

Some ichneumonids (Insecta, Hymenoptera, Ichneumonoidea) from the Upper Mesozoic of China and Mongolia

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Accepted 5 March 2003

Abstract

Five new species and one new genus of ichneumonids (wasps) are established herein, namely *Tanychora exquisita* sp. nov., *Tanychora beipiaoensis* sp. nov., *Tanychora spinata* sp. nov. and *Tanychorella dubia* sp. nov. from the uppermost Jurassic or Lower Cretaceous Yixian Formation of Beipiao, China, and *Paratanychora mongoliensis* gen. et sp. nov. from the Lower Cretaceous Anda-Khuduk Formation of Anda-Khuduk, Mongolia. They are all assigned to the family Ichneumonidae (Insecta: Hymenoptera: Ichneumonoidea). *Paratanychora* can be considered to be an intermediate between *Tanychora* Townes and *Tanychorella* Rasnitsyn. The Mesozoic Ichneumonidae that have been found in China are reviewed.

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Keywords: Hymenoptera; Ichneumonidae; New taxa; Latest Jurassic; Early Cretaceous; Yixian Formation; Anda-Khuduk Formation; China; Mongolia

1. Introduction

The family Ichneumonidae is an extremely large group consisting of approximately 60,000 species worldwide, as estimated by Townes (1969); based on these data, Rasnitsyn (1978) estimated the minimum number of ichneumonid species to be as much as 100,000. Hence, it is probably one of the largest family of insects. Almost all ichneumonids develop as parasites on larvae or pupae of holometabolous insects including Lepidoptera, Coleoptera, Diptera, Neuroptera, Trichoptera and other Hymenoptera, and on arachnids (Gillott, 1980; He et al., 1996).

The earliest occurrence of the Ichneumonidae is in the Lower Cretaceous of Russia, Mongolia and China (Townes, 1973a; Rasnitsyn, 1975; Zhang, 1991) but it was not until the Oligocene that this family began to flourish (Carpenter, 1992). Until now seven species

assigned to the Ichneumonidae have been reported from the Mesozoic, of which four are known from the Early Cretaceous (Townes, 1973a; Rasnitsyn, 1975; Zhang, 1991) and three from the Late Cretaceous (Townes, 1973b) (Table 1).

Here four new species of Ichneumonidae are erected from the uppermost Jurassic or Lower Cretaceous Yixian Formation of Beipiao, China, and one new genus and species from the Lower Cretaceous Anda-Khuduk Formation of Anda-Khuduk, Mongolia.

2. Review of Ichneumonidae from the Mesozoic of China

Three species referred to this family have been reported previously from the Mesozoic of China: *Polychorella magica* Zhang, 1985, *Tanychora sinensis* Zhang, 1991 and *Tanychora petiolata* Townes, 1973 (Zhang, 1985, 1991; Hong, 1988).

Polychorella magica Zhang was erected on the basis of a poorly preserved specimen from the Laiyang Formation exposed at the village of Nanlighezhuang,

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Table 1

Geographical distribution of the known taxa of Ichneumonidae in the Mesozoic. Abbreviations: J, Jurassic; J₃, Late Jurassic; K, Cretaceous; K₁, Early Cretaceous; K₂, Late Cretaceous

AGE	TAXON	LOCALITY AND HORIZON	REFERENCES
K ₂	<i>Urotryphon pusillus</i> Townes, 1973	Yantardakh, East Taimyr Peninsula, Russia; Kheta Formation	Townes, 1937b
	<i>Catochora minor</i> Townes, 1973		
	<i>Eubaeus leiponeura</i> Townes, 1973		
K	<i>Paratanychora mongoliensis</i> gen et sp. nov.	Anda-Khuduk, Mongolia; Anda-Khuduk Formation	this paper
	<i>Tanychora petiolata</i> Townes, 1973	Zaza, Siberia, Russia; Zaza Formation	Townes, 1973a
	K ₁ <i>Tanychora sessilis</i> Townes, 1973	Baissa, Siberia, Russia; Zaza Formation	Townes, 1973a
	<i>Tanychorella parvula</i> Rasnitsyn, 1975	Romanovka, Transbaikalia, Russia; Zaza Formation	Rasnitsyn, 1975
	<i>Tanychora sinensis</i> Zhang, 1991	Nanligeshuang, Laiyang, Shandong, China; Laiyang Formation	Zhang, 1991
K or J	K ₁ <i>Tanychora exquisita</i> sp. nov.	Huangbanjigou, Beipiao, Liaoning, China; Yixian Formation	this paper
	or <i>Tanychora beipiaoensis</i> sp. nov.		
	or <i>Tanychora spinata</i> sp. nov.		
	J ₃ <i>Tanychorella dubia</i> sp. nov.		

Laiyang, Shandong Province (Zhang, 1985). From the figures (see Zhang, 1985, text-fig. 12, pl. 7, figs 33, 34), however, some characteristics, such as very few flagellomeres (10 or 11), quite a broad costal area, and an apically oblique basal vein in the forewing, are not in agreement with the family Ichneumonidae. It is better placed in the family Megalyridae (subfamily Cleistogastrinae).

