

## Re-description of the genus *Nganasania* Zherikhin, 1977 from Upper Cretaceous of Taimyr (Coleoptera: Cryptophagidae)

### Переописание рода *Nganasania* Zherikhin, 1977 из верхнего мела Таймыра (Coleoptera: Cryptophagidae)

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КЛЮЧЕВЫЕ СЛОВА: таксономия, Cryptophagidae, *Nganasania*, верхний мел, таймырский янтарь, Россия

ABSTRACT. A re-description of the genus *Nganasania* known from the Upper Cretaceous is given. The inclusion of the genus in the subfamily Atomariinae was confirmed. The key for distinguishing close genera of the subfamily is given. *Nganasania* belongs to the group of atomariine genera, which is characterized by tibia with apical spurs, tarsal formula 5-5-5, mostly broadly-oval shape of the body, metasternum without a median longitudinal line, and prosternal process with parallel lines in sides: *Ootypus*, *Tisactia*, *Curelius*, *Ephistemus*.

РЕЗЮМЕ. Приводится переописание известного из позднего мела рода *Nganasania*. Подтверждена принадлежность рода к подсемейству Atomariinae. Приводится ключ для различения близких родов подсемейства. *Nganasania* относится к группе родов Atomariinae, характеризующихся следующими признаками: голени с апикальными шпорами, формула лапок 5-5-5, форма тела широко-овальная, заднегрудь без срединной продольной линии, вырост переднегруды с параллельными линиями по бокам: *Ootypus*, *Tisactia*, *Curelius*, *Ephistemus*.

#### Introduction

The family Cryptophagidae has about 60 genera and 1000 described species. The Cryptophagidae are distributed in all biogeographic realms. The present-day representatives of this group occupy various cryptic forest habitats (litter, decomposing wood, burrows and nests of animals); they feed primarily on mold fungi, rarely on plant shoots.

Mesozoic records of Cryptophagidae are quite rare. Oldest is *Atomaria cretacea* from Lower Cretaceous of southern China [Cai, Wang, 2013]; the paper includes a brief overview of all other fossil Cryptophagidae.

*Microticus khatanga* Lyubarsky et Perkovsky [Lyubarsky, Perkovsky, 2015] was described based on an inclusion in Upper Cretaceous (Santonian) amber from Taimyr (Russia). This genus belongs to the tribe Cryptophagini. Attributed to the same tribe are the newly described *Ennoticus mnemosynon* Lyubarsky et Perkovsky, 2017 (Upper Cretaceous (Santonian) amber from Taimyr, Russia). The newest Cretaceous cryptophagid *Albocryptophagus cantabricus* described based on a fossil specimen from the Lower Albian El Soplao amber deposit (Spain) [Peris et al., 2017]. This genus belongs to the tribe Cryptophagini.

In this paper, we re-describe *Nganasania khetica* Zherikhin, 1977 from the Late Cretaceous of Taimyr amber (Russia).

The relationship of this genus with other genera of the family has not been established so far, not was it included in the revision of the family [Leschen, 1996], so its position in the family is unclear. The second species of the genus *Nganasania*, *N. taymyrica* Lyubarsky et Perkovsky, 2014 differs from *N. khetica* in shape of pronotum, weakly narrowed anteriorly in the new species, in less long elytra, and shorter body.

#### Material and methods

The type specimen *N. khetica* is poorly preserved; this was noted in the original description. The retinite was muddy, and the specimen was very poorly visible. The specimen was stored in castor oil, and then in sugar solution (to see the features of the specimen better, as sugar solution has different optical indices than castor oil). The sugar has crystallized over the past decades. We tried to wash it in warm water, but not all the sugar has dissolved, and part of sugar crystals was not separated from the castor oil and the retinitis. Besides, the

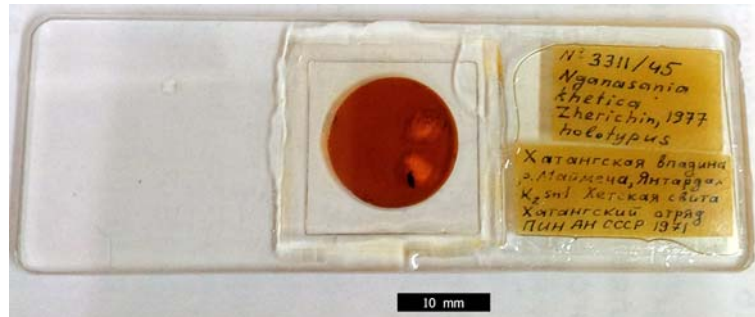


Fig. 1. Holotype of *Nganasania khetica*.

