

A New Subfamily of Ichneumonids from the Lower Cretaceous of Transbaikalia and Mongolia (Insecta: Hymenoptera: Ichneumonidae)

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Abstract—A new subfamily of ichneumonids, Palaeoichneumoninae, is described from the Lower Cretaceous of Transbaikalia (Baisa locality) and Mongolia (Bon Tsagan and Kholbotu Gol localities). The new subfamily is intermediate between the archaic subfamily Tanychorinae and the Recent Ichneumonidae. It includes 12 new species, described in three new genera: *Palaeoichneumon freja* gen. et sp. nov., *P. ornatus* sp. nov., *P. danu* sp. nov., *P. micron* sp. nov., *P. mirabilis* sp. nov., *P. tenebrosus* sp. nov., *P. townesi* sp. nov., *Rudimentifera mora* gen. et sp. nov., *R. suspecta* sp. nov., *Dischysma maculata* gen. et sp. nov., *D. similis* sp. nov., and *D. ramulata* sp. nov.

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INTRODUCTION

In the Recent fauna, the family Ichneumonidae (ichneumon wasps or ichneumonids) of the order Hymenoptera includes approximately 60000 parasitoid species, distributed around the globe (Wahl and Sharkey, 1993). Although the systematics of this highly important family has been elucidated by many studies, the classification of ichneumonids remains inadequate. In my opinion, some difficulties in developing this classification could be overcome if fossil taxa, as well as recent, are taken into consideration.

The oldest fossil ichneumonids are known from the Lower Cretaceous of Transbaikalia (Baisa, Zaza, Romanovka), Mongolia (Anda Khuduk), and China (Yixian Formation). Until now, the Mesozoic fauna was poorly studied. Only nine ichneumon species have previously been described from the Lower Cretaceous, all belonging to the single extinct subfamily, Tanychorinae Rasnitsyn, 1975 (Townes, 1973; Rasnitsyn, 1975; Zhang, 1991; Zhang and Rasnitsyn 2003). Numerous undescribed species were found during a revision of the collection of ichneumon imprints at the Paleontological Institute of the Russian Academy of Sciences, Moscow (PIN).

All the specimens described below come from three localities: Baisa (Russia, Transbaikalia, left bank of the Vitim River, 3 km downstream from the mouth of the Baisa River; Zaza Formation) (Martinson, 1961; Zherikhin et al., 1999), Kholbotu Gol (Mongolia, Bayan-Khongor Aimag, northern slope of Bayan Tsagan Ula Range; Barremian–Aptian, Bon Tsagan Group, Khurilt sequence) and Bon Tsagan (Mongolia, Bayan-Khongor Aimag, 5–8 km south of Bon Tsagan Lake;

Barremian–Aptian, Bon Tsagan Group, Khurilt sequence) (Sinitsa, 1993).

There is still no universally accepted nomenclature for ichneumon wing veins; the same structure sometimes has different names in different sources. To avoid confusion, the nomenclature of wing veins and cells followed in this paper is illustrated in Fig. 1.

SYSTEMATIC PALEONTOLOGY

Family Ichneumonidae Latreille, 1802

Subfamily Palaeoichneumoninae Kopylov, subfam. nov.

Type genus. *Palaeoichneumon* gen. nov.

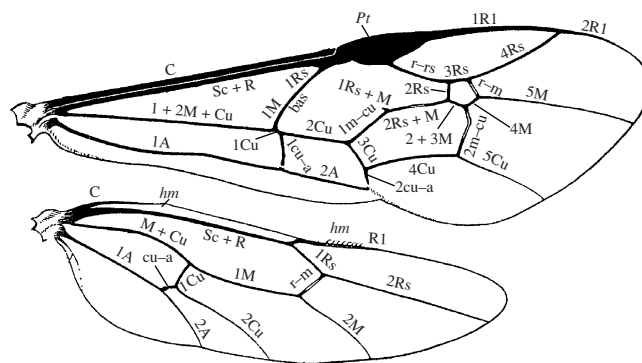


Fig. 1. Wing venation in the Recent Ichneumonidae (after Kasparyan, 1981, with modifications after Huber and Sharkey, 1993). The numbers preceding the names of longitudinal veins indicate the numbers of the corresponding abscissae. Designations: (*Pt*) pterostigma; (*hm*) hamuli.

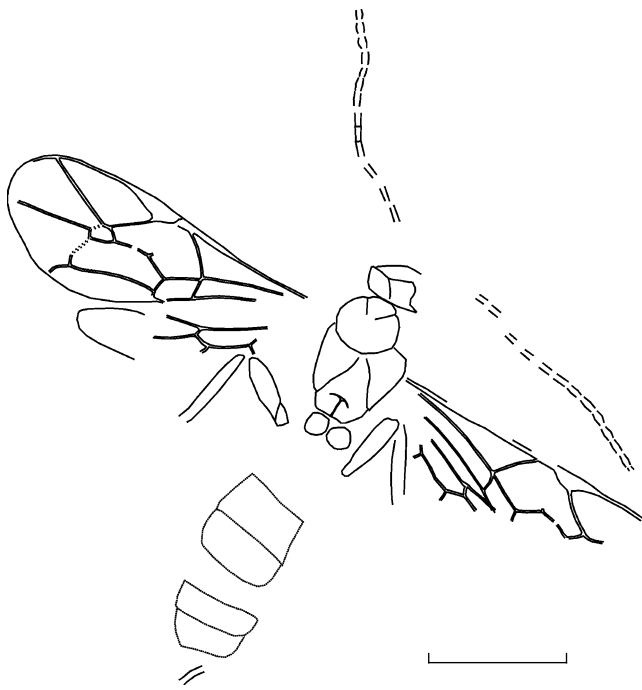


Fig. 2. *Palaeoichneumon freja* sp. nov., holotype PIN, no. 4210/1146, female. Scale bar hereinafter, 1 mm.

Diagnosis. Mesoscutum with notauli well developed, complete or posteriorly incomplete, straight, converging toward posterior margin of mesoscutum (often connected with one another). First abscissa of Rs + M reduced (entirely or at least in its middle part). Areolet pentagonal, much shorter than in Tanychorinae, but longer than in Recent Ichneumonidae, except some Labeninae. Anal rudiment (a_1 - a_2) absent. First segment of metasoma short and wide.

Generic composition. Three new genera.

Comparison. The new subfamily differs from the Tanychorinae in the reduction of the first abscissa of Rs + M (at least of its middle part), the reduced areolet, and the absence of the anal rudiment. It differs from the Recent subfamilies (except the Labeninae) in the larger areolet. It differs from the Labeninae and other recent subfamilies in the shape of the notauli. Several Recent representatives of the family have similar notauli (for example, *Megarhyssa*, *Odontocolon*, and *Xorides*), but apparently they have acquired this character independently. It differs from the Labeninae in the first segment of the metasoma being short and wide (not petiolate).

