

ZOOGEOGRAPHY AND SOME MORPHOLOGICAL PECULIARITIES
OF THE FAMILY TRIGONALOIDAE (HYMENOPTERA)

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The tropical character of the family *Trigonaloidae* is beyond any doubt. According to Bischoff's (1) review, two of the four subfamilies are purely tropical and widespread. The subfamily *Seminotinae* is also tropical, but its distribution is limited to South and Central America. Finally, the subfamily *Trigonaloidae* is the most widespread one, having its representatives in the Palaeartic and Nearctic regions. Out of the 75 species known up to the present, 9 species were found in the Palaeartic and 11 species in the Nearctic regions. However, 8 species out of this number were found in Japan and Korea, and 6 species in Mexico. Only a single species is known (*Pseudogonalos hahni* Spin.) to be widely spread nearly all over the palaeartic region. The same is true of North America. *Bareogonalos canadensis* Harrington, found in Canada and British Columbia, is obviously of southern and foreign origin. Two centres of the most intensive species formation may be pointed out at present. One of these is South- and Central American (including Mexico) comprising 26 species (or 35.1 per cent). The other is Oriental (including Malacca, Japan, and Korea). It comprises 30 species (or 40.6 per cent).

Information as to the parasitism of *Trigonaloidae* is rather scanty. Representatives of the subfamily *Trigonaloidae* are the hyperparasites (or secondary parasites) of parasitic *Ichneumonidae*. Representatives of the remaining three subfamilies are parasitic of various *Vespidae*. It is evident that *Trigonaloidae* are no homotopic parasites, and their geographical distribution is dependent not only on the distribution of the corresponding various hosts, but in the first place on abiotic factors. The fact that they are confined to humid, warm, forest districts is quite evident. According to Brues (2), the most primitive groups of *Hymenoptera*, not only subsisting on plants but also parasitic, are characterized by being confined to districts with woody vegetation.

From this point of view of interest is the northern boundary of distribution of *Pseudogonalos hahni* (Spin.), and the northern boundary of penetration of the elements of Oriental region into the Palaeartic one. The following data resulting from a study of the materials of the Zoological Institute of the Academy of Sciences of the USSR may contribute to the actual knowledge of this group.

1. *Bareogonalos jezoensis* (Uchida). The species was known from Japan (Uchida, 1929) and Java mountainous districts, at an altitude of 1200—1500 m above sea level (van der Vecht, 1933). At Java its hosts are *Vespa velutina* Lep. and *V. analis* F. A new place of finding is the Soviet Harbor, the Maritime Province, VII, 1909, 1 ♀ (V. Arseniev). The species is closely related to *B. canadensis* Harrington (Canada, British Columbia) parasitic of *Vespa occidentalis* Cr. (*Vespula pennsylvanica* (Sauss.) after van der Vecht, 1933). The second and last

species of this genus and of the *laris* Cam., known from Mexico

2. *Nanogonalos mongolicus* lia, 27.VIII.1899, 1 ♂ (V. Soldatov), 1 ♂ (V. Soldatov),

Body 7—8 mm length. Antenna of 25 segments. Segments 11 to 3 and 4 teeth, respectively.

Head equal to the body width. The clots vary from 1/3 to 1 of the body width. Head slightly punctured, bright. Body densely, nearly wrinkled. Body surface punctured. Very bright spaces between the clots, diameter, or somewhat more. Tergites smooth. Apical parts of II and III bright. The apical non-punctured

Black. Very narrow stripes shorter on the inner orbit; two are yellow in colour. Antennae Mandibulae reddish-brown near base. Wings dark. Stigma brownish-yellow. Sides near the anterior edge of the thorax three transversal yellow spots near the apex of the trochanters. I and II of the third pair of legs and third pair are reddish. Tarsus of I tergite, the narrow subapical spots close to each other. Wide submarginal spots in the middle of tergite and in the middle of sternite (transversely) and rounded spots on the sides, rounded, nearly four times as wide as narrow. Sternite VIII angular, near the anterior edge and straight basal lobes and long. Setae well developed and rather long. Setae of the first pair slightly constricted; their apical ends are covered with short hairs. Sagittae rounded apically with rather sharp point at the free end; volsellae ventral and dorsal, cuspis and digitus volsellaris. Ocelli wide and regularly rounded laterally.

