6 pairs in *G. turkestana* and *G. loricata,* more than 7 in *G. parvulum* and *G. squamaeum*). New species also has a scutum with convex posterior edge and reduced number of lateral setae of the body (if compared to *G. parvulum, G. loricata*). Having five or more intercoxal setae differs the new species from *G. loricata* and *G. parvulum* (more often 4 inetrcoxal setae), and three femoral setae of *G. sharygini* sp. n. from *G. parvulum* (only 2 setae on femora I).

Just a few species in the genus *Geckobia* bear ventral scale-like setae; they belong to the "group 1" base on the leg chaetotaxy (Jack, 1964) with general formula from tibia to trochanter: (5–5–5–5) (1–0–0–1) (3–2–2–2) (1–1–1–1). An exception are the South African species with scale-like setae: *G. australis* Hirst, 1925 (out from group 1–4) and *G. ovambica* Lawrence 1936 (group 3), hosted by *Lygodactylus capensis* Smith, 1849 and *Rhoptropus barnardi* Hewitt, 1926, both diurnal and arborical lizards (Johnson et al., 2005). The reduced number of terminal tarsal setae (*tlm* absent) makes the new species belonging to the Jack's group B by tarsal chaetotaxy together with *G. turkestana*, *G. rhoptropi* and *G. australis.* The improved key to Pterygosomatidae and some *Geckobia* is given to update the previous one (Bertrand et al. 2008), compiling also the data from some modern (Paredes-Leyn et al., 2012) and important (Bochkov, Mironov, 2000) sources.

Infestation of *Mediodactylus kotschyi* Crimean populations. Totally 266 geckos from 5 localities of 3 geografic points of Crimean Southern coast were examined to find 176 animals with 1267 specimens of parasitic mites.

About 89 % of mites were found on ventral surface of lizards' bodies, especially body parts covered by comparatively larger tiles-like scales, commonly in the skin folds (42 % on the belly, 21 % on the thighs and shanks of the limb hinds and 13 % on the lower surface of the tail). The infestation rate differs in different cases. It varies greatly between localities, during different seasons and maximal in the synanthropic populations: Sevastopol, ancient town Chersonesos Taurica, 6 infested from 6 with 155 mites in contrast to South-Western Coast between Balaklava and Massandra, 7 from 17 with 62; settlements around Ayu-Dagh Mountain (Artek, Karasan), 14 from 72 lizards with 129 mites (Sharygin, 1977), in contrast to Ayu-Dagh Mountain, 18 from 19 with 110; guard-post "Verchnie Trassy" in Karadagh Reserve near Koktebel settlement, 142 geckos from 163 with 936 parasites in contrary to Karadagh Reserve, Ridge Kara-Agach, 3 from 61 with only 4 mites. The homogenous largest infestation in synanthropic areas could be facilitated by the higher density of shelters, giving favorable habitats to lizards and so, the pop-

Table 2. Infestation rate of *M. kotschyi* synanthropic population
Таблица 2. Уровень зараженности *M. kotschyi* в синантропных популяциях

Size, mm	Number of geckos checked	lizard infested, %	Maximal parasite charge	Number of mites collected	Mean number of parasite per individual	
					males	females
20–25	9	33.3	4	8	0.9	–
25–30	19	68.4	15	62	2.9	5.7
30–35	35	85.7	22	218	6.2	5.8
35–40	33	93.9	23	206	6.8	6.5
40–45	30	93.3	21	200	4.9	8.5
> 45	12	91.7	7	48	0.0	3.2

ulation density of geckos in the settlement buildings and ruins are generally higher than in natural habitats.

Karadagh Nature Reserve survey in 2003–2004 showed (table 2) that 742 mites observed from 138 hosts were infested, i. e., more than 5 mites per host in average. The estimated mean is similar for females and males. The most infested gecko size classes were 30 to 45 mm long, so the number of infested animals increases with age, as well as the maximal number of mites per gecko.

Maximum observed number of parasites per one lizard differs in synanthropic locality (60) and in natural landscapes (17). However, more serious infestation of Crimean gecko has noted by Szczerbak, (1960) (220 mites) and was observed by our own data of 1990s (311 mites). The juvenile geckos were found to be infested with a larger number of parasites than adult ones, especially in early spring. This contamination of younger animals is greatly facilitated by the frequentation of communal nests or in the collective wintering shelters (Kukushkin, 2005 b, 2005 c). This distribution was already pointed to geckobian population parasitic on insular geckos (Bertrand, Ineich, 1989). With exception of the newborn lizards, infestation rate is slightly increasing from spring to autumn. The Ayu-Dagh location high level of geckos infestation could be caused by specific abiding in the gabbro-diabase rocks with a few deep fissures, and so large lizard congestion in the shelters and effective transmission of parasites. In most Crimean natural localities geckos inhabit rocks (Jurassic limestone, basalt, volcanic tuff) with numerous fissures and normally they form only small groups in warm period of the year.