Рис. 1. Голотип *Nganasania khetica*.

petrified specimen partially separated from the retinitis, which made the sample very brittle and does not allow it to be treated mechanically without damaging it.

For this study, the specimen was put in the original marple syrup, but transferred into a two-sided container. The container is a 1.5 mm-thick piece of plexiglass with a 1 cm circular aperture, bottomed and covered with two coverslips, each ringed with Buehler's EpoThin epoxy resin (Fig. 1). The original label, which has become very brittle, is also covered with a coverslip and glued to the container with EpoThin.

The morphological notation is as given by Leschen [Leschen, 1996].

Photographs were taken at the Paleontological Institute, Russian Academy of Sciences (PIN PAS) in Moscow by Alexandr P. Rasnitsyn using a Leica M 165 microscope and Leica DFC 425 camera.

## Taxonomical part

### Family Cryptophagidae Kirby, 1826

The specimen belongs to family Cryptophagidae. The specimen has characteristic features of the family: antenna 11-jointed with 3-jointed club; fore coxal cavities open posteriorly; converging coxae; incomplete epipleuron; presence of two spurs on fore tibiae; tarsal formula 5-5-5; tarsi without lobes; elytra completely covering the abdomen, with confused punctation.

The specimen is partially obscured by the opacities in the resin, so some details of the structure can not be determined.

### *Nganasania* Zherikhin, 1977 Figs 2–6.

TYPE SPECIES. *Nganasania khetica* Zherikhin, 1977. Upper Cretaceous of Taimyr.

INCLUDED SPECIES: *Nganasania khetica* Zherikhin, 1977; *Nganasania taymyrica* Lyubarsky et Perkovsky, 2014.

DESCRIPTION. Body broadly elongate, slightly flattened dorsoventrally, unicolorous, testaceous, elytra with fine hairs (Fig. 3).

Head considerably narrower than pronotum, transverse. Eyes normal, rounded, well development, moderately convex, with small facets. Temporal ridge absent, temples absent. Head not constricted behind the eyes. Antennae freely attached to anterior part of frons in front of eyes, rather long and thick, reaching humeral tubercles of elytra. The antenna

is inserted near eye, the distance between antennal insertions greater than the distance between insertion and eye. Antennal insertion forms a concavity which is smaller than the diameter of the 1<sup>st</sup> joint (Figs 2, 4). Ridge surrounding antennal concavity absent. Antennal club loose, 3-segmented (Fig. 5). Boss on front of head absent. Frontoclypeal suture present. Clypeus in the same plane as that of frons. Tubercles on margin of frons absent. Subgenal spine absent. Gular suture