Tanychora sinensis Zhang, a wasp from the same locality and horizon as *P. magica*, is doubtless a component of Ichneumonidae.

Hong (1988) described a female wasp, which he identified as *Tanychora petiolata* Townes (misspelled *petiolata* by Hong; see Hong, 1988, pp. 123, 130), from the Early Cretaceous Shale Formation of Meileyingzi, Kazuo (misspelled Kezuo by Hong, 1987, 1988), Liaoning Province. This wasp, however, has a forewing with the first abscissae of Rs and M meeting at an angle; hence, it should be placed in the family Eoichneumonidae. On the other hand, considering the lithology with which it is associated and other fossils, such as the fish *Lycopera*, that are preserved with it, the bed yielding this insect should belong to the Jiufotang Formation, as Hong (1987) pointed out.

3. Systematic palaeontology

Order: Hymenoptera Linnaeus, 1758
 Suborder: Apocrita Gerstaecker, 1867
 Superfamily: Ichneumonoidea Latreille, 1802
 Family: Ichneumonidae Latreille, 1802
 Subfamily: Tanychorinae Rasnitsyn, 1980
 Genus *Tanychora* Townes, 1973

3.1. Type species

Tanychora petiolata Townes, 1973; Lower Cretaceous, Siberia, Russia.

3.2. Species included

Six species, namely *Tanychora petiolata* Townes, 1973, *T. sessilis* Townes, 1973, *T. sinensis* Zhang, 1991, *T. exquisita* sp. nov., *T. beipiaoensis* sp. nov. and *T. spinata* sp. nov.

3.3. Diagnosis

Antenna with 18–22 flagellomeres. Forewing with large pterostigma, Rs+M present, separating cell 1+2r from 1m-cu; cell 2+3r elongate with base approaching, or reaching, crossvein 1 m-cu; crossvein cu-a postfurcal; vestigial a₁-a₂ present.

3.4. Remarks

As noted above, three species of this genus have been reported previously: *Tanychora petiolata* Townes and *T. sessilis* Townes from the Lower Cretaceous of Siberia, and *T. sinensis* Zhang from the Laiyang Formation in China. Three more are described below from the Yixian Formation in western Liaoning Province, China. The Mongolian paratype of *T. petiolata* (Townes, 1973a, p. 217) differs from all of the other species of *Tanychora* and is attributed here to a separate new genus.

Townes (1973a) noticed two vein stubs on vein 1A in the forewing of *T. sessilis* and one in the left forewing of *T. petiolata*; however, he was unsure that they were remnants of anal veins. Judging by the new material from Liaoning and *T. sinensis* from Shandong, the single stub in *T. petiolata* and the basal one in *T. sessilis* are remnants of crossvein a₁-a₂, and the distal stub in *T. sessilis* is a remnant of vein 2A. The three new species described below (see figures 1A–D, 2–4) have a distinct vestige of vein a₁-a₂. *T. sinensis* has a distinct remnant of a₁-a₂ in its left forewing (see Zhang, 1991, pl. 1) although this character was not noticed by Zhang (1991, text-fig. 1).

