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On the Wasps of the Genus *Crabro* s. l. from Hokkaido, with Descriptions of New Species and Subspecies (Hymenoptera)[1)]

By

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(With 5 Textfigures)

Crabronidae of Hokkaido were studied by S. Matsumura (1911–1912), H. Bischoff (1922) and K. Iwata (1933, 1938), and 23 species are known up to date. In the present paper have been recorded 45 species of Crabro s. Kohl including 4 subspecies and 3 forms. Among them 11 species with asterisks are new to the fauna of Hokkaido, 3 species with double asterisks being new to Japan and 8 species, 1 subspecies and 2 forms new to science. I have also newly described the males of *Crabro* (*Ceratocolus*) *reiteri* Kohl and *C.* (*Coelocrabro*) *shibuyai* Iwata, and made some emendations on the description of *Crabro* (*Ceratocolus*) *collaris* Matsumura. The paper contains also notes on the density of the distribution of each species and some observations on the unknown or little known habits of them.

The materials used in the present study consist chiefly of those collected by me during 1944–1946. I have, besides them, reexamined the specimens preserved in the Entomological Laboratory, Faculty of Agriculture, Hokkaido University on which the study of Iwata (1938) was based, and extracted some that were not included in his report. As regards the collecting records, only rare or new species were alluded to. Unless otherwise stated, the examples are captured by me and are in my collection, but if the collecter's name is given, the specimens are deposited in the Entomological Laboratory of Hokkaido University.

I wish to express here my warmest gratitudes particularly to Professor Tohru Uchida, not only for the kind helps rendered in the course of the present study but also for reading through the manuscript. Thanks are also due to Professor Toichi Uchida and As-

1) Contribution No. 204 from the Zoological Institute, Faculty of Science, Hokkaido University.

sistant Professor Chihisa Watanabe of the Faculty of Agriculture, Hokkaido University who generously permitted me to study the voluminous materials at my disposal and lent me a loan of valuable literature. I am also indebted very much to Mr. Munemoto Yano in Tokyo for consulting the literature.

1. *Crabro (Crabro) iridifrons* Pérez (1905).

This wasp is common but not abundant. The male, however, is quite rare. Only two examples have hitherto been collected. Antenna of ♂: Fig. 4, H. The species burrows the branched gallaries in rotten wood and stores their chambers with Dipterous insects as food for the larvae.

1♂, 10. VII. 1909 (Jôzankei, Matsumura leg.); 1♂, 7. VII. 1946 (Sapporo). 56 ♀♀, 25, VII. 1944-22. VIII. 1946 (Sapporo, Jôzankei, Sôunkyo).

2. *Crabro (Crabro) konowii* Kohl (1905).

This species is rather rare in the lowland country, but very abundant in the mountain region. I once collected 93♂♂38♀♀ a day in August at Sôunkyo. The nest of the wasp is burrowed in decayed wood. The main tunnel is 20–30 cm. in length and 8–10 cm. in diameter and branches off several gallaries of the same width. Each branch is comparatively long and terminates in a cell or linearly arranged two cells or often branches off again a short gallary near the end. In the case when the nest is burrowed in a standing rotten tree, the tunnels go upward after penetrating 5–7 cm. from the surface of the tree and each cell stands vertically. The cell is slightly enlarged than the tunnel, about 9–10 mm. in diameter and 22–30 mm. in length. The preys consist of large sized flies belonging to Syrphidae—*Eristalomyia tenax* Linné, *Eristalis cerealis* Fabricius, *Eristalis ocularius* Coquillett, *Chrysotoxum japonicum* Matsumura —, and the number taken in one cell is 3–5 according to the size of the flies and, perhaps, also to the sex of the hatching larva. The wasp catches the prey from the backside with her middle legs keeping the head of the prey forward and transports it on a wing. The preys are packed in the cell with the heads always directing inward, but with their ventral sides not keeping in a same direction. The egg of the wasp, 1 mm. in width 3 mm. in length and wax white in colour,

is glued to the neck region beneath of the prey and lying transversely with its caudal pole directing laterally. The fly that is attached with the wasp's egg lies always innermost, but this does not always mean that it is the first prey taken in, because the wasp leaves the hunted preys aside in the cell or in the connecting gallary loosely until the adequate number of prey is accumulated, when she arranges the prey in the cell and the oviposition takes place. In the case of a cell lying vertically the fly which carries the egg is tightly packed in, keeping its body axis obliquely and its ventral side upward and with its caudal portion bending ventrally so as not to fall down from the place. After the provision and the oviposition of the cell is over, the tunnel is tightly packed with the saw dust taken, perhaps, from a new tunnel. The cocoon is, at first, yellowish white in colour but later changing into deep brown.

3. *Crabro* (*Crabro*) *spinipes* A. Morawitz (1866).

This species is very common and more abundant than the preceding species. They are burrowers in rotten wood and hunters of small moths (mainly *Pyralidae* and *Noctuidae*). The preys are packed in the cell, always directing their heads inwards and their wings towards the cell-wall so as to form an envelop for the eatable portions for the wasp's larva. The egg of the wasp is glued to the neck-region beneath of the prey lying innermost, but the oviposition does not take place just after the first prey has been taken in, but after finishing the provisioning. Until that time the preys are left side in the cell or in the connecting gallery. The method of the transportation of the prey by this wasp is very peculiar. She catches the prey, venter to venter, by the front and mid legs which are bundled together between her hind coxae; the coxae lie closely from one other and are fitted to hold a small object. Perhaps, during her flight, she may support the prey by the mid-legs as usually seen among the hunting wasps, but when she arrives at the entrance of the burrow, her six legs are always free from holding the burden and can walk about as freely as usual dragging the prey under her body.

4. *Crabro* (*Clytochrysus*) *cavifrons* Thomson (1870).

This species is common and rather abundant.

5. *Crabro* (*Clytochrysus*) *planifrons* Thomson (1870).

This species is common in the mountain regions but rather rare in the plain. The habits of the species have hitherto been reported only fragmentarily. According to my observation their habits are very similar, as in morphological aspect, to the preceding species. The burrow in rotten wood branches into single- or double-"Zweig Bau"-type. The preys hunted by the wasps consist mainly of Syrphid flies (*Syrphus corollae* F., *S. balteatus* de Geer, *S. ribesii* L., *S. spp*, *Ischilosyrphus laternarius* L., *Sphaerophoria menthastri* L., *Chilosia yezonica* Mats., *Tachytrechus genualis* Loew, *Phasia separata* Mats.). The egg of the wasp is attached to the neck region of the prey lying upside-down and innermost of the chamber with its cephalic pole and lying obliquely to the axis of the prey's body. The number of the prey taken in a cell is 3–7. The largest record of the number of cells contained in a single nest was 24.

6. *Crabro* (*Clytochrysus*) *chrysostomus* Lepeletier et Brullé (1834).

This is one of the common species of Crabronid in Hokkaido, but the female is rather rare.

7. *Crabro* (*Clytochrysus*) *nigritarsus* Herrich-Schaeffer (1841).

Two colour types of *nigritarsus* occur in Japan:

a). Typical form: Black. A lengthened marking on the outer margin near the base of mandibles (often disappeared), scape of antennae except a spot near the apex, an elongated lateral spot on the tergites 2 and 5, a large marking on the hind tibiae and the apical spurs yellow.

b.) forma *mizuho* nom. nov. (=Kohl's Japanische Stücke) : Black. Outer face of mandibles and antennal scape, two spots on the pronotum, a spot on the humeral angles, a lengthened lateral marking in the middle of segments 2–4 of the abdomen, apex of front femora, mid femora beneath and most part of the hind tibiae yellow In some examples antero-lateral angles of the scutellum and two spots on the postscutellum are yellow.

Both forms occur in Hokkaido; while the former is rather rare, the latter is very common in the mountain regions.

8. *Crabro* (*Solenius Clytochrysus*) *munakatai* sp. nov.

This species is similar in the general structure and the punctuation of the body to *Crabro* (*Clytochrysus*) *nigritarsus* H.-Sch., but is remarkable in the forms of clypeus and antennae, in the condition of frontal longitusinal furrow, in the punctuation on the head and somewhat in colour.

♂. Black. Anterior face of scape of antennae, a lateral spot on the tergite 2 (large) and 3 (small), a band on 5 and 6, and posterior face of hind tibiae cream yellow. Inner face of front tibiae and front tarsi (apically becoming dark brown) and all tibial spurs testaceous brown. Clypeus (Fig. 1, B) narrower than in *nigritarsus*. Front

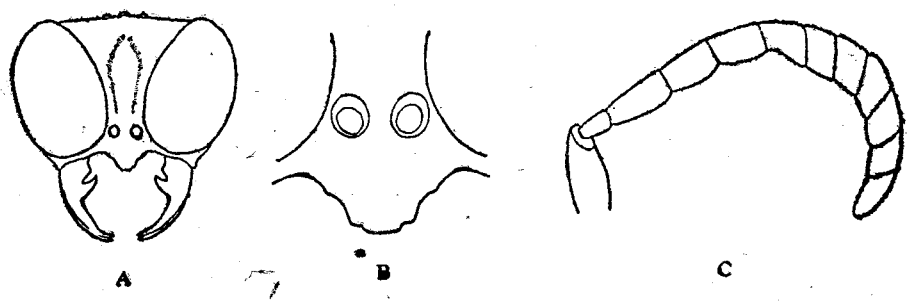

Fig. 1. A. Head of *Crabro* (*Clytochrysus*) *munakatai* sp. nov. ♂ seen in front. B. Clypeus of do. C. Antenna of do.

slightly sloped toward the middle forming a well-defined frontal furrow. Oculocellar space : postocellar space=5:3. Ocelli are larger in diameter than in *nigritarsus*. Antennae : Fig. 1, C. The scape is long, about twice as long as the clypeus in the middle. Antennal joints 3, 4 and 5 gently swollen beneath in the middle, 6 slightly excavated beneath at the base and remarkably incrassate toward the apex, remaining joints are thick but gradually tapering apically. Joint 3 2.3 times, 4 1.5 times as long as broad at the apex. Front distinctly (but more sparsely than in *nigritarsus*), vertex very feebly punctured. Oculocellar space broadly and temples wholly impunctate. Punctuation on the thorax and the median segment is as in *nigritarsus*, except that the longitudinal striae on the sides of the latter are much finer and denser. Length 8.7 mm.

Holotype: ♂. 27. VIII. 1946. (Akanuma near Hakodate, M. Munakata leg, and is in my collection).

