

## New Aradidae in Mesozoic Burmese Amber (Hemiptera, Heteroptera)

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(With 13 figures)

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### Abstract

Two new genera and species of the flat bug family Aradidae in Burmese Amber, *Myanmezira longicornis* nov. gen., nov. spec. belonging to the extant subfamily *Mezirinae* and *Microaradus anticus* nov. gen., nov. spec. assigned to the fossil subfamily *Archaearadinae* respectively, are described and illustrated. They are compared with the two genera thus far described from Burmese Amber as well as with related extant taxa.

**Keywords:** Burmese amber, Mesozoic, Aradidae, Mezirinae, Archaearadinae, new taxa

### Zusammenfassung

Bisher sind nur zwei Gattungen mit je einer Art von Rindenwanzen der Familie Aradidae aus Burmesischem Bernstein bekanntgeworden. Hier werden nun zwei weitere Gattungen mit je einer Art beschrieben, von denen *Myanmezira longicornis* nov. gen., nov. spec. in die rezente Unterfamilie *Mezirinae* und *Microaradus anticus* nov. gen., nov. spec. in die fossile Unterfamilie *Archaearadinae* gestellt und mit den aus Burmesischem Bernstein beschriebenen fossilen und verwandten rezenten Taxa verglichen werden.

**Schlüsselwörter:** Burmesischer Bernstein, Mesozoikum, Aradidae, Mezirinae, Archaearadinae, neue Taxa

### Introduction

The flat bug fauna of the Mesozoic (Upper Cretaceous) Burmese amber deposits has been little studied (GRIMALDI et al. 2002). Only two genera and species were described

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to date: the first one was *Archaearadus burmensis* HEISS & GRIMALDI, 2001 for which the subfamily *Archaearadinae* HEISS & GRIMALDI, 2002 was later erected; the second one, *Cretopiesma suukyiae* GRIMALDI & ENGEL, 2008, was originally placed in the family *Piesmatidae*, however it was later recognized as belonging to the *Aradidae* by CASSIS & SCHUH, 2010 in their excellent cladistic study of Heteropteran phylogeny.

In the present study, two additional genera and species, *Myanmezira longicornis* nov. gen., nov. spec. belonging to the extant subfamily *Mezirinae* OSHANIN, 1908 and *Microaradus anticus* nov. gen., nov. spec. assigned to the fossil subfamily *Arachaearadinae* are described and illustrated.

## Material and Methods

Burmese Amber is of Upper Cretaceous age, probably from the Turonian or Cenomanian (90–100 Ma) (GRIMALDI et al. 2002). As the locality of origin of the treated inclusions is unknown but most probably from Kachin Province in Northern Myanmar, no further stratigraphic informations are available.

This study is based on material belonging to and deposited in the collections of the authors' institutions.

The type repositories are as follows:

CEHI Collection Ernst Heiss, Tiroler Landesmuseum, Innsbruck, Austria

CGPC Collection George O. Poinar Jr., Oregon State University, Corvallis, USA

Measurements were taken with a micrometer eyepiece and are given in millimetres.

Abbreviations: deltg = dorsal external laterotergite (connexivum), mtg = medio-tergite, vltg = ventral laterotergite; ptg = paratergite; PT = paratype.

## Systematic Palaeontology

Order Hemiptera LINNÉ, 1758

Suborder Heteroptera LATREILLE, 1810

Infraorder Pentatomomorpha LESTON, PENDERGRAST & SOUTHWOOD, 1954

Family Aradidae AMYOT & SERVILLE, 1843

Subfamily Mezirinae OSHANIN, 1908

*Myanmezira* nov. gen.

**Type species:** *Myanmezira longicornis* nov. spec.

**Etymology:** Refers to Myanmar (Burma) the country of origin and *Mezira*, the type genus of the subfamily Mezirinae.

**Diagnosis:** Distinguished from all extant genera of Oriental-Australian Mezirinae by the following set of characters:

- small size, not reaching three mm
- long clypeus
- long antennae with segment II longest
- open rostral atrium
- midlateral apodemal impressions (glabrous areas of USINGER & MATSUDA 1959) included in tergal plate
- spiracle II obsolete, III-VIII lateral
- claws with distinct pulvilli

**Description:** Macropterous, small, less than three mm; body elongate subparallel, surface of head pronotum and scutellum with irregular rugose structure and small deep punctures.