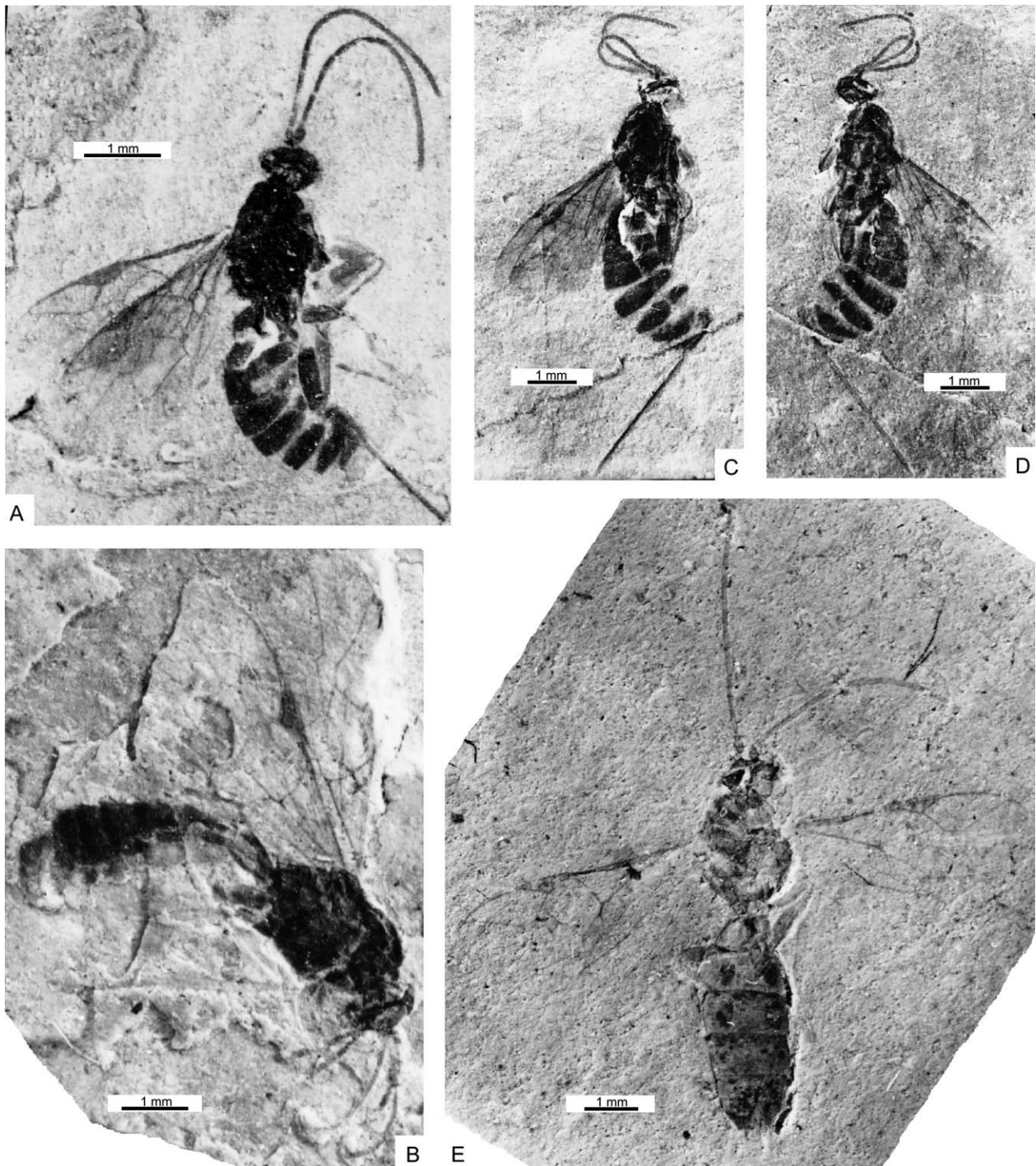


Fig. 1. A, *Tanychora beipiaoensis* sp. nov., holotype, NIGP134821. B, *Tanychora exquisita* sp. nov., holotype, NIGP134820. C, *Tanychora spinata* sp. nov., holotype, NIGP134822a. D, *Tanychora spinata* sp. nov., holotype, NIGP134822b. E, *Tanychorella dubia* sp. nov., holotype, NIGP134823.

Tanychora is considered to be the most primitive representative of the family Ichneumonidae (Townes, 1973a; Rasnitsyn, 1980), at least with respect to the following in the forewing: vein R+M normal, cell 2+3rm large with base reaching 1m-cu, and vestigial a_1 - a_2

present. But a recent analysis has cast doubt on its systematic placement (Quicke et al., 1999).

Tanychora exquisita sp. nov.

Fig. 1B, Fig. 2

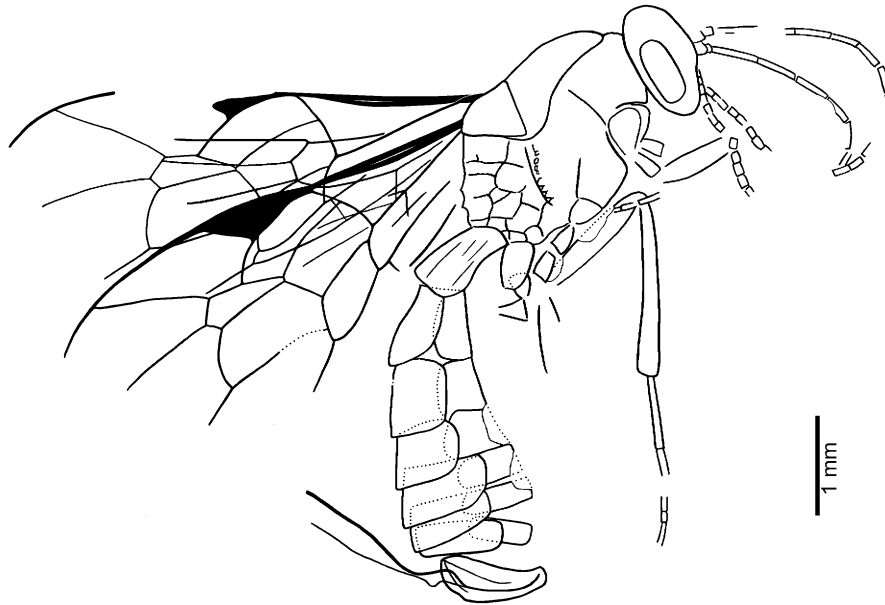


Fig. 2. *Tanychora exquisita* sp. nov., female, lateral aspect, camera lucida drawing of holotype, NIGP134820.

3.5. Etymology

Latin, *exquisitus*, fine.

3.6. Material

Holotype LBSH98050/NIGP134820 (female). Antennae, legs, wings and ovipositor incomplete. Collected from the Yixian Formation, Huangbanjigou village, Beipiao, Liaoning Province, China; deposited in the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences.