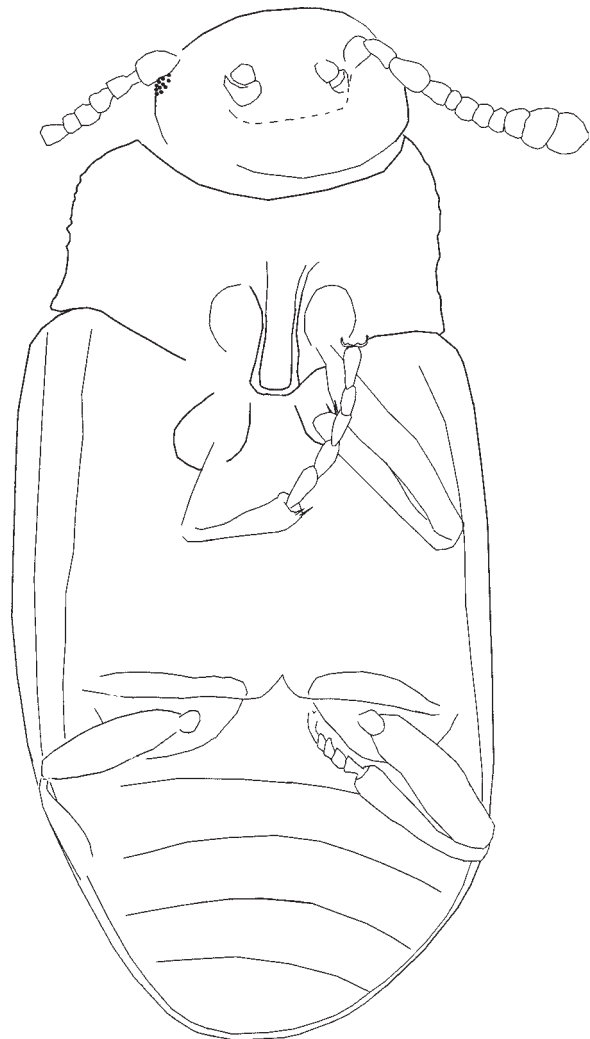
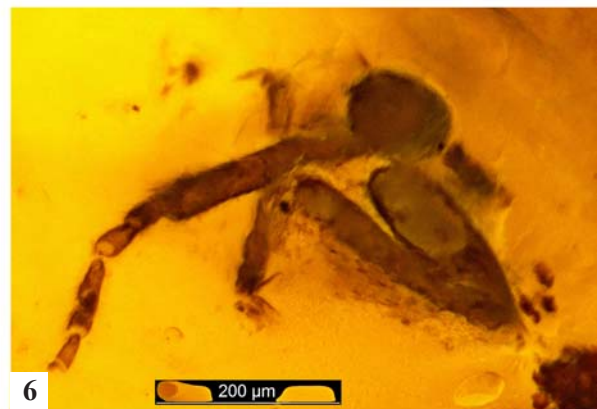
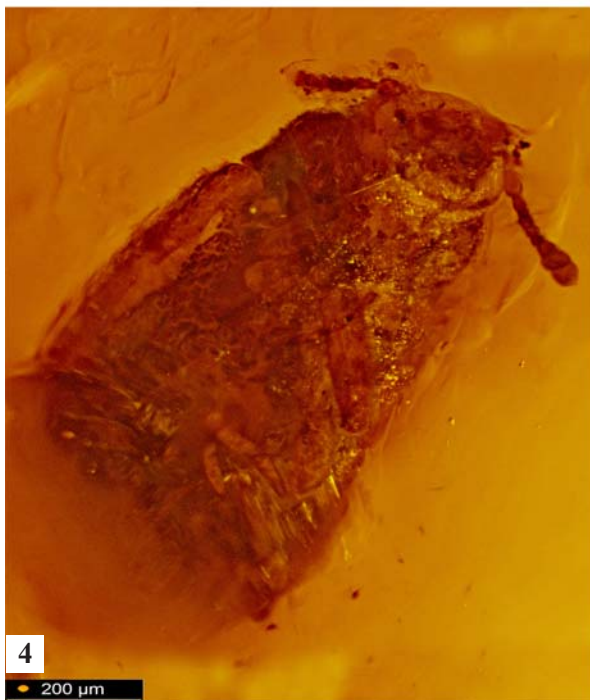
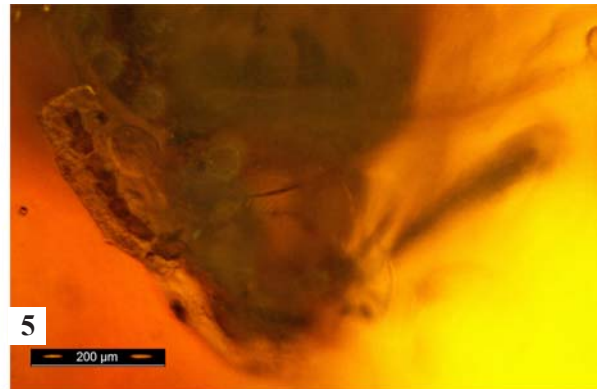
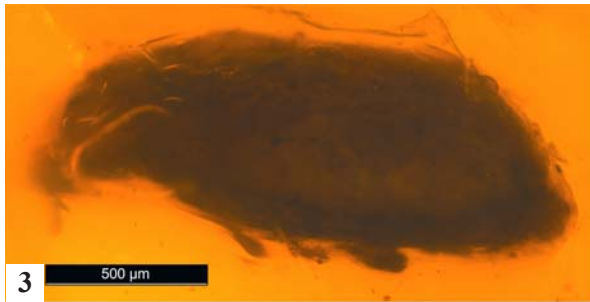


Fig. 2. Line drawings of *Nganasania khetica*.

Рис. 2. Рисунок *Nganasania khetica*.



