SUBFAMILY MELLININAE

The taxonomical status not fixed. The group was treated as a tribe within the Nyssoninae by Bohart and Menke (1975), Beaumont (1954) and several others, whereas Evans (1959) gave it subfamily rank, concluding from larval morphology that the group is apparently not closely related to the Nyssoninae. As concerns subfamily characters of imagines, see generic description of Mellinus. In addition, it should be noticed that the epicnemium is not differentiated, since the epicnemial carina is absent and the transverse discoidal veins join first and third cubital cells, respectively. The latter character is only found in Ampulex (Ampulicinae) and some Pison (Larrinae, Trypoxylonini), suggesting it to be rather primitive. The only specialized character of imagines might be the petiolate abdomen.

As regards larval morphology the following description it based only on the single species being described. Body with pleural lobes and a series of dorso-lateral prominences conically produced, dark-tipped, and armed with numerous short, stout spinules (Figs. 37, 38). Integument otherwise smooth. Parietal bands only indicated. Antennal papillae absent. Apical margin of labrum bristly, with a strong V-shaped emargination. Mandibles bidentate, strongly excavate proximally. Maxillary palpus slightly longer than galea. Maxillae directed medially. Spinneret paired, the salivary openings at the tip of slender prolongations, proximally connected by a membrane.

The subfamily only comprises a single genus. Probably all species display terrestrial nesting habits.

Genus *Mellinus* Fabricius

Mellinus Fabricius, 1790:226.
Type-species: Vespa arvensis Linné, 1758.

Rather large, easily recognizable species (Fig. 273) with extensive and very variable yellow pattern. Head large, in front view broader than long. In females the lower two-thirds of inner orbits of eyes are parallel, whereas they are distinctly converging downwards in the males. Antennae long, filiform, inserted far from each other. Clypeus with three rounded teeth on anterior border, its yellow or white-yellow pattern most strongly developed in the males. Mandibles stout, in females tridentate, in males bidentate. Thorax with yellow pattern on pronotum, scutellum, and mesopleuron. Propodeum elongate, slightly convex, dorsally with distinctly delimited area

cordiformis, in which is found a drop-shaped, strongly sculptured depression. Lateral faces of propodeum delimited from posterior face by sharply protruding carinae. Tergum 1 long and narrow, posteriorly swollen, only very seldom with yellow pattern. Terga 2, 3 and 5 in female with yellow or white-yellow transverse bands or lateral spots. In males there are yellow patterns on second and third, and usually also on fourth and sixth terga. Females with well developed pygidial area. Legs with more or less extensive yellow or red-brown pattern. Pretarsi very large. Tibia 2 with two apical spurs. Metatarsus 1 in female with 4 to 5 very weak spines. Forewings with three cubital cells. First discoidal transverse vein joins first, the second the third cubital cell.

The genus has a Holarctic distribution and comprises about 10 species.

The nests are excavated in the soil. The prey consists of Diptera Brachycera and Cyclorrhapha.

Key to species of Mellinus

1 Female: abdomen with bright yellow transverse bands, at least complete on tergum 2. The remaining bands may be interrupted in the middle. The distal flagellar segments black or brown-black dorsally. Tibiae yellow or red-brown.
Male: distal antennal segments black dorsally. Propodeum rather strongly sculptured, laterally distinctly, but finely rugoso-punctate ..... 86. arvensis (Linné)

\- Female: abdomen with white-yellow lateral spots that very rarely fuse to form bands. The distal antennal segments uniform red-yellow, of the same shade as the tibiae.
Male: distal antennal segments darker dorsally. Propodeum relatively weakly sculptured, with only indications of rugae, punctate ..... 87. crabronea (Thunberg)

86. MELLINUS ARVENSIS (Linné, 1758)
Fig. 273.

Vespa arvensis Linné, 1758:573.
Mellinus alpinus Handlirsch, 1887:283.

Female: 11-16 mm. Face dull, very densely punctate, dull. Clypeus very slightly convex, anterior half finely pustulate, posterior half punctate- reti-

culate. The surface itself with long, scattered brownish bristles. Head with very short pubescence, which along inner orbits and on lower part of face has a felt-like appearance. Antennae long and slender, black dorsally and brown-yellow ventrally. Pronotum pad-like raised, with a transverse yellow spot, often interrupted in the middle. Scutum dull, very densely punctate. Mesopleuron with very strong episternal and epimeral sutures. Dorsal face of propodeum with a shiny area, in whose middle is a drop-shaped depression, rugose at the bottom. Abdomen shiny with bright yellow transverse bands on terga 2, 3 and 5, and larger or smaller lateral spots on terga 1 and 4. Pygidial area with very dense and fine longitudinal rugae, basally mixed with a rather coarse punctation. Tibiae usually yellow with a dark spot on the inner side.

Yellow pattern varying greatly. Specimens from Denmark and southern Sweden very often carry a larger or smaller basal, and occasionally also a more effaced yellow spot near the middle on mandibles. These spots may coalesce. In this case there is usually a yellow transverse band on clypeus. In addition, the yellow lines along inner orbits are strongly developed, reaching to epistomal suture. A well developed pattern on the head is often

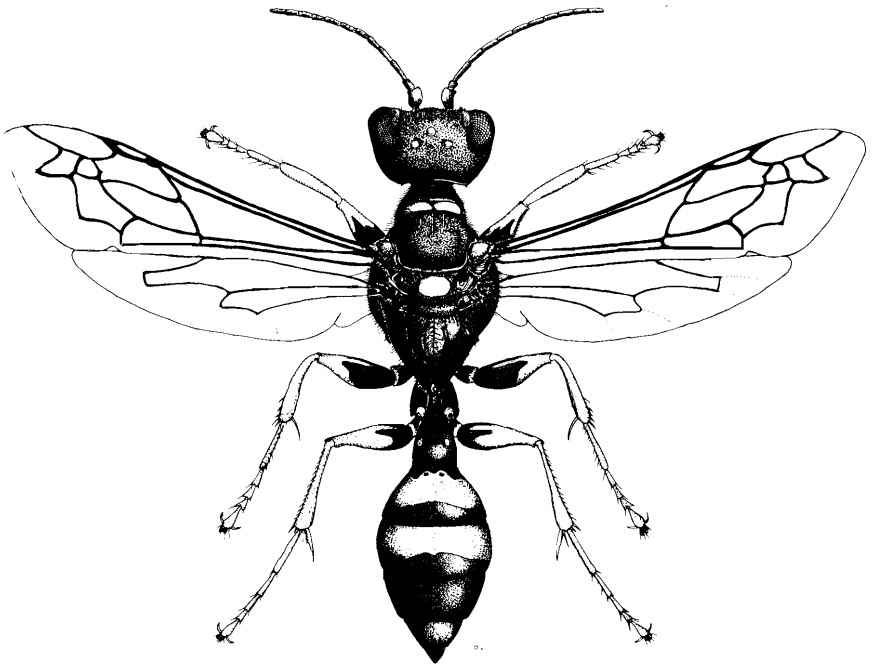


Fig. 273. Female of Mellinus arvensis (L.). Length: 11-16 mm.

correlated with yellow spots on coxae. A few specimens from southern Denmark, besides the large yellow spot on mesopleuron may have one or two additional ones just behind the humeral tubercle ventro-laterally on mesopleuron. In most specimens tergum 1 is entirely black, but small yellow spots occur, especially in individuals from SJ in Denmark and in specimens from Central and South Europe. Terga 2, 3 and 5 with broad transverse bands, which especially in specimens from the northernmost areas of the species' range, are interrupted in the middle. This also applies to specimens from the Alps (see note). Tergum 4 and sternum 3 may carry yellow spots, especially in material from Denmark, South Sweden and Åland. The main rule is that the extent of the yellow colour decreases gradually towards the north. Specimens from Finland nearly always have entirely black femora, mandibles and clypeus, and the yellow markings are absent from coxae and usually from tergum 4.

Male: 8-13 mm. More slender than female. Yellow pattern on head considerably more extensive. Clypeus often all yellow. Mandibles with a large, triangular yellow spot at the base, sometimes extending across the greater part of the anterior face of the mandible. Antennae black, brown-yellow ventrally. Segments 8-12 ventrally with small oval excavations. Head behind ocelli with very weak microsculpture. Propodeum behind shiny raised area dorsally with irregular rugae, which are partly coalescing. True punctation often missing. In addition to the yellow pattern described in the female yellow spots are occasionally found on the humeral tubercle. Abdomen with bright yellow lateral spots on terga 2, 3 and 6. Yellow pattern of legs varying greatly, but coxae usually black with apical spot and a larger or smaller yellow spot ventrally. Small specimens, and particularly individuals from the northernmost regions of the distribution range, may lack yellow pattern on tergum 2 as well as on femora. Tibiae yellow, tibiae 1-2 with dark streak on the inner side.

One of the most common species in Fennoscandia and Denmark. - Denmark: records from all districts except SZ. - Sweden: known from all districts up to Dlr., Hls. and Med. - Norway: northern distribution limit runs through NRy, On, and HEs. - In Finland this species seems to have a southern and southeastern distribution pattern, not being recorded from Oa and Om. - Soviet Karelia: Ib, Kr. - Although it is a very common species, its distribution area seems to include only the European countries, except the close Mediterranean areas.

Frequently met with in sandy localities, but relatively seldom on coastal biotopes. The nests are constructed, often in aggregations, in places with-

out vegetation, in horizontal areas as well as on slopes. Females hunting prey and constructing nests are seen from late June to late September or even October. Males often seen swarming in small aggregations round detached sun-baked trees and bushes, especially of Quercus and Myrica, on whose leaves they often are seen resting and licking honey dew.

The main tunnel of the nest often goes 30-40 cm almost vertically down into the soil, to a single cell; or several cells are constructed at the end of rather short, horizontal side tunnels. These are provisioned with flies of the families Tabanidae, Syrphidae, Muscidae, Calliphoridae and Tachinidae. Many arvensis females seek their prey on fresh cow droppings, where it is attacked with a sudden jump, and held fast with mandibles and forelegs. Then the wasp bends its abdomen forwards to paralyze the fly with one or two stings. After very few seconds, the movements of the fly cease, and it is flown back to the nest. Each cell is provisioned with 4-13 flies. The egg is usually laid on the first-paralyzed fly (Huber, 1961). When fully grown, the larva spins a pale, parchment-like cocoon, covered on the outside with sand grains and food remains. The larva was described by Evans (1959) and Maneval (1939). Known dipterous parasites are Macronychia griseola Fall. and Sphecapata conica Fall. (Sarcophagidae).

Note. Specimens from the Alps were traditionally recorded under the name M. alpinus Handlirsch, and recently Romanova (1969) recorded the species from Northern Caucasus as alpinus. European material has been compared with alpinus, and I must conclude, in agreement with Bohart & Menke (1975), that alpinus is simply to be regarded a junior synonym of arvensis. Material from the Alps is very similar to Finnish specimens, but might be distinguished by the slightly darker yellow colour. It seems probable that the variation in colour-intensity and -distribution is geographically/climatically conditioned.

87. MELLINUS CRABRONEUS (Thunberg, 1791)

Sphex crabronea Thunberg, 1791:126.
Mellinus sabulosus auctt.

Female: 10-12 mm. Head and scapus golden-yellow or light brown-yellow, very different from the white-yellow colour on thorax and abdomen. Mandibles lighter or darker brown, never completely black, only seldom with a yellow basal spot. Clypeus slightly more convex than in arvensis, anterior part finely pustulate, posterior part punctate-reticulate. Yellow patterns may be absent, but often forms an almost complete transverse band. Bristles pale. Antennae brown-yellow or red-yellow, proximal part black

dorsally. The posterior face of propodeum with distinct punctation, sometimes also with weak rugae. Abdomen with white-yellow spots on terga 2, 3 and 5. These are never fused into transverse bands. Legs red-yellow, femora, however, with dark base.

Male: 7-11 mm. Pattern of face of same shade as that of abdomen. Mandibles black with larger or smaller spot at base. Antennae red-yellow, only proximal segments black dorsally. Antennal segment 8-12 with very small excavation ventrally. Frons behind ocelli shiny, with microsculpture sometimes vestigial. Thorax with same yellow pattern as in female. Propodeum considerably more weakly sculptured than in arvensis, posterior face punctate with weak rugae, just above articulation of abdomen. Abdomen with yellow lateral spots on terga 2, 3 and 6. Legs red-yellow with black femora, these often with white-yellow spot near apex.

Not common, but sometimes occurs in large numbers locally. A southern species in Fennoscandia and Denmark. - Sweden: northern distribution limit in southern Vrm., Nrk. and Ög. - Norway: a very small material from AK and VE. - Finland: some rather old specimens from N. - Soviet Karelia: Ib, Kr. - The distribution area covers Europe, extending eastwards through the steppe areas in southern Siberia to Mongolia, Manchuria and Korea.

The nests are often constructed in dry, often coastal localities, usually in aggregations. From a main tunnel, 5-30 cm long, 3-6 short side tunnels issue, each terminating in a cell. Round the entrance the characteristic superstructure of excavated material is found, as in arvensis. The cells are provisioned with flies of the families Syrphidae, Muscidae and Anthomyiidae.

SUBFAMILY ASTATINAE

A small, probably monophyletic subfamily closely related to the Larrinae. It comprises the two tribes Astatini and Dinetini. Size of species about 10 mm. Head large, almost as wide as thorax. Inner orbits strongly diverging ventrally, especially in holoptic Astata-males. Ommatids very small in ventral fourth of the eye. Ocelli circular, the anterior the largest. Mandibles bidentate, the ventral margin in Astata (and Diploplectron) very slightly emarginate, suggesting a strong reduction of both the proximal tooth and the deep emargination found in Dinetus and Larrinae. Antennae filiform, in males with pronounced secondary sexual characters. Prothorax very short, humeral tubercles almost reaching tegulae. Mesopleuron with epicnemial furrow,

epicnemium absent. Propodeum large. Abdomen sessile, depressed and triangular in outline in Astata. Pygidial area of females plane, bordered by dark bristles. Tarsus 1 of females with strong tarsal pecten (also present in Dinetus-males). Tibia 2 with two apical spurs (absent in Dinetus-males). Radial cell truncate, appendiculate. Three or two cubital cells and two discoidal cells. The first cubital cell divided by a very indistinct vein. Hindwings in Astata with a very large jugal lobe.

Larval head much wider than high. Parietal bands strong. Antennal papillae present. Mandibles with a hyaline, strongly setose area laterally near the base, the apex with from two to four strong teeth. Galea slightly shorter and much more slender than the maxillary palpus. Spinneret paired. Maxillae directed medially, closely associated with the labium. Fourth abdominal segment humped dorsally.

The subfamily only comprises four genera of which two are represented in the European fauna. All species nest in the soil, using Heteroptera as prey.

Genus *Astata* Latreille

Astata Latreille, 1796:114.
Type-species: Tiphia abdominalis Panzer, 1798 (=Sphex boops Schrank, 1781).

Medium to small species. Head short, in front view almost circular. Inner orbits of eyes strongly diverging ventrally. Ocelli placed far in front of posterior border of eyes, anterior one much larger than posterior. Antennal segments inserted very low on face, immediately above epistomal suture. Scapus short and thick. Anterior border of clypeus slightly reflexed. Pronotum short, cone-shaped. Thorax weakly convex dorsally, broad and flat. Abdomen short, triangular, base red in Danish and Fennoscandian species. Last tergum in females with pygidial area. Metatarsus 1 with stout pecten in females. Tibia 3 very spiny. Males holoptic (Figs. 278, 279). Upper and forwardly directed ommatids considerably larger than those situated above mandibular articulations. In the subgenus Dryudella males have a large white double spot on anterior frons. Forewing with three cubital cells, of which the first is divided by a pale transverse vein. The second is joined by both discoidal transverse veins (Fig. 274). Hindwing, especially in males, with very large vannus.

The geographically conditioned intraspecific variation, both as regards morphology and colour, is rather little, and also the interspecific variation within the two subgenera is surprisingly slight. The genus has a cosmopolitan distribution, but is unknown in the Australian region.

The species are associated with dry, sandy biotopes, where the nests are constructed in the ground. Prey consists of nymphs or imagines of Heteroptera: Geocorisae.

Note. Dryudella Spinola is here considered a subgenus of Astata, although Parker (1962, 1969) argues that it should have full generic status.

Key to species of Astata
(Sub-genera in brackets)

1 Propodeum dorsally with strong, obliquely, outwardly directed, longitudinal carinae, connected with weaker transverse rugae, in this way giving the sculpture a reticulate appearance. Interspaces shiny, without microsculpture. Males: frons completely black (Astata) 2

\- Propodeum dorsally very strongly microsculptured, of dull appearance, without protruding ribs. Males: frons with white double spot in front of anterior ocellus (Dryudella) 3

2(1) Female: metatarsus 1 ventrally with 16-18 short, stout spines (Fig. 280). Third flagellar segment in dorsal view at least three times longer than broad. Male: third antennal segment 3 - 3.5 times longer than broad, tyloidea as Fig. 282 ..... 88. boops (Schrank)

\- Female: metatarsus 1 ventrally with only 7 - 9 spines (Fig. 281). Third flagellar segment seen from above about twice as long as broad. Male: third antennal segment at most 2.5 times longer than broad, tyloidea as Fig. 283 ..... 89. minor Kohl

3(1) Female: anterior border of clypeus with evenly convex mid-part and two small lateral teeth (Fig. 277). Male: spots on frons above delimited by a strongly arcuate line (Fig. 278). Tyloidea distinct on segments 6 - 8, almost linear ..... 90. stigma (Panzer)

\- Female: anterior border of median lobe of clypeus with two emarginations, whereby three small rounded teeth appear (Fig. 276).

Male: spots on frons above delimited by an almost straight line (Fig. 279). Tyloidea very indistinct, forming oblique, weak convexities on segments 6 - 8 ..... 91. pinguis (Dahlbom)

88. ASTATA (ASTATA) BOOPS (Schrank, 1781)
Figs. 275, 280, 282.

Sphex boops Schrank, 1781:384.
Astata picea Costa, 1867:90.
Astata sicula Kohl, 1884:436.
Astata carbonaria Kohl, 1884:437.
Astata agilis Smith, 1875:39.

Female: 10-13 mm. Frons in front of ocelli shiny and densely punctate. Genae laterally, and area behind ocelli, with only very scattered punctation. Occiput with superficial, but rather dense punctation and long, silvery pilosity. Dorsally on head a weak microsculpture may sometimes be recognizable. Lower part of face with dense, silvery pubescence. Central part of clypeus strongly produced, its anterior border with two very weak

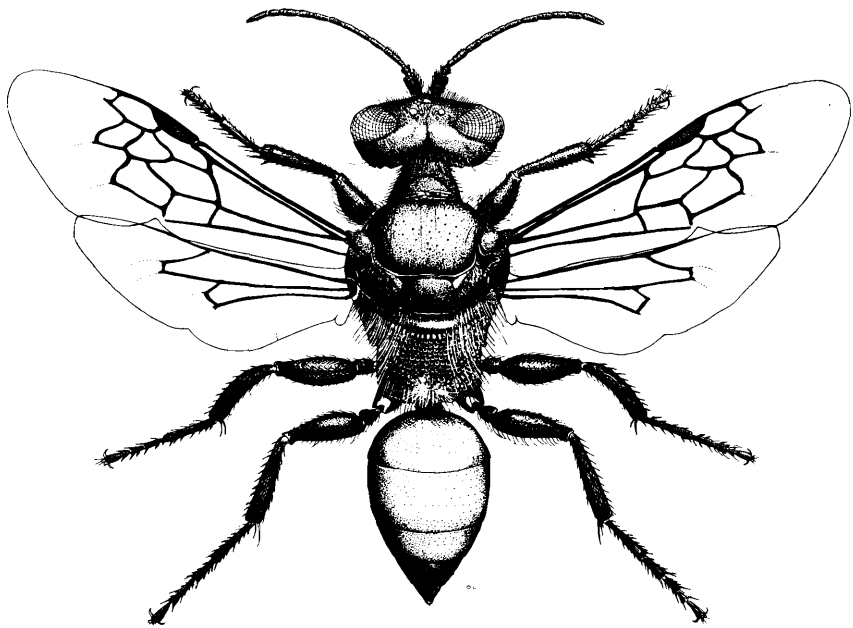


Fig. 274. Female of Astata pinguis (Dahlbom). Length: 6-8 mm.

rounded lobes (Fig. 275). Pubescence here brown. Ocelli forming an obtuse angle. Mandibles stout, slightly reddish with black apex. Antennae long and slender, segment 3 at least three times as long as broad, as long as scapus. Remaining segments more than twice as long as broad. Second segment of labial palpi strongly asymmetrically dilated, triangular. Pronotum dorsally with fine transverse rugae or striae. Scutum shining, smooth, anteriorly very densely, but irregularly and superficially punctate. Posteriorly, punctation becomes very sparse. Scutellum also shiny, with only few scattered punctures. Metanotum appears as a shiny, impunctate transverse pad. Mesopleuron with rather coarse rugoso-punctate sculpture, becoming gradually finer and more superficial ventrally. Pubescence whitish. Lateral faces of propodeum coarsely sculptured, posteriorly usually with very irregular striation. Dorsal face with coarse and rather regular, reticulate sculpture on shiny background. Posterior face with weak and very irregular sculpture and long, whitish pubescence. Abdomen depressed, first three segments red. Pygidial area triangular, broad and plane, with very distinct microsculpture, bordered by dense black or brown bristles. Metatarsus 1 ventrally with 16-18 short spines (Fig. 280). Legs uniform black or slightly red-brown. Radial cell of forewings twice as long as broad. Distal half of forewings distinctly darkened.