Remarks. The characters of the new subfamily, particularly the size and shape of the areolet, are intermediate between the basal subfamily Tanychorinae and the Recent subfamilies. It is similar to the Tanychorinae in the shape of the notauli and to the Recent subfamilies in the reduction of the first abscissa of Rs + M. The primitive, short and wide first segment of the metasoma and the convergent notauli prevent the assignment of the species described below to the subfamily Labeni-

nae, which is similar to the new subfamily in the structure of the areolet, but differs from it in the long petiole of the first segment of the metasoma and the poorly developed, parallel notauli.

Genus *Palaeoichneumon* Kopylov, gen. nov.

Etymology. From the Greek *palaios* (ancient) and the family name Ichneumonidae. The gender is masculine.

Type species. *Palaeoichneumon freja* sp. nov.

Diagnosis. First abscissa of Rs + M completely reduced (ramulus may remain). Areolet 1.5–1.8 times longer than wide. Second abscissa of Rs + M 1.0–1.5 times as long as areolet. Vein r-m with no more than one bulla, 2m-cu almost always with single bulla. 1cu-a postfurcal or, rarely, interstitial. Hindwing with M + Cu branching much basal to R + Rs branching. Forewing length, in the known representatives, from 1.6 to 4.1 mm.

Species composition. Seven new species.

Palaeoichneumon freja Kopylov, sp. nov.

Plate 11, figs. 1a, 1b

Etymology. From the name of the Scandinavian goddess Freya.

Holotype. PIN, no. 4210/1146, positive and negative impressions of a female; the antennae are damaged at the bases and at the apices, their middle parts are not always distinct; the head, thorax, and metasoma are indistinct, their structure is only partly visible; the wings are well preserved (on one side broken near the apices); the metasoma with four segments and a fragment of the ovipositor preserved; Russia, Transbaikalia, Baisa locality; Lower Cretaceous, Zaza Formation, layer 4.

Description (Fig. 2). The body is uniformly brown; the antennae, legs, and wing veins are brown, somewhat lighter than the body. The antennae with at least 15 antennomeres; the preserved basal antennomeres are cylindrical, four times as long as wide; the more apical antennomeres are shorter and wider, moniliform; the apical antennomeres are twice as long as their maximum diameter. The mesonotum has a weakly distinct trace of the longitudinal suture between notauli. In the forewing, the pterostigma is narrow; r-rs is 2.5 times as long as the pterostigma width; the distance between the pterostigma and the basal vein is one-quarter of the vein length; the ramulus is present, short (as long as the vein width); the second abscissa of Rs + M is interrupted in the middle, 1.4 times as long as the areolet; the areolet is 1.5 times as long as wide, open apically (the vein r-m is spectral throughout its length); the vein 2m-cu is developed only in its lower quarter, spectral elsewhere; the vein 1cu-a is slightly postfurcal (shifted with reference to M by the distance equal to the

vein width), 0.4 as long as the basal vein. In the hindwing, the first abscissa of Rs is short, 0.6 of the length of r-m; the free end of Rs is arched down; at the wing base, M + Cu is contiguous with Sc + R; the first abscissa of Cu weakly curves toward the posterior wing margin.

Measurements, mm. Head length, 0.4; length of thorax plus metasoma (the division indistinct), 2.7; length of preserved ovipositor fragment, 0.5; forewing length, 2.4; forewing width, 0.8; hindwing length, 1.9.

Material. Holotype.

Palaeoichneumon ornatus Kopylov, sp. nov.

Plate 11, fig. 2

Etymology. From the Latin *ornatus* (decorated).

Holotype. PIN, no. 3559/4488, positive and negative impressions of a female; the antennae are indistinct; the structure of the head is indiscernible; the thorax with distinct mesonotal sutures, the structure of the propodeum is indiscernible; the metasoma and a short ovipositor are well preserved (although it is unclear whether the ovipositor is complete); the legs are poorly visible, the right forewing is well preserved; the left forewing is fractured longitudinally, the hindwings are poorly preserved; Bon Tsagan locality, outcrop 87/8, Bon Tsagan Group, Khurilt sequence.

Description (Fig. 3). The head, thorax, antennae, and femora are dark brown; the tibiae and wing veins are light; the metasoma is brown, with small paired dark brown maculae on sternites II–VI. The antennae with at least 15 antennomeres; the scape and pedicel are large, spherical, each approximately as long as wide; the basal flagellomeres are cylindrical, each approximately 4–5 times as long as wide; the more apical flagellomeres gradually become shorter, each approximately twice as long as wide. The mesonotum with a longitudinal suture between the notauli. The forewing has a narrow pterostigma; r-rs is twice as long as the pterostigma width; the fourth abscissa of R is twice as long as r-rs; areolet is 1.5 times as long as wide; r-m is developed; the distance between the pterostigma and the basal vein is one quarter of the vein length; the ramulus is absent; the second abscissa of Rs + M is interrupted in its basal part (at 0.3 of the abscissa length from its base), 1.2 times as long as the areolet; the vein 2m-cu is complete; 1cu-a is slightly postfurcal, 0.4 times as long as the basal vein. The metasoma is fusiform. Metasomal segment I is wide, at its base half as wide as at the apex, as long as its apical width; segment II is 0.83 times as long and 1.5 times as wide as segment I; segment III is 0.77 times as long and 1.6 times as wide as segment I; segment IV is the widest, 1.7 times as wide as segment I; the more apical segments are shorter and narrower than the preceding ones. The ovipositor is short.

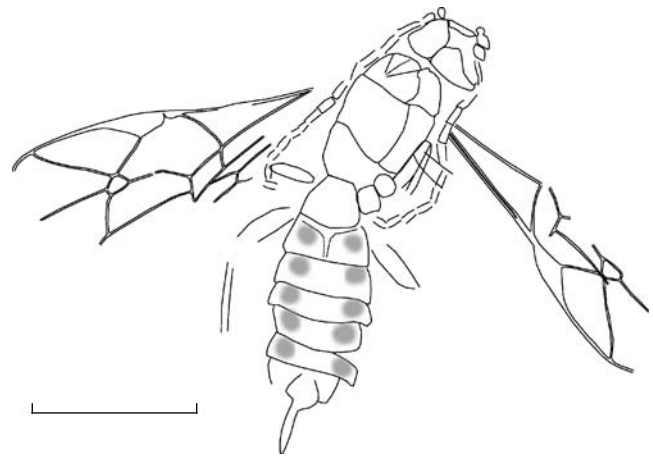


Fig. 3. *Palaeoichneumon ornatus* sp. nov., holotype PIN, no. 3559/4488, female.