3.7. Description

Female; male unknown. Body brown, antennae and legs (tibiae and tarsi) pale. Head fairly large, protruding downwards; eyes medium-sized, elongate-oval. Antennae with at least 20 segments; scape large; pedicel distinctly thinner than scape, about as long as wide; first flagellomere slightly thinner than pedicel, parallel-sided and seven times as long as wide; second and third similar to first in shape, five times as long as wide; fourth and fifth three times, and sixth twice as long as wide; several following flagellomeres similar to sixth; apical ones slightly longer than or as long as wide. Mesosoma with large mesonotum; metanotum transversely broad; propodeum large, coarsely areolated. Foreleg and midleg thin; hindleg with coxa distinctly larger than mid coxa; trochanter small and trapezoid; femur elongate; tibia distinctly longer than femur; tarsus nearly as long as tibia, basitarsus longest and fourth tarsomere shortest. Forewing with pterostigma broad, subtriangular; first

abscissa of Rs slightly shorter than that of M; 2r-rs oblique apicad, slightly longer than pterostigmal width; 1+2r narrow, slightly arched; 2+3rm elongate-hexagonal, reaching 1m-cu; cu-a quite postfurcal; 2cua slightly shorter than 1mcu; vestigial a_1 - a_2 long. Hindwing with first abscissa of Rs oblique, slightly longer than r-m; Rs straight beyond r-m, and parallel to R; M+Cu straight, divided into M and Cu far basad of origin of Rs; M curved downwards before r-m, and straight beyond r-m. Metasoma in side view gradually increasing in thickness apically; first metasomal segment thin basally and gradually thickened apically, and 1.7 times as long as wide; second as long as first, and as long as wide; third as long as second but slightly thicker; following segments gradually shortened; terminal segment rounded apically. Ovipositor thin, longer than basal plate (actual length unknown). Head length 0.6 mm, mesosoma 2.4 mm, metasoma 4.3 mm, antenna, as preserved, 4.2 mm, ovipositor sheath, as preserved, 1.7 mm; forewing, as preserved, length 4.9 mm, width 1.9 mm; hindwing, as preserved, length 2.8 mm, width 1.3 mm.

3.8. Comparison

Unlike all previously described species, *Tanychora exquisita* has a forewing with a vestigial a_1 - a_2 that is long though weak. It also differs from all congeners (except possibly *T. sessilis*) in having very thin and long flagellomeres, and from all except *T. petiolata* in that the first metasomal segment is petiolate (comparatively long and narrow). Furthermore, it has an ovipositor that is longer than (at least) in *T. sessilis* and *T. sinensis*.

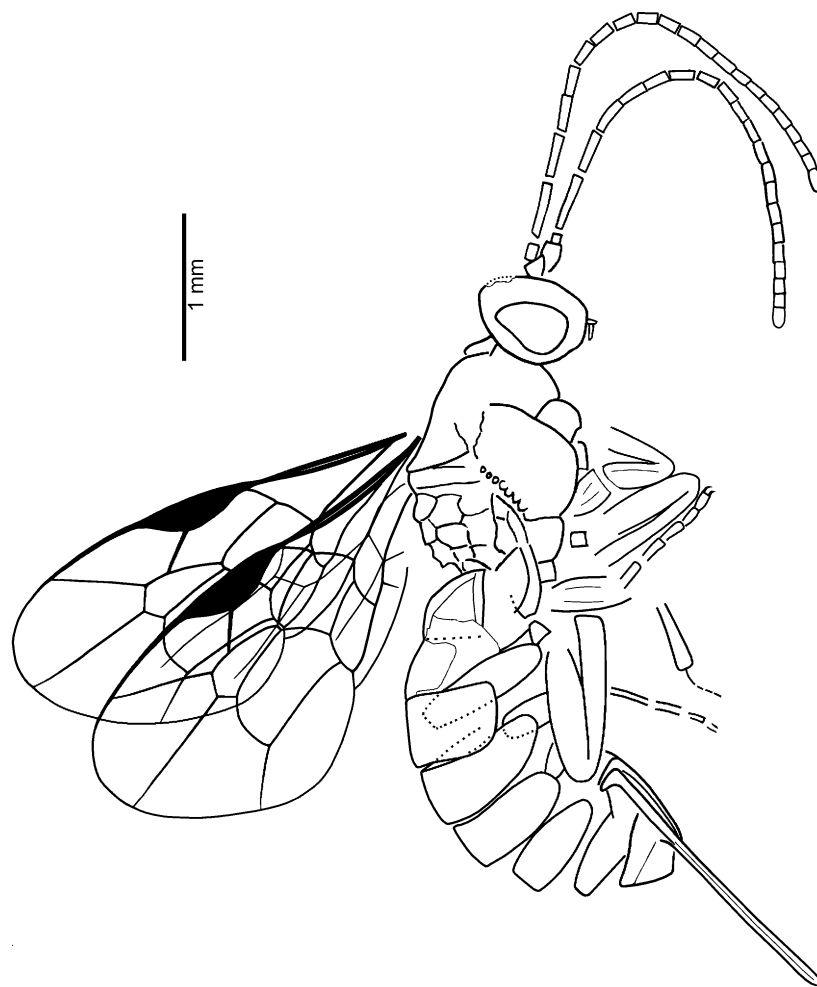


Fig. 3. *Tanychora beipiaoensis* sp. nov., female, lateral aspect, camera lucida drawing of holotype, NIGP134821.

