

Ammostigmus, a New Genus of Digger Wasps of the Subtribe Ammoplanina (Hymenoptera, Crabronidae) from Southwestern India

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Abstract—A new pemphredonine genus, *Ammostigmus* (Hymenoptera, Crabronidae), is described from southwestern India. The new genus differs from the other genera of the subtribe Ammoplanina in the quadridentate apical margin of the clypeus, non-bilobed labrum, the presence of postspiracular carina and omaulus, and the absence of episternal sulcus. Phylogenetically the new genus is most closely related to the genus *Protostigmus* Turner, 1918.

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The tribe Ammoplanini was first distinguished in the subfamily Pemphredoninae for several genera of small digger wasps with a hypertrophied pterostigma and a strongly reduced wing venation (Evans, 1959). Later, the taxon was downgraded to the subtribe Ammoplanina of the tribe Pemphredonini in the same subfamily (Bohart and Menke, 1976) and was treated in such a way by the subsequent researchers (Marshakov, 1976, 1979; Bouček, 2001). Only once a proposition was advanced, based on cladistic analysis, that this group should be placed within the subfamily Asiatinae and assigned the rank of the tribe Ammoplanini (Melo, 1999). However, this point of view was not supported by other authors (Engel, 2005; Hanson and Menke, 2006). In my opinion too, the current position of the taxon in the classification of suprageneric taxa in Pulawski's (2009) catalog, based on examination of much more extensive material, is better grounded. According to this classification, the subtribe Ammoplanina belongs to the tribe Pemphredonini of the subfamily Pemphredoninae and comprises the genera *Ammoplanops* Gussakovskij, 1931 (15 species), *Ammoplanus* Giraud, 1869 (42 species of the nominotypical subgenus and 19 species of the subgenus *Ammoplanellus* Gussakovskij, 1931), *Protostigmus* Turner, 1918 (= *Anomiapteryx* Gussakovskij, 1935) (4 species), *Pulverro* Pate, 1937 (13 species), and *Timberlakea* Pate, 1939 (5 species). One of the prominent features of the representatives of the subtribe Ammoplanina is the strongly reduced venation of their fore wings caused by their extremely small sizes bodies

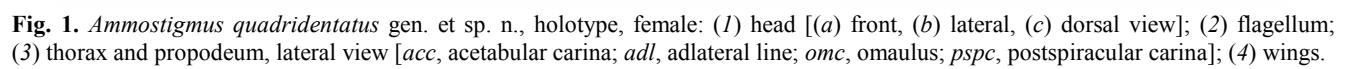
(Rasnitsyn, 1980). The members of this group seem to be the smallest digger wasps with the body length exceeding 4 mm only in exceptional cases and mostly varying between 2 and 3 mm, which can be compared only with the size of the representatives of the subtribe Spilomenina of the same tribe, and also some genera of the tribe Miscophini (Crabronidae, Crabroninae) (Lomholdt, 1985). The species of the subtribe Ammoplanina are mainly distributed in arid biotopes, known only from the Holarctic and Ethiopian Regions.

In the present paper, I describe the monotypical genus *Ammostigmus* gen. n., which, in my opinion, also belongs to the subtribe Ammoplanina (Crabronidae, Pemphredoninae, Pemphredonini).

AMMOSTIGMUS Antropov, gen. n.

Type species *Ammostigmus quadridentatus* Antropov, sp. n.; designated here.

Diagnosis. Small wasps with body length not exceeding 2.0–2.5 mm. Head nearly prognathous; vertex above eyes considerably convex (Fig. 1, 1a); lower part of frons weakly depressed along sharp median carina passing onto base of clypeus and terminating with sharp triangular tooth; inner orbits of eyes slightly converging in lower part; antennal scrobes adjoining clypeus; clypeus short, with quadridentate apical margin, without deep apical emargination; inconspicuous occipital carina present only in dorsal part; hypostomal carina entire; mandibular emargina-