Measurements, mm. Head length, 0.35; thorax length, 0.85; metasoma length, 1.5; ovipositor length, 0.3; forewing length, 2.2; forewing width, 1.0.

Comparison. The new species is similar to *P. freja*, from which it differs in having the forewing with r-m and 2m-cu developed and in the absence of the ramulus.

Remarks. The longitudinal suture on the mesonotum, which is present in both *P. freja* and *P. ornatus*, is uncharacteristic of most known Ichneumonidae. Apparently, it is inherited from the primitive Apocrita.

Material. Holotype.

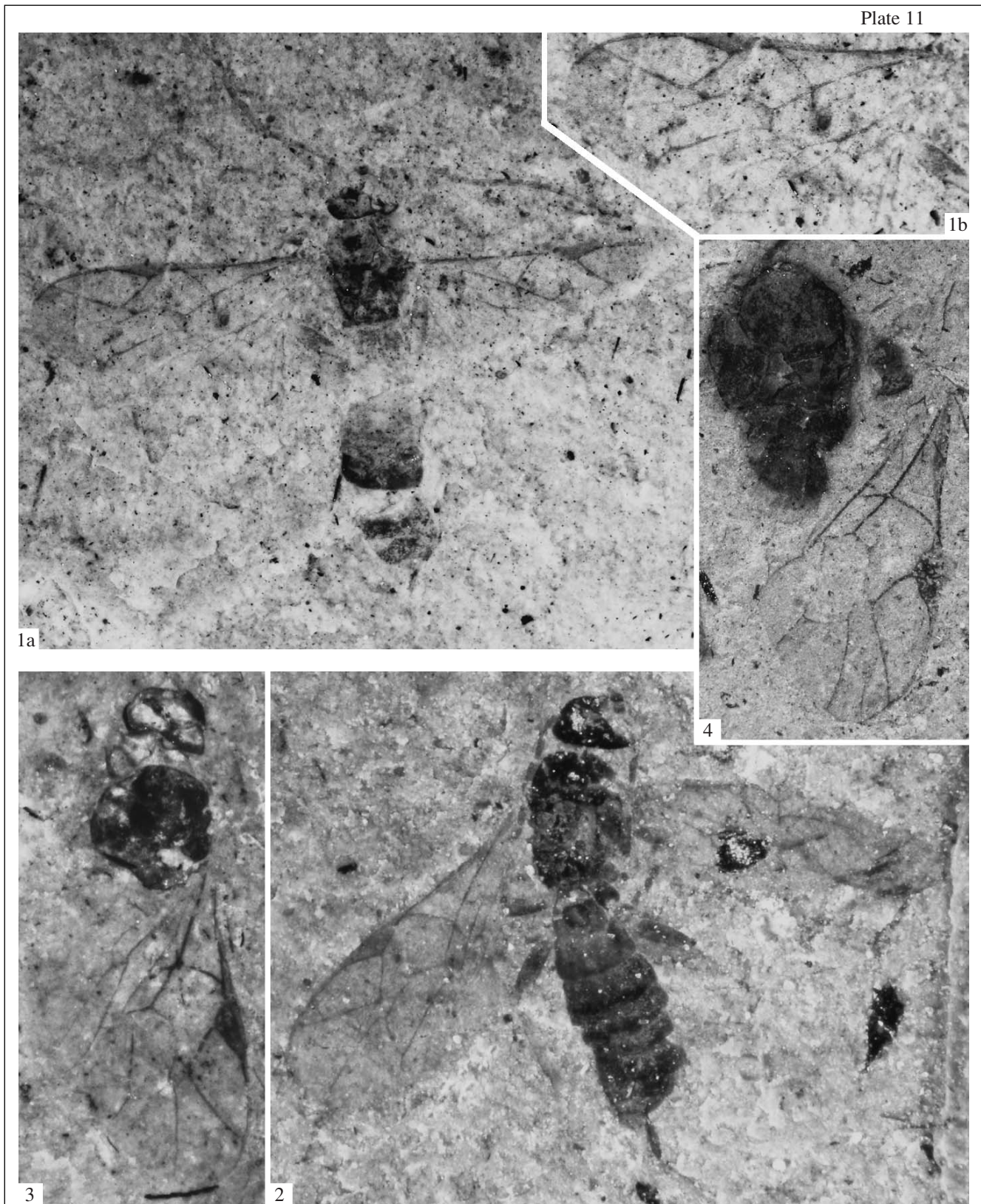
Palaeoichneumon danu Kopylov, sp. nov.

Plate 11, fig. 3

Etymology. From the name of the Celtic goddess Danu.

Holotype. PIN, no. 3559/4489, positive and negative impressions (sex unknown); the head and thorax are poorly preserved, one complete flagellomere is preserved, the legs and metasoma are missing, one forewing and one hindwing are well preserved; Bon Tsagan locality, outcrop 87/8; Bon Tsagan Group, Khurilt sequence.

Description (Fig. 4). The body is dark brown, the wing veins are light brown. The forewing is very wide, only twice as long as wide; the pterostigma is wide; the vein C + Sc + R basad of pterostigma is very wide; the interval between C and Sc + R is distinct; r-rs is 1.7 times as long as the pterostigma width; the distal abscissa of Rs is 1.7 times as long as r-rs; the distance between the pterostigma base and the basal vein equals one-third of the vein length; the ramulus is well developed; the second abscissa of Rs + M is 1.4 times as long as the areolet, interrupted at the middle; the areolet is 1.5 times as long as wide; r-m is reduced (except a small part on R); 2m-cu is interrupted at two points, very faint at the middle; 1cu-a is postfurcal, one-third



the length of the basal vein. In the hindwing, the first abscissa of R is strongly curved; the first abscissa of Rs is curved anterad, as long as r-m; the free end of Rs is

somewhat arched posterad at its base, recurved posterad near the wing apex; r-m is interrupted at the middle; the first abscissa and the free end of M are both

Explanation of Plate 11

Fig. 1. *Palaeoichneumon freja* sp. nov., holotype PIN, no. 4210/1146, Baisa locality: (a) general appearance, $\times 22$; (b) wing, magnified, $\times 29$.

Fig. 2. *Palaeoichneumon ornatus* sp. nov., holotype PIN, no. 3559/4488, Bon Tsagan locality, $\times 30$.

Fig. 3. *Palaeoichneumon danu* sp. nov., holotype PIN, no. 3559/4489, Bon Tsagan locality, $\times 26$.