**Head:** Distinctly longer than wide, clypeus longer than genae, reaching apex of antennal segment I; antenniferous lobes short, antennae long and slender about 2.6× as long as width of head; segment I shortest and thickest, II longest, III shorter than II, IV shorter than III; rostrum arising far from apex of clypeus, rostral atrium open, length of rostrum not exceeding head.

**Pronotum:** About twice as wide as long, lateral margins sinuate, converging anteriorly, anterolateral angles rounded; disk with two (1+1) posteriorly diverging ridges on anterior lobe, posterior lobe raised.

**Scutellum:** Triangular, wider than long, disk with longitudinal median carina.

**Hemelytra:** Base of corium wider than pronotum, clavus small but distinct; membrane reaching 1/2 of tergite VII, no veins discernible.

**Abdomen:** Ovate, lateral margins evenly rounded without projections, pattern of apodemal impressions 2:2:1 (as typical for Mezirinae).

**Venter:** Under surface of prosternum carinate at middle, depressed and flat on meso- and metasternum, their lateral parts rugose and punctured; spiracles II not discernible, III-VII lateral, VIII terminal on ptg VIII.

**Legs:** Long and slender, trochanters fused to femora but with distinct fusion suture; tarsi two-segmented, claws with pulvilli.

**Discussion:** There are only few genera of extant Oriental-Australian Mezirinae genera with macropterous species of such small size and midlateral apodemal impressions included in tergal plate, but none of them shares the long produced clypeus and the slender antennae with segment II longest (USINGER & MATSUDA 1959; KORMILEV 1971; KORMILEV & FROESCHNER 1987).

*Arbanatus* KORMILEV, 1955 (5 spp.) has a closed rostral atrium, shorter and thicker antennae, membrane with veins, anterolateral angles of pronotum angulate and projecting anteriorly and spiracles II lateral.

*Clavicornia* KORMILEV, 1960 (4 spp.) shares these characters with *Arbanatus* but has a shorter clypeus not longer than antenniferous lobes and lacks the veins on membrane.

*Glochocoris* USINGER & MATSUDA, 1959 (26 spp.) has also a closed rostral atrium, short and stout antennae, clypeus only as long as antenniferous lobes and membrane with veins.

*Chiastoplonia* CHINA, 1930 (15 spp.) seems to be the closest related genus due to similar habitus, open rostral atrium and rounded anterolateral angles of pronotum, however, spiracles II are lateral, antennae are short and stout with segment III longest and clypeus not longer than antenniferous lobes.

***Myanmezira longicornis* nov. spec.**

(Fig. 1)

**Holotype:** Male in a honey coloured transparent piece of Burmese Amber (10 × 7 × 4.5 mm); dorsal and ventral side are visible; right part of pronotum, scutellum and median part of abdomen depressed; left eye displaced anteriorly. It is designated as holotype and deposited in the collection of G.O. POINAR (CGPC).

**Etymology:** Referring to the long slender antennae of this species.

**Description:** Head: Longer than wide across eyes (0.47/0.35 mm = measured right half × 2); clypeus long and thin, dorsally forming an elevated granulate ridge, reaching apex of antennal segment I; genae shorter with acute apices, antenniferous lobes short and blunt, lateral margins subparallel; antennae thin and slender 2.64× as long as width of head, segment I shortest and stoutest, II twice as long as I tapering toward base, III shorter than II and also tapering posteriorly, IV shorter than III fusiform with pilose apex; length of segments I/II/III/IV = 0.15/0.30/0.25/0.22 mm; eyes (only right one in original position) inserted in head, protruding laterally; postocular lobes rounded; vertex elevated along midline depressed laterally; rostrum arising far behind apex of clypeus, rostral atrium open, rostral groove distinct, length of rostrum not exceeding head.