9. *Crabro* (*Solenius*) *continuus* Fabricius (1805).

This species is very common and abundant throughout the land.

*10. *Crabro* (*Solenius*) *schlettereri* Kohl (1888).

This species is very common in Japan proper, but is very rare in Hokkaido and hitherto unrecorded.

3♂♂, 16. VI.- 25. VI. 1944 (Sapporo); 2♀♀, 7. VIII. 1945 (Sôunkyo).

11. *Crabro* (*Solenius*) *larvatus* Wesmael (1852).

This species is common but not abundant.

12. *Crabro* (*Ectemnius*) *dives* Lepeletier et Brullé (1834).

This species occurs mainly in the mountain regions, but not abundant.

13. *Crabro* (*Ectemnius*) *nigrinus* Herrich-Schaeffer (1841).

Dr. K. Iwata recorded the species from Jôzankei in 1933, but in my frequent visits at the place I have as yet been unable to find the species.

14. *Crabro* (*Clypeocrabro*) *camelus* Eversmann (1849).

16 ♂♂ 15 ♀♀ are collected at Sapporo, Jôzankei and Sôunkyo during three years.

15. *Crabro* (*Ceratocolus*) *reiteri kuramensis* Iwata (1938).

This species is rare and the male has hitherto been unrecorded.

♂: Very similar to *C.* (*Ceratocolus*) *quadriceps* Bingham ♂[1], but differs from it in the length of the oculo-mandibular space, in the form of front- and hind metatarsi, and somewhat in punctuation and coloration. The species resembles also *C. pluschtschevskyi*, A. Morawitz, but is easily distinguished by the very narrow oculo-mandibular

1) Yasumatsu, K. Mushi, Vol. XIII, No. 2, p. 153, 1939.

space and by the difference of the form of the mid- and hind-legs.

Body covered with long white pubescence, those on the dorsal surface greyish, those at the apex of abdomen brownish. They are longer on the head and thorax beneath, coxae and trochanters of all

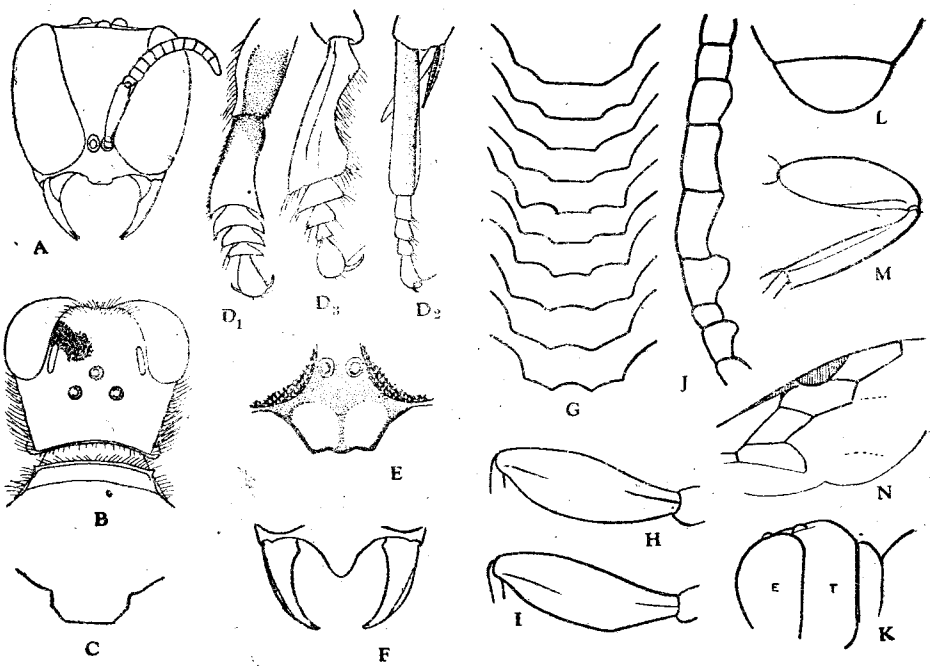

Fig. 2. A. Head of *Crabro* (*Ceratocolus*) *reiteri* Kohl ♂, seen in front. B. Head and pronotum of do. seen from above. C. Clypeus of do. D_1, D_2, D_3. Front-, mid- and hind leg of do. respectively. E. Clypeus of *Crabro* (*Crossocerus*) *opacifrons* sp. nov. ♀. F. Clypeus and mandibles of *Crabro* (*Coelocrabro*) *flavitarsus* sp. nov. ♂. G. Variation of the clypeus of *Crabro* (*Acanthocrabro*) *vagabundus* subsp. *yamatonicus* subsp. nov. ♂. H, I. Front femera of do. J. Antenna of *Crabro* (*Rhopalum*) *kiesenwetteri* A. Morawitz ♂. K. Head of *Crabro* (*Crossocerus*) *uchidai* sp. nov. seen in profile. L. Apex of abdomen of do. ♂. M. Mid leg of do. N. Fore wing of do.

legs, femora and outer margin of tibiae of front legs, mid femora beneath and the apex of the abdomen. Black. Scape of antennae except the inner face, trochanters, femora and outer face of tibiae of front legs, trochanters beneath, three stripes (inner one is rather brownish) on the femora and tibiae partly of mid legs and a lengthened lateral spot in the middle of segments 1–5 of the abdomen

yellow. Greater part of the 2nd and underside of subsequent joints of antennae, outer portion of tegrae, and most part of tarsi of all legs ferruginous yellow or ferruginous brown. Apex of mandibles and veins of wings dark brown. Wings pale brownish, basally paler. Head: Fig. 2, A & B. Eyes reach the base of mandibles; clypeus (Fig. 2, C) broadly produced, with the apical margin truncate and with the lateral margins angulate in the middle. Ocellar arrangement and the character of occipital margin as in *quadriceps* ♂. Antennal flagella beneath with dense erect hairs; the 2nd joint of antennae much shorter than broad; apical joint as in *quadr.* Frons irregularly and somewhat coarsely reticulated, near the median ocellus becoming subrugose; oculocellar area impunctate; vertex irregularly and rather coarsely punctured-subreticulate. Thorax: Pronotum (Fig. 2, B) with latero-anterior spines as in *quadr.* Front coxae anteriorly truncate, with the margin carinated. Prosternum on each side just anterior to front coxa with a lateral tooth which is fairly acute. Mesopleuron with a minute tubercle as often seen in the subg. *Crossocerus* s. l. Sculpture on mesonotum irregularly subreticulate, on the remaining portions as in *quadr.* Abdomen: the form as in *quadr.* Punctures on each segment moderately large and very dense, becoming smaller anteriorly and posteriorly with the apical margin fairly broadly impunctate. The 2nd sternite smooth and polished, with a few scattered punctures; the 3rd with a transverse zone of punctures near the apex; the 4th and 5th with the apical half minutely and densely punctured, almost mat; the 6th and 7th very minutely coriaceous and mat. Legs: (Fig. 2, D.) The forms are quite similar to those of *quadr.* The differences: front metatarsi approximately twice as long in the middle as broad at the apex, as in *pluschtschevskyi*. Mid legs similar in shape to those of *quadr.*; hind metatarsi most broadly swollen near the apex, not in the middle as in *quadr.*

Allotype: ♂, 17. VIII. 1945 (Sôunkyo).

1♂, 16. VII. 1926; 1♂, 12. VII. 19?? (Jôzankei, Matsumura leg.); 1♀, 27. VII. 1944, 1♀, 3. X. 1945. (Sapporo); 1♀, 25. VIII. 1945 (Senmiri; 1♀, 17, 2♀♀, 24. VII. 1946; 7♂♂19♀♀, 14. VIII., 4♂♂8♀♀, 16. VIII. 1946 (Jôzankei).

16. *Crabro* (*Ceratocolus*) *alatus* Panzer subsp. *japonicus* Schulz (1904).

This species is common in the vicinity of Sapporo.

17. *Crabro* (*Ceratocolus*) *collaris* Matsumura (1912) nec Arnold (1932).

Crabro (*Thyreus*) *collaris* Matsumura, Thous. Ins. Jap. Suppl., IV, p. 174, Pl. LIII. fig. 9, 1912 (♀).

Crabro (*Ceratocolus*) *aberrans* Gussakovsky, Ark. Zool., Bd. 24 A, No. 10, p. 17, 1933 (♀).

Crabro (*Ceratocolus*) *collaris* Iwata, Ins. Mats., Vol. XII, No. 2 & 3, p. 84, 1938 (♀ ♂).

This species, especially the male, is very common in the vicinity of Sapporo. In the year 1933 Gussakovsky reported a new *Ceratocolus* from the Ussuri region—*aberrans*—, according to the description, however, his species may be a synonym of *collaris* Mats.. Furthermore, *C. collaris* Arnold (1932) is invalid. Since the original description is too brief, the detailed redescription of the species will be given below:

♀. Black. Basal 3 joints of antennae, a medially interrupted broad band on the pronotum, postscutellum, a band in the middle of the 2nd tergite, a small indistinct lateral spot in the middle of the tergites 3–5 of the abdomen, anterior face of front-, outer face of mid- and a faint stripe (often disappeared) on the hind tibiae and metatarsi of all legs orange or cream yellow. Remaining tarsi of front- and mid legs mostly yellowish but becoming ferruginous apically. Caudal margin of each segment of abdomen, both ends of all femora, posterior face of front-, inner face of mid- and the base of hind-tibiae, and the stigma and veins of wings brown; tegrae dark brown. Mandibles tridentate at the apex, with a lateral tooth on the inner margin near the middle, which is not strong. Clypeus (Fig. 4, F) carinated in the middle, much more than half the length of the scape of antennae. Apical margin quadridentate, with the median pair much produced; on the lateral margin near the base, usually hidden under the silvery piles a small tooth produced. Eyes reach the bases of mandibles and of antennae. The distance between the eyes at the base of clypeus approximately half the length of the antennal scape. The 3rd joint of antennae slightly shorter than the 2nd, 1.5 times as long as broad at its apex. The 4th and 5th subequal to the 3rd respectively, remaining joints slightly shorter, apical one as long as the preceding two joints taken together. The head above (Fig. 4, E) convex, and roundly sloped posteriorly; frontal line absent, frontal impression well-defined, clavate; temples, seen from above, roundly convergent