Fig. 4. *Palaeoichneumon tenebrosus* sp. nov., holotype PIN, no. 3559/676, Bon Tsagan locality, $\times 16$.

arched posterad; the first abscissa of Cu is straight, 1.5 times as long as r-m.

Measurements, mm. Head length, 0.5; thorax length, 1.2; forewing length, 2.4; forewing width, 1.25; hindwing length, 1.8.

Comparison. The new species differs from *P. freja* in the better developed 2m-cu in the forewing and the longer first abscissa of Rs in the hindwing. It differs from *P. ornatus* in the forewing with r-m absent and the ramulus present. It differs from both species in the wider forewing (half as wide as long), the wider pterostigma, and the presence of the costal vein.

Material. Holotype.

Palaeoichneumon micron Kopylov, sp. nov.

Etymology. From the Greek *mikron* (small).

Holotype. PIN, no. 4210/1147, positive and negative impressions (sex unknown); the body is relatively well-preserved, except the apical metasomal segments, which are missing; the antennae each with the scape, pedicel, and three flagellomeres preserved; in the positive impression, the forewing shows distinct venation, is broken at the base, and rotated posterad, its venation is distinct; the hindwing venation is distinct on the reverse impression; Russia, Transbaikalia, Baisa locality; Lower Cretaceous, Zaza Formation, layer 4.

Description (Fig. 5). The body is dark brown, the wing veins are light brown, the scapes are dark, the pedicels are light, the flagellomeres are light brown. The scapes are short, spherical, slightly longer than wide; the pedicels are small, conical, each as long as wide at the base; the preserved flagellomeres are cylindrical, each 3.5 times as long as wide. The forewing is 2.5 times as long as wide; the pterostigma is narrow, twice as long as wide; r-rs is straight, relatively short; the areolet is incompletely preserved, apparently pentagonal, displaced toward the wing base due to the shortening of r-rs and the second abscissae of Rs + M and lengthening of the distal abscissae of Rs and M; r-m is developed; the ramulus is in the shape of a small protuberance; the basal vein is weakly curved; 1cu-a is postfurcal, positioned at a distance from the basal vein that is greater than its length.

Measurements, mm. Head length, 0.3; thorax length, 0.7; length of preserved part of metasoma, 0.95; length of preserved flagellomeres, 0.12–0.14; forewing length, 1.6; forewing width, 0.6.

Comparison. The new species differs from congeners in the smaller size. In addition, it differs from

P. freja and *P. ornatus* in the greater distance between the basal vein and 1cu-a and from *P. freja* and *P. danu* in the absence of a well-developed ramulus and the presence of the vein r-m.

Material. Holotype.

Palaeoichneumon mirabilis Kopylov, sp. nov.

Plate 12, fig. 1

Etymology. From the Latin *mirabilis* (strange).

Holotype. PIN, no. 4210/1155, positive and negative impressions of an adult (sex unknown), the

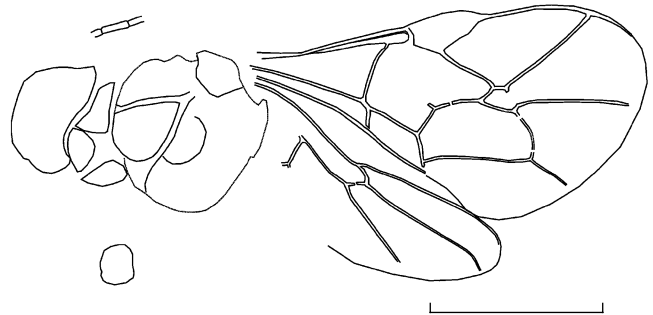


Fig. 4. *Palaeoichneumon danu* sp. nov., holotype PIN, no. 3559/4489.

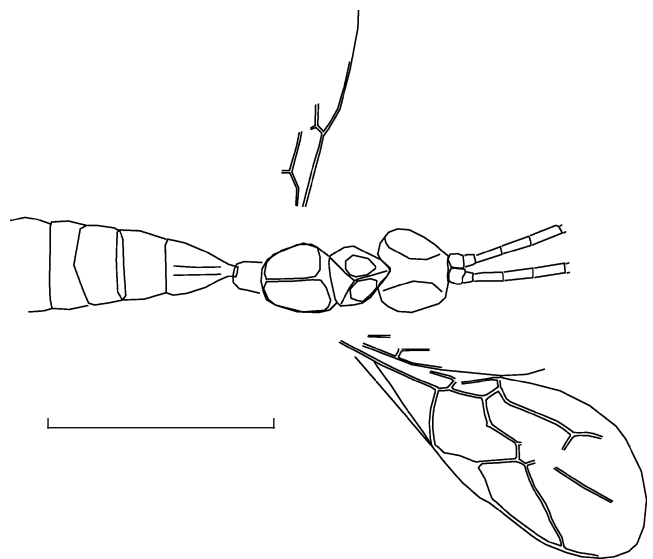
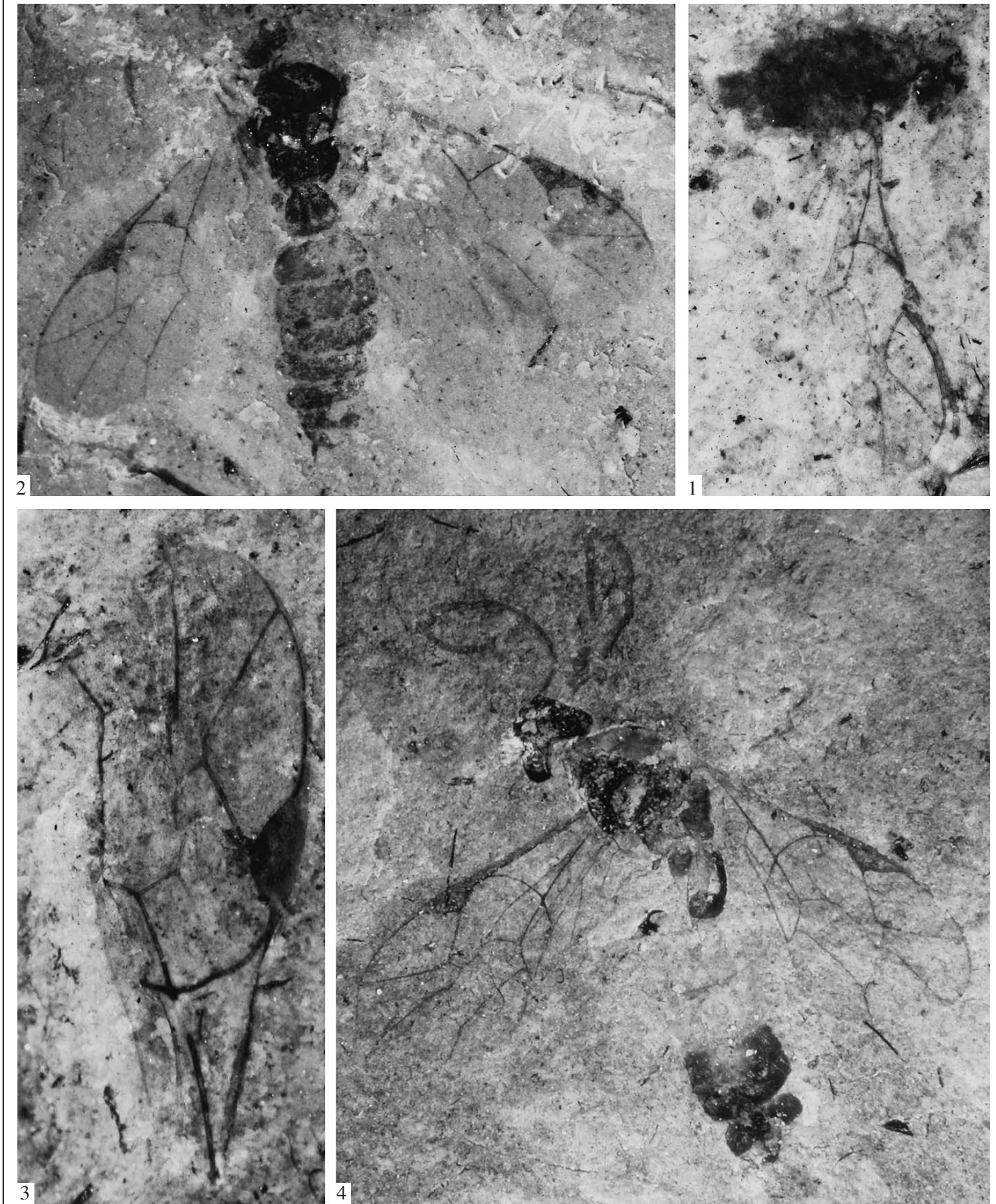