tions closed on inner surface by sharp triangular processes of hypostoma; mandible with apical tooth and with flat, ovally widened inner lobe, without ventral projection (Fig. 1, 1a); labrum widened at base, strongly narrowed in apical part, deflexed apically; palpal formula 6-4; scape slightly shorter than 1/3 of length of antenna; all flagellar segments longer than wide (Fig. 1, 2). Pronotal collar low, with ill-defined transverse costa; mesonotum strongly convex; admedian and parapsidal lines absent, adlateral lines in form of distinct sulci running from posterior margin of mesonotum and reaching 2/3 of its length; postspiracular carina developed; omaulus developed, originating from median part of humeral callus of pronotum, connected below with those fragments of acetabular carina which running in parallel to anterior margin of mesopleura and separated near median line of lower part of thorax (Fig. 1, 3); subomaulus, episternal and scrobal sutures, hypersternaulus, sternaulus, verticaulus, and precoxal tooth absent; scrobus inconspicuous, situated in posterior part of mesopleura; anterior part of metapleura weakly narrowed below, without widened dorsal ridge. Middle and hind coxae approximate; legs not modified, slender; outer side of hind tibia with fine spines longest in basal part; fore tarsus without outer setae of digging rake. Fore wing (Fig. 1, 4) with large pterostigma pointed at apex (*ptStg*), marginal cell very short and not closed at apex (*r*); 1*R* absent; 2*RS* + 1*r-m* shorter than 2*r-rs*; outer free angle of submarginal cell (1*rm*) rectangular, not projecting beyond apex of pterostigma; recurrent vein (1*m-cu*) approaching submarginal cell in its basal third; discoidal cell (1*mcu*) weakly elongate; 1*RS* subequal to *prStg*; median vein (*M*) very weakly curved; 2*M* + *Cu* distinctly longer than antefurcal *cu-a*; submedian (1*cua*) and subdiscoidal (2*cua*) cells closed. Hind wing with hyaline but distinctly outlined veins, except for costal vein, with 2 cells closed on outer side; 1*M* + *Cu* incomplete, situated far from base of wing; *cu-a* interstitial; 2nd mediocubital abscissa (2*M* + *Cu*) and median vein (*M*) forming arc strongly concave inwards; anterior margin of wing with 4 hamuli; jugal lobe weakly separated, slightly shorter than submedian cell (*cua*). Propodeum without lateral carinae; its dorsal side without median carina, slightly longer than posterior side which bearing median depressions. Metasoma shorter than mesosoma, flattened dorsoventrally, without pronounced stem; apical tergite with narrow lustrous pygidial area bounded at sides by subparallel ridges.

Distribution. The only known species originates from southwestern India, being, thus, the first representative of the subtribe Ammoplanina found in the Oriental Region.

Biology unknown, but, judging by the structure of the mandibles, fore tarsus, and apex of the female metasoma may be similar to that of the other representatives of the subtribe.

Comparison. The new genus is similar to some species of the subgenus *Ammoplanellus*, genus *Ammoplanus*, in the fore-wing venation, especially in the apically open radial cell and the absence of 1*R*, but differs in the apically pointed pterostigma, in the submarginal cell with the rectangular outer angle not projecting beyond the apex of the pterostigma, in the shorter discoidal cell, the recurrent vein connected with the submarginal cell in its basal third, the slightly curved median vein, and the vein *cu-a* shorter than 2*M*+*Cu*.

The new genus is most similar to the genus *Prostigmus* Turner, 1918 in the hind-wing venation, especially, in the interstitial position of *cu-a* and in the inward-concave vein formed by the 2nd mediocubital abscissa and median veins, and also in the apically pointed pterostigma and the slightly curved median vein of the fore wing, but differs in the marginal cell open at the apex and in the absence of the 2nd submarginal cell.

Ammostigmus differs from all the genera of the subtribe Ammoplanina in the short clypeus without median emargination and with four teeth along the apical margin, the strongly narrowed apical part of the labrum, and also in the presence of postspiracular carina and omaulus and the absence of episternal suture (Fig. 1, 1a, 3).

Systematics. Owing to their extremely small size, the representatives of Ammoplanina demonstrate a scanty set of external diagnostic features not depending on the concrete characters of their biology and, consequently, not subject to reduction or reversion. Among the available features, the characters of the wing venation seem to be most suitable for analysis.