Discussion

Geckobia sharygini sp. n. from the Crimean Peninsula is the third species of *Geckobia* recorded from Europe. Two species of *Geckobia* described earlier, *G. latasti* Mégnin, 1878 and *G. loricata* Berlese, 1892, are widespread in Europe. Both are hosted by *Tarentola mauritanica* Linnaeus, 1758, and distributed in Western Europe and North Africa (Haitlinger, 2004), whereas two species (*G. canariensis*, *G. tinerfensis*) were described from Canary Islands (Zapatero-Ramos et al., 1989). In the East Mediterranean Basin, the genera *Ptyodactylus* and *Mediodactylus* are habitual hosts of *Geckobia* species (Bertrand et al., 1999). Parasite of Crimean Kotschy's gecko completes the data on the distribution of the genus *Geckobia* in Europe.

The similarity with the South African species underlines the limits of the groups that separated solely based on leg chaetotaxy. First, when the leg setation is reduced (a very few number of setae by leg segment), and second, when the species are submitted to similar environmental constraints due to the parasitic way of life — a relatively high degree of convergences must be suspected. These considerations denote that in the Old World the barycenter of the distribution of the geckobian with venter scales is clearly African. Three Mediterranean species (*G. turkestana, G. parvulum* and *G. sharygini)* are hosted by Gekkonidae (genus *Mediodactylus*), two species *(G. squamaeum and G. loricata*) are parasite of Phyllodactylidae (*Ptyodactylus* and *Tarentola,* respectively) (table 3). In spite of

Table 3. Host and distribution of mites of the genus *Geckobia* with scale-like ventral setae
Таблица 3. Хозяева и распространение клещей рода *Geckobia* с чешуевидными вентральными щетинками

Species of *Geckobia*	Host	Locus typicus of Geckobia species	Type of distribution of the host
G. loricata	*Tarentola mauritanica* Linneus, 1758 (Phyllodactylidae)	Italy	Western Mediterranean
G. squamaeum	*Ptyodactylus puiseuxi* Boutan, 1893 (Phyllodactylidae)	Israel, Golan plateau and Lake Kinereth surroundings	Eastern Mediterra-nean — Arabian
	P. hasselquistii (Donndorff, 1788) / *P. guttatus* Heyden, 1827 (Phyllodactylidae)	Israel, Negev desert and Sinai Peninsula	Eastern African — Arabian
G. turkestana	*Mediodactylus russowi* (Strauch, 1887) (Gekkonidae)	Turkmenistan	Irano-Turanian (Central Asian)
G. parvulum	*M. kotschyi orientalis* (Štěpánek, 1937) (Gekkonidae)	Israeli-Syrian border, Mt. Hermon	Eastern Mediterranean
G. sharygini sp. n.	*M. kotschyi danilewskii* (Strauch, 1887) (Gekkonidae)	Ukraine, Sothern Crimea	Eastern Mediterranean

suspected high convergence (because of reduced leg setation typical for parasitic mites), it is obvious that the new species is morphologically closest to *G. turkestana, G. parvulum* and *G. loricata*. Except *G. loricata*, the parasite of *Tarentola* (Phyllodactylidae), the two remaining and new one species occur on the hosts from the same Gekkonidae clade, which diverged from pointed before 100 million years ago, in Middle Cretaceous (Gamble et al., 2008 a, b, 2010). So, these three species, *G. turkestana, G. parvulum* and *G. sharygini* sp. n., with scale-like ventral setae, belonging to the same group considering the leg chaetotaxy, occur in and around the area of Ancient Mediterranean Domain of the North Hemisphere and are connected with the monophyletic genus (*Mediodactylus* Szczerbak, Golubev, 1977) sharing a common origin (Macey et al., 2000). The question is how close they are really related, or it is just a convergence due to the arboreal way of life, or due to the scales morphology of the host? If the answer to the first interrogation is yes, is it possible that the group features allow some representative to switch on some new host on which they had have to compete? By a paraphrase of R. Poulin (2007, chapter I) "...we can say that the different parasite lineages can be observed but not their ancestors. By accumulation of observations on different parasite load of hosts, we observe solely the results of experimentations done in the past, but done without our control on the process from the initial hypothesis." In the actual state of knowledge we propose to consider that *G. sharygini* witnesses of the speciation on the mediodactylid complex that differentiated in the Middle and Late Miocene (Kasapidis et al., 2005) more than 10 million years ago in the South-Western Asia and Aegean land massif.