**Pronotum:** About twice as wide as long (0.92/0.45 mm); lateral margins sinuate converging anteriorly toward round anterolateral angles; anterior lobe of disk medially with two posteriorly diverging elevated ridges, their surface with deep punctures, depressed between and laterally; posterior lobe roundedly elevated (left half); humeri subparallel and carinate.

**Scutellum:** Wider than long (0.47/0.32 mm), triangular with straight carinate lateral margins and rounded apex; disk with median longitudinal carina, transversely rugose laterally.

**Hemelytra:** Base of corium laterally expanded with subparallel sides, longer than scutellum; clavus small, triangular; membrane without visible veins covering ½ of tergite VII.

**Abdomen:** Lateral margins evenly rounded without angular projections, posterior margin widely rounded; midlateral apodemal impressions included in tergal plate and

covered by hemelytra; pygophore small and globose, projecting over posterior abdominal margin, surface with a thin median ridge on dorsal side; paratergites VIII thin and small, reaching  $\frac{1}{2}$  of pygophore.

**Venter:** Prosternum with median elevation, meso- and metasternum depressed at middle, pleural parts rugose and deeply punctured; metapleural scent gland structure not discernible; sternites II+III fused, the following ones separated by transverse sutures, their surface with fine punctures.

**Legs:** Long and slender, femora moderately incrassate and tapering toward base and apex, trochanters fused to femora but fusion line is distinct; tibiae cylindrical thinner than femora; tarsi with short first and longer second segment, claws with curved pulvilli.

**Measurements:** Length 2.8 mm (including pygophore); width of abdomen 1.2 mm.

Subfamily Archaearadinae HEISS & GRIMALDI, 2002

*Microaradus* nov. gen.

**Type species:** *Microaradus anticus* nov. spec.

**Etymology:** Refers to the very small size of this genus.

**Diagnosis:** Small sized species of *Aradus*-like habitus with very long clypeus, areolate thorax and hemelytra, and four longitudinal pronotal carinae.

**Remarks:** Two genera of Aradidae with one species each are described so far from Burmese Amber from which *Microaradus* is distinguished by the following characters:

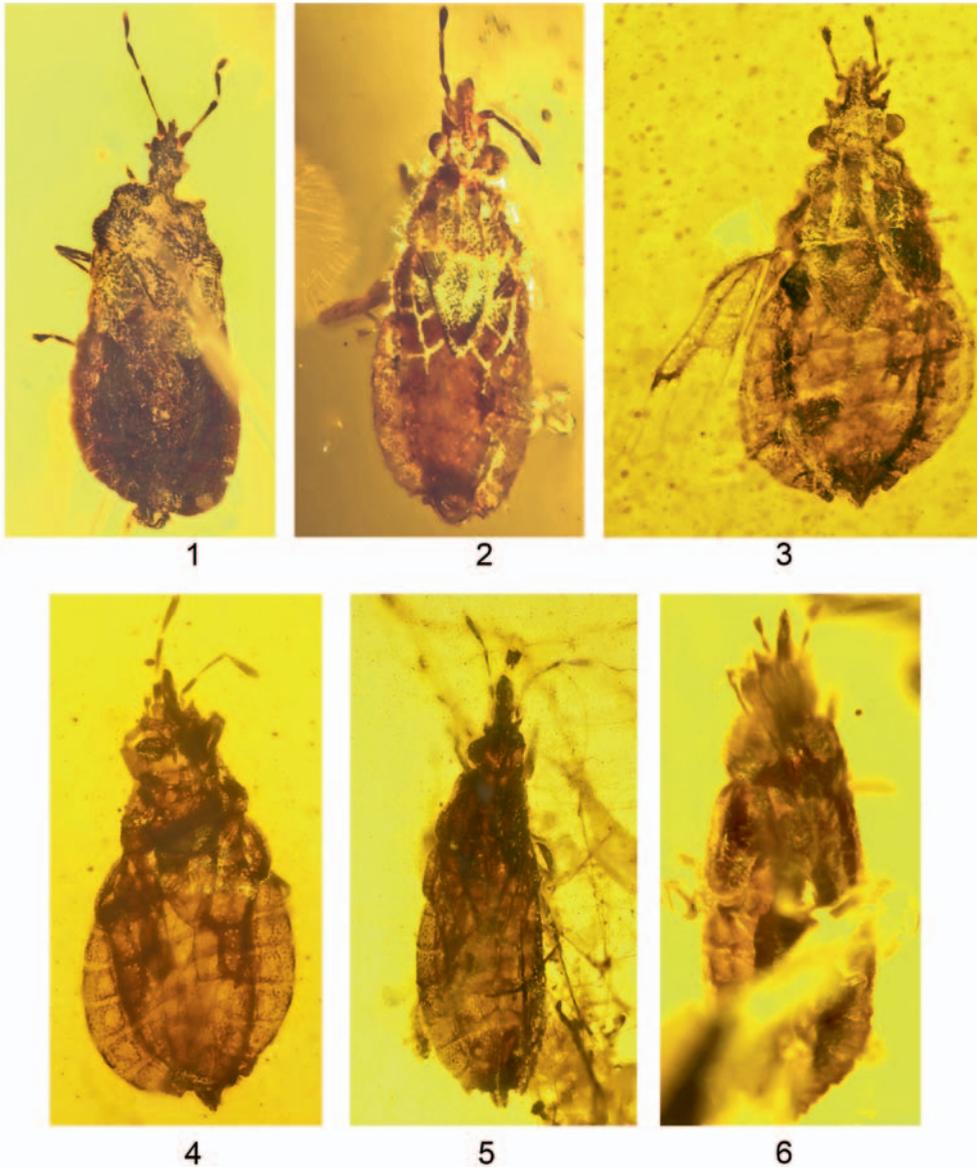
*Archaearadus burmensis* is much larger (F 5.1 mm, M 3.85 mm), has long postocular lobes, lateral margins of pronotum nearly straight and beset with spines, disk of pronotum with 2 longitudinal carinae, deltg II-VII with lateral expansions in male (HEISS & GRIMALDI 2001, 2002).