Tanychora beipiaoensis sp. nov.

Fig. 1A, Fig. 3

3.9. Etymology

From the locality that yielded the type specimen.

3.10. Material

Holotype LBSH98051/NIGP134821 (female). Nearly complete wasp. Collected from the Yixian Formation, Huangbanjigou village, Beipiao, Liaoning Province, China; deposited in the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences.

3.11. Description

Female; male unknown. Body brown, antennae and legs (tibiae and tarsi) pale. Head medium-sized, oval in side view; eyes large and oval; two moderately long palp segments distinguishable. Antennae with 22 segments;

scape thin basally, swollen apically, and slightly longer than wide; pedicel thin, slightly longer than wide; first flagellomere slightly thinner than pedicel, gradually increasing in thickness apically and five times as long as wide; following flagellomeres, except for terminal, similar to first in shape but gradually decreasing in length and increasing in thickness; terminal rounded apically and 1.5 times as long as wide. Mesosoma with short pronotum; mesonotum long; metanotum short but transversely broad; propodeum coarsely areolated. Foreleg short; midleg longer than foreleg; hindleg with large coxa, trochanter small, femur thick, tibia slightly longer than femur, tarsus thin and nearly as long as tibia. Forewing with pterostigmal ventral contour arc-like; first abscissa of M 1.4 times as long as that of Rs; 2r-rs issuing distinctly beyond pterostigmal midlength and 1.5 times as long as pterostigmal width; 1+2r narrow, pentagonal; 2+3rm elongate-hexagonal, reaching 1m-cu; cu-a quite postfurcal; vestigial a_1 - a_2 long. Hindwing with first abscissa of Rs about as long as r-m, and second abscissa slightly arched; M+Cu arched,

branched into M and Cu far basad of origin of Rs; M slightly curved downwards before r-m, and straight beyond r-m. First metasomal segment short, its dorsal contour obtusely angular at midlength; second tergum distinctly shorter than third; third slightly longer than fourth and fifth; following ones much shorter. Ovipositor straight with sheaths about half as long as forewing. Head length 0.6 mm, mesosoma 1.6 mm, metasoma 2.9 mm, antenna 3.8 mm, ovipositor sheath 1.5 mm; forewing length 3.3 mm, width 1.5 mm; hindwing, as preserved, length 2.2 mm, width 0.8 mm.

3.12. Comparison

This new species is unique within *Tanychora* in having a wing length of under 3.5 mm and a flagellum that is distinctly incrassate toward the apex (unknown for *T. sessilis*). Unlike all species apart from *T. spinata*, described below, the crossvein 2r-rs of *T. beipiaoensis* issues from the pterostigma well beyond its midlength.

Tanychora spinata sp. nov.

Fig. 1C–D, Fig. 4

3.13. Etymology

Latin, *spinatus*, spinal.

3.14. Material

Holotype LBSH98053/NIGP134822 (female). Hindwings not distinct, otherwise nearly complete. Collected from the Yixian Formation, Huangbanjigou village, Beipiao, Liaoning Province, China; deposited in the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences.

3.15. Description

Female; male unknown. Body brown, antennae, legs (tibiae and tarsi) pale. Head medium-sized, protruding downwards; eyes large, elongate-oval. Antennae with 23 segments; scape thin basally, swollen apically, and slightly longer than wide; pedicel thin, slightly longer than wide; first flagellomere slightly thinner than pedicel, gradually increasing in thickness apically and four times as long as wide; following flagellomeres, except for terminal, similar to first in shape, second to fourth twice as long as wide, others slightly longer than or as long as wide; terminal twice as long as wide and rounded apically. Ten segments of labial and maxillary palps preserved, varying in length from 0.05–0.10 mm; their precise homology is obscure. Mesosoma with short pronotum; mesonotum long; metanotum short but transversely broad; propodeum coarsely areolated. Fore- and midleg short; hindleg with large coxa, trochanter thin, femur thick, tibia nearly as long as femur,