Male: 9-11 mm. Frons without white spot, with well developed and rather dense, white pilosity. Anterior ocellus much larger than posterior ones. Frons densely and rather strongly punctate, without microsculpture. Clypeus with only slightly protruding mid-part, which has obtuse-angled corners and very slightly emarginate anterior border. Breadth of mid-part only slightly greater than distance between antennal sockets. Flagellum long and slender, its second segment seen from above at least three times longer than broad distally. Segments 3-9 ventrally with light brown, broadly interrupted tyloidea (Fig. 282). Middle flagellar segments more than twice as long as broad. Punctation on scutum except in middle dense and uniform. Scutellum centrally and anteriorly shiny, almost impunctate, posteriorly with dense punctation. Metanotum very weakly and irregularly rugose. Mesopleuron laterally coarsely but rather superficially rugoso-punctate. Lateral faces of propodeum with finely undulating striation. Sculpture dorsally on propodeum dominated by the regularly running longitudinal carinae. Pilosity whitish, long and slightly curly. First, second and basal part of third abdominal segments red-yellow. First and second sterna usually with large black or brown central spot in Nordic specimens. Sterna 4-6 with long, downwardly directed, yellowish pubescence, Metatarsus 1 long and slender, at least six times longer than broad, ventrally with 8-10 spines.

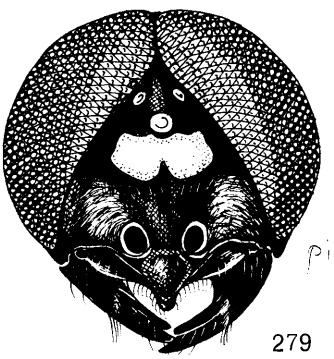
The species is rare in most parts of Fennoscandia, but occasionally occurs in rather large "colonies" on the Swedish islands of Öland and Gotland. - Denmark: a single male, without locality (coll. Schiødte?) - Sweden: widespread in the southern parts, northern distribution limit in Vrm., Dlr. and Gstr. - Norway: a few specimens from AK and TEy. - Finland: found from Al, Ab and N in the south to Om, Sb and Kb in the north. - Soviet Karelia: Ib. - Widely distributed in the Palaearctic Region, eastwards to northern India, northern China and Korea.

275

276

277 stigma ♀

278



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Figs. 275-276. Heads in frontal view of female Astata. - 275: boops (Schrank); 276: pinguis (Dahlbom).
Fig. 277. Anterior margin of clypeus of female Astata stigma (Panzer).
Figs. 278-279. Heads in frontal view of male Astata. - 278: stigma (Panzer); 279: pinguis (Dahlbom).

The nest (Tsuneki, 1969) consists of a short tunnel, about 10 cm long, ending in from one to three cells. These are placed, one after the other, as simple dilations of the tunnel. Partitions between the cells consist of loosely packed sand or earth. Side branches often occur in the nest system so that a single nest may contain 12 larval chambers. As breeding habitat are usually chosen dry, sandy paths and the like exposed to the sun. Prey mainly comprises immature bugs, but a few imagines may be taken. It is stated that the species in Sweden uses bugs of the family Pentatomidae, e. g. Picromerus bidens, Dolychoris baccarum, Eurydema sp., Aelia acuminata and Pitedia junipera. The prey is flown to the nest, where it is temporarily placed in immediate vicinity of the sealed entrance, while this is cleaned and re-opened. Thereupon it is pulled down, usually by the antennae. Sometimes a number of paralyzed nymphs are found temporarily deposited in one of the tunnels (a phenomenon which can also be observed in Cerceris and Philanthus). None of these nymphs, however, bear either eggs or larvae of Astata. Not until a sufficient number has been collected are they carried to the cells. In this way several cells are finally provisioned simultaneously. Each larval chamber contains two to fifteen nymphs. The egg is placed on the first-deposited prey. Development of the larva (in Korea!) takes three days. After a short resting period the larva spins a cocoon, which consists of a silky lining on the walls of the cell. In this it remains as prepupa for 4-5 days. The pupal stage lasts 11-12 days. It is doubtful whether the Nordic populations succeed in getting more than one generation on the wing per year. Here the species presumably hibernates as a pupa. Hedychridium roseum Rossi (Chrysididae) is known as a parasite.

89. ASTATA (ASTATA) MINOR Kohl, 1885
Figs. 281, 283.

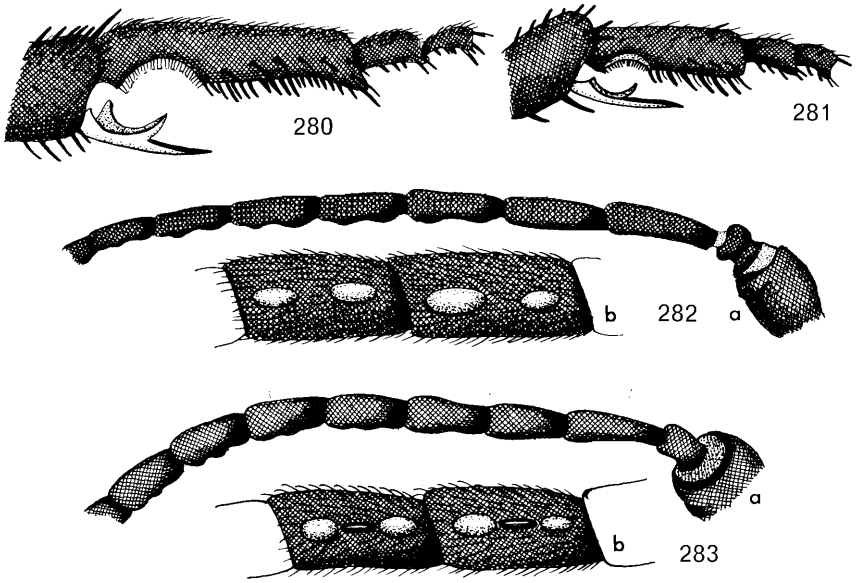
Astata minor Kohl, 1885:434.

Closely related to boops. Distinguished from this, besides being on average slightly smaller, by the morphology of the antennae and the relatively shorter tarsi. Female: 9-12 mm. Clypeus with protruding, narrow, lamellar median part, whose anterior border is arcuate. Third antennal segment seen from above about twice as long as distally broad. The succeeding segments at most twice as long as broad. Punctation of mesopleuron considerably weaker than in boops, only posteriorly with an indication of rugae. Lateral faces of propodeum in Nordic specimens usually with stronger, regular and dense transverse striation. Pygidial area comparatively large, its sides only slightly concave. The bordering bristles very short. Metatarsus 1 short, along

ventral border with at most 9 short spines (Fig. 281). Femora black, tibiae, especially the anterior ones, on the outer side with extensive yellow or red-brown pattern.

Male: 7-10 mm. Middle of anterior border of clypeus distinctly arcuately incised, distance between rounded corners considerably greater than distance between antennal sockets. Antennae comparatively short, their third segment seen from above at most three times longer than broad. Tyloidea of middle segments consisting of longitudinal pads centrally black or dark brown, distally and proximally weaker, narrower and pale brown (Fig. 283). These segments at most twice as long as broad. Metatarsus 1 at most six times longer than distally broad, ventral border with a row of short and very weak spines. Coxa 3 mesally with a broad, fairly deep excavation.

The species has a very restricted occurrence in Fennoscandia and Denmark. - Denmark: only recorded from Bornholm. - Sweden: stable populations on Öland and Gotland. A single specimen from Sm., Kalmar. - Finland: a southern species, only found in Ab, N, Ka, Ta, and Sa. - Soviet Karelia:



Figs. 280-281. Metatarsus 1 of female Astata. - 280: boops (Schrank); 281: minor Kohl.
Figs. 282-283. Antennae of male Astata. - 282: boops (Schrank), a: lateral view, b: two median segments in ventral view; 283: minor Kohl, a: lateral view, b: two median segments in ventral view.

Ib and Kr. - Widespread in Europe, North Africa and western Asia to Kazakhstan.

The species can be found nesting in sandy or gravelly localities fully exposed to the sun. The prey consists of species of the genera Sehirus, and Aphanus (Heteroptera, Pentatomidae). A known parasite is Hedychridium roseum Rossi (Hymenoptera, Chrysididae). Immature stages described by Grandi (1961).

90. ASTATA (DRYUDELLA) STIGMA (Panzer, 1809)
Figs. 277, 278.

Dimorpha stigma Panzer, 1809:H. 107, T. 13.

Female: 7-11 mm. Front of head dull owing to the well-developed microsculpture. Punctation very weak and sparse. Ocelli placed in very acute triangle. Pilosity of lower part of face whitish, very thin. Clypeus with narrow, protruding, rounded midpart and very small,rounded lateral teeth (Fig. 277), the remainder with strong brown bristles. Mandibles stout, black with red-brown or red-yellow middle. Scapus short and thick, considerably shorter than third antennal segment. Flagellum long and slender, its second segment seen from above four times longer than broad. Remaining segments about three times longer than broad. Second segment of labial palpi not dilated. Pronotum strongly microsculptured like the anterior part of scutum. Otherwise with very scattered, but rather coarse punctation, which - like the microsculpture - gradually disappears posteriorly. Scutellum shiny with scattered punctures. Metanotum weakly rugoso-punctate. Mesopleuron laterally strongly microsculptured ventrally shiny, with coarse sparse punctation. Pilosity on thorax dorsally white, ventrally brownish. Whole propodeum with strong microsculpture, lateral faces posteriorly with indicated striae, dorsal face with very weak rugae. Three first abdominal segments red. Pygidial area narrow, with broadly rounded apex. The area itself shiny, at most with indicated microsculpture, posteriorly with scattered punctation. Bordering bristles few and pale. Tarsal spines on metatarsus 1 much longer than width of segment. Legs black or brown. Tibia 1 with a light streak anteriorly. Radial cell of forewings only very slightly longer than broad.

Male: 6-10 mm. Face dull, but without distinct microsculpture. Area in front of anterior ocellus with large, whitish spot (Fig. 278). Central part of clypeus strongly angularly protruding (Fig. 278). Scapus very short and thick, only little more than half as long as third flagellar segment. The latter seen from above almost five times longer than broad. Segments 6-8 ventrally with a long, narrow, black keel. Scutum anteriorly with very dense,

posteriorly with gradually sparser, superficial punctation. Microsculpture weak. Scutellum shiny, with sparse punctures. Metanotum superficially rugose. Mesopleuron as described in female, ventrally punctation weaker, whereas microsculpture here is distinct. Propodeum very strongly microsculptured, laterally and dorsally with very weak rugae or striae. Legs dark, tibia 1 with yellow streak along anterior border.

The species seems to be restricted to coastal localities in Fennoscandia and Denmark, although it inhabits inland localitites in other parts of its distribution area. - Denmark: NEJ: Skagen, 2 specimens. The specimen mentioned by Klefbeck (1951) cannot be verified, but it is almost certain that the specimen belongs to pinguis. - Sweden: several records from the shores of the Baltic Sea and Bottenviken up to Nb. (Valkeila in litt). A few records from the shores of the larger lakes (Ög., Nrk.). - Norway: a female and a male specimen from VE, Frederiksværn and VAi, Sireosen, respectively. - Finland: most specimens originate from the southern archipelago (Ab, N and Ka). Additional material from the shores of Bottenviken in Om and Ob. Recently it was collected at Ylämylly near Joensuu (Kb), 2 ♂, 7. vii. 1975 (O. Martin). - Soviet Karelia: Ib. - The distribution area covers Central Europe, Siberia, Mongolia and Tibet. Townes (1951) recorded the species from Alaska, but as shown by Parker (1969), the Holarctic Astata species is pinguis.

Biology similar to that of boops, but the prey consists of smaller species (Drymus sylvaticus and Sciocoris cursitans). Hedychridium roseum Rossi (Hymenoptera, Chrysididae) is recorded as parasite.

91. ASTATA (DRYUDELLA) PINGUIS (Dahlbom, 1832)
Figs. 274, 276, 279.

Larra pinguis Dahlbom, 1832:50.

Female: 6-8 mm. Frons with shining smooth surface in spite of the strongly developed microsculpture. Punctation sparse as in stigma, but distinct. Ocelli placed at acute angle. Anterior border of clypeus with three small rounded processes (Fig. 276), its pilosity black. Frons with short and very sparse, brownish pilosity. Antennae comparatively short. Third segment at most three times longer than broad, only slightly longer than scapus. Mandibles with a larger or smaller red-brown spot in middle. Pronotum densely microsculptured, without other form of sculpture. Scutum centrally and posteriorly shiny, almost polished, only anteriorly with weak punctation and microsculpture. Scutellum shining, with extremely weak microsculpture and sparse punctures. Mesopleuron strongly microsculptured all over, ventrally weaker and here mixed with superficial punctation. Pubescence short, brownish.

Propodeum uniform and strongly microsculptured, lateral faces posteriorly with short and rather strong striae. The two first and the basal part of third abdominal segment red. Pygidial area shiny, apex rounded. The surface itself with very weak microsculpture and punctation. Bordering bristles almost absent. Tarsal spines on metatarsus 1 not or only slightly longer than breadth of segment. Legs black, tibia 1 yellowish anteriorly. Radial cell of forewing only slightly longer than broad.

Male: 5-7 mm. Frons with white double spot, above delimited by a straight or almost straight line (Fig. 279). Median protruding part of clypeus anteriorly rounded (Fig. 279). Third antennal segment only slightly longer than the very short, almost globular scapus. In dorsal view the segment is at most 3.5 times longer than broad. Segments 6-8 ventrally with slightly protruding black tyloidea. Scutum dull, very densely microsculptured and without proper punctation. Scutellum anteriorly with shining area, otherwise dull, microsculptured. Mesopleuron with only an area anterior to coxa 2 shining, punctation here rather distinct. Microsculpture as on propodeum. First two or three segments of abdomen red. Legs black, tibiae, especially the foremost, yellowish anteriorly. Tarsi brown, yellow-brown anteriorly.

Pinguis is a rare species, but can occur locally in rather large numbers. Recorded from all Nordic countries. - Denmark: restricted to sandy localities along the coasts; found in most districts. - Sweden: from Sk. in the south to Med. and Nb. in the north. - Norway: a very small material from VAi, Sireosen. - Finland: both inland and in littoral localities. Known from Al, Ab and N in the south to Ok and ObS in the north. - A Holarctic species. Distributed in Northern Europe, through Russia to Alaska and Colorado in North America.

The species has been found breeding in small, sandy brinks and banks fully exposed to the sun. The entrance of the nests consists of a tube about six cm long, slightly declining. This merges into a single, slightly enlarged, larval chamber. Provision consists of third and fourth stage nymphs of Lygaeidae, e. g. Trapezonotus arenarius, Drymus sylvaticus and Rhyparochromus pini, of which at least six are deposited in each nest (author's observations from a nest not yet completely provisioned). The female spends the night in the still unfinished cell.

Genus *Dinetus* Panzer

Dinetus Panzer, 1806:192.

Type-species: Crabro pictus Fabricius, 1793.

Medium-sized species, which in habitus (Fig. 284) are similar both to Astatinae and Larrinae. Head large, in front view considerably broader than long. Inner orbits strongly diverging ventrally. Ocelli circular. Clypeus short, with characteristic emarginations and teeth in the anterior broder. Antennae filiform in females, inserted very low on face, just behind epistomal suture. Pronounced sexual dimorphism in morphology of antennae. Mandibles weakly tridentate, with strong emargination in ventral edge, which is proximally delimited by a strong, rounded projection (almost as in Tachysphex). Thorax dull, densely punctate, with weak, short, silvery pubescence. Pronotum, humeral tubercles, mesopleuron, scutellum and metanotum usually with whitish-yellow markings. Propodeal morphology and sculpture almost as in Tachysphex, dorsally without delimited area cordiformis. Abdomen with red and yellow pattern. Both sexes with pygidial area. Females with psammophore. Foretarsi with well developed pecten, strangely enough most strongly developed in males. Tibia 2 with two long apical spurs in females, lacking in males. Radial cell of forewings very short, truncate, with accessory cell

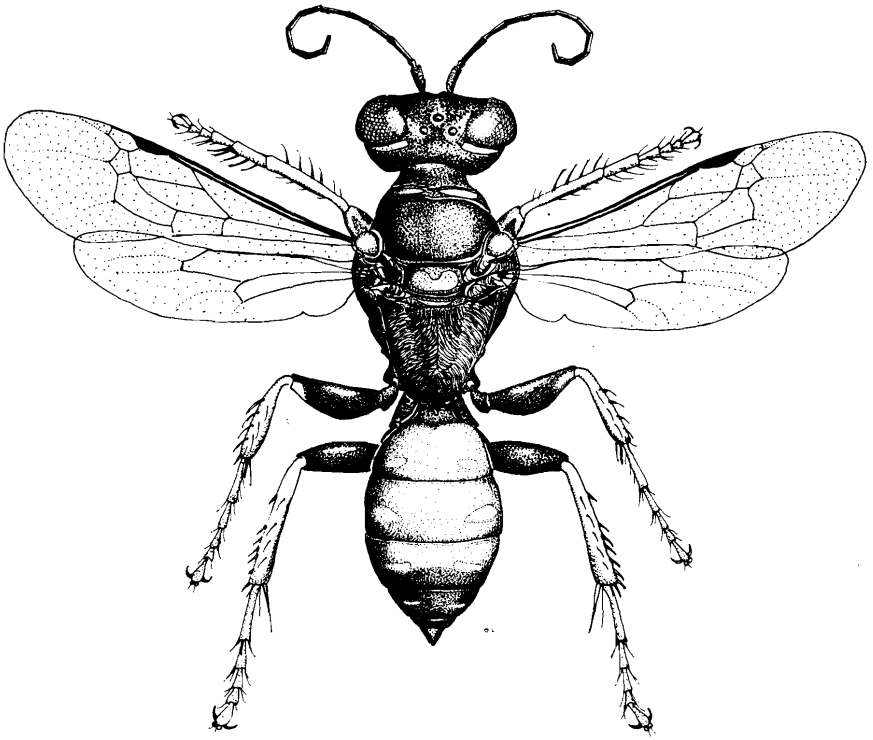


Fig. 284. Female of Dinetus pictus (Fabr.). Length: 6-8 mm.

(Fig. 284). Two cubital cells, of which the second is very small. First and second discoidal transverse veins join first and second cubital cells respectively. In hindwing media issues from anal cell.

The genus is mainly represented in the Mediterranean area, where about seven species occur.

The nest is constructed in the ground, larvae subsisting on Heteroptera, e.g. Nabidae.

92. DINETUS PICTUS (Fabricius, 1793)
Figs. 284-286.

Crabro pictus Fabricius, 1793:299.

Sphex guttata Fabricius, 1793:215.

Female: 6-8 mm. Frons very slightly convex, dorsally very densely punctate except an oblong, shiny area along upper part of inner orbits. Area behind antennal sockets also shiny and impunctate. Lower part of face and lateral faces of clypeus slightly concave, with silvery pubescence. Behind eyes a long yellow or yellow-brown spot. Mandibles yellow with red-brown apex. Antennae long and slender, third antennal segment three times as long as broad. Median area of clypeus shiny, slightly convex. Anterior border with two closely-placed median and two broader lateral teeth (Fig. 285). Pronotum with two white-yellow lateral spots. Scutum black, densely and strongly punctate. Humeral tubercle, and a spot immediately below, white-yellow. Scutellum and metathorax with a white-yellow transverse spot. Mesopleuron dull, very densely punctate, with microsculpture between punctures and with thin silvery pubescence. Propodeum dorsally with dense, obliquely directed striation on minutely reticulate ground, laterally with silvery pubescence. Lateral faces shiny, with stronger striation. First three segments of abdomen red-yellow. Terga 1-4 with small white-yellow lateral spots, tergum 5 with white-yellow transverse band. Pygidial area white-yellow with red-brown apex. Femora black, but femora 1-2 with large, white-yellow apical spot. Tibia white-yellow, black on the inner side. Tibiae 2-3 very spiny.