posteriorly, seen in profile, slightly broader than eye. Occipital margin carinated, not ending into a tooth on the underside of the head. Posterior margins of eyes and of postocelli arranged in a straight line. Ocelli in an isosceles triangle. Oculocellar space* subequal to postocellar space, ocelloccipital space nearly twice as long as oculocellar space. Pronotum (Fig. 4, E) transverse, with the anterior margin carinated, which is interrupted in the middle by a longitudinal furrow; antero-lateral angles acutely pointed. On the mesopleuron epicnemial, sterno-pleural and mesopleural carinae distinct. Median segment truncate posteriorly. Each segment of abdomen convex, intervals being constricted. Pygidial area apically narrowed into a gutter which is as long as the basal triangular portion. Front- and mid-femora beneath near the base remarkably widened and carinated; the carinae extending the whole length. Hind tibiae broadest beyond the middle, with anterior margin carinated, with the outer face strongly spinose. Mandibles at the base coarsely and rugosely punctured. Head and anterior portion of mesonotum finely punctured-reticulate. Temples below anteriorly coarsely punctured-rugose, posteriorly impunctate and shining. Mesonotum posteriorly somewhat coarsely punctured-subrugose. Scutellum longitudinally rugosely punctured with the intervals very minutely striated. Mesopleuron coarsely and very sparsely punctured, on the upper portion longitudinally striated. Metapleuron longitudinally and very coarsely striated. Median segment on the dorsal portion very coarsely and irregularly reticulated and mat; on the posterior plane finely and feebly reticulated; the sides very finely, feebly, closely and longitudinally striated, with the anterior portion in the middle without sculpture and shining. Tergites of abdomen 1–4 strongly and closely punctured, on the posterior margin punctures smaller and denser. Tergite 5 more sparsely punctured, 6 impunctate except the pygidial area where very coarsely and sparsely punctured. The opaque markings on the 2nd sternite circular and very large, with the central portion sparsely and rather largely punctured; the interval between the markings scattered with minute punctures. Other sternites with coarse punctures only on the posterior margins, remaining portions being microscopically finely coriaceous. Length 7–9 mm.

* S. the distance between the inner margin of the compound eye and the outer margin of one of the paired ocelli, the diameter of the ocellus being not taken into account. "Oculocellar line" used by many hymenopterists sometimes includes and sometimes excludes the diameter of the ocellus and seems to induce a confusion.

♂. Very similar to ♀. A large macula on the inner face of the 1st and whole 3rd joint of antennae black. Apex of front and mid femora above and outer face of hind tibiae yellow. In some melanic examples the yellow band on the pronotum and on the 2nd abdominal tergite broadly interrupted in the middle; the lateral markings on the tergites 3–5 entirely disappear and the hind tibiae wholly black. Clypeus (Fig. 4, G) with anterior margin almost straight and carrying two obtuse dens on the lateral margin; the basal one much smaller. Prosternal tooth acuter than in ♀. Mesopleuron punctured-subrugose. The striae on the sides of the median segment much stronger and coarser. Without pygidial area. Abdominal tergites 6 and 7 moderately closely punctured. Legs as in ♀. Length slightly smaller, 6–8 mm.

This species occupies a particular position in the subgenus *Ceratocolus* s. Kohl, because the female has a gutter-like pygidial area and the male with the normal head the thorax.

I have observed 4 females of this wasp nesting in a standing rotten tree. They hunt small moths as food for their larvae. The wasp came flying with a prey, catching it by the neck with her middle legs usually from backside. When she arrived at the entrance of the nest, she used only one of the middle legs for supporting the prey and walked on 5 legs. Owing to the narrowness of the tunnel, the prey was pushed backward and dragged behind her with her hind legs when she entered the nest. The tunnel is 2.5–2.7 mm. in diameter and branches several times into the so-called *Zweig Bau*. In one instance the tunnels went upward, but in another downward or half upward and half downward. Each branch contains linearly arranged several cells which are not broader than the tunnel and 7–12 mm. in length. The prey taken in one cell are 4–11 in number, and are packed in the same manner as in *spinipes* or in *alatus*. The egg of the wasp is elongated elipsoid in shape (2.0×0.5 mm.), and attached to the neck region beneath of the innermost prey in the same manner as in above-cited wasps. Oviposition, however, takes place after the provisioning of the cell is finished. Perhaps this will be the prevailing habit among Crabronidae.

18. *Crabro* (*Ceratocolus*) *heros* Kohl (1915).

This species seems to be very rare. Only 1♂1♀ have been collected by Dr. Matsumura. I have captured 2♂♂1♀ on 14th, August 1946, at Jôzankei.

19. *Crabro* (*Acanthocrabro*) *vagabundus* Panzer (1798) subsp. *yamatonicus* subsp. nov.

One of the important characters of *Crabro vagabundus* Pz. lies in the presence of a spine on the front femur beneath. I examined carefully 50 examples from Hokkaido but was unable to find such spine in any of them. Most of them with the femur gently rounded beneath (Fig. 2, H); few of them, however, have the femur slightly angulated beneath before the middle (Fig. 2, I). Perhaps this will be the trace of the spine occurring in the specimens from Europe. In the female the punctures on the mesopleuron are too distinct to be considered as inserting points of the pubescence.

This subspecies is very common and fairly abundant in the neighbourhood of Sapporo. The female burrows in rotten wood and hunts Tipulidae as food for the larvae. But I once captured a wasp of this species carrying a small moth to her burrow. This may be a very aberrant prey of *vagabundus*, since, so far as I am aware, this wasp has been hitherto known only as a hunter of Dipterous insects.

20. *Crabro* (*Cuphopterus*) *dimidiatus* Fabricius (1781). (=*serripes* Panzer 1797).

This species is not rare in the mountain region. On the path, near a woodman's cottage at Jozankei, I often saw the wasps hunting small flies crouching on th ground and transporting their preys to the nests burrowed in rotten wood. This species often lives in so high a place that other Crabronids can scarcely be found. I once saw the wasps hunitng their preys on tree-tops of a shrub near the summit of Mt. Daisetsu (about 2000 m. high).

21. *Crabro* (*Cuphopterus*) *monstrosus* Dahlbom subsp. *suzukii* Matsumura (1912).

This species is not rare but not abundant in the plain. Early in autumn, in mountain regions, however, they are fairly common. The examples gathered in Hokkaido do not bear a yellowish white band on the 5th and 6th tergites of abdomen.

The nesting habits of the wasps are as in the preceding species. I captured a wasp on October 10th that was flying with her prey—a small fly *Homalomyia canicularis* L.—for her nest, the entrance of which was opening on a stem of a rotten tree at a height of 3 m. from the ground.

22. *Crabro* (*Cuphopterus*) *yanoi* sp. nov.

This new species is quite similar to *Crabro dimidiatus* F., but can easily to distinguished by the following points:

♀. 1) Head above anteriorly with a transverse edge, which is very acute, acuter than in *dimidiatus;* this edge is exacavated

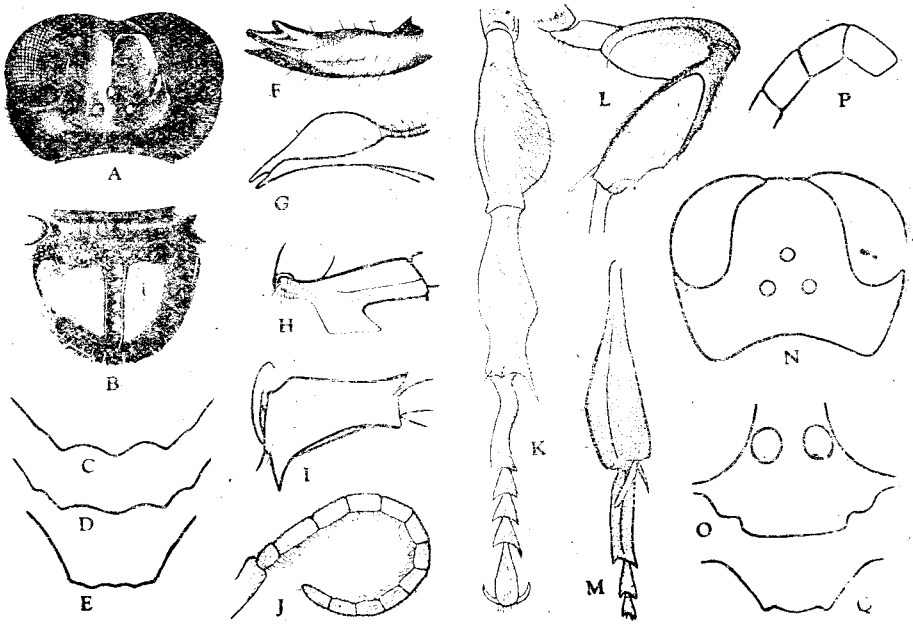

Fig. 3. A. Head of *Crabro* (*Cuphopterus*) *yanoi* sp. nov. ♀, seen from above. B. Area cordata of do. C, D. Anterior margin of the clypeus of do. E. The same, ♂. F. Left mandible of do. ♀. G. The same, ♂. H. Front trochanter of do. I. Hind coxa of do. J. Antenna of do. K, L. Front- and mid leg of do. respectively. M. Hind leg of *Crabro* (*Coelocrabro*) *shibuyai* Iwata ♂. N. Head of do. seen from above. O. Clypeus of do. P. Apical 3 joints of antenna of *Crabro* (*Crossocerus*) *uchidai* sp. nov. ♂. Q. Clypeus of do.

triangularly in the middle by the frontal furrow, the borders of the excavation is sharper, and the width of the furrow is narrower than in the compared species. 2) Mandibles with an angulated prominence on the inner margin near the middle, which is much feebler than in *dimid.* 3) Mesopleural tooth just in front of mid coxae is well-defined, in *dimid.* this tooth is absent. 4) Anterior portion of the side of the median segment is more deeply excavated than in *dimid.* with the surface longitudinally striated. In *dimid.* this area smoth, without sculpture. 5) Longitudinal furrow in the middle of the area cordata is wider than in *dimid.*, the surface of the area finely coriaceous with feeble oblique striae on the outer portion. In *dimid.* the surface of the area is entirely polished and shining. 6) Bordering keel between the sides and posterior slope of the median segment well-defined over the whole extent, in the compared species defined only on the lower portion. The segment latero-anteriorly finely, shallowly and irregularly reticulated, in *dimid.* finely rugulose. 7) Base of the area pygidialis somewhat swollen, in *dimid.* this swelling is less eminent. 8) Tarsi of legs stouter and stronger than in *dimid.* 9) Coloration is somewhat different.