It is beyond doubt that the initial structure of the fore wing of Ammoplanina included an apically closed and sharp unshortened marginal cell, an enlarged pterostigma touching the anterior margin of the wing, two submarginal cells (the 2nd submarginal cell considerably narrowed anteriorly), one discoidal cell, and

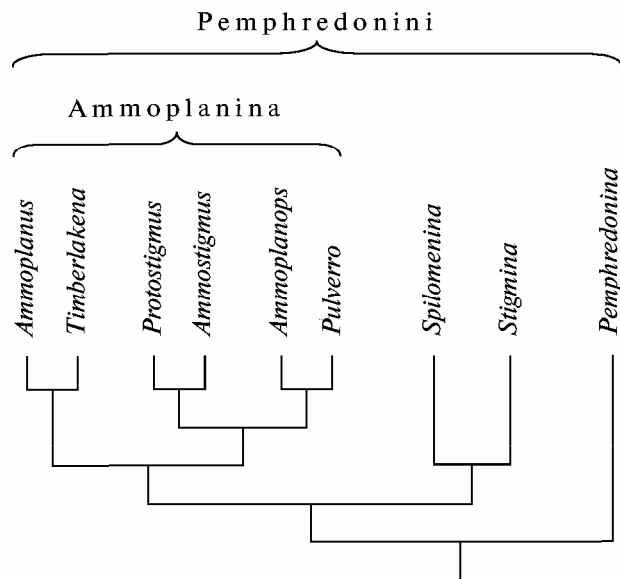


Fig. 2. Scheme of the phylogenetic relationships of the subtribes of the tribe Pemphredonini and the genera of the subtribe Ammoplanina (fossil forms are not included).

also the median cell and the closed submedian and subdiscoidal cells (Melo, 1999). The hind wing has retained two initially closed cells. The structure of the median cell is closest to that typical of Crabronidae, when the vein *RS* approaches the anterior margin of the wing at an acute outer angle, being directed toward the base of the wing, the vein closing the median cell posteriorly ($2M + Cu + M$) is inverted into the cell, whereas the cross-vein *cu-a* is postfurcal.

In my opinion, the subsequent evolution of the wing venation in the genera of the subtribe Ammoplanina followed three directions (Fig. 2).

The first, most generalized lineage is characterized by a slightly shortened, closed marginal cell with a sharp apex touching the anterior margin of the wing, the elongate pterostigma sharp apically, and a weakly curved median vein. At the same time, the synapomorphic states are either the reduction of the 2nd radiomedian cross-vein (*1r-m*) (*Pulverro*) or the loss of this vein and of the 2nd submarginal cell initially petiolate anteriorly (*Ammoplanops*). In both cases, this is substantiated by the position of the anterior end of the 1st recurrent vein near the posterior outer angle of the 1st submarginal cell. The hind-wing venation in both the genera is of the primary type, complete, with the postfurcal cross-vein *cu-a*.

The second lineage of Ammoplanina is similar to the first one in the shape of the pterostigma and me-

dian vein, the synapomorphic states are the strongly shortened marginal cell separated from the anterior margin of the wing and either closed at the end of the pterostigma (*Protostigmus*), or open anteriorly (*Ammostigmus* gen. n.), and also the interstitial position of the cross-vein *cu-a* in the hind wing. Various species of *Protostigmus* have a trapeziform, triangular, or anteriorly petiolate 2nd submarginal cell, but in *Ammostigmus* gen. n., it is reduced, judging by the rectangular posterior outer angle of the 1st submarginal cell, as a result of the gradual reduction of the petiolate variant. The hind-wing venation in both the genera is also of the primary type, complete, though the vein *RS* is even shorter than that in the first group.

And lastly, the third lineage of Ammoplanina includes two genera (*Timberlakena* and *Ammoplanus*), in which the synapomorphic states are the pterostigma rounded at the apex, the median vein strongly curved toward the base of the wing, and also the convex median cell and the antefurcal position of the vein *cu-a* in the hind wing.

The presence of a rather elongate marginal cell and two submarginal cells seems to be the initial state for this lineage. In the genus *Timberlakena*, these cells have nearly the same shape. At the same time, the open apex of the marginal cell and also the tendency toward a gradual reduction of the outer closing vein *1R* should be considered autapomorphies of this genus. The 2nd submarginal cell was initially trapeziform in this genus. Later, both radiomedian cross-veins (*2RS* and *1r-m*) were synchronously reduced, and as a result, the 2nd submarginal cell was lost and the 1st one became open on the outer side. Simultaneously, the rudiment of *1R* was reduced and the vein 4-5*RS* shortened, hence the marginal cell became even more widely open than that in the genera *Ammostigmus* gen. n. and *Ammoplanus*. At last, the hind-wing venation, except for the vein *R* and the bases of *M + Cu* and *1A*, was entirely reduced, and its state can be analyzed only based on the hardly visible traces of the other veins.