Male: 5-7 mm. Punctation of head and pubescence as in female, but a considerably more extensive yellow or red-yellow pattern, except for a black area on upper frons, and sometimes two black spots behind antennal sockets. Eyes very large and strongly convex. Flagellum rolled up as a spring (in museum specimens). Scapus very thick and stout, median antennal segments flat and broad, slightly concave ventrally and with distinct silvery pubescence. The last segments very long and thin (Fig. 286). Yellow transverse spot of

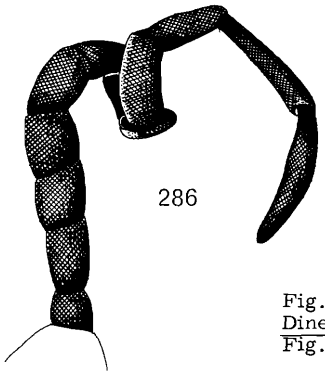
pronotum usually not interrupted in middle. Propleuron, humeral tubercle, a spot behind this, scutellum and metathorax with yellow pattern. Terga 1-3 brown-yellow with yellow transverse bands. Terga 4 and 5 black with yellow lateral spots. Legs yellow, femur 3 and also part of femur 2 black. Metatarsus 1 with very broad and strong spines.

In Fennoscandia only known from Finland: Sa, Taipalsjärvi, and a few localities in Soviet Karelia: Ib, Pyhäjärvi and Muola. A Mediterranean species, widely distributed in southern Europe.

The construction of the nest takes place almost as in Belomicrus, which also has developed a psammophore. By means of the well developed tarsal pecten a small heap of sand is scraped together. This heap is packed together in the psammophore, and by an unbelievably rapid manoeuvre backwards, the excavated material is carried away. It goes so quickly that this procedure cannot be shown sharply on a film, exposed in 1/5000 sec. (Olberg, 1959). The prey consists of nymphs and imagines of Nabis ferus and Aptus myrmecoides (Nabidae). As predator is known Hedychrum szaboi (Hym., Chrysididae).

SUBFAMILY LARRINAE

By far the largest and most diverse group of Sphecidae, probably comprising more than 3000 species. It is highly questionable, however, if the subfamily constitutes a monophyletic unity. Bohart & Menke (1975) consider the crabronine sphecids as making up a subfamily of their own in spite of the consequent injuries to the understanding of phylogeny as elucidated by Evans (1964) on the basis of larval morphology. The Larrinae is the most successful subfamily, having developed a large number of biological adaptations and displaying a



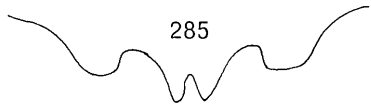


Fig. 285. Anterior margin of clypeus of female Dinetus pictus (Fabr.).
Fig. 286. Antenna of male Dinetus pictus (Fabr.).

rather enormous morphological variation. The subfamily has a cosmopolitan distribution, but most species inhabit tropical and subtropical areas in the Old World, and both terrestrial as well as arboreal nesting habits are displayed. The larvae are more or less cylindrical. Anus directed ventrally, the apical segment forming a rounded, terminal lobe. Pleural lobes prominent, those of thorax most protuberant. Integument often with small spinules on venter. The spiracles with or without a circlet of spines between atrium and subatrium. Head as wide as or wider than high. Parietal bands usually absent. Antennal papillae absent. Labrum broad, bearing sensillae over much of its surfase. Epipharynx spinulose. Mandibles stout, basally with a single, large seta; inner margin with four or five teeth. The lacinial area well developed, usually projecting as a lobe apically. Galea smaller than maxillary palpus, sometimes vestigial. Spinneret paired, much longer than the labial palpus.

The following combination of characters characterises the imagines of the Larrinae: mandibles with a large ventral emargination, proximally delimited by a stout tooth; only a single spur on tibia 2; volsella vestigial.

The Nordic genera are divided into the following tribes: Tachytini, Miscophini, Trypoxylonini, Oxybelini, and Crabronini. Beaumont (1964) included the Dinetini in this subfamily, but I have found it most appropriate to consider it as belonging to the Astatinae.

TRIBE TACHYTINI

Only a single genus in the North. See generic description. Terrestrial species.

Genus *Tachysphex* Kohl

Tachysphex Kohl, 1883:166.

Type-species: Tachysphex filicornis Kohl, 1883.

A genus extremely rich in species, sometimes most difficult to identify, but which in the North comprises only five species. Head short and rather flat, in front view slightly broader than long. Eyes very strongly convex, their inner orbits strongly diverging ventrally. Anterior ocellus circular, posterior ones strongly flattened and elongate. Clypeus behind anterior border usually with an elliptic, shining, smooth area, the remainder with dense silvery or golden pubescence, which also covers the lower part of the face. Antennae long and slender. Mandibles ventrally with strong emargination, basally delimited by a truncate tooth. Thorax stout, at least dorsally with short, dense, slightly silvery pubescence. Sculpture not forming protruding carinae or ribs.

Abdomen usually with more or less distinct silvery transverse bands. Tibia 2 with only one spur. Last tergum in female with pygidial area. Females with long, strongly developed tarsal pecten. Femur 1 of males ventrally with deep emargination. Forewings with three cubital cells, of which the second is joined by both discoidal transverse veins. Apex of radial cell squarely truncate. Stigma very narrow.

The genus is cosmopolitan and comprises more than 300 species, about 30 of which occur in Europe.

The nest is constructed in sandy localities fully exposed to the sun. The prey consists of Orthoptera, Saltatoria and Blattodea.

Key to species of Tachysphex

Females

1	Abdomen uniform black	2
-	First two or three segments of abdomen red	3

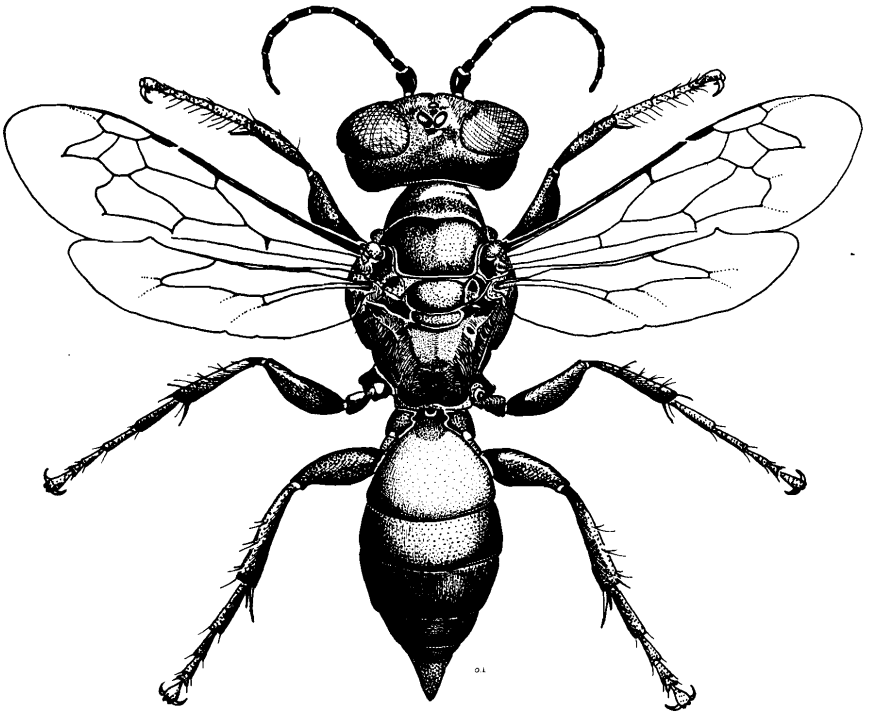


Fig. 287. Female of Tachysphex pompiliformis (Panzer). Length: 7-10 mm.

2(1) Least distance between eyes above on frons at least as great as length of third and fourth antennal segments combined. Clypeus slightly convex, its anterior border as Fig. 296 ..... 97. helveticus Kohl

\- Least distance between eyes above on frons distinctly shorter than total length of third and fourth antennal segments. Clypeus strongly convex, anterior border not emarginate (Fig. 293) ..... 96. nitidus (Spinola)

3(2) Head in front view very broad (Fig. 288). Anterior border of clypeus in the middle with small emargination (Fig. 288). Tibia 1 red-yellow on inner side ..... 93. obscuripennis (Schenck)

\- Head in front view almost circular (Fig. 289). Anterior border of clypeus without emargination. Tibia 1 completely black 4

4(3) Clypeus shallowly convex, its anterior border in the middle protruding almost angularly (Fig. 291). Pygidial area with very strong microsculpture ..... 95. fulvitarsis (Costa)

\- Clypeus strongly convex, anterior border evenly and shallowly concave (Fig. 289). Pygidial area shining, microsculpture weak ..... 94. pompiliformis (Panzer)

Males

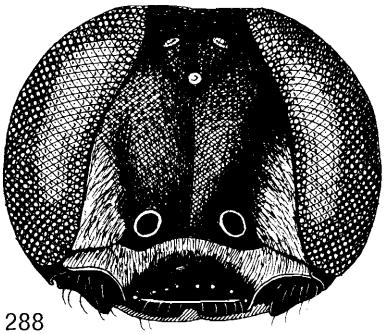
1 Abdomen entirely black 2

\- First two or three segments of abdomen red ... 3

2(1) First and second segments of tarsus 1 distally with two strong, flattened spines, which are considerably longer than width of the tarsus (Fig. 299). Third and fourth antennal segments of almost equal length (Fig. 298) ..... 97. helveticus Kohl

\- First and second segments of tarsus 1 with only a single short spine, much shorter than width of the tarsus. Third antennal segment much shorter than fourth (Fig. 295) ..... 96. nitidus (Spinola)

3(2) Inner side of tibia 1 red-yellow. Frons usually with strong dark golden pubescence ... 93. obscuripennis (Schenck)



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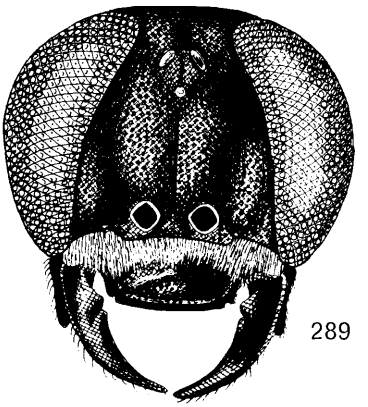

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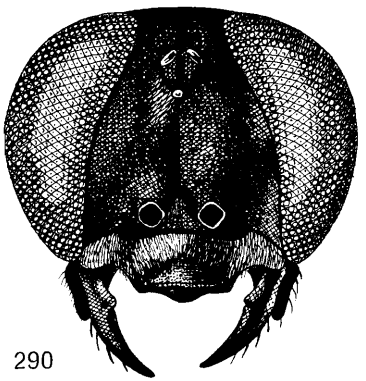

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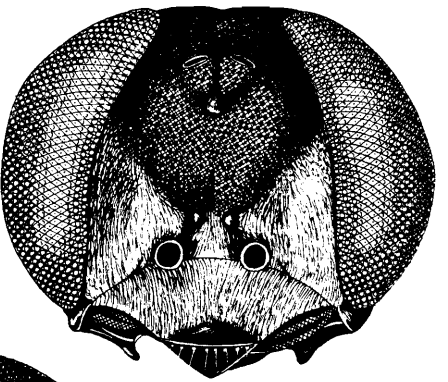

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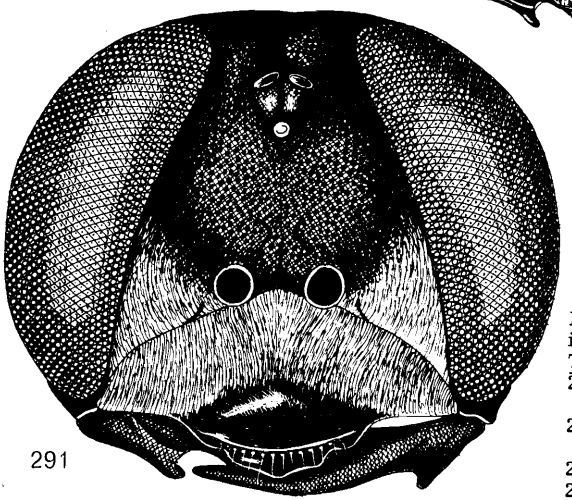

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Figs. 288-292. Heads in frontal view of Tachysphex.
288: obscuripennis (Schenck); ♀;
289: pompiliformis (Panz.), ♀;
290: same, ♂;
291: fulvitarsis (Costa), ♀;
292: same, ♂.

- Tibia 1 completely black. Pubescence of frons silvery 4

4 Mid-part of clypeus strongly protruding (Fig. 292) ..... 95. fulvitarsis (Costa)

- Mid-part of clypeus very slightly protruding, often only evenly convex (Fig. 290) ..... 94. pompiliformis (Panzer)

93. TACHYSPHEX OBSCURIPENNIS (Schenck, 1857)

Fig. 288.

Tachytes obscuripennis Schenck, 1857:194.

Tachysphex lativalvis Thomson, 1870:242.

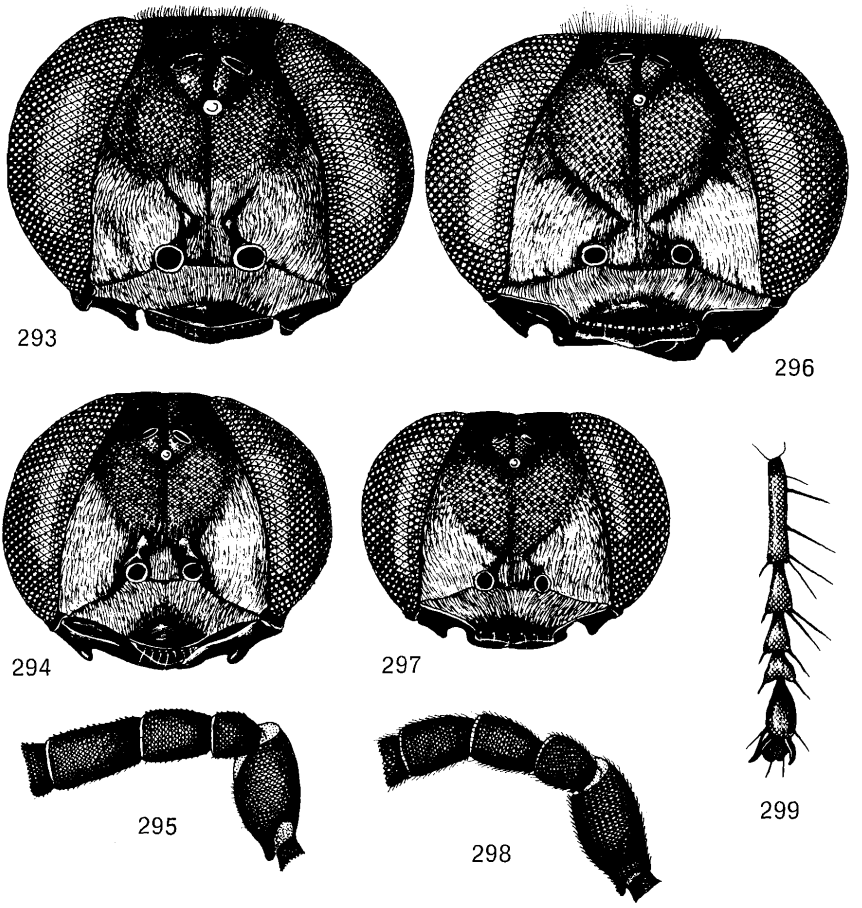
Female: 6-10 mm. Head in front view distinctly broader than long (Fig. 288). Punctation of frons fine and rather sparse, microsculpture well developed in northern material. Silvery pubescence on lower part of face generally less developed than in pompiliformis. Anterior border of clypeus in the middle with a small emargination (Fig. 288). Interstices between punctures on scutum shiny, on average as large as diameter of punctures. Mesopleuron shallowly punctate, with distinct interstitial microsculpture. First two, and often also basal half of third segment of abdomen red. Lateral margins of pygidial area slightly convex, surface itself shiny with scattered punctures and usually without microsculpture. Inner side of tibia 1 yellowish brown. Segment 4 of tarsus 1 and tarsus 2 considerably broader than long. Claws on tarsus 1 and to some extent also on tarsus 2 of unequal size, the mesal the smaller.

Male: 5.5 - 8 mm. Easily distinguishable from pompiliformis by the usually strongly golden, shining pubescence on clypeus and lower part of face. Head much broader than long. Inner orbits throughout their length distinctly diverging ventrally. Whole thorax dull. Pubescence dense, short, usually with a weak golden tinge, at least on scutum. First three segments of abdomen red, silvery transverse bands well developed. Tibia 1 brown-yellow on inner side. Tarsal segment 4 slightly broader than long.

In Fennoscandia this species is rather common in coastal regions in southern Sweden, especially in Sk. and the islands of Öl. and Gtl. Northernmost records in Boh. and Upl. - Finland: a southern and southeastern species, northwards to Sb and Kb. - Soviet Karelia: Ib and Kr. - Not uncommon i NW Africa and Asia Minor, eastwards to Caucasus.

The nest consists of a single cell, situated about 4 cm below the surface of the ground, at the end of a 5-6 cm long tunnel. The entrance is left open during

provisioning. The prey consists of cockroaches, e.g. Ectobius lapponicus or closely allied species, of which 2-3 specimens represent the provision of the larva. The prey is only slightly paralyzed, and before it is dragged into the nest its antennae, legs and palps, wholly or partly, are amputated. A similar behaviour is seen in Dolichurus corniculus. The egg is placed transversely between coxae 1 and 2. The larva was described by Grandi, 1961.



Figs. 293-295. Tachysphex nitidus (Spinola). - 293: female head in frontal view; 294: male head in frontal view; 295: proximal part of male antenna.
Figs. 296-299. Tachysphex helveticus Kohl. - 296: Female head in frontal view; 297: male head in frontal view; 298: proximal part of male antenna; 299: tarsus 1 of male.

94. TACHYSPHEX POMPILIFORMIS (Panzer, 1805)

Figs. 287, 289, 290.

Larra pompiliformis Panzer, 1805:H. 89, T. 13.

Tachytes nigripennis Spinola, 1808:260.

Tachysphex rufo-niger Bingham, 1897:195.

Tachysphex projectus Nurse, 1903:517.

Tachysphex pectinipes auctt.

Female: 7-10 mm. Head in front view almost circular (Fig. 289). Frons in front of ocelli very densely punctate, interstices shining, without microsculpture, much narrower than diameter of punctures. Punctation behind ocelli sparser. Clypeus strongly convex, anterior border evenly convex, only rarely with two weak emarginations (Fig. 289). Pubescence posteriorly on clypeus and on lower part of face strongly silvery. Mandibles black with red central part. Interstices between punctures on scutum shiny, distinctly smaller than diameter of punctures. Mesopleuron dull, with very fine and uniform sculpture. First two or three segments of abdomen red. Pygidial area narrowly triangular, margins straight or very slightly concave. Surface itself slightly convex, with sparse and rather superficial punctation. A fine, reticulate microsculpture is usually present proximally in the area. Legs black, only distal tarsal segments pale. Tarsi 1-2 have segment 4 longer than broad.

Male: 5-7 mm. Head in front view only very slightly wider than high (Fig. 290). Clypeus anteriorly with rounded, obtusely triangular projection. Lateral corners distinct, obtusely protruding (Fig. 290). In small individuals these characters are often very weak so that the anterior margin is almost evenly arcuate. Pubescence on clypeus and lower part of face silvery. Sculpture of head and thorax as described in female, but a little stronger. A weak microsculpture may be present. Pubescence dorsally on thorax sparse, slightly silvery. Three first segments of abdomen normally red, In very small specimens the red colour only covers segments 1 and 2. Legs black, distal tarsal segments, however, gradually paler. Segment 4 of tarsus 1 as long as wide.

A common species in all Nordic countries. Northern records in Sweden: Nb., Norway: On, and Finland: ObN. - The distribution area covers Europe, North Africa, through southern Siberia, Kashmir and Pakistan (?) to Mongolia and Kamchatka.

The nest is constructed in sandy areas, in slopes facing south-west, or in steep, sandy brinks. Entrance short, about 5 cm, larval chamber situated about 3 cm below ground. A female has been seen to have constructed three cells

connected to the same entrance (Adlerz, 1903). During excavation the female frequently undertakes short orientation trips, running on the ground and flying in immediate vicinity of the entrance. The prey consists of nymphs of Acrididae, e. g. Chorthippus and Stenobothrus, flown to the nest, if possible. Here it is deposited, while the female goes into the entrance and turns round. With the mandibles the nymph is pulled down into the cell, where it is placed with the ventral side upward. Each cell is provisioned with 1-10 nymphs, dependent on their size. The egg is laid on the last nymph between coxa 1 and 2. After a few days the young larva hatches, and after a week it is fully grown. Before the cocoon is spun, the inedible remainders are carried outside the cell. The outside of the cocoon is covered with sand grains. The larva was described by Grandi, 1961. The species occurs in Central and South Europe with two generations, and it is probable that similar conditions apply to the populations in the southern part of Denmark and Fennoscandia, since its active period lasts from the beginning of June to the middle of August.