In ♂. 1) The transverse edge on the frons (not so much angled as in ♀, but) acuter, frontal median furrow narrower than in *dimid.* ♂. 2) Mesopleural tooth, side of the median segment and the sculpture on the area cordata are similar to those in ♀. 3) With a lamellar, semitransparent and subquadrate projection on the front trochanter beneath which is large and very distinct, in *dimid.* this projection is indinstinct, merely a dilated narrow fringe. 4) The spine on the hind coxae beneath at the base is slender, spinose and small, in the compared species triangular and large. 5) Two hooks on the 7th sternite further apart from each other than in *dimid.*; the elevation between the hooks is not so much evident as in *dimid.* 6) The form of clypeus and the coloration are also somewhat different.

♀. Black. Outside of the mandibles, front face of the scape, a small spot on each side of the 1st tergite of abdomen (often absent), a lateral marking on the 3rd (large) and 4th (small) tergites, pygidial area except the apex, outer face and apical spurs of all tibiae and the base of all metatarsi yellow. In one example the yellow marking on the hind tibiae broadly interrupted in the middle. A narrow basal ring of front- and mid-femora dirty yellow. Tarsi dark brown. Body sparsely covered with long whitish pubescence, on the clypeus and front anteriorly it is dense and silvery, on the abdominal tergites

very short. Sternites without pubescence, only with a row of sparse long hairs near each posterior margin. Mandibles (Fig. 3, F) tridentate at the apex, with a feeble angulation on the iner margin near the middle. Clypeus (Fig. 3, C & D) broadly produced with the apical border bluntly tridentate; its lateral border provided with a very feeble tooth near the middle. The length of the clypeus is much more than half the length of the scape of antennae. The head above anteriorly depressed as in *dimidiatus* (Fig. 3, A), with a transverse acute edge on the anterior border which is sharply excavated medially by the frontal furrow. Antennae comparatively stout, joint 3 nearly 2.5 times as long as broad at the apex, 4 approximately two thirds the length of 3, 4–7 becoming slightly shorter apically, 7–11 subequal in length to one another, 12 distinctly longer. The distance between the eyes at the base of antennae less than half as long as the scape. Ocelli in an equilateral triangule, with the posterior line slightly wider. Oculocellar space longer than postocellar space and slightly shorter than ocelloccipital space. Frontal impression large but not well-defined, only the inner margin can be seen in the oblique light. Temple, seen in profile, as wide as the eye. Occipital carina not ended in a tooth. Pronotum with the antero-lateral angles rounded. Mesonotum medio-anteriorly shortly and feebly tricarinated. On the mesopleuron, epicnemial plane well developed, almost flat, with the lateral margin slightly carinated; episternal furrow distinct and coarsely crenate; transsternal furrow very wide and deep; mesopleural tooth well-defined, not long but acute at the apex; the stigma seems to be larger than in *dimidiatus*. Area cordata on the median segment thoroughly enclosed by the crenulate furrow, with coarse notchings at the base and with a comparatively broad longitudinal crenate groove in the middle (Fig. 3, B). Posterior plane of the segment medially deeply grooved, laterally evidently carinated over the whole extent. The 1st tergite of abdomen distinctly longer than wide at the apex. Pygidial area almost triangular, somewhat roundly swollen at the base. Wing venation as in *dimidiatus*.. Frons anteriorly finely and sparsely punctured, posteriorly impunctate and polished. Vertex without puncture, shining. Mesonotum finely and closely punctured, half mat. Mesopleuron without puncture except the fine inserting pits of the pubescence. Metapleuron impunctate and shining. Sides of the median segment finely and longitudinally striated, the striae somewhat indistinct in the middle. Area dorsalis

finely and feebly coriaceous, with some faint oblique striae at the base. Antero-lateral portion of the segment finely and irregularly reticulated; upper portion of the posterior slope sparsely punctured-striate, lower portion transversely striated. Abdomen without puncture. Pygidial area with a few large scattered punctures. Sternites with sparse large punctures near each posterior margin, apical segment on the posterior half densely punctured.

♂. Similar to ♀, but differs in the following points: Mandibles (Fig. 3, G) bidentate at the apex, deeply and broadly excavated on the outer face near the middle. Clypeus (Fig. 3, E) more narrowly produced than in ♀, with the apical margin bluntly quinquedentate, the median three (in some examples this portion is almost truncate) much produced. Antennae slenderer than in ♀. Head above anteriorly not so much depressed as in ♀, in some examples rather slightly convex and very smooth; the form and sculpture of the area seems to be variable in this sex. Transverse edge not so acute. Frontal impression is definable only with some difficulties, but in one aberrant form it is clearly bordered and deep (but much smaller in size). Ocelli situated nearer to the posterior margin of the head, consequently ocelloccipital space slightly shorter than oculocellar space as in *dimid.* Antennae: Fig. 3, J. Front leg: Fig. 3, K, trochanter beneath with a lamellate appendage (Fig. 3, H), undersides of femur and of tibia flattened and polished, metatarsus incrassate and deeply excavated beneath at the base. Mid leg: Fig. 3, L, tibia laterally depressed, with the outer face widely and evenly excavated and its posterior margin carinated and transparent. Hind leg: coxa beneath at the base with a short narrow spine (Fig. 3, I), tarsi thoroughly depressed laterally, with the surface longitudinally hollowed out. The 7th sternite with two hooks and median elevation as mentioned above. Coloration similar to ♀, but slightly differs in the following points: mandibles entirely black, transverse band on the 6th tergite of abdomen, most part of coxae, outer margin of metatarsi and tibial spurs of all legs yellow. Mid femora with a large lengthened testaceous macula in the middle which is semitransparent. Apex of pygidial area and metatarsi of legs brown. Length ♀ 8–12 mm, ♂ 7–8 mm.

I have the honour of dedicating this species to Mr. Munemoto Yano in Tokyo.

Holotype: ♂, Allotype: ♀, 7. VI. 1944 (Sapporo).

Paratypes: 5♂ ♂1♀, 7–11, VI. 1944; 1♂, 23. VII. 1945; 2♂ ♂, 8. VII. 1946 (Sapporo); 1♀, 30. VII. 1944 (Jôzankei).

23. *Crabro* (*Cuphopterus*?) *aino* sp. nov.

This species exhibits similar characters in the punctuation on the head, in the condition of frontal impression and in the form of pygidial area to subg. *Acanthocrabro*, but in the wingvenation, in the relative length to width of the 1st abdominal segment and in the absence of mesopleural tooth rather to subg. *Cuphopterus*. The

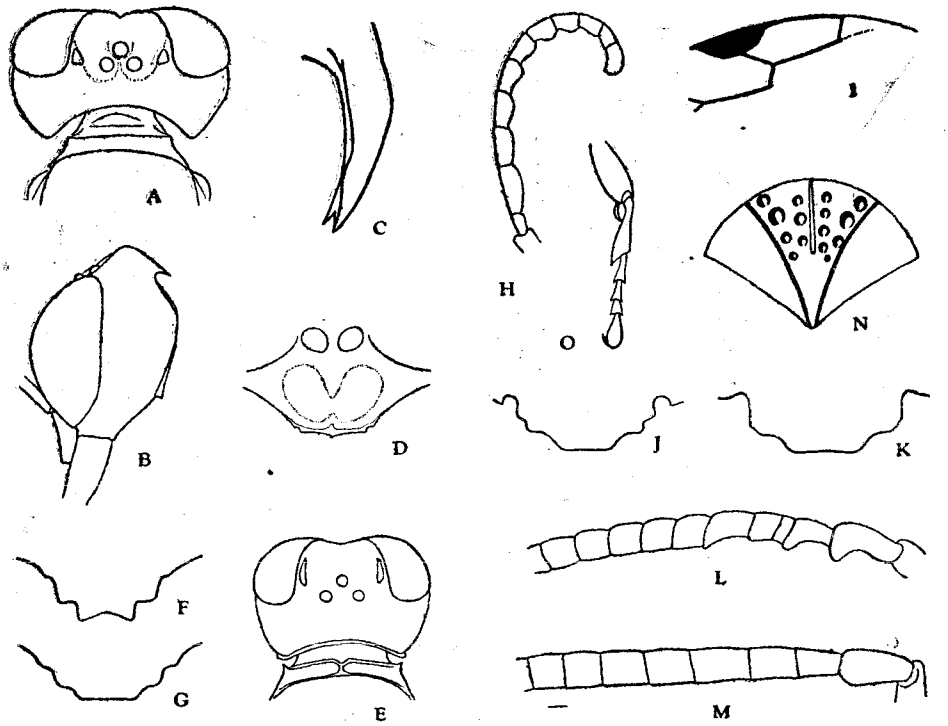

Fig. 4. A. Head and pronotum of *Crabro* (*Cuphopterus*) *aino* sp. nov. ♀, seen from Above. B. Head of do. seen in profile. C. Mandible of do. D. Clypeus of do. E. Head and pronotum of *Crabro* (*Ceratocolus*) *collaris* Matsumura ♀, seen from above. F. Clypeus of do. ♀. G. The same, ♂. H. Antenna of *Crabro* (*Crabro*) *iridifrons* Pérez ♂. I. Stigma and radial cell of fore wing of *Crabro* (*Rhopalum*) *calceatus* sp. nov. ♂♀. J, K. Clypeus of do. ♀♂ respectively. L. Antenna of do. ♂. M. The same, ♀. N. Pygidial area of do. ♀. O. Front leg of do. ♂.

species, however, is dissimilar to both subg. in the form of mandibles and of pronotum and in possession of a terminal tooth of occipital carina on the underside of the head. This species seems, in general aspects, to resemblde *Crabro* (*Cuphopterus*) *malaisei* Gussakovsky (1933) from the Ussuri region, but can readily be distinguished by the differences of the forms of mandibles, clypeus and pronotum, by the considerably depressed front and vertex, and by differently disposed yellow maculae on the abdomen.