Figs 3–6. Photo of *Nganasania khetica*: 3 — dorsal view; 4 — ventral view; 5 — head and antennae; 6 — tarsi.

Рис. 3–6. Фото *Nganasania khetica*: 3 — сверху; 4 — снизу; 5 — голова и усики; 6 — лапки.

not visible in available material. Width of labial palpomere 1 greater than that of palpomere 2. Antennal grooves on head and prosternum absent.

Pronotum strongly transverse, 1.7 times as wide as long, in lateral view appearing to form a common flat arc with elytra, not delineated from the latter by a depression. Sagittal view archlike, with common convexity of pronotum and elytra, pronotum in a total arc with elytra, without decrease. Sides of pronotum almost parallel in posterior half, converging anteriorly, not explanate, without denticles or projections. Pronotum widest at the base; its base weakly bisinuate. Pronotum lacking discrete lateral margin. Disk of pronotum with smooth ornamentation, without keel or depression; basal depression absent. Median fold absent. Pronotal bead absent. Basal pits of pronotum absent. Scutellum large, equal in length and width, flat, pentagonal, not punctured.

Prothorax with long prosternal process, prosternal process with parallel lines and punctured, not vaulted, cut in top. Prothorax in front of procoxae short, approximately equal to length of prosternal process. Punctuation in the prosternal area present. Lines on the prosternal process absent. Transverse pits on the prosternum not visible in available material. Antennal grooves on the hypomeron absent. Forecoxal cavities open posteriorly. Forecoxae transverse, projecting, closely convergent.

Mesothorax short, sloping backward, but not vertically. Mesepimeron and mesepisternum not fused. Lateral closure of the mesocoxa by the metasternum present. Parallel line of mesosternum not visible in available material. Width of mesosternal process equal to width of mesocoxa and equal to width of prosternal process in top. Middle coxae strongly convergent, rounded. Width of submesocoxal bead narrow. Metasternum long, approximately equal to combined length of head and prothorax, punctured. Metasternal pit below mesocoxa not visible in available material. Longitudinal line of metasternum absent. Metacoxae small, triangular. Metasubcoxal lines absent.

All trochanters large. Femora moderately thickened. Tibiae slender, straight, equal in length to femora. Foretibiae and mesotibiae apically with two slender indistinct spurs. Tarsal formula 5-5-5. First four segments of tarsi identical in shape, simple, not lobed (Figs 2, 6). 5<sup>th</sup> tarsomere of foretarsus long, a little longer to the preceding tarsomere. Claws simple, slender and short, claw with notch.

Elytra almost parallel-sided, basally slightly wider than pronotum, with slightly projecting shoulders, without tooth, posteriorly bluntly tapering, fully covering abdomen. Subapical gape of elytra present. Punctuation confused; punctate stria on elytron absent. Presutural row of punctures not visible in available material. Epipleura of elytra developed in basal half, rather wide, disappearing further on.

Abdominal sternites weakly convex; ventrite 1 longer than each of the remaining ventrites; third and fourth sternites of same length. Ventrite 5 flat, evenly arcuate, with longitudinal groove.

*Nganasania khetica* Zherikhin, 1977

**MATERIAL:** Holotype. PIN, No. 3311/45, inclusion of an entire beetle in fossil resin (retinite); partially hidden by detritus and opacities in the resin. Therefore, it was not possible to identify some structural details (particularly of the ventral side). Sex could not be determined. Krasnoyarskiy Krai: Taimyrsky (Dolgano-Nenetsky) District: Taimyr Peninsula: right bank of the Maimecha River 3 km upstream from its confluence with the Kheta River (a left tributary of the Khatanga River), Yantardakh Hill (Yantardakh locality) [71.307222°N, 99.562778°E]. Upper Cretaceous, Santonian, Khetta formation.

**DESCRIPTION.** Body unicolorous, elytra with short and fine pubescence. 1<sup>st</sup> antennal segment elongate, thickened, twice as long as wide, longer and broader than 2<sup>nd</sup>. 2<sup>nd</sup> segment slightly thinner than 1<sup>st</sup>, three-fourths the length of the latter; 3<sup>rd</sup> segment considerably longer than wide, up to 2x the length of the antennomere 4; the following four segments similar, more or less cylindrical, of same thickness but considerably shorter than 3<sup>rd</sup>, equal in length and width. Longest segment of flagellum: 3<sup>rd</sup>, shortest: 5<sup>th</sup>. 8<sup>th</sup> segment of same length and width as preceding segments, almost spherical. 9<sup>th</sup> twice as wide as 8<sup>th</sup>, equal in length and width, almost square shaped; 10<sup>th</sup> slightly wider than 9<sup>th</sup>, equal in length and width, slightly broadening apically. 11<sup>th</sup> slightly narrower than 10<sup>th</sup>, slightly longer, symmetrical, pointed apically.