95. TACHYSPHEX FULVITARSIS (Costa, 1867)

Figs. 291, 292.

Tachytes fulvitarsis Costa, 1867:86.

Tachysphex acrobates Kohl, 1878:705.

Female: 10-14 mm. Easily recognizable by its large size. Frons very densely and finely punctate, interstices shining smooth. Pubescence of face silvery. Clypeus posteriorly very finely and densely punctate, mixed with punctures bearing single, stout bristles. Anteriorly shining, smooth, with only large punctures. Anterior border itself almost angularly protruding (Fig. 291). Scutum with dense and uniform punctation. First two or three segments of abdomen red. The silvery transverse bands weakly developed or absent. Pygidial area large, with evenly distributed, strong punctation, which, especially basally, may fuse into a weak, longitudinally rugose punctation. Microsculpture almost missing in Nordic specimens. It is, however, strongly developed in specimens from South Europe. Tarsus 1 with very strongly developed tarsal pecten.

Male: 6-13 mm. Very similar to pompiliformis, but usually easily distinguished by the shape of clypeus (Fig. 292). Mesopleuron dull with very dense and distinct punctation. Interstices between punctures with microsculpture. Propodeum dorsally with irregular rugose sculpture on strongly micro-sculptured ground. Lateral faces shiny, with strong, dense and regular transverse striation. Tarsus 1 completely devoid of pecten. Femur 1 ventrally only with weak emargination.

A typical Mediterranean species. Only a few records from Sweden: Sk., Löderup, Sandhammaren; Öl., Hornsjön, Algutsrum. Not found in other Nordic countries. - The distribution area covers large parts of Europe, North Africa, Asia Minor, Southern Siberia and Iran.

The nest contains a single cell, which is provisioned with nymphs of Tettigoniidae. The egg is attached to the ventral side of the prey and hatches after about 48 hours.

96. TACHYSPHEX NITIDUS (Spinola, 1805)

Figs. 293-295.

Astata nitida Spinola, 1805:17.

Tachysphex ibericus borealis Pulawski, 1971:148.

Female: 7-10 mm. Completely black. Head in front view only slightly broader than high (Fig. 293). Punctation in front of ocelli dense, interstices on average smaller than diameter of punctures, shiny, usually without microsculpture. Punctation posteriorly between eyes distinctly weaker, interstices broad, shining, smooth. A weak micropunctation may occur. Pubescence on frons very short. Distance between eyes above on frons distinctly less than total length of antennal segments 3 and 4. Mandibles black, often with rust-coloured apex. Clypeus strongly convex in middle, outline of anterior margin somewhat variable, but never with distinct emarginations on either side of midline as in helveticus. Punctation on scutum almost as punctation behind ocelli, interstices shining, smooth, on the disc broader than diameter of punctures. Punctation of scutellum finer. Punctation of mesopleuron almost obsolete, only distinct laterally below base of forewings. Propodeum dorsally with coarse and granular microsculpture, basally with more or less distinct longitudinal rugae. Lateral areas somewhat more shining, with distinct transverse striation. Abdomen with four silvery transverse bands. Pygidial area shiny, proximally with weak microsculpture.

Male: 4-6 mm. Head in front view slightly broader than high (Fig. 294). Clypeus anteriorly with a more or less rounded triangular projection, posteriorly with a slightly golden or rarely silvery pubescence, which also covers lower part of face. Mandibles black with red-yellow middle and red apex. Sculpture of head and thorax as in female. Sculpture of propodeum rather uniform, granular. In large specimens a weak striation may occur laterally and caudally. Pecten on tarsus 1 very weak, its spines seldom longer than width of tarsal segments.

A common species in Fennoscandia and Denmark, especially in coastal localitites and along rivers. Northern distribution limit in Sweden in Nb. - Not recorded from Norway. - Finland: Ks and ObN. - Soviet Karelia: Ib. - The species is widely distributed in western Palaearctic, eastwards to the South-Siberian steppes in Uzbekistan and southwards to North Africa.

Construction of the nest takes place in sandy localities in June and July. The main entrance may reach a length of more than 30 cm. It forms a very acute angle with the surface of the ground, in such way that the single larval chamber is situated at a depth of about 3 cm. The prey consists of nymphs of locusts (Acrididae), which, depending on their size, are flown or dragged to the entrance of the nest. Here it is left for a period, while the female turns in the nest tunnel. Then she pulls the prey down after her. The larval chamber is provisioned with about five nymphs. The elongate, slightly curved egg is laid between first and second pair of legs on the nymph first paralyzed. It is stated (Bonelli, 1969) that a single female may construct several nests simultaneously. Taxigramma sp. (Dipt., Sarcophagidae) is recorded as parasitoid.

97. TACHYSPHEX HELVETICUS Kohl, 1885

Figs. 296-299.

Tachysphex helveticus Kohl, 1885:374.

Female: 7-9 mm. In habitus this species is very similar to nitidus, but the head in front view much broader than high (Fig. 296). Frons anterior to ocelli with moderately strong punctation, interstices with a very distinct and granular microsculpture, whereby the face obtains a dull appearance. Punctation behind ocelli stronger, and interstices more shiny. Pubescence of head longer than in nitidus. Uppermost distance between inner orbits as great as or greater than combined length of third and fourth antennal segments. Mandibles black. Clypeus slightly convex, the shiny area proximal to the weakly double-emarginate frontal margin (Fig. 296) considerably narrower than in nitidus. Scutum shiny. Punctation much denser than on frons behind ocelli. Interstices between punctures smaller than diameter of these. Scutellum likewise very densely punctate. Mesopleuron shiny, punctation a little weaker and sparser than on scutum. Propodeum as in nitidus, but usually with slightly protruding irregular, longitudinal ribs. Legs, except the most distal tarsal segments, black.

Male: 5-7 mm. Head in front view very broad (Fig. 297). Clypeus on either side with a small rounded tubercle or slightly protruding corner. Pubescence silvery. Punctation of head and thorax as in female. Propodeum

dorsally often with distinct longitudinal ribs with shining interstices. Metatarsus 1 with four long, pale spines, tarsal segments 2 and 3 with two and one pale spine, respectively (Fig. 299).

A south-eastern element in the Fennoscandian fauna. Only known from Sweden: Bl., Gtl., Ög., Boh. and Sdm.; and Finland: Al (very common), Ab, N and Ka. - The species is not recorded from England and North Germany. - Distributed in Europe, North Africa, through Jordan to southern Siberia and Mongolia.

The nests are constructed in sand. During excavation the forelegs are used to remove the fine material, whereas the mandibles are employed when removing pebbles and the like. Only one cell is constructed per entrance. The prey consists of nymphs of Acrididae, of which four or five are deposited in each cell. The egg is laid on one of the first deposited nymphs between coxae 1 and 2. The female seals the nest by gradually working her way out through the tunnel, while brushing sand together behind her. The abdomen is used to pack the material together.

TRIBE MISCOPHINI

Inner orbits parallel or diverging ventrally. Ocelli normal. Antennae inserted immediately above epistomal suture, often in large concavities. Mandible with large emargination and tooth in Miscophus and several other genera. In Nitela, the taxonomical status of which is doubtful, the mandible is simple. Tarsus 1 in females with spines in Miscophus; these are absent in Nitela (arboreal). Propodeum large, area cordiformis usually absent. Venation very variable: in Nordic Miscophus the forewings have two cubital cells of which the second is petiolate. In Nitela only a single cubital cell is present. Pygidial area absent in Nordic species. Volsellae vestigial or absent.

According to the concept of Bohart & Menke (1975) the tribe comprises 14 genera, most of which are endemic to southern Africa or Australia. Only three genera in Europe.

Genus *Miscophus* Jurine

Miscophus Jurine, 1807:206.

Type-species: Miscophus bicolor Jurine, 1807.

Small, black, often more or less metallic species (Fig. 300), easily recognizable by petiolate second cubital cell of forewings. Stigma very narrow, some-

times almost vestigial. First and second discoidal transverse veins join first and second cubital cells respectively. Head comparatively large, in front view considerably broader than high. Base of mandibles with strong emargination, proximally delimited by a strong tooth. Propodeum large, dorsal face usually with a distinct longitudinal median carina and more or less distinct oblique rugae. In Nordic species lateral faces with weak, irregular, longitudinal rugulae, which continue on the posterior face. Punctation usually very fine and sparse.

The species, especially the males, may vary considerably, and to make a reliable identification of certain species, it is often necessary to make preparations of the genital organs, which show good specific characters.

As regards the biology, only few fragmentary particulars exist, since the small size of the species and their agility in connection with their rather sporadic occurrence, make investigation difficult. The species occur in sandy areas. Here the nest is constructed in the form of a tube, a few cm long. The prey consists of small spiders. The genus comprises more than 80 species in the Palaearctic region.

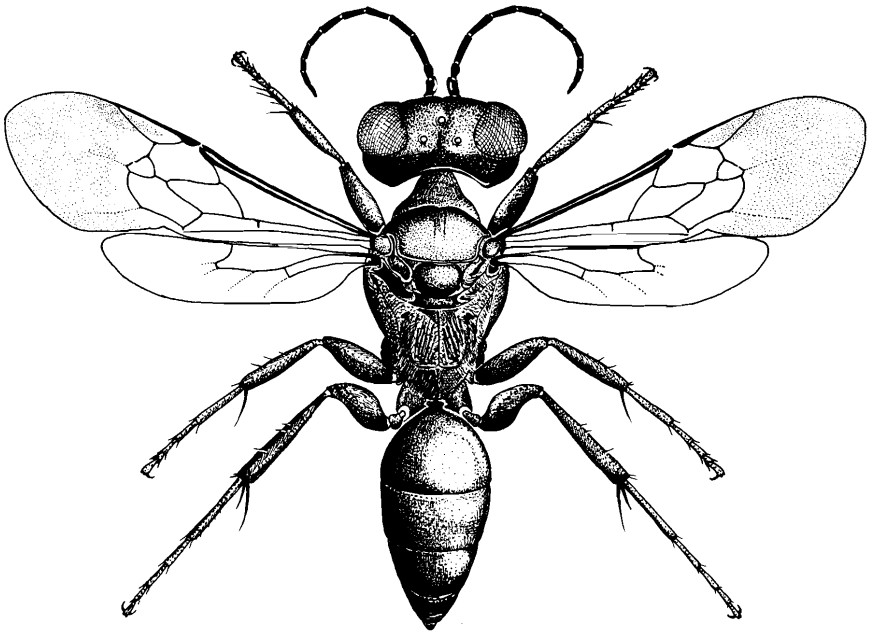


Fig.300. Female of Miscophus ater Lep. Length: 3.7-5.0 mm.

Key to species of Miscophus

Females

1 First segment of abdomen, and partly also second, red ..... 98. concolor Dahlbom

\- Abdomen completely black 2

2(1) Pubescence on lateral faces of propodeum very fine. Hairs neither depressed nor silvery. The broad and somewhat depressed posterior border of terga 2-4 without pubescence or punctures 99. spurius (Dahlbom)

\- Pubescence on lateral faces of propodeum silvery. Terga 2-4 with very fine punctures on posterior borders, with fine but distinct pubescence 3

3(2) Basal part of mandibles mainly red-brown or red-yellow, never uniformly black. Punctation of scutum weak, punctures anteriorly distinctly delimited, posteriorly merging evenly into the shining interstices. Head, pronotum, scutum, scutellum and metanotum with faint greenish or bronzy tinge ..... 100. ater Lepeletier

\- Basal part of mandibles usually completely black or brown-black, never mixed with red or red-yellow. Scutum with regular, well-defined punctures. Head and thorax black, without metallic lustre ..... 101. niger Dahlbom

Males

1 Pubescence on lateral faces of propodeum very fine. Hairs neither depressed, nor silvery. Mid-rib dorsally on propodeum strong, longitudinal rugae regular, without transverse connections. 99. spurius (Dahlbom)

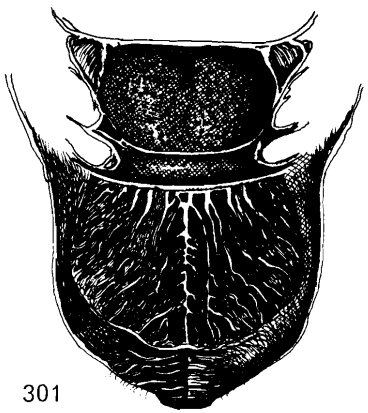
\- Pubescence on lateral faces of propodeum partly consisting of fine, light hairs, partly of depressed silvery hairs 2

2(1) Interstices between punctures of frons shiny, with or without very weak microsculpture. Distance between punctures round ocelli as great as or greater than diameter of punctures 98. concolor Dahlbom

- Interstices between punctures of frons either with strong microsculpture or with fine irregular rugulae, whereby frons has a coriaceous appearance. Distance between punctures round ocelli smaller than diameter of punctures 3

3(2) Basal part of mandibles usually completely black. Sculpture of scutum consisting of regular, well-defined punctures. Genitalia: see Fig. 307 101. niger Dahlbom

- Basal part of mandibles more or less extensively pale. Punctures of scutum weak, posteriorly indistinctly delimited. Genitalia: see Fig. 306 100. ater Lepeletier



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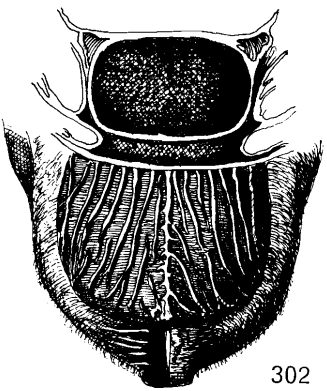

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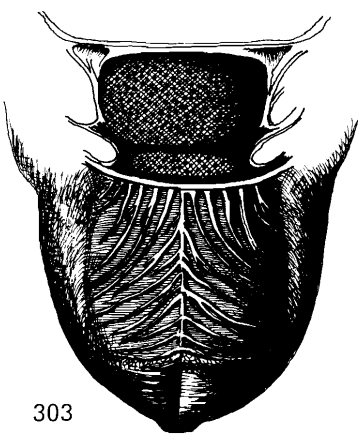


303

Figs. 301-303. Propodeum in dorsal view of female Miscophus. - 301, 302: ater Lep.; 303: spurius (Dahlbom).

98. MISCOPHUS CONCOLOR Dahlbom, 1844

Fig. 304.

Miscophus concolor Dahlbom, 1844:236.

Miscophus bicolor Smith, 1858:91.

Miscophus moravicus Balthasar, 1957:109.

Female: 4-5 mm. Easily distinguished from the remaining Nordic species by red base of abdomen. Head with very dense punctures. Interstices with fairly strong microsculpture, consisting of irregular rugulae. Clypeus strongly convex in middle and rather densely punctate. Silvery pubescence on clypeus and lower part of face very thin, hairs only very slightly depressed. Basal tooth of mandibles very strong, mandible itself yellow-brown centrally, apex red and base brown. Scutum with weak punctures which tend to coalesce transversely. Propodeum dorsally rather strongly excavated. Median carina stout. Pubescence laterally very thin and sparse.

Male: 3,3 - 4,0 mm. As female, abdomen usually completely black. Occasional specimens have sternum 1 slightly reddish laterally. Genitalia as Fig. 304.

Denmark: not uncommon in NEZ. Otherwise scattered throughout the country. - Sweden: rather common along the south coasts of Sk., northernmost localities in Sdm. - Not found in Norway. - Finland: a southern and south-eastern species occurring towards the north to Om and Ok. - Soviet Karelia: Ib and Kr. - Scattered in Europe.

Occur in very warm, sandy localities, both near the coast and inland. Hunting takes place in vegetation. The paralyzed spiders are flown to the entrance of the nest. The species may occur, at least locally, in rather large numbers.

99. MISCOPHUS SPURIUS (Dahlbom, 1832)

Figs. 303, 305.

Larra spurius Dahlbom, 1832:56; Dahlbom, 1844:237.

Female: 4.2 - 6.5 mm. Entirely black. Sculpture of frons partly consisting of a rather dense punctation, partly of a strong, granulate microsculpture, whereby the surface obtains a dull appearance. Clypeus laterally densely and finely punctate, centrally shining, with larger and more scattered punctures. The bristle-bearing punctures along the apical margin very large and well developed. Apical margin itself evenly convexly arcuate. Mandibles red-brown with darker

apex and black base. Scutum rather strongly punctate with distinct transverse or reticulate microsculpture. Longitudinal medial carina in area cordiformis well developed. Oblique rugae almost regular (Fig. 303). Pubescence laterally extremely fine and sparse, without any silvery tinge. Mesopleuron anterior to coxa 2 without distinct reticulate microsculpture. Terga shining, smooth; sterna with microsculpture.

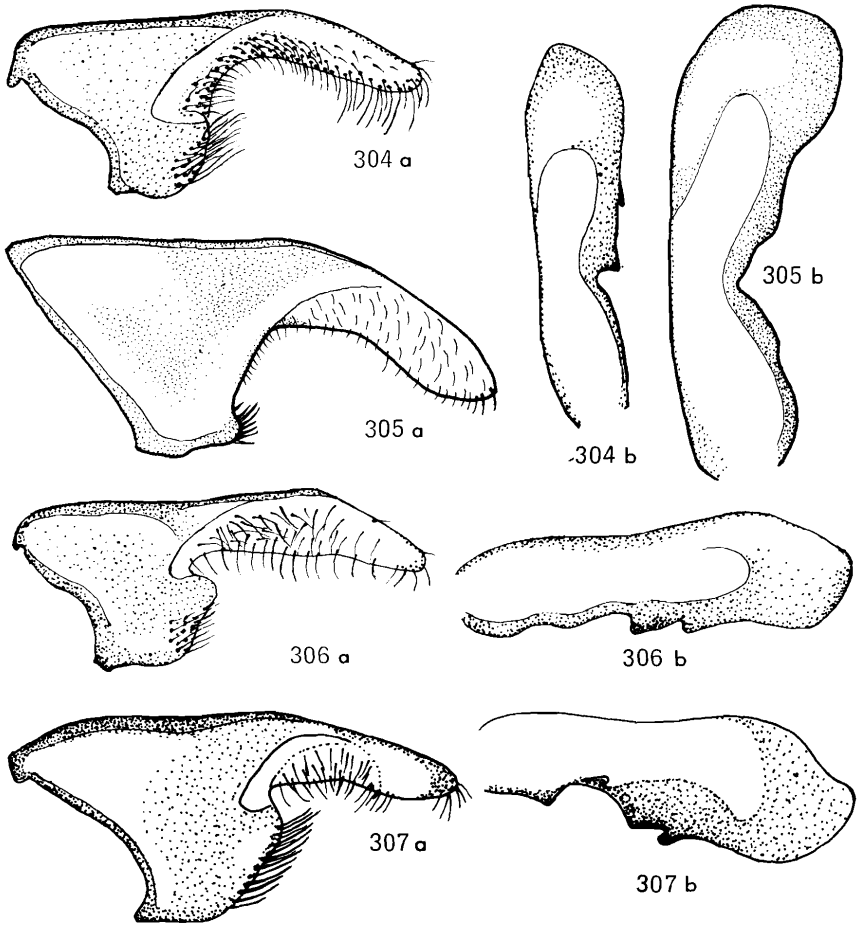


Fig. 304-307. Sclerites of male genitalia of Miscophus. - 304: concolor Dahlbom; 305: spurius (Dahlbom); 306: ater Lep.; 307: niger Dahlbom; a: paramere, b: aedeagus.

Male: 3.5 - 4.5 mm. Like female, but punctation on average weaker and the microsculpture absent except from frons. Mesopleuron shining, smooth, with rather sparse punctation. Genitalia as Fig. 305.

Widespread in Fennoscandia and Denmark, but a rather local species. - Denmark: small material from EJ, NEJ, LFM and NEZ. - Sweden: from Sk., Öl. and Gtl. to Gstr. and Med. - Not recorded from Norway. - Finland: like the preceding species it has a southern and south-eastern distribution. Northernmost records are from ObS. - Soviet Karelia: Ib and Kr. - Scattered occurrence in northern and eastern Europe.

100. MISCOPHUS ATER Lepeletier, 1845

Figs. 300-302, 306.

Miscophus ater Lepeletier, 1845:238.

Miscophus maritimus Smith, 1858:91.