*Cretopiesma suukyiae* is distinctly smaller (F 1.45 mm), disk of pronotum with only two longitudinal carinae, the lateral margins less sinuate and spiracles II-V situated dorsally on deltg II-V.

**Description:** Macropterous, small, less than three mm; surface of pronotum with smaller deep punctures or areolae, those of corium are more shallow and larger.

**Head:** Longer than wide across eyes, clypeus long and tapering toward apex reaching at least base of antennal segment III; antenniferous lobes acute; antennae about 1.7× as long as width of head, segment I and II short and thicker than III and IV, III longest; eyes large, protruding, postocular lobes rounded; rostrum arising well behind apex of clypeus from an open atrium, about as long as head.

**Pronotum:** Wider than long, lateral margins sinuate and attenuated anteriorly, disk with four distinct longitudinal veins.



Figs 1–6. 1: *Myanmezira longicornis* nov. gen. et spec.; 2–6 *Microaradus anticus* nov. gen. et spec.: 2: holotype male; 3: paratype PT1 female; 4: paratype PT2 female; 5: paratype PT3 female; 6: larval stage V.

**Scutellum:** Triangular, longer than wide, lateral margins carinate, disk with median longitudinal carina depressed posterolaterally.

**Hemelytra:** Corium with carinate veins, depressed between veins and deeply punctured, transverse veins Cu-R+M and Cu-A developed; membrane hyaline with four thin veins.

**Abdomen:** Elongate ovate in male, wider and more rounded in female; tergites II-VII separated by transverse sutures; deltg II-VII flat with evenly rounded lateral margins.

**Venter:** Pro-, meso- and metasternum flat at middle; sternite II-VII separated by transverse sutures without median longitudinal sulcus; pattern of apodemal impressions hardly visible but seemingly 2:1:1; position of spiracles not clearly discernable. A ventral position of spiracles II-VII (as in extant and fossil *Aradus* spp.) seems most probable, although a small lateral tubercle on deltg VI and VII might indicate a lateral position, but there is no trace of a dorsal placement as indicated for *Cretopiesma*.