♀. Black. Basal two thirds of mandibles on the outer face, two large medially confluent maculae on the clypeus, scape of antennae entirely, a small spot on the lateral extremities of pronotum, a large lateral macula on the 3rd tergite of abdomen and outer face of front and mid tibiae cream yellow. Apex and inner face of mandibles, apical margin of the clypeus in the middle, pulpi, tegulae of wings, posteror margin of the 4th (narrow) and 5th abdominal tergite, apical portion of the pygidial area, tibial spurs and all tarsi testaceous; front and mid tarsi basally much paler and more or less yellowish. Flagella of antennae beneath, distal extremities of all femora, greater part of front tibiae, base and apex of mid and hind tibiae, terminal tarsal joints and veins of wings dark brown. Pubescence on the clypeus, frons and temples below silvery, on the vertex above, and abdomen more or less yellowish, on the thorax beneath, legs, median segment and the 1st tergite of abdomen greyish. The yellowshi pubescence on the head, thorax and apex of abdomen and the whole greyish pubescence are comparatively long. Abdominal sternites glabrous, only with sparse long hairs near each posterior margin. Head, seen from above (Fig. 4, A), slightly broader than mesothorax, twice as broad as long in the middle, with the lateral margins roundly and remarkably convergent posteriorly and with the occipital margin roundly emarginated; seen in profile (Fig. 4, B), temple slightly broader than eye. Mandibles (Fig. 4, C) rather slender and long, subequal in length to the front tibia, with the apex sharply bidentate, upper tooth being very slightly longer; on the inner margin near the apex with a feeble rounded swelling which corresponds to the inner tooth in the case of tridentate species. No tooth nor prominence on the inner margin in the middle. Clypeus (Fig. 4, D) with the anterior margin bluntly tridentate, carrying a small emargination on the lateral margin near the apex; medial line slightly raised. Relative length of clypeus : the distance between the eyes at the base of antennae : the antennal scape is about 4:3:7. Antennae

slender, with the 1st joint subequal in length to the 2nd, 3rd and 4th combined. The 3rd 3.5 times as long as broad at the apex and 1.5 tmies as long as the 4th. Frons and vertex depressed. Median frontal line fairly deep. Frontal impression well-defined, large and triangular as in *Acanthocrabro vagabundus* Pz. Ocelli comparatively large, much more in diameter than the interval between the paired ocelli, and disposed in a nearly equilateral triangle. The intervals between them remarkably elevated. OOS:POS=2:1. The former much shorter than ocelloccipital space. Vertex roundly inclined backward. Occipital carina ending into a small tooth on the underside of the head. Pronotum (Fig. 4, A) well developed, with the anterolateral angles shortly pointed. Prosternal teeth rather obtuse. Mesopleural tooth absent. Epicnemial margin sharply carinated. Area cordata on the median segment well defined, enclosed by the sparsely crenate groove, with a median longitudinal furrow which narrows basally and apically and reaches the posterior slope of the segment where it becomes somewhat broadened again. This portion slightly convex and with the lateral carina evident. The forms of the abdomen is similar to that of *Cuphopterus dimidiatus*. The 1st segment about 1.5 times as long as broad at the apex. Pygidial area slightly narrows apically as in the case of *Acanthocrabro*, and gently swollen basally, but without medial carina. Legs normal. In the venation of the fore wing, $Rs=R_3$. Head above, pro- and mesonotum and scutellum finely but distinctly and moderately closely punctured, on the posterior portion of mesonotum and on the scutellum the punctures longitudinally confluent and becoming subrugulose. Temples impunctate, except the very minute inserting pits of the pubescence. Mesopleuron with more sparsely scattered pits of the pubescence, but they are somewhat large and distinct. Metapleuron below longitudinally striate, with the striae running archwise posteriorly. Episternal and metapleural furrows strongly costate. Median segment minutely punctured, on the area cordata mediobasally, on the posterior slope medially impunctate; the punctures being more closely disposed and longitudinally subrugose on the latero-anterior portion. The sides of the segment faintly and irregularly uneven, with some longitudinal striae near the lateral carinae of the posterior slope. Abdominal tergites impunctate, sternite 2 with scattered punctures, 3–5 with a few strong punctures near the posterior margin, 6 with close and strong punctures posteriorly. Length 12.5 mm.

Holotype: ♀, 17. VII. 1946 (Jôzankei).

*24. *Crabro* (*Coelocrabro*) *cetratus* Shuckard (1837).

This species is common.

*25. *Crabro* (*Coelocrabro*) *cinxius* Dahlbom (1838).

This species is not abundant.

2♂♂, 6, 9. VI, 1944; 2♀♀, 25, 26. VII. 1945; 2♀♀, 14. VI. 1946 (Sapporo); 2♂♂, 20. VI. 1946 (Sôunkyo).

26. *Crabro* (*Coelocrabro*) *capitosus* Shuckard (1837).

This species is rather rare. The examples collected in Hokkaido have hind trochanters yellowish white in colour.

2♂♂, 11. VI. 1944; 2♀♀, 14. VI., 1♂, 5. VII. 1946 (Sapporo).

*27. *Crabro* (*Coelocrabro*) *ambiguus* Dahlbom (1842).

In the eastern part of Asia, this species has hitherto been recorded only from Manchuria and Saghalien. The examples from Hokkaido bear the following characters: 1) Occipital edge not ended into an acute tooth on the underside of the head. The end is rather blunt. 2) Front and vertex with small punctures sparsely scattered, mesonotum finely and somewhat closely and feebly punctured. 3) Beside the typical markings, a transverse band on the pronotum (narrowed in the middle), a longitudinal stripe on the outer face of mid tibiae and most part of tarsi of all legs yellow.

1♀, 6. VI. 1944 (Sapporo); 3♀♀, 10. IX., 1♀, 22. IX. 1945; 1♀, 2. VIII. 1946 (Jôzankei).

28. *Crabro* (*Coelocrabro*) *amurensis* Kohl (1892).

The species is rare. The examples from Hokkaido with rather dark coloration: Black. A faint macula on the outer face of the antennal scape, and the basal ring of the hind tibiae dark yellow. Apex of mandibles, of tibiae, of pygidial area and all tarsi reddish brown.

1♂, 8. VIII. 1944; 1♀, 15. VIII. 1945 Sôunkyô); 1♂, 10. IX. 1945; 1♀, 5. VIII. 1946 (Jôzankei).

*29. *Crabro* (*Coelocrabro*) *barbipes* Dahlbom (1845).

Crabro barbipes Dahlbom, Hymen. Europ., I, p. 521, 1815.
Crabro (*Coelocrabro*) *barbipes* Kohl, Ann. k.k. naturh. Hofm. Wien, Bd. XXIX, p. 234, 1915; Yasumatsu, Mushi, VII, 2, p. 63, 1934.

This species has hitherto been known from North Europe and the Ryukyu-Islands. This is the first record of the species from Hokkaido. In my collection are found several examples from Japan proper (Nikko and Chichibu). Here in Hokkaido the species seems to be rather rare.

**30. *Crabro* (*Coelocrabro*) *walkeri* Shuckard (1837).

Crabro Walkeri Shuckard, Essay indig. fossor. Hymen., p. 170, 1837.
Crabro (*Coelocrabro*) *Walkeri* Kohl, Ann. k. k. naturh. Hofm. Wien, Bd. XXIX, p. 244, 1915; Gussakovsky, Ark. Zool., Bd. 24A, No. 10, p. 22, 1933.
Coelocrabro Walkeri, Baudot, Bull. Soc. Zool. Fr., LIV, p. 492, 1929.

This species has hitherto been reported from Europe and the Ussuri region, and is new to the fauna of Japan. The species seems to be very rare, only 1 ♂ was collected in the suburbs of Sapporo.

1♂, 26. VII. 1904 (leg. Dr. S. Matsumura?).

31. *Crabro* (*Coelocrabro*) *pubescens* Shuckard (1837).

This species is common but not abundant. The examples captured in Hokkaido exhibit the following characters:

♀. Clypeus: lateral border carries a distinctly projecting tooth near the middle.

♂. Mesopleural tooth: in most specimens it is entirely absent, if present it is merely represnted by a very short tubercle. Area cordata: partly (posteriorly) enclosed by a line of puncture. In most cases, the surface of the area is smooth and polished, but often it is obliquely and irregularly striated.

f. *melanogaster* kohl (1879).

This form is almost entirely black in colour and is not provided with the mesopleural tooth. Only known in ♀.

1♀, 12. VI. 1945 (Sapporo).

f. *daisetsuzanus* f. nov.

♂. 1) Clypeus produced anteriorly, its apical margin bluntly

tridentate, with the median lobe rounded and not so conspicuously produced as in the typical form. 2) Area cordata distinctly and perfectly enclosed by a line of punctures which on the posterior portion becomes almost crenate groove. 3) With more brightly coloured legs than in the typical form: outer face of front- and mid tibiae except the apical third, basal half of hind tbiae and basal 2 segments or more of all tarsi yellow. Remaining segments of tarsi ferruginous.

1♂, 16. VIII. 1945 (Daisetsu-zan).

32. *Crabro* (*Coelocrabro*) *shibuyai* Iwata (1934).

The male of this species has hitherto been unknown. It resembles closely *Crabro* (*Coelocrabro*) *capitosus Shuckard*, but can be distinguished by the following points: 1) Mandibles with a small tooth on the inner margin near the middle. 2) Clypeus with anterior border not conspicuously produced in the middle, but gently rounded. 3) Mesopleural tooth distinct. 4) Area cordata on the median segment without median longidinal groove. 5) Very small size of the body.

♂. Pubescence of the body very short and sparse, almost indistinct, but on the mesosternum it is very long and dense and quite characteristic. Black. Outer face of the scape of antennae, a spot on the humeral angles, anterior face of front-, basal ring of med- and hind-tibiae, front- and mid-tarsi yellow. Apex of mandibles, flagella of antennae beneath, tegulae and apical segments of front- and mid-tarsi brown. Wings hyaline, apically slightly fuscous. Head, seen in front, slightly wider than long, seen from above: Fig. 3, N, seen in profile with eye somewhat broader than temple. Mandibles bifid at the apex, with a small lateral tooth on the inner margin near the middle. Clypeus (Fig. 3, O) convex, broadly produced anteriorly with the apical margin almost truncate; lateral margin with a blunt tooth near the middle. Falgela of antennae beneath fringed with short erect hairs. The length of each flagellar joint nearly equal to one another. The 3rd joint of antennae slightly shorter than the 2nd, 1.5 times as long as broad at the apex. The 6th and apical joint normal. Eyes reach the base of mandibles and the sockets of antennae. The distance between the eyes at the base of antennae slightly longer than half the length of the scape. Front and vertex convex. Frontal impression comparatively long but poorly defined, only can be seen in the oblique light. Frontal groove distinct. Ocelli in a nearly

equilateral triangle; Oculocellar space slightly longer than postocellar space and approximately equal to ocelloccipital space. Antero-lateral angles of pronotum well-developed, rounded, but seem to be somewhat angulated than in *capitosus*. Mesonotum on the posterior margin not crenate. On the mesopleuron episternal groove crenulate, mesopleural tooth just in front of the mid coxa distinct. Area cordata on the median segment not enclosed by the groove, only distinguishable by the difference of the sculpture. Median longitudinal groove entirely absent. Posterior slope of the segment, however, with median longitudinal groove which is rather broad and shallow. Lateral carinae absent. The sides of the segment moderately excavated, consequently the segment dorso-laterally appears to be sharply edged. The 1st segment of abdomen about 1.5 times as long as broad at the posterior margin. Each segment normal, not constricted. The 7th sternite wihtout hook or tubercle. Mid femora beneath without tooth, hind tibiae clavate, not spinose on the outer face (with 2 or 3 very feeble spines only). Hind metatarsi strongly incrassate. Head shining, with a few scattered punctures on the front. Mesonotum sparsely punctured, with microscopically fine sculptures on the intervals, the surface half opaque. Mesopleuron anterior to episternal furrow finely and closely punctured, remaining portions impunctate and shining. Sides of the median segment microscopically finely and closely striated that can be seen under 100 times magnifying. Area cordata shining, with the transverse crenate furrow at the base. Abdomen without puncture. Anal tergite also impunctate. Length 4 mm.