Female: 3.7 - 5.0 mm. Head, pronotum, scutum, scutellum and metanotum often with a faint greenish or bronzy tinge. Mandibles mainly red-yellow or red-brown, only black near articulations. Posterior face of head and genae very indistinctly and superficially punctate. Punctation of pronotum and scutum slightly stronger, but not distinct. Only when scutum is viewed at a slight angle from behind, with the light coming horizontally from in front, are the individual punctures visible. Sculpture of mesopleuron likewise weak and indistinct. Sculpture of the somewhat swollen area just ventral to the base of forewings does not differ distinctly from the punctation of the remaining part of mesopleuron. Lateral faces of propodeum usually with regular, transverse striation. Pubescence, especially posteriorly, distinctly silvery, the hairs slightly depressed. Sculpture on dorsal face of propodeum extremely variable (Figs. 301, 302).

Male: 3.7 - 4.6 mm. Differs from female by the following characters. The weak metallic tinge considerably less pronounced, often completely missing. Anterior face of head distinctly and densely punctate, with only very weak interstitial microsculpture. Punctation on lateral faces of mesopleuron somewhat more regular. The shining swelling below base of forewings with very fine and scattered punctation. Genitalia as Fig. 306.

The species occurs in large numbers in several localities in Denmark, especially along the west coast of Jutland and on the island of Læsø in the Kattegat. - Sweden: common on the southern coasts of Sk. and on northern Öland. - Not recorded from Norway. - Finland: scattered occurrence along the

southern and north-western coasts. - Soviet Karelia: Ib. - The species is recorded from most European countries and seems to occur rather frequently along the southern coasts of England and on the Friesian Islands.

101. MISCOPHUS NIGER Dahlbom, 1844

Fig. 307.

Miscophus niger Dahlbom, 1844:236.

Close to spurius as well as to ater. It is absolutely necessary to have material for comparison during identification.

Female: 3.8 - 5.6 mm. Head and thorax only rarely with weak metallic lustre. Midpart of mandibles red-brown, base up to the tooth ventrally usually completely black. Punctation on scutum as in spurius, consisting of well-defined punctures. Central carina dorsally on propodeum very indistinct or quite missing. Pubescence on lateral faces of propodeum as in ater, depressed and silvery.

Male: 2.8 - 5 mm. Besides the characters mentioned in the key, characterized by the morphology of the genitalia (Fig. 307).

This species seems to have a pronounced eastern occurrence in Fenno-scandia and is apparently absent from both Denmark and Norway. - Sweden: Sk., Löderup, Sandhammaren; Gtl.; G.Sand.; Ög. and Sdm. - Finland: widely distributed from Al, Ab, N and Ka in the south to Ok and ObN in the north. - Soviet Karelia: Ib and Kr. - Scattered throughout Europe.

Genus *Nitela* Latreille

Nitela Latreille, 1809:77.

Type-species: Nitela spinolae Latreille, 1809.

Small, black species (Fig. 308). Head in front view slightly broader than high. Inner orbits diverging ventrally. Lower part of face with strong concavity on either side, covered with silvery pubescence. Clypeus narrow, with sharply projecting longitudinal keel. Antennae inserted very low on face. Mandibles bidentate in female, simply pointed in males. Pronotum on either side with a broad, deeply depressed furrow, between which is found an acutely triangular area. Distance between humeral tubercle and tegula very small. Thorax depressed. Scutum with short oblique rugae near posterior border. Propodeum large, with strong, usually reticulate sculpture. Abdomen shining, smooth, last tergum in females without pygidial area. Legs long and slender, without

spines. Tibia 2 with a single apical spur. Forewings slightly fuscous, with only one discoidal and cubital cell. Distal half of anal vein only indicated. In hindwing the veins are strongly reduced, only radius and first anal vein are sclerotized.

The genus is widely distributed and represented in the Holarctic (c. 10 species), Neotropical (c. 2 species), Ethiopian (c. 10 species), Oriental (c. 4 species), and Australian regions (7 species).

The species use hollow plant stems, abandoned larval tunnels of xylophagous insects and the like for constructing the nests. The prey consists of nymphs of Psocidae and Aphididae.

Key to species of Nitela

1 Terga 1 and 2 with extremely weak, sparse punctation. Propodeum with coarse, reticulate sculpture with shiny, very weakly sculptured interstices. Male: anterior border of clypeus as fig. 309 ..... 102. borealis Valkeila

\- Terga 1 and 2 with distinct and rather dense punctation. Propodeum with fine, reticulate sculpture, interstices rather dull, with distinct microsculpture. Male: anterior border of clypeus as fig. 311 ..... 103. spinolae Latreille

102. NITELA BOREALIS Valkeila, 1974

Figs. 308-310.

Nitela borealis Valkeila, 1974:75

Nitela spinolae Dahlbom, 1845, p.p.

Female and male: 3.5 - 4 mm. Frons shining, with fine, dense punctation. Punctures partly coalescing, so that the interstices form weak, longitudinal rugulae. Anterior border of clypeus with three indistinct lobes in female, in male the lobes are considerably more pronounced (Fig. 309). Dorsal to the horizontally running, coarsely pitted furrow the mesopleuron is shining, smooth, with or without very weak reticulate microsculpture. Propodeum, especially in female, coarsely, reticulately sculptured, with smooth interstices. Terga 1 and 2 with extremely weak, sparse punctation. Male genitalia, Fig. 310.

The species is rare, but probably overlooked. In Sweden and Finland it occurs locally in rather large numbers. A few specimens from Denmark: EJ, NEZ. - Norway: AK. - Northern limit in Sweden in Vb. and in Finland in Sb. - Soviet Karelia: Ib and Kr. - Scattered occurrence in Europe.

The species is usually met with on trunks, fencing posts and wooden houses, fully exposed to the sun. The nests are found in abandoned insect tunnels (e.g. Ernobius sp., Coleoptera, Anobiidae). Hollow plant stems (e.g. Rubus idaeus Chamaenerion angustifolium and Urtica dioica) may also be used (Valkeila, 1955). The number of cells is stated to vary from one to five. The partition between the cells is made of fine plant material. The adult larva was described by Valkeila, 1955. The prey consists of nymphs of Psocidae, of which each cell may contain up to 30 specimens. Eurytoma rubicola (Hym., Eurytomidae) has been found as parasite.

103. NITELA SPINOLAE Latreille, 1809

Figs. 311, 312.

Nitela spinolae Latreille, 1809:77.

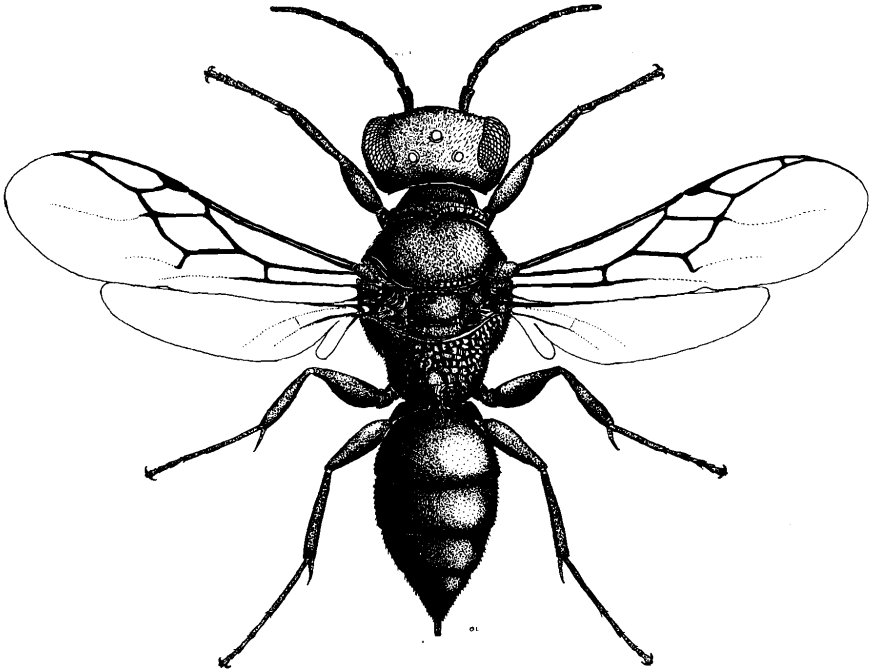
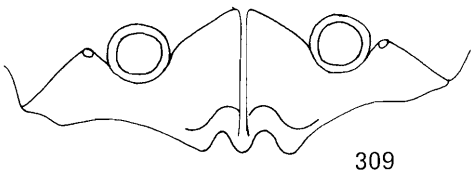


Fig. 308. Female of Nitela borealis Valkeila. Length: 3.5-4.0 mm.

Female and male: 3-4 mm. Close to the preceding species, with which it was long confused (Valkeila, 1974). Can be separated by the characters mentioned in the key. Male genitalia, Fig. 312.

Nitela spinolae seems to have a more southern distribution in Europe. In Fennoscandia it has only been found in Sweden: Sk., Bl., Öl., Gtl., Ög., Vg., Nrk., Vstm. and Upl. Northernmost findings in Dlr.

The habits of this species are similar to those of the preceding one, but the prey consists of both Psocidae and Aphididae. The larva was described by Janvier, 1962.



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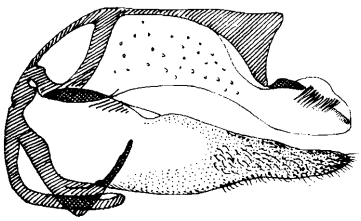

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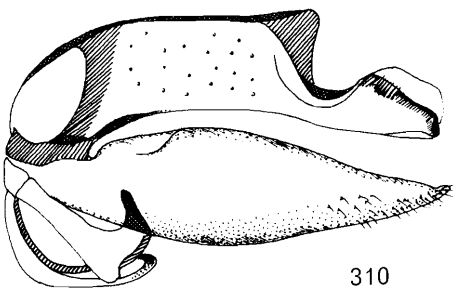

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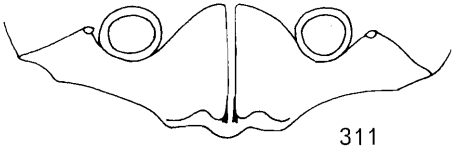

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Figs. 309, 310. Nitela borealis Valkeila. - 309: clypeus of male; 310: male genitalia in lateral view.
Figs. 311, 312. Nitela spinolae Latr. - 311: clypeus of male; 312: male genitalia in lateral view.
309 and 311 redrawn after Valkeila, 1974.

TRIBE TRYPOXYLONINI

Only a single genus in the North. See generic description. Several species use wet clay as building material.

Genus *Trypoxylon* Latreille

Trypoxylon Latreille, 1802:338.

Type-species: Sphex figulus Linné, 1758.

The genus is easily recognizable by the very elongate habitus and deep V-shaped emargination in the inner orbits. Body entirely black in Nordic species. Head in front view considerably narrowing ventrally. Clypeus large, with silvery pubescence. Antennae long, slightly dilated distally in females, considerably in males. Scapus short and thick, only slightly longer than broad. Eyes strongly convex. Ommatids of very varying size, the forwardly directed ones near antennal sockets several times larger than those placed dorsally in the eye. Thorax elongate, usually dull, but without actual sculpture. Propodeum dorsally with indistinctly delimited area cordiformis, whose sculpture is usually radiately striate. Forelegs comparatively short, metatarsus 1 without pecten. Tibia 2 with a single apical spur. Radial cell of forewings very long, almost reaching apex of wings. One cubital and one discoidal cell. Hamuli in two well separated groups. Females without pygidial area. Last antennal segments of males thickened, distal segment slightly hook-shaped apically.

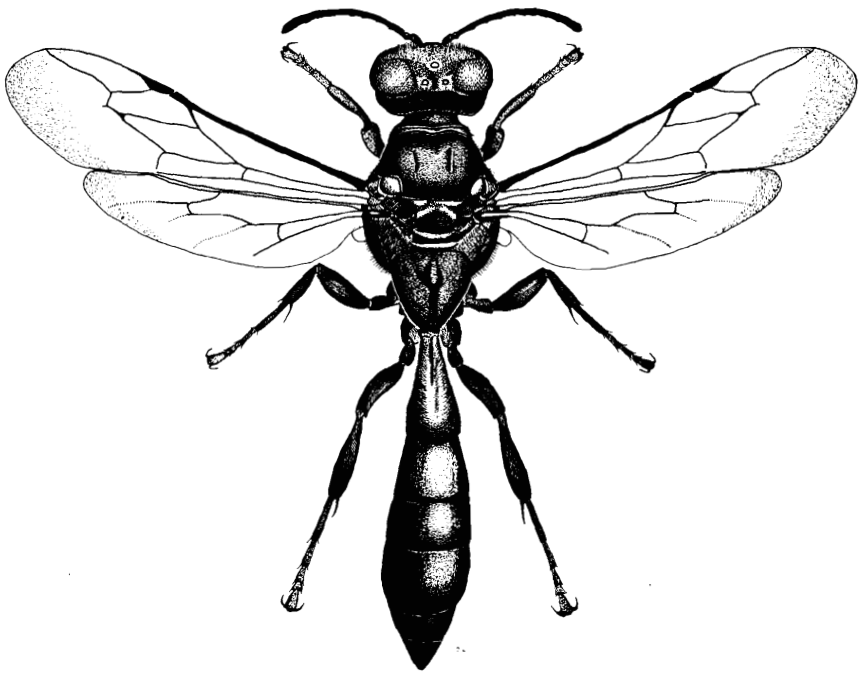


Fig. 313. Female of Trypoxylon figulus (L.). Length: 8-12 mm.

The genus is cosmopolitan, comprising a large number of species, of which many are tropical. Eight species in Europe. The Palaearctic species are found breeding in hollow plant stems, abandoned insect tunnels in dry wood and the like. The prey consists of spiders. The partitions between the cells, and also the final nest closure, are made of clay.

Key to species of Trypoxylon

1 Tibia 1 and tarsus 1 completely or partly brown-yellow. Mandibles mainly brown-yellow or red-yellow.
Female: head in front view, fig. 314.
Male: distal segment of antennae short, at most twice as long as broad. Apex not, or only slightly, directed outward (Fig. 319) ..... 104. clavicerum Lepeletier

\- Foreleg all black. Basal part of mandibles black 2

2(1) Smallest distance between eyes below antennal sockets considerably smaller than distance between eyes just behind ocelli (Fig. 315). First abdominal segment very long (Fig. 317). Anterior border of clypeus with two rounded teeth. Male: last antennal segment very long (Fig. 320) ..... 105. attenuatum Smith

\- Smallest distance between eyes below antennal sockets equal to distance between eyes just behind ocelli (Fig. 316). First abdominal segment at most 2.5 times longer than broad (Fig. 318). Clypeus without teeth, at most with weakly arcuately incised emarginate anterior border. Male: last antennal segment, fig. 321 ..... 106. figulus (Linné)

104. TRYPOXYLON CLAVICERUM Lepeletier, 1825

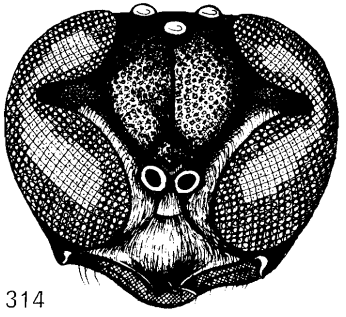
Figs. 314, 319.

Trypoxylon clavicerum Lepeletier, 1825:750.

Female: 7-10 mm, male: 6-8 mm. Easily recognizable by the light yellow-brown colour on tibia 1 and tarsus 1. Head ventrally strongly narrowed (Fig. 314). Scutum dull, finely and densely punctate, with distinct microsculpture. Lateral faces of mesopleuron shiny with very fine, sparse punctures; micro-

sculpture effaced. Lateral faces of propodeum shiny, impunctate, only upper part finely and densely striate.

Not quite so common as figulus, but may locally occur in very large num-



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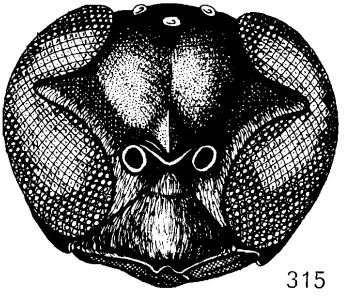

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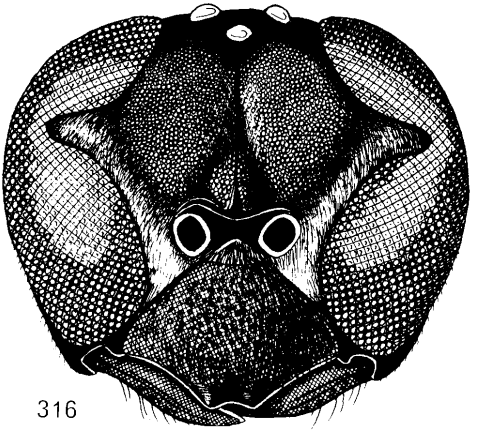

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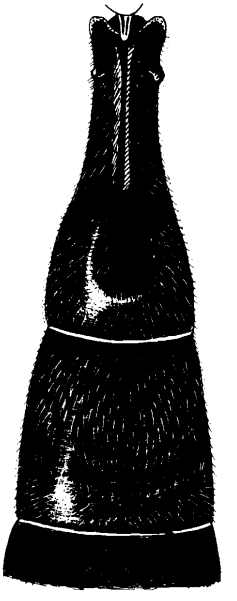

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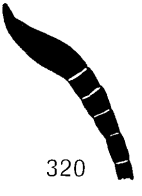

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Figs. 314-316. Heads in frontal view of female Trypoxylon. - 314: clavicerum Lep.; 315: attenuatum Smith; 316: figulus (L.).
Figs. 317, 318. Base of abdomen of female Trypoxylon. - 317: attenuatum Smith; 318: figulus (L.).
Figs. 319-321. Distal part of antennae of male Trypoxylon. - 319: clavicerum Lep.; 320: attenuatum Smith; 321: figulus (L.).

bers. - Denmark: not found in WJ. - Sweden: distributed northwards to Jmt. - Norway: sporadic, mainly in the southern and south-eastern districts; northernmost records from SFi. - Finland: not common, occurring mainly in the southern districts; northernmost record from Kb. - Widely distributed in Europe and further through Asia to Japan.

The nests are constructed in abandoned insect tunnels in dry wood, hollow plant stems (Phragmites) or stems of Artemisia vulgaris gnawed by the tortricid moth, Epiblema foenella. The cells are provisioned with small spiders, e. g. of the genera Epeira, Linyphia and Tetragnatha. As parasitoids are known Ephialtes manifestator L. (Hym., Ichneumonidae), Omalus pusillus Fabr. (Hym., Chrysididae) and Pachyophthalmus signatus Meig. (Dipt., Sarcophagidae).

105. TRYPOXYLON ATTENUATUM Smith, 1851

Figs. 315, 317, 320.

Trypoxylon attenuatum Smith, 1851:120.

Female: 7-10 mm, male 7-9 mm. Completely black. Mesopleuron dull with distinct microsculpture, punctation very fine and sparse. Lateral faces of propodeum finely and very densely striate throughout. First abdominal segment very long, almost as long as second and third combined (Fig. 317). Last antennal segment of male very long, almost as long as segments 9-12 together (Fig. 320).

Not common, but very widely distributed in Denmark and Fennoscandia. - Denmark: occurs everywhere. - Sweden: distributed in South and Central Sweden, to the north to Gstr. - Norway: a few specimens from AK. - Finland: distributed northwards to a line from Om through Sb to Kb. - In Soviet Karelia from Ib. - The distribution area covers most of Europe, North Africa and great parts of Asia.

The nests are exclusively found in hollow plant stems, usually of Phragmites. The prey consists of e. g. Bolyphaltes and Tetragnatha. As parasitoids are known Chrysis cyanea, Omalus pusillus, O. auratus (Hym., Chrysididae), Eurytoma rubicola Gir. (Hym., Eurytomidae) and Pachyophthalmus signatus Meig. (Dipt., Sarcophagidae).

106. TRYPOXYLON FIGULUS (Linné, 1758)

Figs. 313, 316, 318, 321.

Sphex figulus Linné, 1758:570.

Female: 8-12 mm, male: 6-11 mm. Recognizable by its often considerable size. Microsculpture of head very strong, granular. Whole thorax with somewhat weaker, but still strong microsculpture. Pubescence greyish. Lateral faces of propodeum finely and densely striate. First abdominal segment comparatively short, not reaching farther backwards than apex of femur 3 (Fig. 318). Last antennal segment of males very large, apically somewhat outwardly directed (Fig. 321).