**Legs:** Unarmed, femora thickened at middle; tibiae cylindrical, tarsi two-segmented, claws with distinct pulvilli.

**Discussion:** *Microaradus* is very suggestive of typical *Aradinae* and *Chinamyersiinae* in body shape, structure of the head and pronotum and venation of the corium but is distinct from both extant subfamilies. In *Aradinae* pulvilli are generally lacking and the clypeus never reaches antennal segment III; *Chinamyersiinae* differ by trisegmented tarsi, distinct metapleural scent glands, dorsally placed spiracles of deltg IV-V and fusion of mtg III-VI to a tergal plate. All these characters are not shared by *Microaradus* nov. gen.

As the set of characters given for the fossil subfamily *Archaearadinae* (clypeus very long, open rostral atrium arising behind apex of clypeus, abdominal tergites III-VI not fused and separated by sutures, tarsi two-segmented with claws bearing pulvilli) is also observed in *Microaradus* (except the metapleural scent gland which is lacking) it seems reasonable to place this genus in *Archaearadinae*, which is recorded so far only from Burmese Amber.

***Microaradus anticus* nov. spec.**

(Figs 2–13)

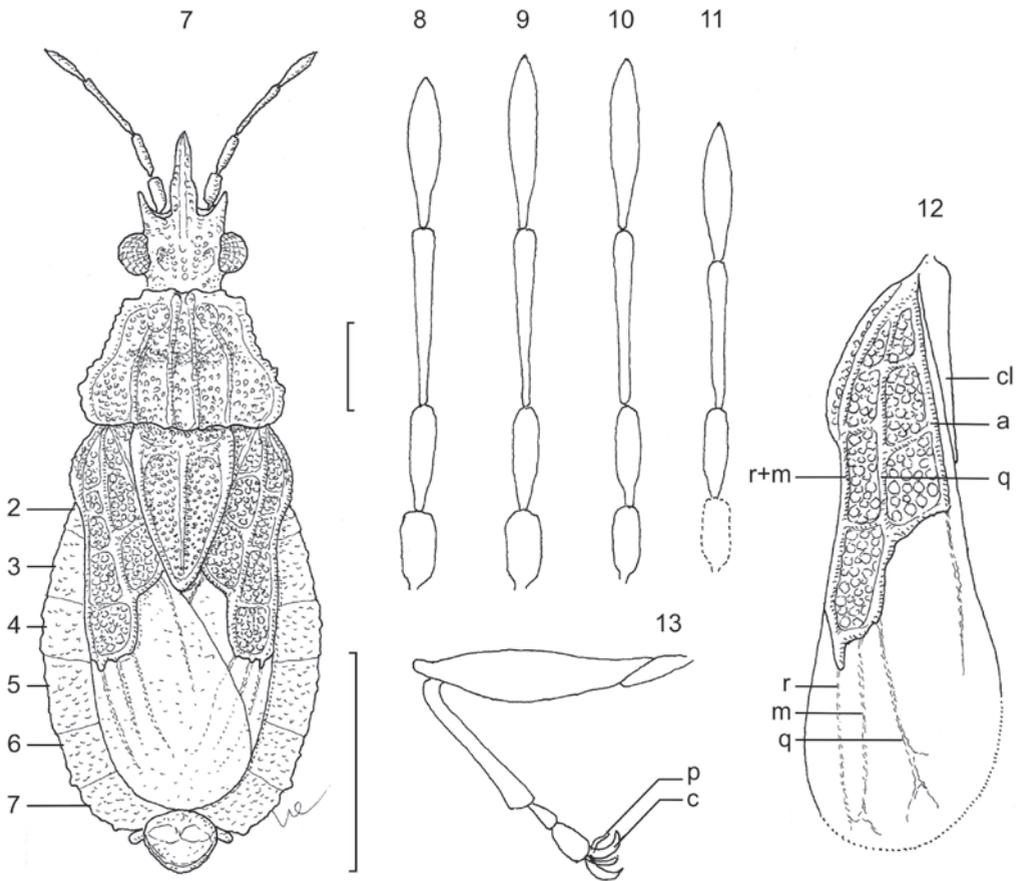
**Holotype:** Male in a piece of Burmese Amber, 25 × 12 × 8 mm which is not yet separated from a synincluded species of *Enicocephalidae*; no locality or deposit indicating from where this piece originates is known (Fig. 2) CEHI.