The genus *Ammoplanus* demonstrates the following autapomorphies: the marginal cell is considerably shortened and the outer angle of the only, distinctly elongate submarginal cell is acute and distinctly projects beyond the apex of the pterostigma. This cell seems to be formed as a result of the reduction of the 1st radiomedian cross-vein (*2RS*) and the fusion of the 1st submarginal cell and the 2nd submarginal cell (the

latter, judging by the short vein *2r-rs*, was initially triangular). Part of species (subgenus *Ammoplanellus*) are additionally characterized by a more or less reduced *1R* and by the shortened vein *4-5RS* separated from the anterior margin of the wing, which makes the marginal cell open. The hind-wing venation is complete, with a considerably shortened vein *RS* nearly perpendicular to the anterior margin of the wing. In addition, most veins of the hind wing, except for *R* and the bases of *M + Cu* and *1A*, are rather strongly discolored. However, a rather great width of the median cell points to its origin from the initial type.

Thus, though being similar to the representatives of *Ammoplanus* (*Ammoplanellus*) and *Timberlakena* in the structure of the marginal cell, *Ammostigmus* gen. n. is most similar and, obviously, closely related to *Protostigmus* in its other characters.

No fossil representatives of the subtribe *Ammoplanina* have been known, which can be accounted for by the minimum chance to find in soil the remains of such tiny terrabiont forms associated with arid biotopes exclusively. However, judging by rather numerous findings in ambers from Taimyr, New Jersey, the Baltic, and Rovno (Ukraine) of the fossil xylobiont forms attributed to, or considered being rather closely related to the modern *Spilomenina* and *Pemphredonina* (Evans, 1973; Sorg, 1986; Budrys, 1993; Antropov, 2000, 2000a), the formation of *Ammoplanina* can also be assigned at least to the Upper Cretaceous.

Etymology. The genus name of the masculine gender is formed by the Greek nouns αμμος (sand—the habitat of the genus) and στίγμα (spot—an enlarged pterostigma).

Ammostigmus quadridentatus Antropov, sp. n.

Material. Holotype: ♀: "INDIA, GOA [Ghoa], Padi. ~15.092°N, 74.0325°E, forest. 3.III.2009, leg. K. Tomkovich" [ZMMU—Zoological Museum of the Moscow State University].

Description. Female. Head in front view slightly wider than long, width to height ratio of head in front view 99 : 90; inner orbits of eyes nearly parallel, slightly curved in lower part toward median line (Fig. 1, 1a); ratio of distances between inner orbits of eyes at level of median ocellus and at level of antennal scrobes equal to 73 : 56; lower part of frons regularly convex at sides, strongly depressed near middle, with sharp carina along median line, length of carina at least 1/3 of distance from apex of clypeus to anterior

ocellus (32 : 76); dorsal side of frons weakly convex, with inconspicuous median sulcus; clypeus very short, with 4 triangular teeth at apical margin; distance between apices of inner teeth shorter than that between apices of inner tooth and nearest outer tooth; distance from antennal scrobe to apex of inner tooth subequal to diameter of scrobe, and that to apex of outer tooth shorter than diameter of scrobe; distance between apices of outer teeth exceeding that between their centers, but shorter than that between outer margins of antennal scrobes; median lobe of clypeus with distinctly separated, depressed apical border; lateral lobes with fine curved transverse costa between antennal scrobe and base of mandible; distance between antennal scrobes nearly twice their diameter and subequal to distance between outer margin of antennal scrobe and nearest ocellus; vertex regularly convex, without plates; ratio of distance between inner eye orbit on vertex and nearest lateral ocellus to diameter of ocellus and to distance between lateral ocelli 15 : 5 : 8; temples regularly rounded posteriorly, their maximum length subequal to length of eye (Fig. 1, 1b); occipital opening and hypostomal carina connected by fine, shortly transversely rugose sulcus; labrum not bifurcate, rounded at sides, strongly narrowed in apical 1/3 (Fig. 1, 1a); length of apical flagellar segment no less than twice its maximum width (Fig. 1, 2). Pronotal collar flattened dorsally, with weak transverse costa anteriorly, without median depression; humeral calli rounded, without ridges. Mesonotum strongly elevated above level of pronotal collar, regularly convex, transverse, nearly twice as wide as long; transverse sulcus between mesonotum and scutellum fine, without inner costae; scutellum regularly plano-convex, with deep transverse depression anteriorly; postscutellum plano-convex, 0.33 times as long as scutellum; mesopleura regularly convex at sides. Fore trochanter elongate, its length 2.8 times its maximum width at apex; middle and hind trochanters not elongate, their length 1.5 times their maximum width at apex; fore femur longitudinally depressed on inner surface in apical half, narrow at base and at apex, regularly widened ventrally in middle, its length 4 times its maximum width; middle femur narrow at base and at apex, regularly widened ventrally in middle, its length 3.3 times its maximum width; hind femur narrow at base, sharply widened dorsally in basal 1/4, then regularly narrowed, its length 4 times its maximum width near base; all tibiae long and slender, not curved, regularly widened toward apices; length of fore, middle, and hind tibiae 4.8, 4.3, and 5.5 times their maximum