The most common species of Trypoxylon in the north. - Occurring throughout Denmark. - Sweden: known from all districts except T. Lpm., Nb., Ås. Lpm., Ång. and Med., but certainly occurs in the four last-mentioned districts. - Norway: comparatively few records; northernmost occurrence in Fn. - Finland: probably throughout the country. - In Soviet Karelia records from Ib and Kr. - The species has a Holarctic distribution. It is common in temperate and subtropical regions of the Northern Hemisphere and found in the Palaearctic region from the Atlantic in the west to the Pacific in the east.

Often found in very large numbers in thatched roofs. Several other hollow plant stems, abandoned tunnel systems of xylophagous insect larvae and cavities in brickwork are also used for nesting. The prey is mainly species of Epeira, but several other genera are also used, e.g. Tetragnatha, Linyphia and Salticus. Of predators are known a long series of parasitic Hymenoptera within Chrysididae, Ichneumonidae, Chalcidoidea and Evaniidae. Larva described by Soika, 1934.

Note. This species has undergone considerable taxonomical consideration through the time. Beaumont (1945) considered it as comprising three European "forms": T. figulus major Kohl, 1883, T. figulus media Beaumont, 1945, and T. figulus minor Beaumont, 1945. Wolf (1959) argued that these forms should be regarded as subspecies and described a new "variety": figulus minus rubi, which Beaumont (1963) considered a junior synonym for figulus media. Valkeila (1961) reared major and minor from the same nest and correctly concluded that these taxa had no validity. Tsuneki (1956) described two new subspecies: T. figulus koma from Korea and T. figulus yezo from Japan. It seems doubtful whether the Japanese populations are referable to separate subspecies.

TRIBE OXYBELINI

A small tribe with cosmopolitan distribution, only comprising five genera that probably constitute a monophyletic unity. Easily recognizable by the following combination of characters: the single cubital and discoidal cells are fused;

metanotum with lateral dilations, partly translucent; propodeum with a medial carina either strongly raised or developed into a backwardly directed, deeply grooved furrow.

Three genera in Europe. Terrestrial species.

Genus *Belomicrus* A. Costa

Belomicrus A. Costa, 1866:80.

Type-species: Belomicrus italicus A. Costa, 1866.

Small, robust species (Fig. 322), which share several characters with both Oxybelus and several genera within Crabronini, e.g. Encopognathus Kohl (Africa) and Entomognathus Dahlbom. The genus is, however, placed near Oxybelus, primarily because of the venation (Fig. 322). Shape of eyes as in Oxybelus, but species with relatively large eyes occur, in which the inner orbits converge strongly ventrally. In these the forwardly directed ommatids are considerably larger than the others. The ocelli are placed in a very obtuse triangle. Clypeus and the lower part of the face with silvery pubescence. The sexual dimorphism in the anterior margin of the clypeus is considerably less

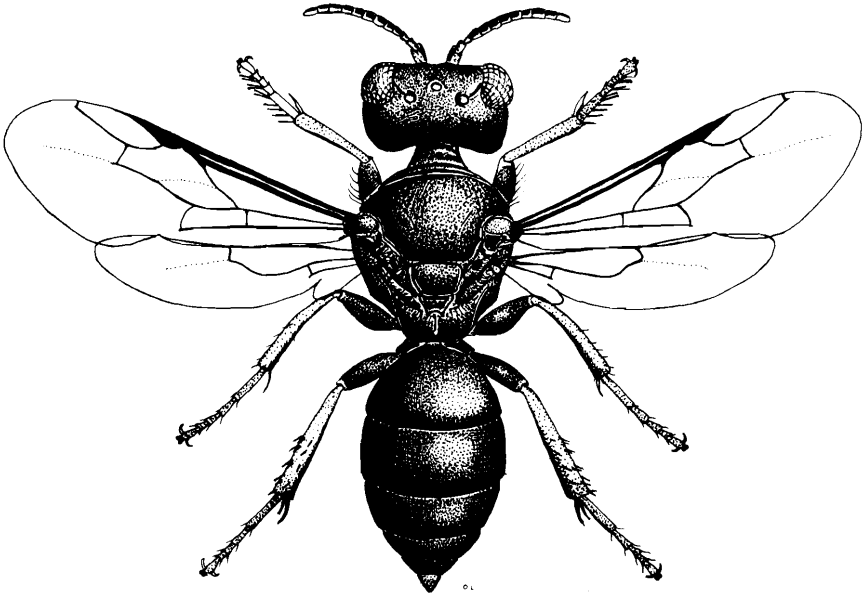


Fig. 322. Female of Belomicrus borealis Forsius. Length: 5 mm.

than in Oxybelus, and the teeth and emarginations are weaker. Antennae short, median segment of flagellum wider than long (Belomicrus s.str.). Mandibles simply attenuate (Belomicrus s.str.), with an obtuse process on the inner side. Pronotum conical, evenly rounded,dorsally without transverse carina. Thorax robust, with fine sculpture. Metanotum with more or less well-developed lateral lamellae which are posteriorly attenuate. Propodeum dorsally with narrow spine or a longitudinal, lamellar, protruding carina (subgenus Oxybeloides). Lateral faces of propodeum delimited from posterior face by a sharp carina. Mesopleuron in the Fennoscandian species without epicnemial carina, evenly rounded in front of coxa 2. Abdomen ovoid. Male as well as female with pygidial area. Female with psammophore, i.e. a row of bristles on external side of femur 1, which together with a corresponding row on ventral face of head form a basket for collecting dug out material. Tibia 2 with a single apical spur. Tibiae 2-3 with strong spines.

The genus comprises about 50 species and is distributed in the Nearctic, Palaearctic and Ethiopian regions. In Palaearctis 26 species occur.

The nest is constructed in warm, dry, sandy ground. The prey consists (exclusively?) of Coleoptera, Dasytidae (Williams, 1936; Valkeila, 1963).

107. BELOMICRUS BOREALIS Forsius, 1923

Fig. 322.

Belomicrus (Oxybeloides) borealis Forsius, 1923:65.

Female: 5 mm. Clypeus strongly convex, anteriorly with three rounded teeth, the foremost part shiny, impunctate. Mandibles black with red-brown middle, without emargination in lower edge. Frons anterior to ocelli shining, very finely and densely punctate, interstices with very fine microsculpture. Behind ocelli, especially laterally, with fine, transversely striate microsculpture. Facial fovea anteriorly delimited by a sharply depressed groove. Antennae brown, flagellum brown-yellow ventrally. Thorax all black. Scutum and scutellum with fine punctation, interstices larger than diameter of the punctures, with extremely weak microsculpture. Metanatum with translucent, posteriorly attenuate, lamellae. Propodeum dorsally with a short longitudinal, infuscate lamella, otherwise with fine reticulate microsculpture and fine, short rugae. Area cordiformis very indistinctly marked. Abdomen dull, with fine microsculpture. Pygidial area apically red-yellow, shining, with rather coarse, sparse punctation. Femur 1 and trochanter 1 flattened ventrally, along outer side with a row of stiff bristles. Tibia 1 yellow with a brown spot on the inner

side. Tarsus 1 brown-yellow, with well developed pecten. Tibiae 2-3 yellow with a brown spot on the inner side.

Male: 5 mm. Head in front view considerably longer than in female. The convex areas behind the eyes more strongly developed, whereby the head acquires a rounded, rectangular outline. Sculpture of head as in female, punctation slightly stronger. Mandibles brown, slightly paler distally. Antennae brown, ventral surface of flagellum and posterior surface of scapus yellow. Sculpture of thorax and abdomen as in female. Pygidial area with almost parallel sides, red-yellow. Femur 1 with a large distal yellow spot, extending especially along ventral margin. Femur 2-3 with a small distal yellow spot. Tibiae 1-2 yellow with a brown spot on the inner side. Tibia 3 with rather extensive black markings.

The species is only recorded from Fennoscandia, but may also occur in western Siberia. - Sweden: a few specimens from Upl., Eckerö; Gstr., Forsby near Hille, and Dlr., Mora. - Finland: Ab, Pernio; Ta, Hattula; Sa. - Soviet Karelia: Ib, Sakkola, holotype.

The species inhabits warm, sandy glades in pine forests. Flying at a height of 2-4 cm the female seeks a suitable nesting site, e.g. where the sandy surface already forms a small pit. The first section of the nest is excavated as follows: the female quickly throws herself on the ground, collects a small amount of sand in the psammophore, and very rapidly flies about 10 cm backwards, when she drops the load. This is repeated several times, all the time at an angle of about 30° with the ground. The last section of the tunnel and the cells, which are situated in the horizontal plane, a few cm below the surface of the ground, are excavated in the normal way. The prey consists of Dasytes niger, of which 4-5 are placed in each cell. Each nest may contain four cells (Valkeila, 1963).

Genus *Oxybelus* Latreille

Oxybelus Latreille, 1796:129.

Type-species: Vespa uniglumis Linné, 1758.

Small to medium-sized species (Fig. 323). Head short, in front view almost circular or distinctly broader than high. In males the head is comparatively higher than in females. Inner orbits slightly diverging ventrally. Antennae inserted just above the epistomal suture, distance between antennal sockets greater than diameter of a socket. Clypeus in males with a very strong median

keel. On either side of this the anterior margin is deeply emarginate, whereby two strong teeth are formed. Anterior margin of clypeus in female of rather simple shape, with two small lateral teeth. Frons and clypeus with silvery pubescence, most strongly developed in the male. Ocelli placed in a very obtuse angle, the lateral often larger than the median. The compound eyes rather small, all ommatids of fairly equal size. Mandibles ending in a single tooth, basally with an obtuse process on the inner side. Head densely punctate. Pronotum very short, with strong transverse carina, often ending in sharp lateral corners. Mesothorax very robust. Mesopleuron usually strongly sculptered, anteriorly with well developed epicnemium; the epicnemial carina continues to the ventral midline. Precoxal carina very well developed. Scutellum with median keel, laterally produced into narrow, lamellar-like, translucent dilations. Metanotum with two backwardly directed, often bidentate, more or less translucent dilations. Propodeum with a strong dorsal spine, or more or less leaf-shaped, grooved process. Lateral areas of propodeum with transverse sculpture, separated from posterior face by a sharply protruding carina. Abdomen broadly triangular, usually with yellow or white-yellow lateral spots. Pygidial area of females broadly triangular, that of the males trapezoid. Legs short and strong, tarsus 1 in females with well developed pecten. Tibia 2 with a single spur. Last tarsal segments strongly thickened, pulvilli large. Dis-

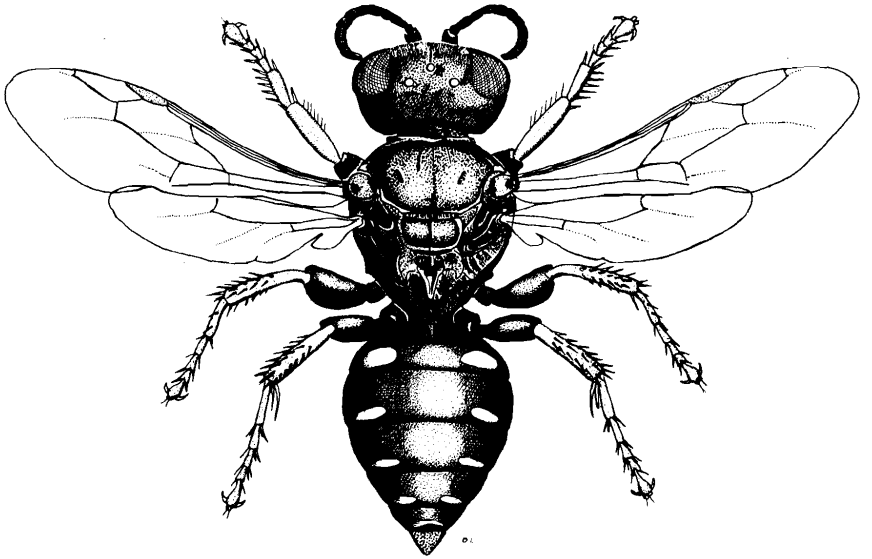


Fig. 323. Female of Oxybelus uniglumis (L.). Length: 5-8 mm.

coidal and cubital cells of forewing fused, only separated by an indistinct vein. Radial cell with a small accessory cell.

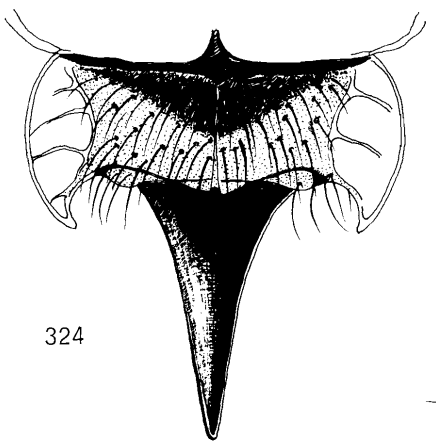
The genus, which has a cosmopolitan distribution, but seems to be absent in the Australian region, comprises about 160 species, of which c. 90 occur in the northern hemisphere. Of these about 20 occur in Europe.

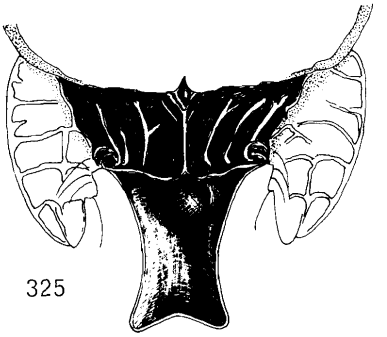
The species nest, especially in sandy, strongly sun-exposed localities, where the nests are excavated in the soil. The prey consists of Diptera.

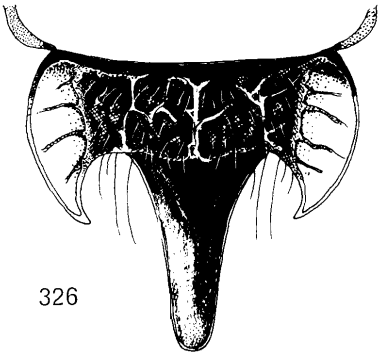
Key to species of Oxybelus

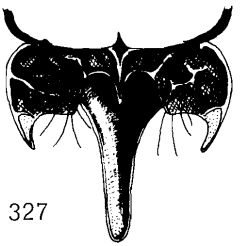
Females

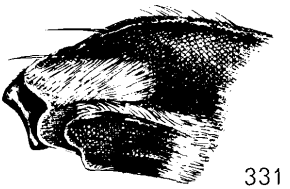
1	Femora 2-3 red or yellow-brown. Metanotum between lamellae with more or less yellow markings	2
-	All femora black or brown-black, at most with a small, distal, paler spot	3
2(1)	Scutum with yellow longitudinal lines. Remaining part of thorax and abdomen with rich yellow pattern. Mandibles yellow or brown-yellow centrally. Propodeal spine depressed, with parallel sides, and truncate apex ..... 108. lineatus (Fabricius)	
-	Scutum without yellow markings. Mandibles light yellow-brown or brown-black. Terga 1-5 with lateral spots, which on the last terga are fused into transverse bands. The whole surface often with densely adpressed silvery pubescence. Propodeal spine attenuate (Fig. 324) ..... 109. argentatus Curtis	
3(1)	Propodeal spine broadest subapically, here only slightly narrower than long, apex itself emarginate (Fig. 325) ..... 111. latidens Gerstäcker	
-	Spine much longer than broad apically, not emarginate	4
4(3)	Mandibles mainly yellow, red-yellow or yellow-brown, with dark red to black apex. Propodeal spine excavated in a groove, sides almost parallel, apex rounded. Tibiae 2-3 uniform light or dark brown	5
-	Mandibles brown or brown-black	6











Figs. 324-327. Metanotal processes and propodeal spine of female Oxybelus. - 324: argentatus Curtis; 325: latidens Gerstäcker; 326: uniglumis (L.); 327: bipunctatus Olivier.
Figs. 328-330. Anterior part of clypeus of male Oxybelus. - 328: argentatus Curtis; 329: mandibularis Dahlbom; 330: trispinosus (Fabr.).
Fig. 331. Clypeus in antero-lateral view of male Oxybelus latidens Gerstäcker.

5(4) Metanotal lamellae brownish transparent or infuscate. Metanotum black. Tarsal spines on metatarsus 1 2-2.5 times longer than width of the metatarsus. Abdomen shining smooth, very finely punctate. Tergum 1 with almost circular lateral spots ..... 113. bipunctatus Olivier

- Metanotal lamellae mainly yellow, their transparent part colourless. Metanotum between lamellae often yellow. Spines on metatarsus 1 almost as long as width of the metatarsus. Abdomen with scattered punctation. Tibiae light red or yellow-brown. Terga 1-3 with oval lateral spots ..... 110. mandibularis Dahlbom

6(4) The transparent part of the lamellae colourless. Tibiae 2-3 pale brown, proximally with a small, often somewhat effaced whitish spot. Pubescence on lower part of frons closely adpressed, silvery. Spines on metatarsus 1 about 1.5 times longer than width of the metatarsus. Terga 1-4, often also tergum 5, with ivory lateral spots ..... 112. uniglumis (Linné)

- Lamellae brown-black, their transparent part strongly infuscate. Tibiae 2-3 dark-brown, almost as dark as femora. Pubescence on lower part of frons sparse with faint reddish tinge. Spines on metatarsus 1 shorter than width of the metatarsus. Usually only terga 1 and 2 have yellow lateral spots. ..... 114. trispinosus (Fabricius)

Males

1 Sterna 3-6 with strong, very conspicuous white or yellowish hair fringe, whose base is covered by the anterior sternum. The median part of sterna smooth, very sparsely and indistinctly punctate, almost bare. Mandibles with yellow or yellow-brown median area 2

- Sterna 3-6 without distinct hair fringe. Sterna usually distinctly punctate 3

2(1) Large species (8-10 mm). Sutures between scu-

tellum and metanotum and between metanotum and propodeum yellow. Propodeal spine depressed and broad with rounded apex. Metanotum between lamellae yellow. Lamellae with very large medial dilations. Tarsi, tibiae and femora extensively yellow or brown-yellow ..... 108. lineatus (Fabricius)

- Smaller (5-7 mm). Sutures dorso-posteriorly on thorax black. Propodeal spine excavated in a groove. Metanotum between lamellae black. Lamellae without medial dilations, at most slightly thickened. Femora mainly black 110. mandibularis Dahlbom

3(1) Sutures between scutellum and metanotum and between metanotum and propodeum yellow 4

- These sutures black 5

4(3) Anterior margin of clypeus on the steeply declining part below the median keel with a small tubercle, giving the median keel, seen in profile, a bidentate appearance (Fig. 331). Propodeal spine broadest subapically, usually incised apically. Mesopleuron deeply and densely punctate, without true rugae. Tibia 1 usually uniform yellow. Femora 1-2 as a rule each with a small yellow spot ..... 111. latidens Gerstäcker

- Anterior margin of clypeus on the steeply declining part without tooth or tubercle. Median keel strongly compressed. Propodeal spine evenly narrowed with rounded apex. Mesopleuron coarsely, almost reticulately rugose. Tibia 1 with a large brownish spot on the inner side. Femora 1-2 on the outer side each with a large yellow spot, usually reaching farther than to middle of femora ..... 114. trispinosus (Fabricius)

5(3) Mandibles black or brown-black, seldom red-brown, with a rounded, triangular, subapical dilation ventrally. Propodeal spine with rounded apex. Lateral angles of pronotum attenuate in front view. All femora black. Tibiae 1-2 usually brown-yellow, often with a yellow stripe along the front side. Femur 1 sometimes with a yel-

low spot on the inner side near apex ..... 112. uniglumis (Linné)

- Mandibles without triangular dilation ventrally 6

6(5) Mandibles yellow with red apex. Metanotal lamellae with large median dilations (Fig. 327). Propodeal spine rounded apically. Femora black with yellow apex. Tibiae 1-2 yellow with brown or brown-black inner side. Tibia 3 with yellow basal half. Abdomen shining, smooth, with fine, sparse punctation and pubescence ..... 113. bipunctatus Olivier

- Mandibles black or brown-black. Metanotal lamellae without medial dilations. Propodeal spine attenuate. Femora 1-2 extensively yellow. All tibiae yellow with only weakly indicated spot on the inner side. Abdomen rather densely and strongly punctate, often with rather dense silvery pubescence ..... 109. argentatus Curtis

108. OXYBELUS LINEATUS (Fabricius, 1787)

Nomada lineata Fabricius, 1787:306.