**Paratypes:** PT1, female in amber slab 6.5 × 6 × 3 mm, left hemelytron spread laterally (Fig. 3) CGPC; PT2, female in amber slab 8.5 × 6.5 × 2 mm (Fig. 4) CEHI; PT3, female in small slab of amber 7.5 × 5 × 1.5 mm, right side of body reflexed (Fig. 5) CGPC.

In addition there is a larval stage V in a Burmese Amber slab 5.5 × 4 × 2.5 mm which shares the habitus, head structure with large eyes and long clypeus of adult *Microaradus anticus* and is therefore tentatively assigned to this taxon (Fig. 6) CEHI.

**Etymology:** Recalling the age of these insects “*anticus*” (Latin) = of old age.

**Description:** **Head:** Longer than wide across eyes (0.37/0.32 mm); clypeus long, nose-like, granulate and carinate dorsally, reaching base of antennal segment III; antenniferous lobes diverging anteriorly, apices acute; antennae slender 1.73 × as long as width of head (0.56/0.32 mm), segment I shortest and thickest, II cylindrical, constricted at



Figs 7–13. *Microaradus anticus* nov. spec. **7**: habitus reconstruction of male holotype; **8**: left antenna of holotype; **9**: right antenna of PT2; **10**: left antenna of PT3; **11**: left antenna of PT1; **12**: left hemelytrum of PT2; **13**: left foreleg of holotype. Abbreviations: a = anal vein; c = claw; cl = clavus; m = medial vein; p = pulvillus; q = cubital vein; r = radial vein; 2–7 = tergites II–VII. Scale: 0.5 mm for Fig. 7; 0.1 mm for Figs 8–11.

basal 1/3, III longest and thinnest tapering toward base, IV fusiform; length of segments I/II/III/IV = 0.1/0.11/0.2/0.15 mm; eyes large and laterally protruding; postocular lobes short and rounded; vertex granulate at middle with two (1+1) smooth ovate depressions laterad; rostrum as long as head arising behind apex of clypeus from an open atrium, bucculae developed.

**Pronotum**: Trapezoidal, distinctly wider than long (0.65/0.35 mm), lateral margins rounded at humeri, then sinuately converging to round anterolateral angles; disk with four carinae, the median ones extending from anterior to posterior margin, the lateral ones shorter anteriorly; posterior lobe roundedly elevated; surface deeply punctured between carinae, posterior margin slightly sinuate.

**Scutellum:** Triangular, longer than wide (0.40/0.25 mm), lateral margins nearly straight, carinate and converging posteriorly to rounded apex, basal  $\frac{1}{3}$  of disk raised, depressed posteriorly between longitudinal carina and lateral margins, surface deeply punctured.

**Hemelytra:** Clavus and corium distinct, the latter reaching anterior margin of deltgV, longitudinal (A, Cu, R+M) and transverse veins (CU-R+M, Cu-A) carinate, surface between them with larger punctures or areolae; membrane hyaline with four veins covering mtg VII.

**Abdomen:** Lateral margins of ovate outline; tergites II-VII separated by transverse sutures; surface and lateral margin of deltg II-VII finely granulate; mtg VII raised at middle for reception of globose pygophore, ptg VIII short, finger-like; posterolateral angles subangulate. Venter and legs as described for genus.

**Measurements:** Length 1.8 mm; width of abdomen 0.67 mm.

**Female paratypes:** As far as recognizable all three specimens share the basic characters of the male, however they are larger in size, their abdomen is wider and more ovate, the lateral margins evenly rounded, the posterolateral angles of tergite VIII angulate and with the triangular tergites IX+X projecting posteriorly and visible from above.

**Length of specimens:** PT1 – 2.5 mm, width of abdomen 1.35 mm; PT2 – 2.0 mm, width of abdomen 0.95 mm; PT3 – 2.05 mm.

Measurements of the antennae are mostly not reliable due to their inclined position and different stage of depression or artificial elongation which is shown by the fact that the left and right antennae are of different length and proportion of segments. In specimen PT1, segment I and II are displaced and IV seems to be thicker, which is caused by a layer of dirty incrustation.

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