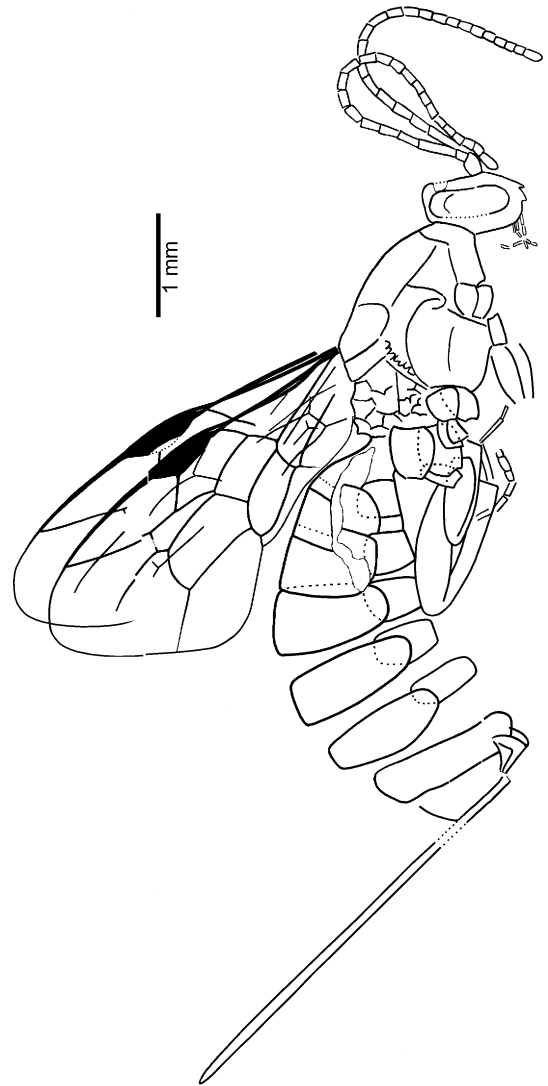


Fig. 4. *Tanychora spinata* sp. nov., female, lateral aspect, camera lucida drawing of holotype, NIGP134822a.

tarsus incomplete with fourth tarsomere shortest. Forewing with pterostigma comparatively narrow, with ventral contour arc-like; first abscissa of Rs about as long as that of M; 2r-rs issued from pterostigma at about two-thirds of its length and 1.5 times as long as pterostigmal width; 1+2r narrow, pentagonal; 2+3rm narrow, elongate, reaching 1m-cu, with 3r-m spectral for its middle part; cu-a distinctly postfurcal; a₁-a₂ nearly reaching posterior margin of wing. Hindwing with first abscissa of Rs oblique, and second slightly arched; M long and slightly curved beyond r-m. First metasomal segment short, with dorsal contour gently arcuate; second to fourth terga subequal in length and as long as first; following terga short; sterna shorter than corresponding terga. Ovipositor straight with sheaths slightly shorter than forewing. Head length 0.6 mm, mesosoma

2.3 mm, metasoma 4.2 mm, antenna 3.8 mm, ovipositor sheath 3.6 mm; forewing length 4.0 mm, width 1.7 mm.

3.16. Comparison

Unlike other congeners, the ovipositor sheath of *Tanychopa spinota* is almost as long as the forewing. The species is most similar to *T. beipiaoensis* in that 2r-m issues clearly beyond the midlength of the pterostigma the first metasomal segment is short, but it differs in having a longer ovipositor and in the gently curved dorsal contour of the first metasomal segment.

Genus *Tanychorella* Rasnitsyn, 1975

3.17. Type species

Tanychorella parvula Rasnitsyn, 1975; Lower Cretaceous, Transbaikalia, Russia.

3.18. Species included

The type species and the *T. dubia* described below.

3.19. Diagnosis

Antenna with more than 15 flagellomeres. Forewing with comparatively small pterostigma, Rs+M weak or incomplete; cell 2+3rm short, basad of vein 2r-rs (distant of 1m-cu); crossvein cu-a postfurcal; rudiment of a_1 - a_2 absent. Hindwing with veins A and Cu short or absent beyond cell cua. Ovipositor with fairly short sheaths.

3.20. Remarks

The type species, *T. parvula* Rasnitsyn, was erected on the basis of a poorly preserved specimen from the Lower Cretaceous of Transbaikalia (Rasnitsyn, 1975), in which vein R+M is present but weak in the right forewing and unseen in the left forewing (see Rasnitsyn, 1975, p. 89, fig. 99); it is vestigial in both forewings of the new species (see Fig. 1E, Fig. 5).

Tanychorella Rasnitsyn has a forewing with a weak Rs+M although complete or vestigial; cell 2+3rm recedes apically (not basad of vein 2r-rs), and a_1 - a_2 is absent. This genus is, therefore, more advanced than *Tanychora* Townes and distinctly different from the Late Cretaceous ichneumonids that are similar to extant Ichneumonidae and were placed in the extant subfamily Tryphoninae by Townes (1973b).

Tanychorella dubia sp. nov.

Fig. 1E, Fig. 5

3.21. Etymology

Latin, *dubius*, dubious, doubtful.

3.22. Material

Holotype LBSH98052/NIGP134823 (female). Legs and hindwings slightly damaged, otherwise complete. Collected from the Yixian Formation, Huangbanjigou village, Beipiao, Liaoning Province, China; deposited in the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences.