Allotype: ♂, 30. VII. 1944 (Jôzankei).

2♀♀, 14, 16. VIII. 1946 (Jôzankei).

33. *Crabro* (*Coelocrabro*) *flavitarsus* sp. nov.

This species seems to be near to *C. distinguendus* A. Moraw. etc. in the form of apical joint of antennae, but is very characteristic in the form of clypeus, in the aspects of frontal groove, frontal impression and ends of ocipital rdige, in the absence of mesopleural tooth, in the structure of area cordata and in the general punctuation of the body.

♂. Body covered with comparatively long greyish pubescence, those on the clypeus and frons silvery. Abdominal sternites glabrous, except on each posterior margin. Black. Scape of antennae entirely, two elongate spots on the pronotum, humeral angles, tegulae of wings,

front and mid legs except the base of femora, basal half of tibiae and tarsi of hind legs yellow. Base of front and mid femora and the tarsi of all legs apically brownish. Flagella of antennae dark brown, with underside testaceuos. Mandibles bidentate at the apex; clypeus long, approximately half the length of the antennal scape, it is triangular in shape with the apex obtuse and medially carinated (Fig. 2, F). Eyes reach nearly the base of mandibles and the sockets of antennae. The distance between the eyes at the base of antennae is shorter than the length of the clypeus. Head above somewhat convex, frontal furrow and frontal impressions indistinct, the former feebly defined only on the anterior portion and near the front ocellus. No groove nor ridge between the postocelli. Ocelli in a nearly equilateral triangle, oculocellar space slightly longer than postocellar space, occipital margin ended into an obtused tooth on each side beneath the head. Antennae rather short, flagella beneath without erect pubescence. The 2nd joint of antenna long and thick, twice as long as the 3rd, and as broad as the broadest portion of the flagellum. The 3rd joint very small, two-thirds the length of the 4th, and only slightly longer than broad at the apex, the 5th slightly shorter than 4th but longer than the 3rd, distal joint obliquely truncate at the apex. Pronotum broad, with the antero-lateral angles rounded; mesonotum convex, not crenate on the posterior margin. On the mesopleuron episternal furrow moderately deep and crenate; without mesopleural tooth. The groove between mose- and metapleuron shallow and not crenate, whereas that between metapleuron and median segment deep and crenate. Area cordata on the median segment with transverse crenate furrow at the base, not enclosed by the groove, only defined from the surrounding area by the slight elevation. Median longitudinal groove only defined anteriorly, not attaining to the posterior margin. Hinder slopse of the segment with longitudinal furrow in the middle which is wider and deeper on the upper portion. Lateral carinae feeble and can be seen only on the posterior half. The 1st segment of abdomen slightly longer than broad at the apex. Sternites exhibit no notable character. Legs normal; hind tibiae with a few feeble spines on the outer surface. Vertex finely and sparsely punctured; punctuation on the temples much weaker, and on the front much closer. On the mesonotum and scutellum it is somewhat stronger and closer. Mesopleuron impunctate, mesosternum finely and moderately closely punctured. Median segmnet entirely smooth and polished, except the dorsal portion antero-laterally where the

surface is finely coriaceous. Mat markings on the 2nd sternite ill-defined, the 5th and 6th sternites finely and densely punctured, half mat. Length 55 mm.

Holotype: ♂, 23. VI. 1945 (Sapporo).
Paratype: 1♂, 26. VI. 1945 (Sapporo).

*34. *Crabro* (*Crossocerus*) *varius* Lepeletier et Brullé (1834).

In the adjacent territories of Japan this species occurs in Saghalien and the Kurile Islands. This is the first record of the species from Hokkaido.

2♀♀, 3. VII. 1944 (Sapporo); 1♀, 17. VIII. 1945 (Sôunkyo).

*35. *Crabro* (*Crossocerus*) *denticrus* (Herrich-Schaffer 1841).

This species is distributed over Europe, East Siberia, Korea and Japan proper (Kyôto) and new to the fauna of Hokkaido.

1♀, 28. VII. 1945 (Sapporo); 1♀, 17. VIII. 1945 (Sôunkyo); 1♀4♂♂, 11. VII. 1946 (Nopporo).

*36. *Crabro* (*Crossocerus*) *uchidai* sp. nov.

This species closely resembles *Crabo* (*Crossocerus*) *distinguendus* A. Morawitz (1866)[1], but can be distinguished by the following points: In ♂; 1) The 3rd joint of antennae 1.3 times as long as broad at the apex. 2) The 7th tergite rounded at the apex (Fig. 2, L). 3) The 7th sternite broader than long, with the apical margin almost straight or very faintly emarginated in the middle. 4) Mid femora beneath, near the trochanter, slightly projecting ventrally as in *elongatulus* v. d. Linden. 5) Hind tibiae not normally armed with spines on the outer face, but with only 2 or 3 (rather indistinct) spines. 6) Without erect hairs on the flagella of antennae beneath. 7) Hairs on the front femora beneath which extends almost over the whole length are rather short. 8) Hairs on the mesonotum anteriorly are not long. 9) Different sculpture on the mesopleuron. In ♀; 1) Punctures on the mesopleuron moderately large, anteriorly longitudinally confluent and rugosely disposed.

1) cf. Richards, O.W., Bull. Soc. ent. Fr., No. 14, p. 221, 1928.

♂. Black. Outer face of antennal scape, anterior face of front-, outer face of mid- and basal half of hind-tibiae and rarely two spots on the pronotum yellow. Flagella of antennae beneath, a line on the front femora beneath, tegulae and tibial spurs ferruginous yellow. Apex of mandibles broadly and tarsi of all legs brown or dark brown. Mandibles bifid at the apex, without a tooth on the inner margin. Clypeus covered with silvery piles, broadly and roundly produced in the middle, with a small lateral tooth near the apical margin (Fig. 3, Q). Eyes large, extending below to the base of mandibles and inward to the sockets of antetnnae. The distance between the eyes at the base of clypus almost half the length of the antennal scape. Flagella beneath without erect hairs. The 3rd joint of antennae 1.3 times as long as broad at the apex, the 4th subequal to the 3rd (very slightly shorter), terminal joint somewhat longer than the preceding and laterally flattened and obliquely truncate at the apex as in *distinguendus* A. Morawitz (Fig. 3, P). Frontal furrow broad and shallow but well-defined, frontal impression long and slender with the posterior margin poorly defined. Ocelli in an equilateral triangle; oculocellar space nearly equal to postocellar space and shorter than the ocelloccipital space. Interval between the paired ocelli somewhat elevated. Occipital margin carinated, not ended into a tooth on the underside of the head. Antero-lateral angles of pronotum rounded. Mesonotum just in front of the scutellum with a deep, finely crenulated furrow. On the mesopleuron episternal groove distinct, deep and coarsely crenate; without mesopleural tooth. Area cordata on the median segment enclosed by a crenate groove, with coarse notchings at the base, median longitudinal crenate groove distinct, that extends to the posterior slope of the segment, and deepened and widened. Lateral carinae well-defined accompanying a narrow groove. The first segment of abdomen as long as broad at the posterior margin. Apical segment without pygidial area, semi-circular in form, seen from above. The 7th sternite broader than long, with the apical margin almost straight. Squama of genitalia narrowed apically and rather sharply pointed as in *distinguendus*. Fringe of hairs on the front femora beneath short, but extending over the whole length. Mid femora beneath near the base slihtly projecting ventrally as in *elongatulus* (Fig. 2, M). Hind tibiae with few short spines on the outer margin. Head very finely and closely punctured, punctures on the thorax slightly larger than those on the head, and closely distributed. On the mesopleuron the punctures somewhat longitudinally

elongated and rugulosely arranged, which becoming rather longitudinal striae on the marginal portion. Metapleuron and sides of the median segment finely and closely punctured-striate, the middle of the latter smooth and shining. Area cordata polished, with minute punctures medio-basally or, in some examples, with fine oblique striae antero-laterally. Abdomen without puncture. Apical tergite somewhat largely punctured. Opaque markings on the 2nd sternite small and elongate, but well-defined.

♀. Similar to ♂. Mandibles bidentate at the apex. Apical joint of antennae normal. Head above anteriorly more densely punctured than in ♂, half mat. Area cordata with fine oblique striae near the median groove, but the surface is shining. Pygidial area triangular in shape, with the base somewhat roundly swollen, and scattered sparsely with very coarse punctures. Outer face of hind tibiae more strongly spinose than in ♂. Length ♂ 4–5, ♀ 5–6 mm.

I have the honour of dedicating this species to Professor Tohru Uchida, under whom the work has done.

Holotype: ♂, 30. VII. 1944 (Jôzankei). Allotype: ♀, 15. VI. 1944 (Sapporo). Paratypes: 1♂, 7. VI. 1944; 1♀, 15. VI, 1♂, 20. VII, 2♂♂, 23. VII, 1♀, 28. VII. 1945 (Sapporo).

37. *Crabro* (*Crossocerus*) *opacifrons* sp. nov.

This species closely resembles *C.* (*crossocerus*) *denticoxa* Bischoff ♀, but is easily distinguished from it by the fine, dense, granular punctuation on the frons.