width, respectively; tarsal segments slender, not modified; fore and middle tarsi subequal in length to corresponding tibiae, hind tarsus 1.4 times as long as hind tibia. Propodeum without bounded dorsal area and lateral carinae; its dorsal side without median sulcus or carina, and posterior side with fine median sulcus.

Metasomal tergites I–V regularly plano-convex; tergite I basally with flat median depression projecting beyond middle of tergite, width of this depression exceeding maximum width of hind femur; tergite VI flat, with narrow pygidial area bounded at sides by straight and subparallel ridges, obtused at apex; metasomal sternites I–V flattened, concealed to a great extent by lateral parts of corresponding tergites bent onto ventral side; sternite VI weakly convex, narrowly obtused at apex.

Sculpture of body inconspicuous. Frons, vertex, temples, mesonotum, scutellum, postscutellum, mesopleura, posterior side of propodeum, and metasomal tergites I–IV polished, with single scattered micropunctures at bases of microscopic hairs, minimum distance between punctures much greater than 10 their diameters. Pronotum dorsally with fine oblique uniform costae before carina, costae running from median line to sides; pronotal collar bounded anteriorly by fine transverse ridge, finely transversely rugose before this ridge. Metapleura polished, without sculpture. Dorsal part of propodeum with large irregular cells bounded by fine costae, bottom of cells finely alveolate; posterior part of propodeum separated from dorsal part by fine transverse ridge; sides of propodeum with short oblique costae along border with posterior part and intercoxal carina, polished on rest of surface, with single inconspicuous micropunctures.

Metasomal tergites polished, with scattered and very sparse micropunctures at bases of hardly visible short hairs; only tergite V with distinct but irregular sculpture; metasomal sternites lustrous, with slightly more distinct punctures; sternite II with fine transverse rugae at base.

Pubescence of body very sparse, inconspicuous, only mandibles with several raised setae longer than diameter of vertex ocellus. Apical half of flagellum with raised microscopic hairs ventrally. Metasomal segments IV–VI with sparse, semi-recumbent hairs length of which equal to diameter of vertex ocellus. Fore wing with short recumbent setae only on distal part of membrane free from veins, densest setae situated along anterior margin of wing near pterostigma;

entire membrane of hind wing uniformly covered with recumbent setae length of which not exceeding width of veins, posterior margin of wing with fringe of uniform straight setae length of which 1.5 times width of veins.

Body mainly black. Apical border of median lobe of clypeus rufous. Lower corners of frons between clypeus and inner eye orbit with roundly triangular pale yellow spots not larger than antennal scrobe. Mandibles white with rufous apices of teeth. Scape posteriorly and flagellum dorsally blackish brown; scape anteriorly and flagellum ventrally rufescent brown. Labrum pale rufescent yellow; palpi yellowish white. Humeral calli, tegulae, and basal wing sclerites dark brown. Fore and middle coxae rufous, hind coxa dark brown; all trochanters rufous; fore femur rufous at base, rufescent brown in middle and at apex; middle and hind femora dark brown; fore tibia rufous, slightly brownish on inner surface; middle and hind tibiae mainly dark brown, brownish rufous on inner surface at base and apex; all apical spurs of legs pale rufous; tarsal segments pale rufous, apical segments rufous. Wing veins mainly colorless, hyaline, only veins surrounding marginal and median cells of fore wing brownish; pterostigma hyaline at base, brown on rest of surface, with slightly paler middle. Metasoma mainly black; apical tergite brown.

Length (mm): body 2.15, thorax 0.62, propodeum 0.32, metasoma 0.76, fore wing 1.65.

Male unknown.

Etymology. The species name originates from the Latin adjective *quadridentatus* (quadridentate) and points to the shape of the apical margin of the clypeus.

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