Two competitive hypotheses could be enounced here. The first one is about group of *Geckobia* species that lives on Phyllodactylidae and Gekkonidae and sprang up independently the scale-shaped setae, in different place in the same conditions and the same constraints. The host lizards have similar ecological preferences, and the phenomenon of convergence is quite realistic. The second hypothesis that there was a transmission of the geckobians with scale-like setae from African phyllodactilids to Western Asian mediodactylids. Intergeneric transfer of mites seems to be possible in case of sympatry, symbiotopy and ecological preferences are shared by hosts. That was possible after collision of Arabian and Iranian plates and establishment of steady connection between Africa and Eurasia in Early Miocene (18–19 Mya) when a free exchange between African and Western Asian faunas began (Meulenkamp, Sissingh, 2003; Koufos, Kostopoulos, Vlachou, 2005; Khan, 2009). In modern time a wide superposition of the native ranges of the genera *Mediodactylus* (Gekkonidae) and *Ptyodactylus* (Phyllodactylidae) take place over the enormous territory from the Levante to Pakistan (Červenka et al., 2008; Perera, Harris, 2010), and some sympatric species of *Mediodactylus* and *Ptyodactyus* (*M. kotschyi* and *P. puiseuxi* in the some points of Middle East), for example, mainly in Mediterranean zone (Sivan, Werner, 1992; Disi, 2011) demonstrate a similarity in some aspects of biology: they are mainly diurnal or crepuscular with high selected body temperatures (Arad, Raber, Werner, 1989; Holfert, 1999; Szczerbak, Golubev, 1986 Valachos, 1989; Werner, 1987). In turn, the areas of Phyllodactylidae genera *Tarentola* and *Ptyodactylus* are widely overlapped in North Africa (Jirku et al., 2010; Perera, Harris, 2010). Although the abovementioned genera according to the latest molecular data (Gamble et al., 2008 b) had a common ancestor only in the Upper Cretaceous (about 75 million years ago) and are not too close, they possess high immunological similarity (Joger, 1985; Carranza et al., 2002; Gamble et al., 2011). It is possible that this circumstance contributed to the intergeneric transfer of Geckobians in the Phyllodactylidae that happened in Africa on the early Tertiary.

Key to the genera of Pterygosomatidae based (on females)

Таблица для определения родов семейства Pterygosomatidae (по самкам)

1. Body oval or rounded but longer than wide. Legs relatively long. Femur I with 3 or more setae. Dorsum covered by countable setae. **2**
nondedicated Pterygosomatidae
– Body rounded, as wide as long, or wider than long. Legs relatively short. Femur I with 3 or less setae. Dorsum covered by numerous setae. **5**
highly specialized genera of Pterygosomatidae
2. Companion seta (*ft*) of tarsus I strongly reduced, simple and spiniform, hypostome with a rostral flang. .... *Pimeliaphilus* Tragerdh, 1905 (included some former *Hirstiella* species)
– Companion seta (*ft*) of tarsus I long, sometimes barbed or serrated, hypostome simplified with no rostral rib. **3**
3. Typical dorsal idiosomal setae (*c3*) present medially from postocular (*sci*), no seta on coxa IV, caudal genital setae (*g1*) located on the tip of lobes. .... *Geckobiella* Hirst, 1917 (included some former *Hirstiella* species) *
– No dorsal *c*- seta (*c3*) medially from postocular (*sci*), seta is present on coxa IV, caudal genital setae (*g1*) located on the cuticle (not on lobes). **4**
4. Dorsal caudal setae *h1* long, almost as long as nearby seta *h2.* No solenidion on tarsus I. .... *Bertrandiella* Paredes-Leyn, Klompen and Pérez, 2012
– Dorsal caudal setae *h1* strongly reduced, no more than 1/3 of nearby seta *h2.* Tarsus I with solenidion .... *Tequisistlana* Hoffmann, Sánchez, 1980
5. Dorsal scutum present (entire or divided), eyes clearly expressed, 5 setae on each tibia I to IV .... *Geckobia* Mégnin, 1878
– Dorsal scutum absent, eyes absent or minute, 3, 2, 1, or no setae on tibiae II, III, IV **6**
6. Body roundish, dorsum quite entirely covered by setae .... *Zonurobia* Lawrence, 1935
– Body clearly wider than long. Dorsal setae in two dense patches along the anterior part of lateral margins .... *Pterygosoma* Peters, 1849

* Monotypic genus *Bharatoliaphilus* Prasad 1975 with similar to *Geckobiella* morphological characteristics was established based on just one female found on dove in Nothern India.