♀. Black. Mandibles except the apex, pulpi, anterior half of clypeus, fore and outer faces of antennal scape, apical ring of the 2nd joint of antennae, a medially interrupted transverse band on the prootum, humeral angles, base and apex of all trochanters, apex of all femora, front tibiae except the posterior face, outer face of mid and hind tibiae, tibial spurs and all tarsi except the distal 1–3 segments yellow. Apex of mandibles, anterior margin of the clypeus narrowly, tegulae of wings and apical portion of tarsi ferruginous. Wings hyaline, iridescent. Mandibles slender and bifid at the apex, with the teeth equal in length to each other and obtuse at the apex. Clypeus produced anteriorly, with apical margin tridentate (Fig. 2, E). It is nearly half as long as the scape of antennae. Eyes large, reaching the base of mandibles and inwardly the sockets of antennae. The distance between the eyes at the base of clypeus one

third the length of the antennal scape Frontal line deep and distinct, frontal imprssion indistinct. Without groove or ridge between the paired ocelli. Ocelli in an equilateral triangle, oculocellar space: postocellar space=3:2. Occipital edge not ended into a tooth on the head beneath. The 3rd joint of antennae 1.7 times as long as broad at its apex, the 4th slightly shorter than the 3rd and nearly as long as the 2nd. Pronotum with antero-lateral angles rounded. Mesonotum on the posterior margin without crenate groove. On the mesopleuron episternal furrow deep and crenate, transsternal furrow much deeper. Mesopleural tooth absent. Area cordata on the median segment enclosed by a well-defined crenate furrow. Median longitudinal furrow distinct, which is rather broadly divergent basally. Posterior slope of the segment with medial longitudinal groove, also with well-defined lateral carinae. The 1st segment of abdomen slightly longer than broad at the posterior margin. Pygidial area triangular and flattened above. Legs normal; hind tibiae with a few spines on the outer face. Body sparsely covered with very short white pubescence, hairs on the clypeus dense and silvery. Head and mesonotum very minutely and moderately closely punctured. Frons broadly—including median ocellus and extending posteriorly to the oculocellar line—very densely and finely granulate and entirely mat. Temples without puncture. Oculocellar space impunctate and shining. Neck region obliquely striated. Punctures on the pro- and mesonotum somewhat stronger than those on the head, on the scutellum much weaker and sparser, on the mesopleuron scattered only on the anterior portion. Metapleuron and sides of median segment impunctate and polished, the latter with upper and hinder portions longitudinally and rather indistinctly striated. Area cordata with the base coarsely crenate, but the remaining portions impunctate and shining; posterior face of the segment without sculpture, with the exception of feeble transverse striae on the dorso—lateral portion. Abdomen impunctate. Area pygidialis shining, with a few large scattered punctures. Length 5.5 mm.

Holotype: ♀, 10. IX. 1945 (Jôzankei).

38. *Crabro* (*Crossocerus*) *yasumatsui* sp. nov.

This species somewhat resembles *C. acanthophorus* Kohl, but much larger in form and is remarkable in the structure of head above and pronotum, in the general punctuation and coloration.

♂. Body densely covered with comparatively long greyish white pubescence. Black. Mandibles except the apex, a large spot on the latero-basal portion of clypeus, genae near the base of mandibles above (small) and beneath (large), underside of front femora partly yellow. A spot on the base of mid tibiae and outer face of hind tibiae basally dark yellow. Apex of mandibles, pulpi, sockets of antennae, greater part of front legs (except the coxae, inner and outer longitudinal stripes of femora, outer margin of tibiae and distal two joints of tarsi) ferruginous yellow. Antennae apically, outer half of tegrae and tarsi of mid legs dark brown. Wings hyaline, slightly fuscous.

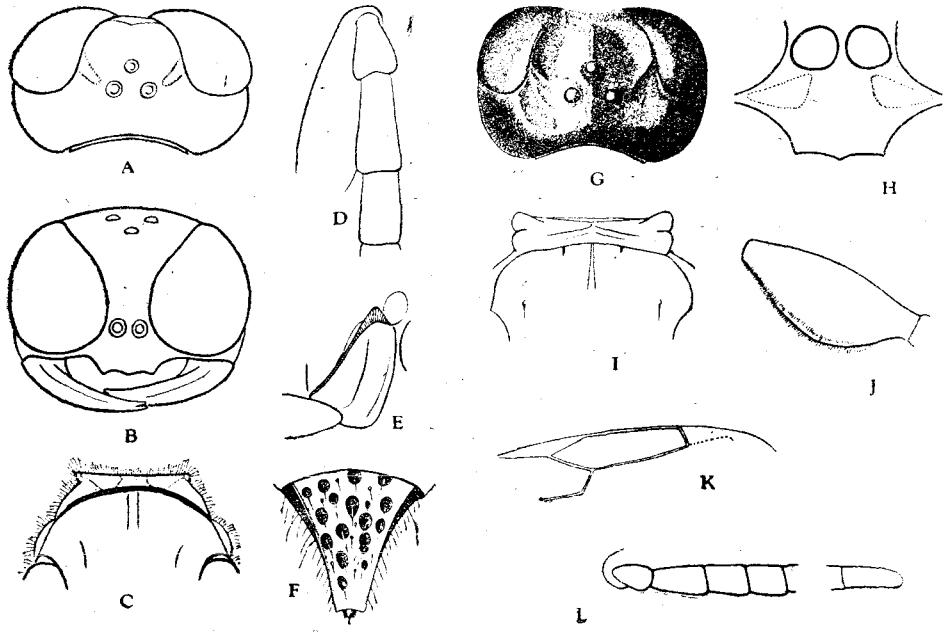

Fig. 5. A. Head of *Crabro* (*Crossocerus*) *yasumatsui* sp. nov. ♀, seen from above. B. Do. seen in front. C. Pro- and mesonotum of do. seen from above. D. Basal 4 joints of antenna of do. E. Front coxa of do. F. Pygidial area of do. G. Head of the same species ♂ seen from above. H. Clypens of do. I. Pro- and mesonotum of do. J. Front femur of do. K. Radial cell of fore wing of do. L. Flagellar joints of antenna of do.

Head seen in front much wider than high, seen from above (Fig. 5, G) with the lateral margins rounded, and with the front margin narrowly and occipital margin broadly and roundly emarginated. Mandibles bidentate at the apex, with the upper tooth slightly larger,

without the lateral tooth on the inner margin. Clypeus (Fig. 5, H) covered with silvery piles, broadly produced anteriorly with the apical margin tridentate, the teeth short and broad but pointed at the apex. It is gently carinated in the middle, and slightly longer than half the length of the antennal scape. Oculo-mandibular spece very narrow. Front and vertex depressed, with the ocellar area broadly elevated (Fig. 5, G). Frontal line, quite peculiar to the genus, distinctly carinated. Frontal impression obliquely disposed, rather ill-defined, but with its medio-anterior border conspicuously raised and sub-carinated. Interval between the paired ocelli medially longitudinally carinated. Occipital edge well-defined, especially on the underside of the head, but not ended into a tooth. Ocelli in an equilateral triangle. Oculocellar space : postocellar space $\fallingdotseq$ 3:2. Ocelloccipital space much longer. Antennae slender, flagella beneath provided with erect fine hairs sparsely. The 3rd joint of antennae (Fig. 5, L) about twice as long as broad at its apex, one and a half times as long as the 4th, apical joint longer and normally attenuate. Temple broad, but slightly narrower than eye seen in profile. Pronotum (Fig. 5, I) strongly developed and characteristic in shape. It is flattened above with a transverse shallow groove near the posterior margin; anterior face steeply truncate. Antero-lateral angles stoutly produced with the apex rounded and slightly reflected; lateral margin with a large (but blunt) projection in the middle. Mesonotum medio-anteriorly with two closely lain longitudinal feeble carinae, which slightly divergent posterorly. One on each side of the carinae and slightly apart from them there is also a short longitudinal carina. The segment, in the middle laterally, provided with a small tubercle. No crenate groove on the posterior margin. On the mesopleuron, epicnemial plane well developed, with the lateral border strongly carinate. Episternal furrow conspicuous, coarsely crenate, transsternal furrow very deep. Mesopleural tooth absent. The borders between the meso- and metapleuron and between the latter and the side of median segment broadly and deeply furrowed, the last mentioned furrow crenate. Scutellum convex, postscutellum transversely highly elevated. Area cordata enclosed by a crenate groove, with transversely arranged coarse notchings at the base, with well-defined median groove, which extends to the posterior slope of the segment where it becomes comparatively shallow and broad. Lateral carinae well-defined only on the posterior portion. Abdomen slender and long, the 1st segment distinctly longer than broad at the apical

margin; each segment slightly constricted. Squama of genitalia on the outer margin roundly convergent apically, with the apex pointed. Front coxae with a longitudinal carina on the outer face. Front femora (Fig. 5, J) roundly swollen posteriorly, front metatarsi slightly dilated and semitransparent. Hind tibiae with a few strong spines on the outer margin. Radial cell of fore wing: Fig. 5, K. Front and temples very minutely and densely punctured. On the vertex punctuation minute but much sparser, on the mesonotum and scutellum close and slightly larger. Mesopleuron with the punctures indistinct; episternum minutely and longitudinally punctured-subrugulose. Upper portion of metapleuron longitudinally striate. Sides of the median segment partly longitudinally punctured-striate; remainder of the segment wholly finely punctured-coriaceous. Abdomen impunctate; apical tergite distinctly and densely punctured. Opaque markings on the 2nd sternite oval but rather indistinct.

♀. Similar to ♂. Two elongated spots on the pronotum and basal half of hind tibiae on the outside cream yellow. A small basal spot on the front and mid tibiae dark yellow. Clypeus with the apical margin bluntly tridentate (Fig. 5, B). The structure of front and vertex as in ♂, in general, however, much feebly represented (Fig. 5, A). Pronotum, seen from above, (Fig. 5, C) almost trapezoidal in form, with the lateral margin slightly reflected and with the anterolateral angles shortly but sharply produced. The segment is flattened above and with the anterior face steeply truncate, constituting an acute edge on the anterior margin, which is excavated in the middle by the longitudinal furrow. Mensonotum without a tubercle laterally in the middle. Posterior slope of the median segment with well-defined lateral carinae. The segment dorso-laterally finely rugulose. Abdomen not so long as in ♂, and not constricted at all; the 1st segment only slightly longer than broad at the apex, pygidial area (Fig. 5, F) triangular and flattened above. Its marginal carina is very strong seen in profile. Punctuation as in ♂, but generally feebler. Front and vertex finely and not very closely punctured. Punctures on the temples are most delicate. Meso- and metapleuron almost impunctate. Scutellum and area cordata very minutely and closely punctured. Sides of the median segment anteriorly impunctate and polished, posteriorly irregularly coriaceous. Pygidial area coarsely punctured (Fig. 5, F). Length ♂ 7.5, ♀ 7–8 mm.