3.23. Description

Female; male unknown. Body pale. Head comparatively small; eyes medium-sized, oval. Antennae with 23 segments, and distinctly longer than head and mesosoma combined; scape thin basally and swollen apically, and slightly longer than wide; pedicel distinctly thinner than scape, slightly longer than wide; first flagellomere slightly thinner than pedicel basally, gradually increasing in thickness apically, twice as long as wide; second to eighth similar to first, those following as thick as first, gradually decreasing in length; terminal slightly longer than twentieth, rounded apically. Mesosoma ovate; pronotum short; propodeum coarsely areolated. Foreleg and midleg thin; hindleg with small coxa, trochanter distinctly smaller than coxa, femur longer than mid femur, tibia distinctly longer than femur, tarsus incomplete. Forewing with pterostigma broad, subtriangular; Rs+M remnant, forming a point on basal vein and a stub on crossvein 1m-cu; 2r-rs issued near pterostigmal midlength, oblique apicad, twice as long as pterostigmal width; 2+3rm elongate-pentagonal with base at the same level of origin of 2r-rs from pterostigma; 3r-m spectral for its middle part; cu-a quite postfurcal. Hindwing with first abscissa of Rs oblique, slightly longer than r-m; Rs long and straight beyond r-m, and parallel to R; M+Cu branching into M and Cu far basad of origin of Rs; M long beyond r-m; cu-a short; Cu and A short beyond cu-a. First metasomal segment comparatively thin basally, gradually thickened apically, and slightly shorter than wide; second as long as first, trapezoid; third and fourth as long as second but slightly narrower, transversely rectangular; fifth and sixth shorter than fourth, inversely trapezoid; seventh distinctly smaller; eighth small and semicircular. Ovipositor short with sheaths slightly protruding out of metasomal apex. Head length 0.8 mm, mesosoma 2.4 mm, metasoma 4.3 mm, antenna 4.7 mm; forewing length 5.2 mm, width 2.2 mm; hindwing, as preserved, length 2.4 mm, width 1.1 mm.

3.24. Comparison

Tanychorella dubia is distinguished from the type species in having a distinctly larger body, forewings with Rs+M reduced as in typical Ichneumonidae, 2r-rs that

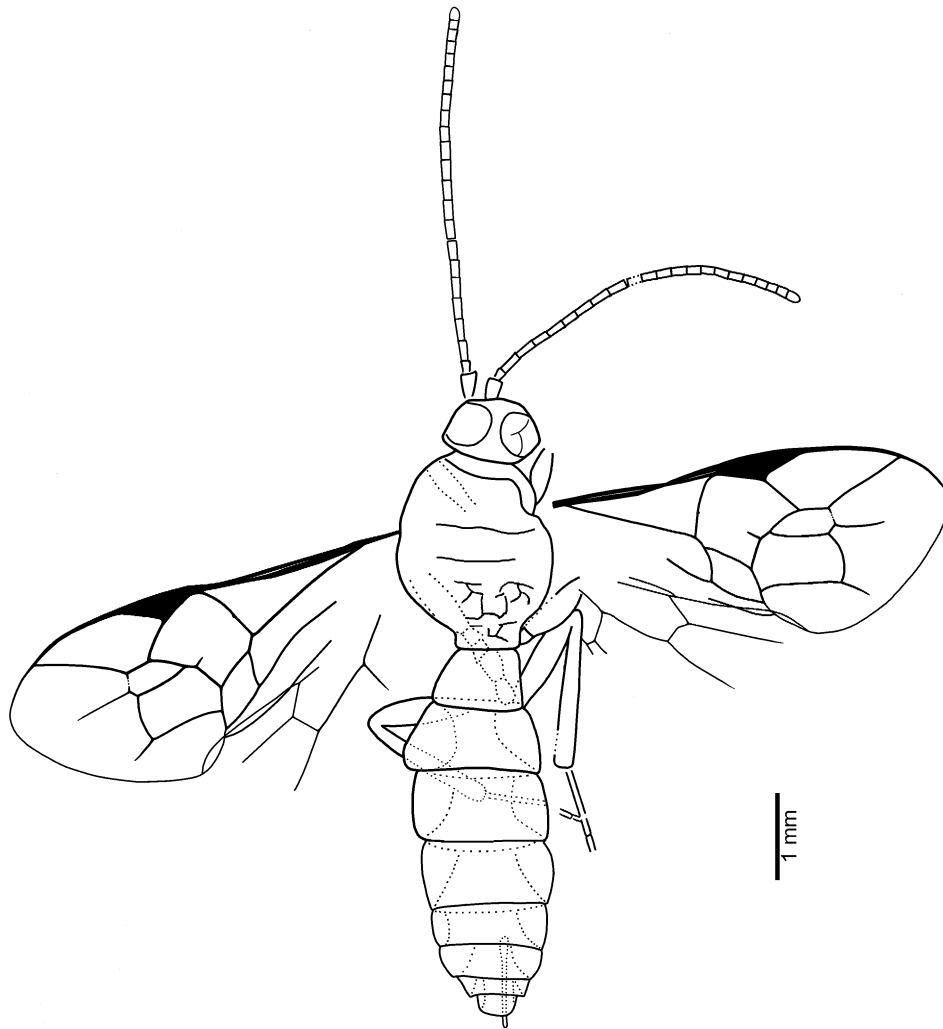


Fig. 5. *Tanychorella dubia* sp. nov., female, dorsal aspect, camera lucida drawing of holotype, NIGP134823.

issues near the midlength of the pterostigma, cell 2+3rm comparatively close to 1m-cu and very postfurcal a crossvein cu-a, hindwings with the free section of M far away from cell cua, veins Cu and A distinct beyond cu-a, and very short ovipositor sheaths.