Key to some species of *Geckobia* (main groups included the major Mediterranean species) based (on females)

Таблица для определения некоторых видов рода *Geckobia* (основные группы, включая средиземноморские виды) (по самкам)

1. 5 setae on tibiae I–IV. **2**
– 4 setae on tibiae I–III. .... Jack's group 3, South African species (not included in this key)
2. Dorsal genual seta on legs I and IV are absent or strongly reduced.* **3**
– Dorsal genual seta on legs I and IV are present, or only on genu I. **5**
3. No seta on trochanter IV. .... *G. keegani* Lawrence, 1953
– One seta on trochanter IV. **4**
4. Genua I and IV without setae. .... *G. bataviensis* Vitzthum, 1926 (= *G. gleadovania* Hirst, 1926)
– Not as above, femur I with two setae. .... *G. oedurae* Lawrence, 1936
5. Three setae on femur I. **6**
– Two setae on femur I. **11**
6. One seta on femur III, one or two setae on femur IV. **13**
– Not one seta on femur III and two setae on femur IV. **7**
7. Genu I without setae. .... *G. diversipilis* Hirst, 1926

– One seta on genu I. **8**
8. No setae on genu IV. **9**
– One seta on genu IV. **10**
(Jack's group1, primitive leg chaetotaxy)
9. Dorsal body setae are similar in shape. .... *G. indica* Hirst, 1917
– Anterior dorsal body setae are short and the posterior setae are long. .... *G. ianocellatus* Bochkov, Mironov, 2000
10. No scale-like setae on ventral surface. .... Jack's group 1, part of species (out of this key table) **
– Central ventral surface covered with scale-like setae. **15**
(Jack's group 1, species with ventral scale-like setae)
11. Genual setae formula (1–0–0–1). **12**
– Genual setae formula not like above — (1–0–0–0), or (0–0–0–1), or (0–0–0–0) Jack's group 2, some of Australian species (not included in this key) ***
12. Only one seta on femora II but two on femora III. Femoral setae formula (2–1–2–2). .... *G. simplex* Hirst, 1926
– One or two setae on both femora II–III. Femoral setae formula (2–2–2–2) or (2–1–1–2). **13**
13. There are scale-like setae on venter. **14**
– Ventral setae not strongly modified. .... *G. simplex* Hirst 1926, on Phyllodactylidae
14. Legs I–IV with only 4 tibial setae. .... Jack's group 3, South African species (out of this key table) ****
– Leg I with five tibial setae. **15**
15. Dorsum densely covered by setae, but lateral fields of dorsum preserved. ...... *G. turkestana* Hirst, 1926
– Dorsum well covered by setae, included lateral parts. **16**
16. Two femoral setae on leg I as well as on legs II–IV. .... *G. squamaeum* Bertrand, Paperna, Finkelmann, 2000
– Three femoral setae on leg I, two femoral setae on legs II–IV. **17**
17. Reduced seta *alm* on tarsus I. .... *G. parvulum* Bertrand, Paperna, Finkelmann, 2000
– Tarsal setae *alm* of leg I well developed. **18**
18. Seta *tlm* present on tarsus I, 4 (sometimes 5) setae in separated group between coxae II and III. .... *G. loricata* Berlese, 1892
– Seta *tlm* absent on tarsus I, between coxae II and III 5 or more setae continuously placed with ventrolateral short setae. .... *G. sharygini* sp. n.

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* Some species exhibit a "vestigial" seta, reduced in size and hardly visible, though they were counted as species with atrichose genu by Jack (1964) i. e. *G. keegani* or *G. bataviensis.*

** Included *G. boulangeri* with 3 setae on femora I and II.

*** Included Diplodactylidae parasites, and *G. manzanelli* on *Phyllurus cornutus.*

**** Included South African species that are not correspond to Jack's group 3, like *G. australis* Hirst, 1917.

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