I wish to dedicate this interesting species to Dr. Keizo Yasumatsu, a leading hymenopterist in Japan.

Holotype: ♂, 27, VII. 1945 (Sapporo).
Allotype: ♀, 1. VIII. 1944 (Sapporo).
Paratypes: 1♀, 2. VII. 1944; 1♀, 27, VII. 1945; 1♀, 5. VII. 1946 (Sapporo); 1♀, 2. VIII. 1946 (Jôzankei).

**39. *Crabro (Entomognathus) brevis* v. d. Linden (1829).

Crabro brevis v. d. Linden, Nouv. Mém. acad. sc., Bruxelles, V, p. 70, 1829.
Entomognathus brevis Perkins, Trans. Ent. Soc. London, p. 396, 1913; Hamm & Richard, Trans. Ent. Soc. London, LXXIV, 2, p. 329, 1926.
Crabro (Entomognathus) brevis Kohl, Ann. k. k. Naturh. Hofm. Wien, XXIX, p. 316, 1915; Benoist, Bull. Soc. ent. France, p. 241, 1915; Grandi, Redia, XVI, pp. 69-78, 1925; Berland, Fauna de France, Hymen. Vespif., p. 176, 1925; Schmiedeknecht, Hymen. N.M. Europ., p. 160, 1930; Yasumatsu, Trans. Kansai Entom. Soc., Vol. IX, Pt. 2, p. 14, 1939.

This species has hitherto been known from Europe, North Africa, Siberia (Irkutsk), Mongolia (Kuchoto) and Manchuria (Dairen) and is new to the fauna of Japan.

This species is not rare in Hokkaido.

1♂, 7. VII. 1944 (Sapporo); 1♂, 15. VII. 1944 (Oshoro); 2♂♂2♀♀, 30. VII. 1944; 4♀♀, 5 VII, 15. IX. 22. IX. 1945; 31♂♂12♀♀, 5. VIII. 1946 (Jôzankei).

40. *Crabro (Rhopalum) latronum* Kohl (1915).

This species is very common in Hokkaido. Some specimens are much brighter in colour than the typical form and always with a lengthened cleam yellow marking on the outer-lower margin near the apex of front- and mid-femora. Ferruginous colour in the typical form becomes cleam yellow and much broader in extention. I often saw the wasp hunting small flies on a wall of a stable or over the filth on the garden patch of Korean at Jôzankei.

**41. *Crabro (Rhopalum) kiesenwetteri* A. Morawitz (1866).

Rhopalum nigrinum Kiesenwetter, Stett. ent. Zeitg., X, p. 91, 1849.
Crabro kiesenwetteri A. Morawitz, Bull. acad. sc. St. Pétersb., IX, p. 267, 1866.
Rhopalum kiesenwetteri Perkins, Trans. Ent. Soc. London, p. 396, 1913; Bernard, Bull. soc. ent. France, XXXIX, p. 62, 1934.
Crabro (Rhopalum) kiesenwetteri Kohl, Ann. k. k. Naturh. Wien, XXIX, p. 342, Fig. 41, 55, 1915; Berland, Fauna de France, X, Hymen, Vespif., p. 181, 1925; Schmiedehnecht, Hym. N. M. Europ., p. 658, 1930.
Corynopus nigrinum Richard, Trans. Ent. Soc. London, p. 168, 1935.

Our examples slightly differ from the interpretation and the figure given by Kohl (1915) in the following points:

In ♀; 1) The form of clypeus: the emargination before the lateral tooth is not so deep as shown by Kohl, 2) The sides of the pygidial area on the apical portion slightly reflected, so as to form a slight gutter, 3) Greater part of mid tibiae and trochanters of all legs yellow.

In ♂, 1) Flagellum of antenna: Fig. 2, J; the form of basal 4 joints is as shown in Kohl's monograph. But the 5th and 6th joints beneath, too, slightly but distinctly emarginated at the base and produced apically, 2) Trochanters and spex of coxae of all legs are yellow in colour.

This condition, at least in the form of flagellum, however, well agrees with the description given by Bernard (1934) on the example from France. I referred, therefore, the specimens from Japan to the typical form. This species hunts Procidae and stores them in the cells that are linearly arranged in a dried reed.

2♂♂, 22. VII, 3♂♂2♀♀, 26. VII, 1♂2♀♀, 28. VII. 1944; 4♂♂2♀♀, 12. VI-11. VII. 1946 (Sapporo); 1♂1♀, 30. VII. 1944 (Jôzankei); 1♂, 6. VIII. 1944 (Sôunkyo).

*42. *Crabro* (*Rhopalum*) *nipponicus* Kohl (1915).

This species has hitherto been known only from Japan proper and new to the fauna of Hokkaido. The species seems to be rare.

1♀, 3. VIII. 1944; 3♂♂3♀♀, 23. VII. 1945; 12♂♂4♀♀, 14. VI.-5. VII. 1946 (Sapporo); 2♂♂1♀, 17. VII. 1945 (Kamikawa).

*43. *Crabro* (*Rhopalum*) *clavipes* (Linné 1758).

This species has hitherto been known from Europe and the Kurile Islands, and is new to Hokkaido. This species is very rare.

1♀, 7. VIII. 1944 (Sôunkyo).

44. *Crabro* (*Rhopalum*) *jessonicus* Bischoff (1922).

No example of this species has been found since the type specimen was captured in 1906 at Akkeshi.

45. *Crabro* (*Rhopalum*) *calceatus* sp. nov.

This new species is similar to *C. clavipes* (L.), but is very characteristic in the forms of antennae (♂), clypeus (♂ ♀) and pygidial area (♀).

♂. Pubescence of body silvery, so short and so fine that it can be seen in the oblique light only; on temples, mesopleuron, posterior slope of median segment and apex of abdomen somewhat long and distinct, on clypeus dense and appressed, very glistening. Body slender. Black. Yellow markings: Mandibles except the apex, pulpi, the 1st and greater part of the 2nd joint of antennae, basal half of flagella beneath, huneral angles partly, tegulae, front leg except the coxa, mid leg except the coxa and terminal joint of the tarsus and hind leg except the femur, apical half of tibia and of basal 4 joints of the tarsus. In some examples base of front and mid femora with a more or less brownish macula and in one bright-coloured example hind femur and apical portions of tibia are brownish. It is very conspicuous that the end segments of mid and hind tarsi are pitchy black. Base and apex of the 2nd and 3rd terigites, the 2nd, 3rd and 4th sternites of abdomen wholly marked with ferruginous. This ferruginous area more or less changable in extent. Mandibles bifid at the apex with upper tooth longer, without lateral tooth on the inner margin. Clypeus (Fig. 4, J) with the apical margin slightly emarginate, on the lateral margin near the base 2 obtused dens produced, which are in some specimens fused into a single mass (Fig. 4, K). Frontal prominence between the base of antennae very low, longitudinally rounded. Frontal line distinct, frontal impression obsolete. Ocelli in an equilateral triangle; oculocellar space: postocellar space ≒ 2:1. Occipital edge very feeble, not ending into a tooth on the head beneath. Temple, seen in profile, much narrower than eye. Antennae irregular in form (Fig. 4, L). The 2nd joint very large, as long as the succeeding 3 joints taken together, joint 3=4+5, 4 remarkably short, about half the length of 5; 6 slightly longer than 4+5. Underside of 2, 3, 4+5, and 6 deeply excavated and produced at the apex. From 7th apically normal, with the distal joint longer and slightly dilated at the apex. Pronotum well-developed, with the antero-lateral angles shortly pointed. Prosternal tubercles obtuse at the apex. Area cordata on the melian segment not enclosed by the groove, with the transverse row of nothchings at the base. Median furrow rather feeble; on the posterior slope,

however, it hollows deeply and widely into a lenticular excavation, lateral carinae only definable on the posterior portion. Sides of the segment anteriorly obliquely and broadly excavated. Adbomen slender, the 1st segment nearly equal in length to the hind femur, more than as long as the 2nd segment. In the legs each trochanter comparatively long. Front metatarsi (Fig. 4, O) dilated and gradually broadened apically, with the apex narowing inward and finally pointed, hind tibiae clavate with a few feeble spines on the outer face, hind metatarsi incrassate and slightly bending. Venation of wings (Fig. 4, I) as in *C. clavipes* (L.) Head and thorox above very delicately and fairly closely punctured, posterior slope of the median segment and basal half of the 1st tergite of abdomen minutely sculptured and half mat. Rest of the body impunctate and very shining.

♀. Similar to ♂. Brownish maculae on the front- and mid-femora above always distinct. Hind tarsi more brownish. Antennae (Fig. 4, M) and legs normal. Pygidial area (Fig. 4, N) triangular, apically narrowed into a gutter, basally somewhat swollown and with a remarkable longitudinal carina in the middle and with a few scattered coarse punctures. Length ♂ ♀, 5.5–6.7 mm.

Holotype: ♂, Allotype: ♀, 2. VII. 1946 (Jôzankei). Paratypes: ♂, VI. 1932 (Yaku leg. Sapporo, the specimen in Ent. Lab. Hokkaido Univ.); 6♂ ♂ 7♀ ♀, 2. VIII. 1946 (Jôzankei).

Addition. The example which was determined as *Crabro* (*Coelocrabro*) *leucostomoides* Richard (1935) (=*leucostoma* Linné) by K. Iwata seems to me, according to my reexamination of the specimen, to be nothing but a female of *C.* (*Coelocrabro*) *pubescens* Shuckard. *C. leucostomoides* Richard has not, as yet, been found in Japan.

(P. S.)

Since this article went to press, the following 3 species were found in Hokkaido, of which two were new to Japan and one might be, perhaps, new to science.

****46. *Crabro* (*Crossocerus*) *elongaturus* v. d. Linden (1829).**

1♀, Esan, near Hakodate, 22. VII.

**47. *Crabro* (*Crossocerus*) *emarginatus* Kohl (1915). f. *pacificus* Gussakovsky (1933)

7♂♂, Hakodate, VIII-IX.

48. *Crabro* (*Coelocrabro*) sp.

3♂♂1♀, Sapporo.

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1) Literature is confined to that relating mainly to Hokkaido and to that published after the publication of Kohl's monograph of the Genus with the exception that is specially consulted in the present study.

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