Pronotum transverse, weakly shagreened. Anterior angles of pronotum straight, not projecting, anterior edge without depression. Posterior angles right, slightly projecting laterally. Metathorax with strong punctures. First four segments of tarsi slightly longer than wide.

Elytra three times as long as pronotum, with fine punctures and weak shagreening. Lower side of body with similar ornamentation.

Body length 2.0 mm.

## Discussion

As already reported [Lyubarsky, Perkovsky, 2014], the genus belongs to the subfamily Atomariinae. The genus *Nganasania* differs from other genera of Atomariinae by frons without tubercle, arcuate shape of sagittal section, depressions at the base of pronotum absent, lateral pronotal margin unmodified, pronotal carina absent, tibia slender, with apical spines, elytral surface covered by decumbent pubescence, rather long epipleuron. According to this set of characters, *Nganasania* belongs to the tribe Atomariini.

Zherikhin [1977] believed the genus to be very close to the extant genus *Ootypus* Ganglbauer, differing in pubescent integument. Zherikhin also believed that the genus resembled *Atomaria* Stephens, differing in the lack of a drop-off between the pronotum and elytra, and by the pronotum not narrowing posteriorly. The character “pronotum not narrowing posteriorly” is inappropriate, because it is present in many *Atomaria*, especially in the subgenus *Anchicera*.

The character “last abdominal sternite with longitudinal groove” is not known in other genera of Cryptophagidae (excluding a slightly similar structure in *Myrme-*

*dophila* Bousquet from subfamily Cryptophaginae). This character is not visible in *Nganasania taymyrica*.

The two species of the genus *Nganasania* differ by size of body (*N. taymyrica* much shorter), shape of posterior angles of pronotum (*N. taymyrica* with rounded angles, *N. khetica* with acute angles), shape of tarsomeres (*N. taymyrica* with short tarsomeres, *N. khetica* with long tarsomeres).

When compared with other genera of Cryptophagidae and characters of the second species from the genus *Nganasania*, the following changes were made in the diagnosis of the genus: eyes normal in size; eyes with small facets; head not constricted behind the eyes; antennal insertion forms a concavity which is smaller than the diameter of the 1st joint; ridge surrounding antennal concavity absent; boss on front of head absent; clypeus in the same plane as that of frons; tubercles on margin of frons absent; subgenal spine absent; antennal grooves on head and prosternum absent; pronotum strongly transverse; median fold of pronotum absent; pronotal bead absent; basal pits of pronotum absent; scutellum not punctured; prothorax with long prosternal process, prosternal process with parallel lines and punctured, not vaulted, cut in top; prothorax in front of procoxae short, approximately equal to length of prosternal process; punctuation in the prosternal area present; lines on the prosternal process absent; mesepimeron and mesepisternum not fused; lateral closure of the mesocoxa by the metasternum present; width of mesosternal process equal to width of mesocoxa and equal to width of prosternal process in top; width of submesocoxal bead narrow; metasternum approximately equal to combined length of head and prothorax, punctured; longitudinal line of metasternum absent; metasubcoxal lines absent; claw of tarsi with notch; ventrite 5 with longitudinal groove.

In the description of the genus are some characters that are not visible in the type-species. These characters can be seen of the species *N. taymyrica*. It's the following characters: antennal insertion, frontoclypeal suture, boss on front, clypeus relative to the frons, width of labial palpomere, width of mesosternal process, width of submesocoxal bead, longitudinal line of metasternum, metasubcoxal lines. A detailed study *N. khetica* allowed to find important characters: length and structure of prosternal process, spurs in foretibiae and mesotibia, structure of ventrite 5.

Among the other genera of Cryptophagidae, the genus *Nganasania* is distinguished by several characters. Below we give the key to the differences of several genera from the subfamily Atomariinae. Atomariinae, tibia with apical spurs, tarsal formula 5-5-5, shape of body broadly-oval, and metasternum without a median longitudinal line: *Ootypus*, *Tisactia*, *Curelius*, *Ephistemus*, *Nganasania*.