Fig. 5. *Palaeoichneumon micron* sp. nov., holotype PIN, no. 4210/1147.



reverse impression is poorly distinct; the preservation is incomplete; the metasoma, hindwing, and the posterior part of the forewing are missing, the structures of the

head and thorax are poorly distinct, the antennal bases are missing, several wing veins are broken, the vein r-m is partly damaged, the apical flagellomeres are

Explanation of Plate 12

Fig. 1. *Palaeoichneumon mirabilis* sp. nov., holotype PIN, no. 4210/1155, Baisa locality, $\times 25$.

Fig. 2. *Palaeoichneumon townesi* sp. nov., holotype PIN, no. 3147/244, Bon Tsagan locality, $\times 17$.

Fig. 3. *Rudimentifera mora* sp. nov., holotype PIN, no. 3559/4486, Bon Tsagan locality, $\times 24$.

Fig. 4. *Dischysma maculata* sp. nov., holotype PIN, no. 3559/4492, Bon Tsagan locality, $\times 14$.

excellently preserved; Russia, Transbaikalia, Baisa locality; Lower Cretaceous, Zaza Formation, layer 35.

Description (Fig. 6). The thorax, antennae, and wing veins are brown, the head is partly black. In the forewing, the pterostigma is narrow; the vein $r-rs$ is arched; the areolet is unusually long, 2.3 times as long as wide, approximately as long as the second abscissa of $R_s + M$; $2R$ and of $2 + 3M$ have spectral segments; the ramulus is completely reduced, the vein $m-cu$ smoothly continues as the second abscissa of $R_s + M$; $1cu-a$ is postfurcal, arched toward the wing apex; the basal vein is arched, twice as long as $1cu-a$.

Measurements, mm. Head length, 0.4; thorax length, 1.2; forewing length, 2.5.

Comparison. The new species differs from other species of the genus in the larger areolet and the absence of a ramulus.

Remarks. The new species retains the primitive structure of the areolet, which is uncharacteristic of other *Palaeoichneumoninae*. However, the complete reduction of the first abscissa of $R_s + M$ is clearly an advanced character.

Material. Holotype.

Palaeoichneumon tenebrosus Kopylov, sp. nov.

Plate 11, fig. 4

Etymology. From the Latin *tenebrosus* (dark).

Holotype. PIN, no. 3559/676, positive and negative impressions of an adult (sex unknown); one forewing well preserved, thoracic sutures distinct; head, antennae, hindwings, and most of the metasoma missing; Mongolia, Bon Tsagan locality, outcrop 45/19; Lower Cretaceous, Bon Tsagan Group, Khurilt sequence.

Description (Fig. 7). The body and wing veins are dark brown; the propodeal carinae are black. The forewing is very broad, only twice as long as wide; the pterostigma is narrow, three times as long as wide; the distal abscissa of R_s is curved towards the anterior wing margin; the areolet is approximately 1.5 times as long as wide, open apically; $r-m$ is completely reduced (M without a sharp bend corresponding to this vein, R with such a sharp bend barely discernible); $2m-cu$ is spectral in its middle part; the ramulus is long; $1cu-a$ is interstitial, weakly curved; the basal vein is straight basally and strongly curved apically, twice as long as $1cu-a$; the postnervulus (the vein formed by $3Cu$ and $2cu-a$) is straight, the fourth abscissa of Cu deviates off its lower part.

Measurements, mm. Forewing length, 4.1; forewing width, 2.1.

Comparison. The new species is larger than other representatives of the genus. In addition, it differs in the shape of the areolet ($r-m$ is reduced without traces visible on either R or M), the shape of the basal vein, the shape of the distal abscissa of R_s , the interstitial position of $1cu-a$ (a similar condition is observed in *P. freja* and *P. ornatus*), and the long ramulus (except for *P. danu*).

Material. Holotype.

Palaeoichneumon townesi Kopylov, sp. nov.

Plate 12, fig. 2

Etymology. In memory of H. Townes.



Fig. 6. *Palaeoichneumon mirabilis* sp. nov., holotype PIN, no. 4210/1155.

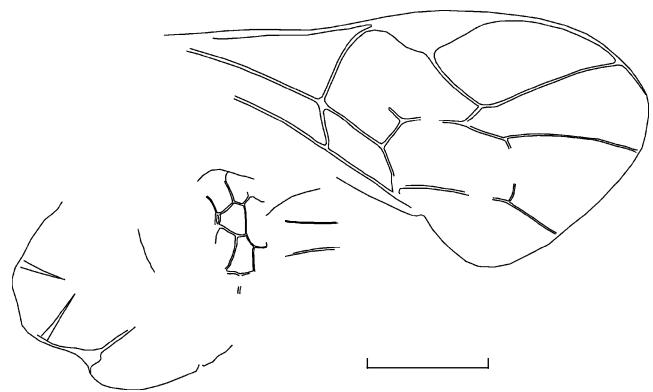


Fig. 7. *Palaeoichneumon tenebrosus* sp. nov., holotype PIN, no. 3559/676.