The species is allied to *N. jezoensis*, well distinguishable by its size, the puncturation of the scape and the details of coloration, e. g. the mesonotum.

The remaining three species *horina* Bischoff, from Bolivia—*N. fuscipennis* Shulz. The area of distribution is known for the genera (Cuba, Burma, Celebes, Java). The remaining three species (*Bareogonalos*, *Trigonalos*, *Ta pinogonalos* and others) point to the fact that *Pseudogonalos* genus with only exception to the general r

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species of this genus and of the subfamily *Bareogoninae* as a whole is *B. scutellaris* Cam., known from Mexico only.

2. *Nanogonalos mongolicus* sp. n. R. Sielchjin, Great Khingan, East Mongolia, 27.VIII.1899, 1 ♂ (V. Soldatov); Buin gol River, East Mongolia, 3.VIII.1899, 1 ♂ (V. Soldatov).

Body 7-8 mm length. Anterior wings 7 mm in length. Antenna consists of 25 segments. Segments 11 to 16 with tiloids. Left and right mandibulae have 3 and 4 teeth, respectively.

Head equal to the body width, densely punctured. The bright spaces between the clots vary from $\frac{1}{3}$ to 1 of their diameter. Scape of antennae densely and rather slightly punctured, bright. Body more or less bright, punctured more roughly and densely, nearly wrinkled. Body sides partly dull. Abdomen rather roughly, evenly punctured. Very bright spaces between the punctures are equal to $\frac{1}{4}$ -1 of their diameter, or somewhat more. Tergit I without angular furrows, very bright and smooth. Apical parts of II and III sternites markedly flattened, sparingly punctured, bright. The apical non-punctured part of sternit III is narrower.

Black. Very narrow stripes along the outer orbit of the eyes, the wider and shorter on the inner orbit; two triangular spots, on the sides of the clypeus are yellow in colour. Antennae, beginning from the apex of scape, light-brown. Mandibulae reddish-brown nearly throughout. Anterior halves of the anterior wings dark. Stigma brownish-yellow. There are two yellow triangular spots on the sides near the anterior edge of mesothorax, humeral yellow tubercles and three transversal yellow spots nearly fused with one another on the metathorax. The apex apices of the trochanter II of the second pair of legs and trochanters I and II of the third pair of legs, yellow. The apex of femurs and tibia of the third pair are reddish. Tarsi dark-reddish. Middle subapical small spot of I tergite, the narrow subapical edge spots of the I sternit nearly fused with each other. Wide submarginal band of the II segment (markedly constricted in the middle of tergite and in the middle and at the edges of sternit and large transversely) and rounded spots of the tergites IV-VI yellow. Sternit VII widely rounded, nearly four times as short as wide; its basal lobes stretched and narrow. Sternit VIII angular, nearly stright along its anterior margin, with narrow and straight basal lobes and longer triangular middle lobe. Basal ring of genitalia well developed and rather long. Stipites wide, rather short, rounded and distally slightly constricted; their apical part separated, laterally flattened, and densely covered with short hairs. Sagittae narrow, nearly straight, rather long, widely rounded apically with rather short and solid basal lobes, slightly bent dorsally at the free end; volsellae ventrally included into stipites, and have well developed cuspis and digitus volsellaris. Of these digitus is narrower and longer, cuspis is wide and regularly rounded laterally.

The species is allied to *N. flavofasciata* Teranishi from Korea, but fairly well distinguishable by its size, number of segments, antennae and their tiloids, the puncturation of the scape of antenna manubrium and tergite I, as well as the details of coloration, e. g. the presence of large yellow spots on the mesonotum.

The remaining three species of this genus are known: from Formosa—*N. taihorina* Bischoff, from Bolivia—*N. schulzi* Bischoff, and from Columbia (Bogota)—*N. fuscipennis* Shulz. The area of the genus in question including the tropical part of South America and East Asia is thus a very characteristic one. A similar distribution is known for the genus *Lycogaster* allied to *Nanogonalos* (USA, Mexico, Cuba, Burma, Celebes, Java). The same is true of the genus *Orthogonalos* (USA, Bolivia, Formosa, Madagascar), genus *Poecilogonalos* (Korea, Japan, Formosa, Burma, Malacca, Accam, Sumatra, Java, India, Ceylon). The distribution of these genera, as well as the presence in the subfamily *Trigonaloidae* of tropical genera (*Trigonalos*, *Discenea*, *Stygnogonalos*, *Ischnogonalos*, *Lycogastroides*, *Lycogonalos*, *Tapinogonalos* and others) points to the tropical character of the whole subfamily, for which *Pseudogonalos* genus with *P. hahni* widely spread in Palaearctic is the only exception to the general rule.