Female: 9-11 mm. Head strikingly small. Mandibles yellow with rusty or red-brown apex. Antennae brown, flagellar segments paler proximally. Pronotum with a very large, white-yellow double spot. Humeral tubercle also white-yellow. Scutum with two median, almost complete, white-yellow longitudinal bands and two shorter, lateral ones. Scutellum with two yellow lateral spots. Metanotum between lamellae white-yellow. Sutures between scutellum and metanotum and between metanotum and propodeum whitish. Just in front of coxae 2-3 two pairs, often indistinct, yellow spots. Propleuron may carry an effaced yellow spot. Whole thorax with slightly silvery pubescence. Spine on propodeum broad, sides almost parallel, apex rounded, often with a median yellow spot or uniform yellow. Abdomen with white-yellow transverse bands on first, fourth and fifth terga, second and third with very large lateral spots. Pygidial area red-brown, slightly arcuately emarginate distally. Sterna 2-6 with larger or smaller transverse spots. Legs mainly white-yellow and brown-yellow. Coxa 1 with a large white-yellow spot.

Male: 8-10 mm. The silvery pubescence on the face very well developed. Mandibles yellow, distally red-brown, subapically with a rounded triangular dil-

ation ventrally. Pronotum and humeral tubercles of same colour as in female. Scutum and scutellum usually devoid of yellow markings. Median tooth on lamellae on metanotum may be highly reduced. Thorax without ventral spots. Abdomen without bands, lateral spots on last terga may be missing. Sterna generally without yellow markings, sterna 3-6 with very well developed hair fringes, the central parts of these sterna shiny without punctation. Pygidial area distally light coloured, with a weak, arcuate emargination. Femur 1 brown with a broad yellow stripe along outer side. Femur 2 with a large yellow distal spot, femur 3 brown-yellow distally. Tibiae 1-2 and tarsi 1-2 yellow and brown-yellow, tibia 3 brown with a proximal yellow ring.

A few specimens from Denmark: EJ, Glatved (Abrahamsen). - Not known from Fennoscandia. - A rare Central and South European species. Nearest records in Holland and North Germany.

109. OXYBELUS ARGENTATUS Curtis, 1833

Figs. 324, 328.

Oxybelus argentatus Curtis, 1833:480.

Oxybelus mucronatus auctt., nec Fæster, 1949:17.

Female: 8-10 mm. Habitus relatively elongate. Face with well developed silvery pubescence. Mandibles red-yellow and brown-yellow basally, red-brown distally. Pronotum dorsally at most with indicated lateral spots. Humeral tubercles white-yellow. Scutum very densely and coarsely punctate, interstices considerably smaller than diameter of punctures. Metanotum with a white-yellow double spot, which may be divided. Lamellae transparent, simply attenuate. Spine on propodeum long and slender, attenuate (Fig. 324). Mesopleuron with silvery pubescence, punctate, with shiny interstices. Abdomen with large, often ivory lateral spots on terga 1-3, and terga 4-5 with bands. Pygidial area distally with a slight emargination. Femur 1 black with a larger or smaller yellow or brown-yellow apical spot. Femur 2 mainly brown-yellow, basally darker, often completely black, distally usually with a yellow spot. Femur 3 usually uniform red-yellow. Tibiae and tarsi red-yellow, but tibiae with larger or smaller white-yellow proximal markings.

Male: 5-9 mm. Mandibles mainly black, often with a slightly paler area proximally; some individuals have extensive yellow markings like mandibularis. Lateral teeth on clypeus very strong, truncate, directed almost straight forward (Fig. 328). Pronotum often with small lateral spots. Humeral tubercle always with a yellow spot. Scutum with very dense and rather strong punctation. Metanotum always with a divided double spot, which in small individuals may be

very reduced. Lamellae on metanotum and the spine on propodeum as in female. Abdomen with very dense punctation, terga 1-5 with yellow spots of which the posteriormost may be missing, especially in small specimens. Femora 1-2 basally black, distally, notably on ventral face, with a large yellow spot. Femur 3 may be almost entirely black, but often yellow and brown-yellow markings extend from the apex along the ventral and outer side.

According to Verhoeff (1948), the species is divided into six subspecies, of which four occur in Denmark and Fennoscandia. This division, in certain cases, especially as the males are concerned, may be rather difficult.

Note. O. mucronatus (Fabr.) sensu Balthasar, 1972, should be identified as argentatus Curt., while the Fabrician species was clearly defined by Fæster, 1949, and Oehlke, 1970. The Fabrician type specimen (a male) runs in Balthasar's key to pungax Oliv.

Key to sub-species of Oxybelus argentatus Curt.

1	Female: abdomen and thorax with dense and very well developed silvery pubescence, consisting of strongly depressed bristles, whereby the sculpture, especially on abdomen, may be difficult to discern. Male: thorax and abdomen with distinct, but rather thin silvery pubescence. Pubescence on thorax, and partly on tergum 1 consists of depressed hairs. Admixture of differently coloured bristles does not occur. ..... argentatus argentatus Curtis	
-	Female: pubescence on thorax with at most slight admixture of silvery bristles, otherwise with grey-golden hairs. Silvery pubescence on abdomen very sparse, covering at most the first two terga. Male: hairs dorsally on abdomen not depressed and at most slightly silvery	2
2(1)	Females	3
-	Males	5
3(2)	Thorax and abdomen dorsally interspersed with silver-shining hairs ..... argentatus aculeatus Thomson	
-	Thorax with uniform and well developed grey-golden to dark pubescence of non-depressed hairs	4

4(3) Markings on abdomen white-yellow or ivory
..... argentatus bouwmani Verhoeff

- Markings on abdomen bright yellow
..... argentatus gerstaeckeri Verhoeff

5(2) Markings on abdomen bright yellow, pubescence dorsally on thorax often slightly gold-shining
..... argentatus gerstaeckeri Verhoeff

- Markings on abdomen white-yellow, pubescence dorsally on thorax with strong admixture of slightly silvery hairs 6

6(5) Occurs in southern Denmark and Sweden
..... argentatus aculeatus Thomson

- Occurs in southern Finland ..... argentatus bouwmani Verhoeff

109a. OXYBELUS ARGENTATUS ARGENTATUS Curtis, 1833

Oxybelus argentatus Curtis, 1833:480.

Associated with coastal shifting sand areas in England, France and Holland. Also distributed in Central and East Europe. In Denmark it occurs in the northernmost and easternmost regions. From Sweden recorded from Hall. and Sk.

109b. OXYBELUS ARGENTATUS ACULEATUS Thomson, 1870

Oxybelus aculeatus Thomson, 1870:177.

Only known from Denmark and southern Sweden including Gotland. In Denmark the subspecies has a pronounced southern occurrence.

109c. OXYBELUS ARGENTATUS GERSTAECKERI Verhoeff, 1948

Oxybelus argentatus gerstaeckeri Verhoeff, 1948:179.

Widely, but sporadically distributed in Central and East Europe, and in southern and south-eastern Sweden.

109d. OXYBELUS ARGENTATUS BOUWMANI Verhoeff, 1948

Oxybelus argentatus bouwmani Verhoeff, 1948:175.

Inhabits inland localities in Holland. Additional occurrence in southern Finland.

The two last-mentioned subspecies are difficult to separate on the basis of morphological characters.

The prey consists of species of Therevidae, often Thereva annulata (Fabr.). The larva was described by Grandi, 1961. Smicromyrme rufipes Fabr. (Hym., Mutillidae) and Metopia argyrocephala (Dipt., Sarcophagidae) are known as predators.

110. OXYBELUS MANDIBULARIS Dahlbom, 1845

Fig. 329.

Oxybelus mandibularis Dahlbom, 1845:514.

Oxybelus sericatus Gerstaecker, 1867:89.

Female: 5-7.5 mm. Head behind ocelli swollen. Pubescence on face sparse, only slightly silvery with a faint golden tinge. Mandibles basally pale yellow, distally gradually darker, apex often black. Pronotum with white-yellow lateral spots. Humeral tubercle with white-yellow spot. Punctation on scutum rather strong, interstices as large as or slightly smaller than diameter of punctures. Pubescence on scutum and scutellum sparse, golden-brown. Lamellae on metanotum simply attenuate, their median margins slightly yellowish. Propodeal spine rather broad, apex rounded. Mesopleuron with sparse and rather weak, somewhat irregularly distributed punctation, without rugose sculpture. Abdomen shining, smooth, very slightly hairy, sparsely and rather finely punctate. Tergum 1 with large, white-yellow lateral spots. Spots on terga 2-4 small, sometimes missing on third and fourth. Femora black, femur 1 and sometimes also femur 2 with a distal white-yellow spot. Tibiae and tarsi red-yellow.

Male: 5-7 mm. Lateral teeth on clypeus very well developed, the strong emarginations on either side of the median keel with a very strong fringe of white, depressed bristles (Fig. 329). Mandibles proximally yellow, distally red-brown with a rounded triangular subapical dilation ventrally. Pronotum with white-yellow lateral spots. Humeral tubercle with a yellow spot. Pubescence on scutum varying from grey-golden to silvery. In occasional cases yellow spots occur on scutellum. Pronotum and metanotum each have a complete transverse band. Mesopleuron dorsally punctate with strong admixture of rugose sculpture. Ventro-laterally is a shining area, often with 3-5 strong transverse carinae or ribs. Lamellae on metanotum fairly long, simply attenuate, yellow on the inner side. Spine on propodeum comparatively broad, rounded distally. Abdomen with varying number of white-yellow lateral spots, seldom less than two pairs. Sterna 3-6 with well developed hair-fringe, with a transverse, slightly convex, impunctate area. Femora black, femur 1 and femur 2 with distal white-yellow spot. Tibiae 1-2 yellow anteriorly. Tibia 3 with proximal yellow ring.

This species is rather common locally in Fennoscandia and Denmark. - Denmark: found in most districts, - Sweden: a southern species, but also material from Ång. - Not found in Norway. - Finland: rather extensive distribution, northwards to ObS. - Soviet Karelia: Ib and Kb. - Widespread in Europe, but not common. Also recorded from Kazakhstan (Kazenas, in litt.).

Prefers warm, sandy localities, but not dunes. The provision consists of Diptera of the families Muscidae, Sarcophagidae and Tachinidae. Each cell contains from four to six flies.

111. OXYBELUS LATIDENS Gerstäcker, 1867

Figs. 325, 331.

Oxybelus latidens Gerstäcker, 1867:92.

Female: 5.5-7.5 mm. Head in front view distinctly broader than high. Face with short, dense, almost felty silvery pubescence. Clypeus slightly protruding. Mandibles yellow or red-yellow, distally red-brown or rust-coloured. Pronotum without yellow markings. Humeral tubercle with a white-yellow spot. Scutum very densely punctate, distance between punctures less than their diameter; pubescence sparse, often slightly grey-golden shining. Punctation on mesopleuron denser, but of same strength as on scutum, interstices only seldom forming rugae. Metanotum black, lamellae bidentate (best seen in profile). Propodeal spine short, broadest distally, here distinctly emarginate (Fig. 325). Sutures between scutellum and metanotum and between metanotum and propodeum often slightly yellowish transparent. Abdomen with strong and dense punctation on terga 1 and 2, gradually finer on succeeding terga. White-yellow lateral spots occur on terga 1-4. Femora black. Femur 1 often with a small yellow distal spot. Femur 2 distally red-yellow. Tibiae and tarsi mainly red-yellow, tibiae 1-2 often with a yellow stripe anteriorly. Tibia 3 may have a somewhat darker shade, whereby the slightly yellowish proximal spot becomes more distinct. Wing-nerves proximally, and tegulae light yellow-brown. Tegulae sometimes with a faint yellow spot.

Male: 4-6.5 mm. Median keel on clypeus in profile more or less distinctly S-shaped curved. Anterior margin with a median, small rounded tubercle, whereby the median keel appears bidentate (Fig. 331). Mandibles as in female, mainly golden or red-yellow. Sculpture of thorax as described in female, but punctation on mesopleuron somewhat stronger, whereby indications of a rugose sculpture appear. Propodeal spine strongly varying in shape, in typical specimens emarginate distally, but specimens with a com-

paratively long, narrow spine, rounded apically, occur. Abdomen with narrow, white-yellow lateral spots on terga 1-5. Spots on tergum 5 may form a transverse band. Pattern of legs almost as in female, but tibia 1 almost uniform yellow. Tibia 3, and also part of tibia 2, brown, with a yellow proximal ring. Tarsi red-yellow.

A small material is available from Denmark: EJ, Horsens, Funder, Gødvad, Alstrup; NEZ, Ll. Esbønderup, Tibirke. - Not found in Fennoscandia. The northernmost German records are from Schleswig-Holstein. - The distribution area covers Central and South Europe. Additional material from SE Kazakhstan.

Note: The species can easily be confused with subspinosus Klug, which seems to have a somewhat more southern distribution range (see Balthasar, 1972).

112. OXYBELUS UNIGLUMIS (Linné, 1758)

Figs. 323, 326.

Vespa uniglumis Linné, 1758:573.
Oxybelus quadrinotatus Say, 1824:338.

Female: 5-8 mm. A highly variable species. Frons in front of ocelli densely and rather finely punctate, with fine rugulae between punctures, whereby the area obtains a slightly longitudinally striate surface. Lower part of face with a rather strong, silvery pubescence. Pubescence on upper frons grey-yellow. Lateral teeth on clypeus acute, directed obliquely forwards. Mandibles usually uniform dark brown or completely black, but specimens with red-brown or slightly red-yellow midpart occur. Humeral tubercle often with an ivory spot. Scutum densely punctate, pubescence slightly brown-yellow, shining. Lamellae on metanotum simply attenuate, laterally hyaline, basally slightly infuscate, medially often with a whitish spot. Propodeal spine broad, apex rounded (Fig. 326). Abdomen with ivory lateral spots, which may form transverse bands on tergum 5 and exceptionally also on tergum 4. Occasional specimens with strongly reduced lateral spots occur. Such can always be distinguished from bipunctatus by the distinct punctation on abdomen. Femora black, often with a tiny, pale apical spot. All tibiae and tarsi usually mainly red-yellow, tibiae with a white-yellow proximal spot. The red-yellow colour on tibia 3 and tibia 2 may be completely or partly replaced by a dark brown pattern, but the proximal white-yellow spot is always retained.

Male: 5-7 mm. Median keel on clypeus very strongly protruding, apically rounded. Lateral teeth also very well developed, emargination on either side

with dense, silvery pubescence. Mandibles usually uniformly dark, with rounded, triangular, subapical dilation ventrally. Sculpture of frons as in female, slightly stronger. Humeral tubercle only seldom light coloured, prolonged into a sharp spine. Thorax otherwise without yellow markings. Scutum and scutellum with a thin, slightly golden or silvery pubescence. Spine on propodeum more slender than in female, apically rounded. Abdomen with comparatively dull surface, which is partly due to the thin, greyish pubescence. Ivory lateral spots are usually present on terga 1 and 2. In addition, there may be very faint spots on tergum 3. Pattern on legs strongly varying. Tibiae 1-2 usually red-yellow with a yellow stripe anteriorly. Tibia 3 red-yellow with a larger or smaller dark brown spot, proximally with a yellow spot. Specimens with almost uniformly black tibiae 2-3 occur.

The species is very abundant and widespread through Fennoscandia and Denmark. - Sweden: northern distribution limit runs through Nb. - Norway: northernmost record from On. - Finland: common from Al, Ab, N and Ka in the south to Ks and LkW in the north. - Soviet Karelia: Ib and Kr. - A Holarctic species. Common in Europe, southern Siberia and southern Canada. Recently recorded from Alaska. Throughout the whole U.S.A., southwards to Mexico (recorded as quadrinotatus Say in America before 1958).

The species has an extensive range of biotopes, and may be found nesting in almost any type of soil, even among paving stones, e.g. in farm yards, often occurring in large aggregations. The nest tunnel is 5-8 cm long and contains a single cell, which is situated at the end of a more or less horizontally running part of the tunnel, about 4 cm below the surface. The entrance is sealed while the female is hunting. The prey is hunted stealthily on the ground among grass, leaves, on stumps and the like. It is paralyzed by a sting in the neck region, and brought home pinned on the sting, with its ventral face upwards. Each cell contains from 4 to 12 Diptera, mainly belonging to the families Muscidae and Anthomyiidae. According to Nuorteva (1945) every female wasp apparently specializes on collecting a single or a very few species. The species produces two or perhaps three generations, from the middle of June to the end of August. As predators are recorded Myrmosa melanocephala Fabr. and Smicromyrme rufipes Fabr. (Hym., Myrmosidae and Mutillidae), Macronychia griseola Fall. and M. polydon Meig. (Dipt., Sarcophagidae).

113. OXYBELUS BIPUNCTATUS Olivier, 1811

Fig. 327.

Oxybelus bipunctatus Olivier, 1811:597.

Female: 3.5-5.5 mm. Head in front view very broad. Frons in front of ocelli shiny, with scattered punctation. Silvery pubescence sparse. Lateral teeth on clypeus acute. Mandibles yellow, with black base and red-brown apex. Antennae distally yellow or yellow-brown ventrally. Thorax without yellow markings, but sometimes a faint yellowish spot on humeral tubercle. Sometimes a slight bronzy tinge is found on thorax as well as on abdomen. Distance between punctures on scutum equal to or larger than diameter of punctures. Lamellae on metanotum simply attenuate, infuscate like the transparent part of the spine on propodeum (Fig. 327). Mesopleuron with superficial and rather sparse punctation. Abdomen rather broad, shining, smooth; slightly green-yellow spots on tergum 1. Only seldom spots on tergum 2. Especially in small specimens abdomen may be completely devoid of yellow markings. Colour of pygidial area varying from dark brown to red-yellow. Legs mainly black. Tibia 1 and tibia 2 partly with a yellow stripe anteriorly. Metatarsus 1 with very long spines.

Male: 3-5 mm. Frons in front of ocelli often with weak longitudinal rugosity, punctation as in female. The two emarginations on either side of median keel on clypeus rather weak; silvery pubescence sparse. Median keel in profile slightly bifid. Mandibles simply attenuate, yellow with red-brown or red-yellow apex and dark base. Thorax black, humeral tubercle sometimes with a yellow spot, sculpture stronger and denser than in female. Lamellae on metanotum medially with a large lobelike dilation, which may be yellowish distally. Number of yellow lateral spots on abdomen varying from 2-5. Terga distinctly, but finely punctate. All tibiae with a yellow stripe anteriorly. Spines on metatarsus 1 considerably longer than width of metatarsus.

The species has a southern distribution in Denmark and is only found in SJ, Spandet Egekrat, Stensbæk Plantage, and F, Svanninge Bakker. - It is not known from Sweden and Norway. - Finland: rare, but rather widely distributed in the southern and southwestern districts. Northwards to Kb. - Soviet Karelia: Ib and Kr. - A Holarctic species. In the Palaearctic region it is known from most European countries, North Africa through southern Siberia to Japan. In North America the species is found in north-eastern U.S.A.

The nests are constructed in sandy soil, often in stony areas. The first short section of the nesting tunnel is constructed at right angles to the surface. Then follows a more or less horizontally running section, and then the tunnel continues almost vertically downwards. It ends with a single cell, situated 8-13 cm below the surface. The provisioning of the cell may take more than two days. The prey usually consists of Anthomyiidae, but species of Calliphoridae and Syrphidae may also be used. The prey is brought home pinned on the sting (Tsuneki, 1969; Olberg, 1959). The egg is laid after the last prey

has been deposited in the cell, but is placed on the first caught prey. The egg hatches after 2-3 days, and about 8 days later the larva is fullgrown. The cocoon is externally covered with sand grains. As predators are known Smicromyrme rufipes Fabr. (Hym., Mutillidae) and Taxigramma multipunctatum Rond. (Dipt., Sarcophagidae). The larva was described by Evans, 1957.

114. OXYBELUS TRISPINOSUS (Fabricius, 1787)

Fig. 330.

Apis trispinosa Fabricius, 1787:303.

Oxybelus nigripes Olivier, 1811:596.

Female: 6-8.5 mm. Head densely punctate, distance between punctures smaller than their diameter. Interstices may be rugose. Silvery pubescence on face with a slightly reddish tinge, sparse, at times vestigial. Frons behind ocelli with long, erect, brownish pubescence. Mandibles dark, often with faintly reddish centre. Thorax without yellow markings. Scutum with short, dark pubescence. Mesopleuron coarsely and somewhat irregularly rugoso-punctate. Lamellae on metanotum brown-black, the transparent part infuscate. Medially an obtuse dilation is present so that the lamellae in profile become slightly bifid. Propodeal spine with often almost parallel sides, apex rounded. Abdomen densely and finely punctate, with yellow lateral spots on terga 1-3 and sometimes also on tergum 4. Tibiae 2-3 uniformly dark brown, almost as dark as femora. The spines on the external side of these remarkably short and thick.