Genus *Paratanychora* gen. nov.

3.25. Etymology

Greek, *para-*, beside, near, and the generic name *Tanychora*; gender feminine.

3.26. Type species

Paratanychora mongoliensis sp. nov.; Lower Cretaceous, Anda-Khuduk Formation, Anda-Khuduk, Mongolia.

3.27. Species included

No other species known at present.

3.28. Diagnosis

Forewing with comparatively small pterostigma, Rs+M weak; cell 2+3rm comparatively short, basad of vein 2r-rs (distant of 1m-cu); crossvein cu-a postfurcal; anal rudiments lost.

3.29. Remarks

This new genus is based on an ichneumonid that was previously assigned to *Tanychora petiolata* Townes as its paratype (Townes, 1973a, p. 217). It differs from *Tanychora* Townes in having a forewing with a small

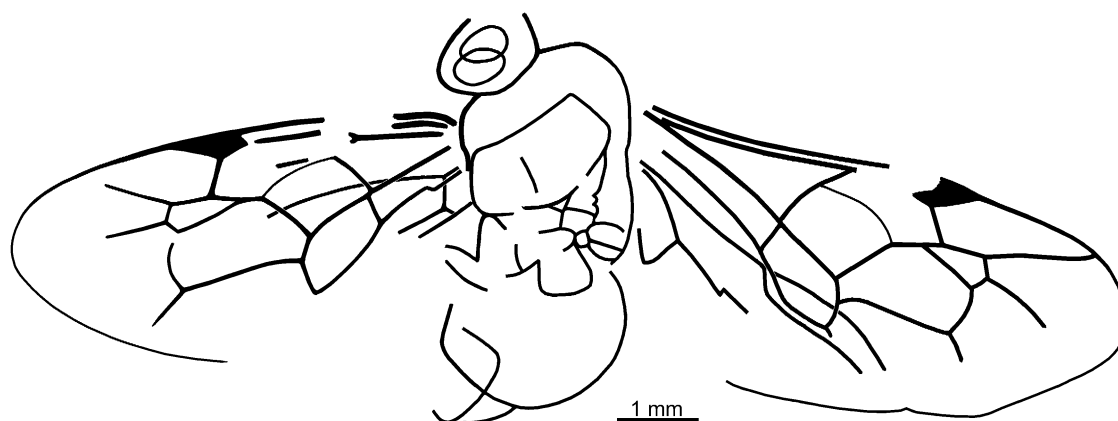


Fig. 6. *Paratanychora mongoliensis* gen et sp. nov, lateroventral aspect, camera lucida drawing of holotype, 3145/1075.

pterostigma, short 2+3rm, weak Rs+M and no anal rudiments; from *Tanychorella* Rasnitsyn in having a complete Rs+M in both forewings. On these grounds, *Paratanychora* can be considered to be intermediate between *Tanychora* and *Tanychorella*.

Paratanychora mongoliensis sp. nov.

Fig. 6

3.30. Etymology

From the country of origin, Mongolia.

3.31. Material

Holotype 3145/1075. Antennae missing, legs, hindwings and metasoma incomplete. Collected from the Anda-Khuduk Formation, Anda-Khuduk, Mongolia; deposited in the Paleontological Institute, Russian Academy of Sciences, Moscow.

3.32. Description

Sex unknown; preserved in lateroventral aspect. Head comparatively small; eyes small, oval. Mesosoma ovate. Hindleg with comparatively large coxa, trochanter small, femur short. Forewing with subtriangular pterostigma; Rs+M complete but weak; 2r-rs issued slightly basad of midlength of pterostigma, oblique apicad, 1.6 times as long as pterostigma width; 2+3rm with base at the same level of origin of 2r-rs from pterostigma; cu-a a little postfurcal. Hindwing with second section of Rs long, parallel to R; M+Cu branching into M and Cu far basad of origin of Rs; M long; cu-a short; Cu and A comparatively long beyond cu-a. Metasoma as wide as mesosoma. Head length 1.0 mm, mesosoma 2.7 mm, metasoma, as preserved, 2.7 mm; forewing length 6.6 mm, width 2.8 mm; hindwing (as preserved) length 4.0 mm, width 1.4 mm.

Acknowledgements

We are deeply indebted to Dr Mike Fitton (Department of Entomology, The Natural History Museum, London), Dr David J. Horne (Department of Earth and Environmental Sciences, Natural Resources Institute, University of Greenwich) and Prof. David J. Batten (Institute of Geography and Earth Sciences, University of Wales) for critically reviewing the manuscript and offering helpful suggestions for its improvement. The research programme from which this paper stems has been financially supported (for Haichun Zhang) by the National Natural Science Foundation of China (40272002), the Chinese Academy of Sciences (KZCX2-114) and the Ministry of Sciences and Technology of China (G2000077700, 2001DEA2002-12).

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