1. Lateral view archlike, with common convexity of pronotum and elytra, pronotum in a total arc with elytra, without decrease. Body form round and convex. .... 2
- Lateral view not archlike, without common convexity of pronotum and elytra, pronotum not in a total arc with elytra,

- with decrease. Body form convex, parallel-sided. 2<sup>nd</sup> antennal segment conical and curved. N America *Tisactia*
2. Body bald, prosternal process without parallel lines in sides. Palaearctic (all Europe, Caucasus, W Siberia) ....  
..... *Ootypus*  
— Body covered by hairs, prosternal process with parallel lines in sides ..... 3
3. Antennal grooves present. Width of mesosternal process greater than mesocoxa. Tarsomeres slightly lobed. North Africa, all Europe, Caucasus, Asia Central, Russia (Siberia, Far East), Mongolia, China, Himalaya (Pakistan, India, Nepal), N America (USA), C America (Guatemala), New Zealand) ..... *Ephistemus*  
— Antennal grooves absent. .... 4
4. Tarsomeres slightly lobed. Width of mesosternal process greater than that of mesocoxa. Epipleuron present to the level of posterior margin of the metasternum. Holarctic, Oriental, Afrotropical, Neotropics (Africa N, all Europe, Caucasus, Asia C, tropical Africa, India, Bhutan, Nepal, China, N Korea, Japan, Indonesia, Malaysia, Thailand, N America (USA), C America, S America (Brazil)) .....  
..... *Curelius*  
— Tarsomeres without lobes. Width of mesosternal process equal to mesocoxa. Epipleuron reaching beyond the level of posterior margin of the metasternum .... *Nganasania*

Subfamily Atomariinae divided into three tribes — Atomariini, Cryptafricini and Hypocoprini [Leschen, 1996]. Tribe Atomariini consists of two branches, one includes taxa that are close to the genus *Atomaria*. The other branch includes *Ootypus*, *Tisactia*, *Ephistemus*, *Curelius*. Diagnosis of the tribe Atomariini included: frons without tubercle, pronotal bead present, prosternum short in front of coxa, tibia with apical spurs. A group of genera, which had previously been allocated to the tribe Ephistemini and now with the addition of genus *Tisactia* included in the tribe Atomariini, is characterized by the mostly broadly-oval shape of the body, frons without tubercle, width of palpomere 1 is greater than that of palpomere 2, pronotum with lateral margin unmodified, prosternum short in front of coxa, procoxal cavity externally open and internally, metasternum without a median longitudinal line, and tibia with apical spurs. The group with these characteristics (*Ootypus*, *Tisactia*, *Curelius*, *Ephistemus*, *Nganasania*) a well-defined group of genera. These genera are ecologically similar, and distribution.

*Curelius* diet: mycetophagous, fungal spores and hyphae; habitat: rotting vegetation (the river sediment, salt marshes, on shore among algae, under the straw, under the bark, under the rotten leaves), mammal dung (in semi-dry cow dung, dung of rabbits). *Ephistemus* diet: mycetophagous, fungal spores and hyphae; habitat: rotting vegetation (in compost, rotten hay, fallen leaves, in the sediment of algae), mammal dung (the straw with the dung of rabbits), nests (nests of rodents, birds). *Tisactia* diet: mycetophagous, fungal spores and

hyphae, habitat: rotting vegetation, leaf litter. *Ootypus* diet: mycetophagous, fungal spores and hyphae. Habitat: rotting vegetation (forest litter), large mammal dung (manure of moose).

All of these genera (*Ootypus*, *Tisactia*, *Curelius*, *Ephistemus*) are mycetophagous, habit in rotten vegetation, leaf litter, and mammal dung. All four genera are known from microthermal Holarctic habitats, and only one widely distributed in tropical regions. It is possible that most part of evolution of this group take place in the temperate regions of Northern Hemisphere, at least since Santonian.

Thus, there are three known Cretaceous genera from the subfamily Cryptophaginae, all three belong to the tribe Cryptophagini and all three belong to extinct genera. From the subfamily Atomariinae two genera with three species are known from Cretaceous, the extant genus *Atomaria* and the extinct genus *Nganasania*. All Late Cretaceous taxa are described from Yantardakh Lagerstätte.

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