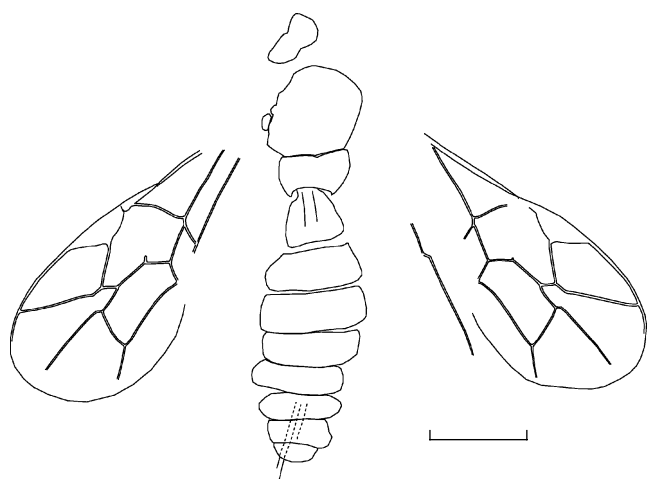


Fig. 8. *Palaeoichneumon townesi* sp. nov., holotype PIN, no. 3147/244, female.

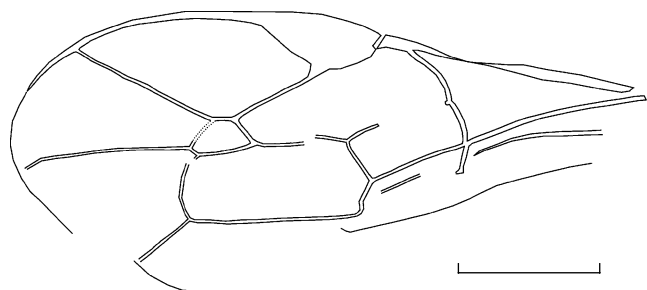


Fig. 9. *Rudimentifera mora* sp. nov., holotype PIN, no. 3559/4486.

Holotype. PIN, no. 3147/244, direct impression of a female; the head and thorax are poorly preserved, the antennae are missing, the forewing and metasoma are well preserved, the hindwings are mostly missing, the ovipositor is broken at the base; Mongolia, Kholbotu Gol locality; Lower Cretaceous, Bon Tsagan Group, Khurilt sequence.

Description (Fig. 8). The head, metasoma, and wing veins are brown, the thorax is dark brown. The forewing is 2.3 times as long as wide; the pterostigma is 2.7 times as long as wide; *r-rs* is straight; the areolet is long, 1.8 times as long as wide; *r-m* is completely reduced; *2m-cu* is weakly curved, without distinct sclerotized parts; the ramulus is short; *1cu-a* is strongly postfurcal, weakly curved; the basal vein is S-shaped, 2.5 times as long as *1cu-a*.

Measurements, mm. Head length, 0.6; thorax length, 1.3; metasoma length, 2.9; forewing length, 3.4; forewing width, 1.5.

Comparison. The new species differs from congeners in the basal vein being S-shaped, *1cu-a* strongly postfurcal (except for *P. danu* and *P. micron*), and in the shape of the areolet (except for *P. freja*).

Material. Holotype.

Genus *Rudimentifera* Kopylov, gen. nov.

Etymology. From the Latin *rudimentum* (rudiment) and *fero* (to bear). The gender is feminine.

Type species. *Rudimentifera mora* sp. nov.

Diagnosis. Imago. First abscissa of *Rs + M* with its central part completely reduced, its rudimentary distal part forming long ramulus, and its small rudimentary proximal part preserved as sharp bend of basal vein; areolet not longer than second abscissa of *Rs + M*; *r-m* with one bulla, *2m-cu* with one or two bullae; *1cu-a* weakly antefurcal or interstitial.

Species composition. Two new species.

Comparison. The new genus differs from *Palaeoichneumon* in the presence of the basal rudiment of *Rs + M*, the ramulus being long, and *1cu-a* antefurcal. Other characters (the shortened areolet and the long second abscissa of *Rs + M*) are shared with *Palaeoichneumon*.

Remarks. In the structure of the first abscissa of *Rs + M* (reduced in the middle, with its rudiments preserved on each end), the new genus resembles *Tanychorella dubia* Zhang et Rasnitsyn, 2003 (Tanychorinae), from which it differs in the shorter areolet, the longer second abscissa of *Rs + M*, and the interstitial or weakly antefurcal *1cu-a*. It differs from the Recent Ichneumonidae in the presence of the *Rs + M* rudiment on the basal vein (such rudiments may appear secondarily, for example, in *Megarhyssa*), and in the larger areolet. Some of the Recent Labeninae are similar to the new genus in the shape of the areolet, but not in the development of the *Rs + M* rudiments.

Rudimentifera mora Kopylov, sp. nov.

Plate 12, fig. 3

Etymology. From the name of the Slavic goddess Mora (Morana).

Holotype. PIN, no. 3559/4486, positive and negative impressions of a well-preserved forewing with its anal region crumpled somewhat; Mongolia, Bon Tsagan locality, outcrop 87/8; Lower Cretaceous, Bon Tsagan Group, Khurilt sequence.

Description (Fig. 9). The pterostigma is wide, semicircular; *r-rs* is 1.8 times as long as the width of the pterostigma, deviates just before the middle of the pterostigma, its base is distinctly thickened and slightly curved; the cell *2R1* is short and wide, 2.4 times as long as wide; *C* extends far beyond the apex of *2R1* (up to half distance to the apex of *M*); the distance between the pterostigma and the basal vein equals 0.3 length of this vein; the first abscissa of *Rs* is 1.5 times as long as the first abscissa of *M*; the basal rudiment of *Rs + M* is distinct; the ramulus is 0.4 as long as the distance between the sharp bend of the basal vein and the apex of *1m-cu*; the areolet length is twice its maximum width; the second abscissa of *Rs + M* is 1.35 times as long as the areolet; *r-m* is distinct only in its posterior part, spectral elsewhere; *2m-cu* almost reaches the apex

of the areolet, is briefly interrupted only before M; the veins M and Cu closely approach the wing margin; 1cu-a is weakly antefurcal, situated basad of M by half of its width.

Measurements, mm. Forewing length, 4.6; width, 2.0.

Material. Holotype.

Rudimentifera suspecta Kopylov, sp. nov.