3. *Pseudogonalos hahni* (Spinola). The species is known from England, Belgium, France, Germany, Switzerland, Hungary, Poland, Japan and also from a number of localities of the USSR: Kharkov (Jaroshevsky, 1889), Ala-Tau (Schulz, 1910), Ural Mountains (Eversmann, 1849), Altai Mountains (Enderlein, 1905). The points to be added to those just mentioned are: Belkino of Yaroslav district, 1 ♀, 1 ♂ (N. Kokuev); Vladimir, 2 ♀, 1 ♂ (N. Kasansky); Gremyachka and Kasachskaya district, 4 ♀, 1 ♂ (A. Semenov-Tyan-Schansky), Suchan of Primorsky district, 1 (R. Malaise).

The second species of this genus—*P. harmandi* Schulz—is known from Darjeeling. One may therefore suppose that like the genus *Lycogaster* the migration of this species towards the North is due to the distribution of the hosts belonging to the genera *Ophion* and *Trogus* (Bischoff) (3). The suggestion that the Palearctic *Trigonaloidae* are relicts of the Tertiary period seems to be quite probable. The question as to whether *Ichneumonidae* or *Vespidae* were the initial hosts of the family, cannot be answered yet. The parasitism of the three subfamilies on the hosts of the family were *Vespidae* rather than *Ichneumonidae*. On the other hand, the taxonomic relation of the family, as well as its unquestionable relation to the lower *Hymenoptera* seem rather to indicate that the relations here are the opposite ones. The fact that it is parasitic of *Ichneumonidae* (hyperparasitism) seems to point not only to an extraordinary complexity of the evolution, but to a secondary nature of the parasitic habit also.

As shown by morphological analysis, the family under consideration is poor in external ectosomatic characters. This is peculiar of a number of parasitic groups of *Hymenoptera* in general. However, genera and subfamilies sex characters in *Trigonaloidae* are extremely poor in morphological traits and are very limited, indeed. The differences in the structure of the sex apparatus of the males are also insignificant, as shown by a comparison of the copulatory apparatus and adjacent sternites in *Nanogonalos mongolicus* and *Pseudogonalos hahni* which are the representatives of two subfamilies. The phylogenetic value of the characters of the sex system is unquestionable. The investigation of the copulative apparatus is still the most conclusive demonstration of the formerly disputable problem as to whether the family *Trigonaloidae* belongs to lower *Hymenoptera* (*Terebrantes*). The general appearance of the copulatory apparatus, the structure of stipites and volsellae, etc. are typical enough.

On the basis of his comparative analysis of the wing venation and the structure of the copulatory apparatus of the males, Telenga (4) suggests to differentiate three phyletic branches in the suborder *Terebrantes* (*Heterophaga*) and to unite *Trigonaloidae* and *Ichneumonidae* into one most ancient and chief branch of the suborder. A decisive argument in the structure of the copulatory apparatus is the presence of a fairly developed volsella with two independent parts—distiovorsella and basiovorsella Peck (5) and Telenga or Snodgrass (6) lamina, cuspis volsellaris and digitus volsellaris. Peck recognized the systematic value of IX sternit and postgenital tergits in *Ichneumonidae*. The form of IX sternit is, on Pratt's opinion (7), the best demonstration of primitivity of tribe *Ichneumonini*. The close genetic relation between *Trigonaloidae* and *Ichneumonidae* is unquestionable from this point of view.

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REFERENCES

- ¹ H. Bischoff, *Trigonaloidae* in *Catalogus Hymenopterorum*, 1938. ² Brues, *J. New York Ent. Soc.*, XVIII (1927). ³ H. Bischoff, *Biologie der Hymenopteren*, 1927. ⁴ Telenga, *C. R. Acad. Sci. URSS*, XXX, No. 9 (1941). ⁵ Peck, *Canad. J. Research.*, Sec. D, 15 (1937). ⁶ Snodgrass, *Smithson Miscell. Coll.*, 99, No. 14 (1941). ⁷ Pratt, *Ann. Ent. Soc. Amer.*, 32 (1939).

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