Etymology. From the Latin *suspectus* (suspicious).

Holotype. PIN, no. 4210/1154, positive and negative impressions, the negative impression is indistinct, the sex is unknown; the wing veins are badly broken, the structure of the areolet is obscure, the hindwing with its veins are well preserved; Russia, Transbaikalia, Baisa locality; Lower Cretaceous, Zaza Formation, layer 31.

Description (Fig. 10). The body, head, and antennae are dark brown, metasomal segments I–III and a part of segment IV are depigmented, the wing veins are brown. In the forewing, the pterostigma is elongate; the basal vein near its middle forms a sharp bend, corresponding to the point of origin of the reduced first abscissa of Rs + M; the ramulus is moderately long; the second abscissa of Rs + M is spectral apically, as long as 1m-cu; the areolet appears to be large, approximately as long as the second abscissa of Rs + M; the vein 2cu-a is interrupted at two points, most likely corresponding to the spectral areas in the original vein; 1cu-a is interstitial, curved toward the wing apex, 0.42 times as long as the basal vein. In the hindwing, the first abscissa of Rs is half as long as r-m; the first abscissa of Cu is four times as long as cu-a.

Measurements, mm. Head length, 0.3; head width, 0.5; maximum length among preserved flagellomeres, 0.11; thorax length, 1.3; metasoma length, 2.2; apparent length of forewing, 2.7.

Comparison. The new species differs from *R. mora* in the smaller size, the reduced basal rudiment and the shorter distal rudiment (ramulus) of the first abscissa of Rs + M, the interstitial position of 1cu-a, and the shorter second abscissa of Rs + M.

Material. Holotype.

Genus *Dischysma* Kopylov, gen. nov.

Etymology. From the Greek *di* (two) and *schisma* (split), referring to the presence of two bullae in the vein r-m. The gender is feminine.

Type species. *Dischysma maculata* sp. nov.

Diagnosis. Forewing without either basal rudiment of Rs + M, or corresponding bend on basal vein; areolet usually short, much shorter than second abscissa of Rs + M or r-rs; veins r-m and 2m-cu each with

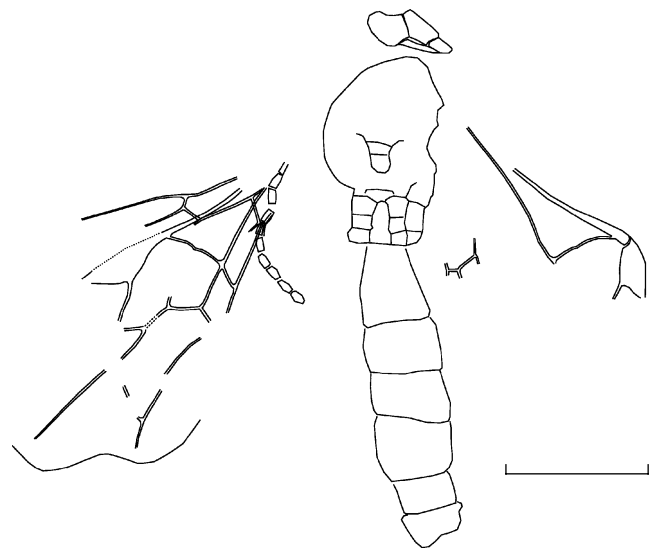


Fig. 10. *Rudimentifera suspecta* sp. nov., holotype PIN, no. 4210/1154.

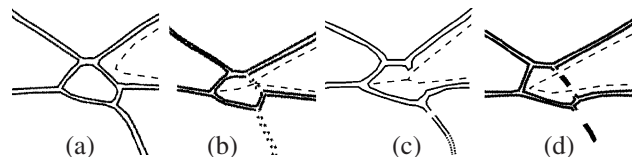


Fig. 11. Areolae of Palaeoichneumoninae: (a) *Palaeoichneumon ornatus* sp. nov., (b) *P. freja* sp. nov., (c) *P. danu* sp. nov., and (d) *Dischysma maculata* sp. nov.

two bullae; 1cu-a postfurcal or interstitial. Large-sized, forewing at least 4 mm long.

Species composition. Three new species.

Comparison. The new genus differs from other genera in having two bullae on the vein r-m. It differs from *Rudimentifera* in the absence of the basal rudiment of Rs + M. The new genus is much larger than the known representatives of *Palaeoichneumon* (with exception of *P. tenebrosus*), in all other respects closely similar to those.

Remarks. Among the Recent Ichneumonidae, the vein r-m interrupted at two points is a relatively rare character. Nevertheless, it occurs in some representatives of Pimplinae (*Pimpla*, *Theronia*), Gelinae (*Stilpnus*), and Orthocentrinae (*Orthocentrus*). This condition arises when the fold coming from inside the areolet branches even inside that cell, so that it crosses r-m as two independent stems (Fig. 11). The position of folds has a significant effect on the aerodynamics of the wing and, consequently, on the flight style, speed, maneuverability, etc. Apparently, the peculiarities of venation in *Dischysma* are associated with its large size.

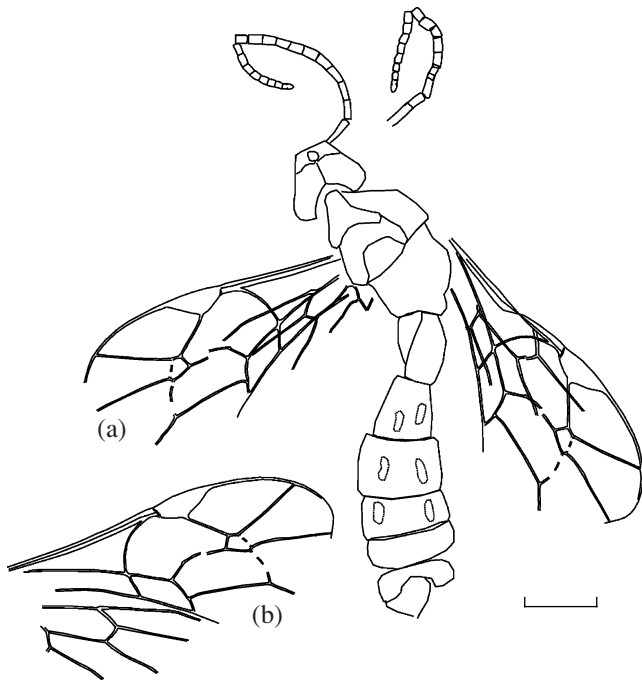


Fig. 12. *Dischysma maculata* sp. nov., holotype PIN, no. 3559/4492: (a) drawing of the impression; (b) reconstruction of the spread-out wings.

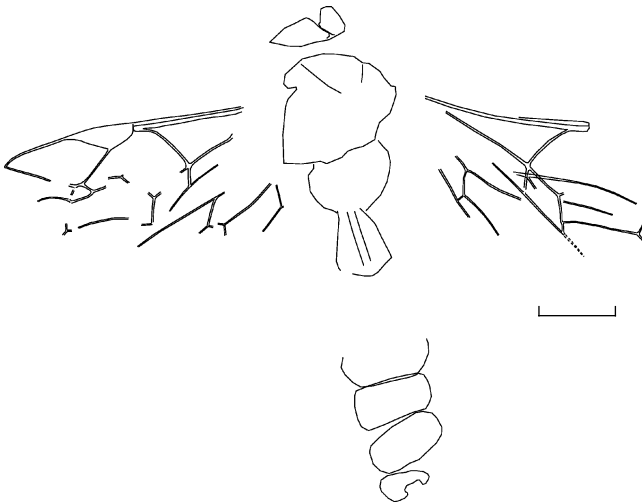


Fig. 13. *Dischysma similis* sp. nov., holotype PIN, no. 3559/4490.

Dischysma maculata Kopylov, sp. nov.

Plate 12, fig. 4

E t y m o l o g y. From the Latin *maculatus* (spotted).

H o l o t y p e. PIN, no. 3559/4492, positive and negative impressions, sex unknown; the fine structure of the antennae, particularly of the apical flagellomeres, is well preserved; venation of the forewings and, partly, of the hindwings is well preserved; the structure of the thorax and metasoma is poorly preserved (in particular,

the notauli are invisible); the negative impression is split in the head area, it shows metasomal segments II–IV with paired elongate darker maculae (not visible in the positive impression); Mongolia, Bon Tsagan locality, outcrop 87/8; Lower Cretaceous, Bon Tsagan Group, Khurilt sequence.

D e s c r i p t i o n (Fig. 12). The head and thorax are black; the antennae, wing veins, and metasoma are brown; metasomal segments II and III are depigmented; sternites II–IV have paired elongate pigmented maculae (apparently, the attachment areas of muscles). In the antennae, 19 antennomeres are discernible, which become gradually shorter towards the apex; the apical antennomere is subdivided into two parts by a constriction. The forewing is 2.4 times longer than wide; the first abscissa of Rs + M is completely missing, with only a small protuberance in the place of the ramulus; the areolet is as long as wide; the second abscissae of Rs + M and of r–rs are twice as long as the areolet; the basal vein is arched; 1cu–a is postfurcal, straight, 0.43 times as long as the basal vein; the second abscissa of Cu is 1.9 times as long as 2cu–a; the postnervulus is weakly arched, without a sharp bend at the point of origin of the third abscissa of Cu. In the hindwing, the first abscissa of Rs is longer than r–m, these two veins are positioned at a right angle.

M e a s u r e m e n t s, mm. Head length, 0.9; thorax length, 2.1; metasoma length, 4.2; forewing length, 4.6; forewing width, 1.9.

M a t e r i a l. Holotype.

Dischysma similis Kopylov, sp. nov.

E t y m o l o g y. From the Latin *similis* (resembling).

H o l o t y p e. PIN, no. 3559/4490, badly damaged positive and negative impressions (the latter is almost completely destroyed), sex unknown; the head is damaged, the antennae are not preserved, some thoracic structures (for example, notauli) and only some metasomal segments are discernible, the wing veins are badly broken; however, the main venation elements are discernible; Mongolia, Bon Tsagan locality, outcrop 87/8; Lower Cretaceous, Bon Tsagan Group, Khurilt sequence.

D e s c r i p t i o n (Fig. 13). The body is dark brown, metasomal segments II and III are depigmented, the wing veins are brown, the basal vein and 1cu–a are black. The notauli are convergent. In the forewing, the first abscissa of Rs + M is missing, the short ramulus (as long as the vein width) is retained; the areolet is 1.5 times longer than wide; r–rs is 1.8 times as long as the areolet; the basal vein is weakly curved; 1cu–a is interstitial, straight, 0.3 times as long as the basal vein.

M e a s u r e m e n t s, mm. Body length, 6.6; thorax length, 2.1; metasoma length, 3.9; length of preserved part of forewing, 3.6 (estimated intact length, 4.1); length of preserved part of hindwing, 2.0.

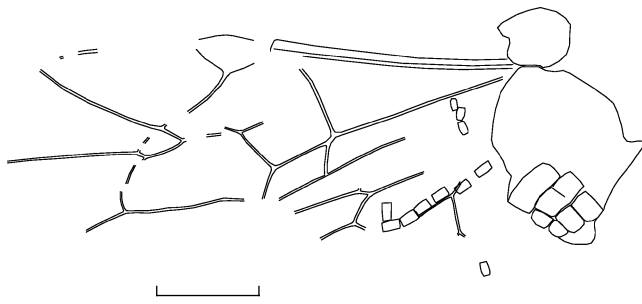


Fig. 14. *Dischysma ramulata* sp. nov., holotype PIN, no. 3559/10155.

Comparison. The new species is highly similar to *D. maculata*, from which it differs in the interstitial position of 1cu-a, the shorter 1cu-a, the larger ramulus, the longer areolet, and the less curved basal vein.

Dischysma ramulata Kopylov, sp. nov.

Etymology. From the Latin *ramulus* (a small branch), which is the name of the rudiment of the first abscissa of Rs + M in the Ichneumonidae.

Holotype. PIN, no. 3559/10155, poorly preserved positive impression; the veins are partly damaged, yet the diagnostic characters of venation are preserved, and several antennomeres are excellently preserved (with some sensilla visible); Mongolia, Bon Tsagan locality, outcrop 74; Lower Cretaceous, Bon Tsagan Group, Khurilt sequence.

Description (Fig. 14). The body, antennae, and wing veins are brown. The preserved antennomeres are cylindrical, slightly convex, each twice as long as wide, the largest among them are 1.5 times as long as the smallest. The forewing has a wide pterostigma; the vein r-rs is arched; the areolet is at most 1.1 times longer than wide; the ramulus is long; 1cu-a is postfurcal, curved towards the wing apex. In the hindwing, the first abscissa of Rs is inclined, positioned at a right angle to r-m; the first abscissa of Cu is long, 1.2 times as long as the first abscissa of Rs.

Measurements, mm. Head length, 0.5; thorax length, 1.8; length of the largest antennomere, 0.17; length of preserved part of forewing, 5.1 (estimated intact length, 5.3).

Comparison. The new species differs from the other congeners by the longer ramulus, the larger size,

and the postfurcal position of the vein 1cu-a, which is distinguished by a noticeable curvature.

Material. Holotype.

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