Male: 5-7 mm. Medial keel on clypeus strongly compressed, sharp-edged, lateral teeth depressed, distally broadly, obliquely truncate (Fig. 330). Mandibles simply attenuate, dark in specimens from Denmark and Fennoscandia. Pronotum with yellow lateral spots, which may form a transverse band. Humeral tubercles generally with yellow spots. Mesopleuron coarsely rugoso-punctate, ventrally with adpressed silvery pubescence, consisting of depressed hairs. This pubescence covers also part of the ventral faces of coxae 2-3. Scutellum may carry two anterolateral spots. Sutures between scutellum and metanotum and between metanotum and propodeum usually yellow. Metanotum, like the median parts of the lamellae, may be yellow. Abdomen with large, oval or ovoid lateral spots on tergum 1. Spots on second, and occasionally also on third and fourth terga narrow, parallel. Yellow pattern on legs very variable. Femur 1 with a large distal spot on external face. Spot on femur 2 may be missing. Femur 3 often with a distal spot dorsally. Tibiae 1-2 yellow with a larger or smaller, brown,longitudinal stripe on the inner side. Tibia 3 with a broad yellow proximal ring. Tarsi yellow, red-yellow or brown.

A few specimens of this species are known from Denmark: SZ, Sorø, Vordingborg; NWZ, Jyderup. - Sweden: very rare, only known from Sk., Sm., Gtl. and Ög. - Not found in Norway. - Finland: a rare southern and south-eastern species, towards the north occurring in Kb. - Soviet Karelia: Ib and Kr. - Widely distributed, but not abundant, in Central, East and South Europe. Additional material from North Caucasus.

The nesting tunnel is often bifurcate, each branch ending in a single cell. The tunnel system is about 5 cm long. As prey are used Anthomyiidae, Muscidae and Calliphoridae. The species produces two generations, at least in South Europe (Bonelli, 1952, 1968-70).

TRIBE CRABRONINI

Taxonomical status much questioned. Here the views of Evans (1964) are followed. A very homogenous group, closely related to the Oxybelini. Forewings with a single cubital and discoidal cell. Eyes very large, the forwardly directed ommatids several times larger than those situated dorsally. Antennae geniculate. Clypeus with dense covering of strongly golden or silvery shining, adpressed pubescence consisting of depressed hairs; the anterior margin with teeth and/or emarginations. Mesopleuron usually with a sharply projecting, precoxal carina which is sometimes reduced to a pointed tubercle. Females and occasional males with pygidial area. The males often with several very conspicuous secondary sexual characters in the antennae and the forelegs. Volsella vestigial or absent.

The tribe is cosmopolitan and comprises 39 genera of which nine are represented in Europe. Ectemnius and Crossocerus comprise by far the largest number of species. Both terrestrial and arboreal nesting habits are displayed. Various dipterous families make up the provision, only occasionally other insect orders are used.

Genus *Crabro* Fabricius

Crabro Fabricius, 1775:373.

Thyreopus Lepeletier & Brullé, 1835:751.

Type-species: Vespa cribraria Linné, 1758.

Rather large, strongly built species with yellow pattern, in habitus similar to Ectemnius. Inner orbits strongly converging ventrally, antennae inserted

very close to each other. Clypeus with well developed silvery pubescence, its anterior margin usually evenly rounded, without teeth or emarginations. Ocelli placed in a very obtuse-angled triangle. Pygidial area of females plane, triangular, surrounded by a sharp carina. Abdomen of males very elongate. Antennae of males with 13 segments. Flagellum often dorso-ventrally flattened and broadened,with strong pubescence ventrally. Mandibles bidentate, without tooth on the inner side. Forelegs of males often strongly modified, tibiae with large, shield-like dilations. Sexual dimorphism in many cases considerably more pronounced in Crabro than in Ectemnius. Mesopleuron without spine in front of coxa 2.

The genus is distributed almost exclusively in the Holarctic region with about 80 species. Only six species in Denmark and Fennoscandia.

The species are met with in the height of the summer, often on large flowering Umbelliferae. The nests are constructed in the soil; the prey consists of Diptera.

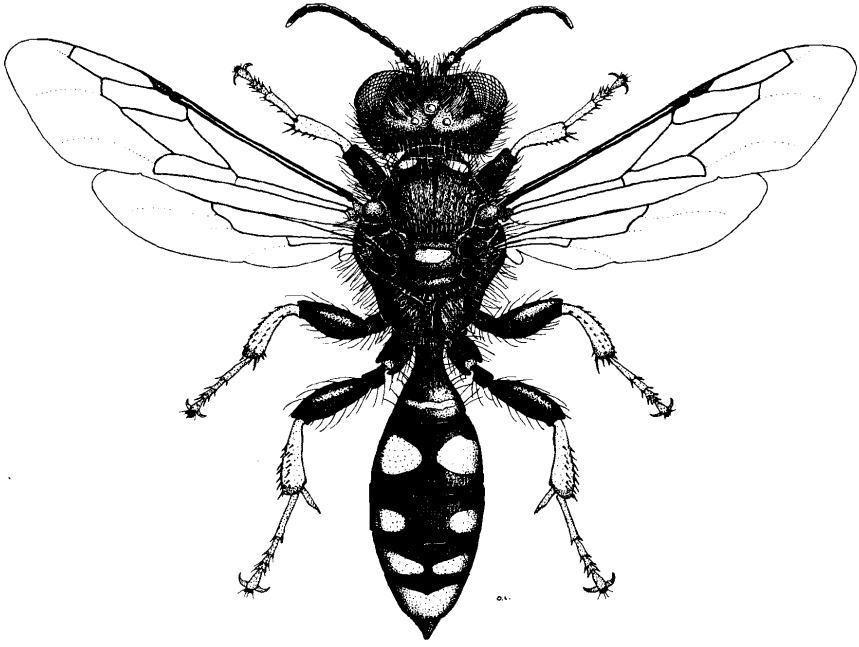


Fig. 332. Female of Crabro cribrarius (L.). Length: 10-16 mm.

Key to species of Crabro

Females

1 Scutum with longitudinal striae. Propodeum evenly rounded, without strong carinae. Vertex depressed like a trough, striate anteriorly. Space between eyes and posterior ocelli twice as large as distance between these ..... 115. cribrarius (Linné)

\- Scutum without striation. Posterior part of propodeum laterally delimited by strong carinae. Frons evenly rounded, vertex without striae. Distance from eyes to lateral ocelli as great as or slightly greater than distance between these 2

2(1) Thorax, especially mesopleuron, dull, with very distinct microsculpture, pubescence long, dark, and erect. Pronotum and humeral tubercle without yellow markings. Sculpture of propodeum weak 3

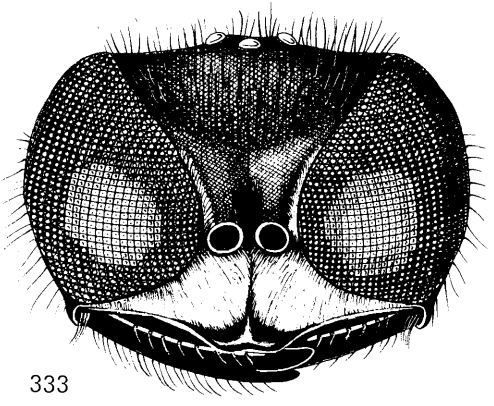
\- Thorax shining, smooth, with or without extremely weak microsculpture; pubescence long and white, or (scutellatus) short and dark. Pronotum often, and humeral tubercle usually, with yellow markings. Propodeum with strongly protruding ribs (except in maeklini) 4

3(2) Scapus all black. Tergum 5 usually with a yellow double spot ..... 119. lapponicus Zetterstedt

\- Scapus with a large yellow spot. Tergum 5 without yellow markings ..... 118. ingricus (F. Morawitz)

4(2) Pronotum with rounded lateral angles, these with a large yellow spot. Propodeum without protruding ribs. Markings of abdomen white-yellow. Tibiae and tarsi red-yellow ..... 120. maeklini A. Morawitz

\- Pronotum with sharp-edged lateral angles. If markings on pronotum are present, they are bright yellow. Propodeum with very strongly protruding carinae, which form a reticulate pattern. Abdomen with bright yellow pattern. Tibiae black and yellow 5



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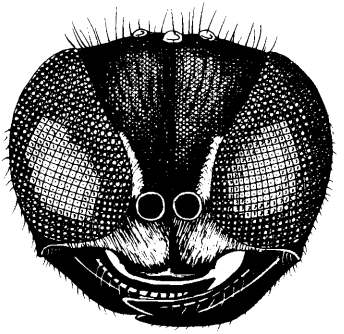

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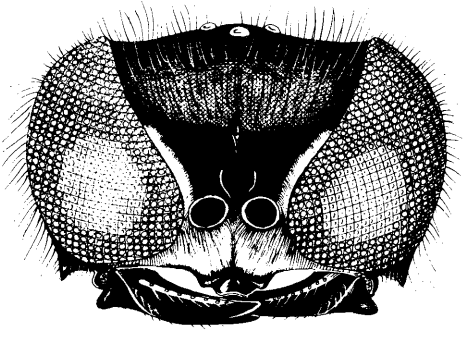

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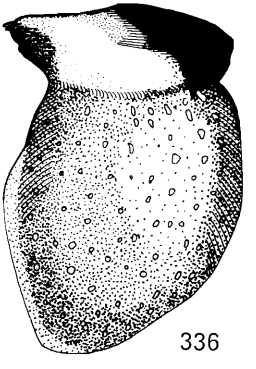

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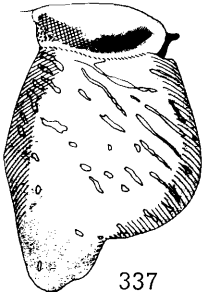

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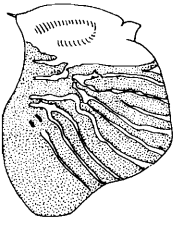

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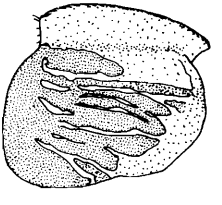

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Figs. 333-335. Heads in frontal view of Crabro. - 333: cribrarius (L.), ♀; 334: same, ♂; 335: lapponicus (Zett.), ♀.
Figs. 336-339. Right femur I in lateral view of male Crabro. - 336: cribrarius (L.); 337: peltarius (Schreber); 338: scutellatus (Scheven); 339: ingricus (F. Morawitz).

5(4) Third antennal segment almost 1.5 times longer than fourth. Tergum 1 usually with large yellow lateral spots. Tibia 1 with a large black spot on the external side. Mandibles black or black-brown ..... 116. peltarius (Schreber)

- Third and fourth antennal segments almost equally long. Tergum 1 without yellow pattern. Tibia 1 with yellow outer side. Mandibles with rust-coloured or red-yellow apex ..... 117. scutellatus (Scheven)

Males

1 Scutum densely and strongly longitudinally striate. Vertex strongly excavate, anteriorly strongly striate. Laterally to the mandibular articulation there is a stout triangular tooth. Femur 1 very short, with a large, irregular process. The shield-shaped dilation with pale dots only (Fig. 336) ..... 115. cribrarius (Linné)

- Scutum punctate. Vertex not excavate, at most with weak rugae (peltarius). No tooth near mandibular articulation. Femur 1 at most with a long, thin process on inner side. If shield-like dilations are present, these, in addition to pale dots, carry pale lines 2

2(1) Forelegs with large shield-shaped dilations. Flagellar segments, except in ingricus, dilated and excavate ventrally 3

- Forelegs and antennae without distinct secondary sexual characters 5

3(2) Last tergum with pygidial area. Head and thorax dull due to strong microsculpture. Antennae not dilated or excavate. Mesopleuron without horizontal, pitted furrow ..... 118. ingricus (F. Morawitz)

- Pygidial area absent. Head and thorax shiny, without microsculpture. Antennae strongly dilated and excavated ventrally. A very coarsely pitted furrow issues from the episternal suture posteriorly towards coxa 2 4

4(3) Flagellar segments ventrally with a fringe of

long, pale hairs. Segments 4-7 twice as broad as long. Trochanter 1 ventrally near apex with a short spine ..... 116. peltarius (Schreber)

- Flagellar segments without hair fringe, with only adpressed short hairs. Segments 4-7 almost as broad as long. Trochanter 1 without spine ..... 117. scutellatus (Scheven)

5(2) Last tergum with pygidial area. Abdomen with white-yellow markings on terga 2-6, often additional small lateral spots on tergum 1. Tibiae rust-coloured with a yellow proximal spot ..... 120. maeklini (A. Morawitz)

- Last tergum without pygidial area. Abdomen with bright yellow markings on terga 2 and 3. Tibiae black with a yellow proximal spot 119. lapponicus Zetterstedt

115. CRABRO (CRABRO) CRIBRARIUS (Linné, 1758)

Figs. 332-334, 336.

Vespa cribraria Linné, 1758:573.

Female: 10-16 mm. Head very broad, in front view as Fig. 333. Vertex in front of ocelli with dense longitudinal striae, usually with dull surface. Punctation fine and sparse. Facial fovea well developed. Ocelli placed in a very obtuse angle, distance from a lateral ocellus to inner orbit about twice as large (1.8 x) as distance between the lateral ocelli. Frons with long, erect, black-brown pubescence. Head ventrally with gradually paler pubescence. Clypeus with triangular, non-pubescent, slightly concave area just behind anterior margin. Mandibles black, sometimes with a faintly red-brown area subapically. Antennae black, but scapus often with a small distal yellow spot on inner side. Pubescence on scapus long, white and erect. Pronotum usually with yellow lateral spots; these never fuse into a transverse band, but may be strongly reduced or missing. Scutum posteriorly with dense longitudinal striae, shiny. Anteriorly with rugoso-punctate sculpture, often with an interstitial, very fine microsculpture. Scutellum shiny, sparsely punctate, with or without yellow median spot. Whole thorax with long pubescence, brownish dorsally, whitish ventrally. Mesopleuron laterally rather shiny, with sparse punctation and very fine reticulate microsculpture. Propodeum with a broad, strongly pitted, median furrow, which together with the anterior, also coarsely pitted transverse furrows, forms a T-shaped area. The remaining part of

propodeum with fine and rather superficial sculpture. Abdomen with yellow transverse bands on terga 1, 4 and 5. In addition, large yellow lateral spots on tergum 2 and a few smaller ones on tergum 3. Femora black. Tibia 1 yellow with a large dark spot on the inner side, distally on the outer side a row of stout spines is found. Metatarsus 1 with 4 stout spines. Tibiae 2-3 and tarsi 2-3 uniform yellow or yellow-brown; tibiae, especially the posterior ones, with very strong spines on outer side.

Male: 9-16 mm. Head in front view as Fig. 334. Striation in front of ocelli stronger and more regular than in female. Anterior margin of clypeus narrowly projecting centrally, lateral teeth distinct. Mandibles near articulations with strong swelling. Just dorsal to this is found a strong tooth. Scapus thickened distally, sometimes with a small yellow spot. Flagellum strongly depressed and dilated, especially the proximal segments with concave ventral face and well developed pubescence. Pronotum with projecting lateral angles; yellow lateral spots are often absent. Scutum with strongly developed longitudinal striation over the entire surface. Spot on scutellum may be missing or be divided into two. Pubescence on head and thorax as described in female. Abdomen with yellow transverse bands on terga 1 and 4-6, and lateral spots on terga 2 and 3. Sternum 7 on either side with compressed rounded tooth. Forelegs very strongly modified. Trochanter depressed ventrally, somewhat dilated and with distal spine. Femora with large, irregular dilation and a smaller, more proximally placed spine. Often a small distal yellow spot is present on front femora. The shield-shaped dilation on tibiae with light, transparent dots (Fig. 336). Tarsi strongly dilated, mesal claw very well developed, the lateral very reduced. Femur 2 strongly dilated, with basal, longitudinal pad. Tibia 2 curved, with a weak, dark-coloured dilation distally on inner side.

The species is common in Fennoscandia and Denmark. Northern distribution limit in Sweden in Jmt. and Ång.; in Norway in MRy and On (a single specimen from TRy); in Finland in Kb and Ok. - Soviet Karelia: Ib and Kr. - The distribution area covers Europe and expands through Asia to Mongolia. The species is also recorded from Korea.

The nest is usually constructed in the soil, in sandy ground exposed to the sun, but the species has also been found nesting in decayed wood (Kohl, 1915). The main tunnel is 15-20 cm long, and ends in a cell. Later two or three cells are constructed at the end of short side branches. The walls of the tunnel system are carefully smoothed. As provision are used medium-sized Diptera of the families Muscidae, Anthomyiidae, Calliphoridae, Therevidae, Tabanidae, and Syrphidae. Each cell contains from 5 to 8 specimens.

Note. Moscar (1901) described C. cribrarius var. inornatus which is distributed in Caucasus, Siberia and northern Mongolia, and Kokujev (1927) published C. cribrarius var. hypotheticus from the region around the Lake Bajcal. Both these forms are melanistic, but all transitions from typical coloured specimens to melanistic forms occur in several European countries. The variation is probably climatically conditioned.

116. CRABRO (CRABRO) PELTARIUS (Schreber, 1784)

Fig. 337.

Sphex peltaria Schreber, 1784:98.

Female: 9-13 mm. Vertex convex, densely punctate, without striation, but with distinct reticulate microsculpture. Distance between lateral ocelli as great as distance to inner orbits. Anterior margin of clypeus very broadly protruding in the middle, evenly rounded. Specimens from Central and South Europe often have two yellow spots on clypeus. Mandibles dark in specimens from Denmark and Fennoscandia, sometimes there is a faint yellowish or red-brown spot along dorsal margin. Scapus with a shorter or longer yellow mark along anterior face. Pubescence on head white. Pronotum with small lateral angles, dorsally without yellow markings in Danish and Fennoscandian specimens. A few specimens from Denmark (SJ) have very small lateral spots. Humeral tubercle, as well as scutellum, often with yellow spots in Danish and South Scandinavian specimens. Scutum shiny, evenly and rather densely punctate. Mesopleuron at most with indicated microsculpture, laterally with very sparse punctation. Pubescence on thorax short. Propodeum dorsally with very coarse, irregular, reticulate sculpture. Abdomen with yellow lateral spots on terga 1-4, tergum 5 with a narrow transverse band. Spots on tergum 4 may coalesce. Spots on tergum 1 only exceptionally missing. Sculpture on pygidial area rather coarse, punctures partly coalescing. Femora usually with yellow or yellow-brown apical spot. Tibia 1 yellow, dark on inner side and with a larger or smaller black spot on outer side. Tibia 2 with a black spot on inner side. Tibia 3 yellow dorsally and yellow-brown ventrally.

Male: 9-12 mm. Vertex in front of ocelli strongly, slightly radially, and somewhat irregularly striate. Pubescence long, white. Genae with very strong concavities. Clypeus with very slightly protruding lateral teeth. Mandibles usually uniformly dark, a light stripe may sometimes be found dorsally. Proximally a triangular concave area. Scapus with yellow frontal face. Proximal segments of flagellum strongly dilated, excavated ventrally. Thorax without yellow markings. Pronotum with distinct lateral angles. Scutum shining, strong-

ly punctate. Mesopleuron ventrally with dense, silvery pubescence, ventro-laterally a horizontally running, strongly pitted furrow. Sculpture dorsally on propodeum strongly outstanding. Abdomen with yellow transverse bands on terga 4 and 5, and yellow lateral spots on terga 1-3. Small yellow spots are also often found on sterna 2 and 3. Sternum 7 distally protruded into two sharp, tooth-shaped processes. Trochanter 1 with short distal spine. Femur 1 with a large, broad dilation and a proximal, slender, strongly curved spine. Dilation of tibia 1 with transparent oblong spots and lines (Fig. 337). Tarsus 1 strongly dilated and depressed, pale, mesal claw very strongly modified, basal lobe transparent, the claw itself drawn out into a long slender spine, the lateral one normally developed. Femur 2 and trochanter 2 yellow ventrally, not dilated, metatarsus 2 very long and slender.

The species is common in Fennoscandia and Denmark. - The northernmost records are in Sweden from Jmt., Ång., Vb.; in Finland from Ok and ObS. - From Norway the species is only known from the southern districts. - Soviet Karelia: Ib and Kr. - Distributed from the Atlantic Ocean and the North Sea in the west to the Pacific Ocean in the east.

The species prefers sloping, sandy localities as nesting places. The main tunnel often has a strongly undulating course descending as far as 28 cm into the soil. The nest contains up to 7 cells. Many families of Diptera serve as prey; e.g. Dolichopodidae, Therevidae, Stratiomyidae, Muscidae, and Calliphoridae. Each cell contains up to 9 specimens, depending on the size of the prey, and sex of the offspring. In rainy weather and during the night, the females remain in the nest, whereas the males seek shelter in cavities in wood. As parasites are known Myrmosa melanocephala Fabr. (Hym., Myrmosidae), Sphecapata conica Fall. and Metopia argyrocephala Meig. (Dipt., Sarcophagidae). For more details, see Simon Thomas & Veenendaal, 1974.

Note. Distribution of the yellow pattern, especially in females, seems to be geographically conditioned, since in specimens from the northernmost parts of the distribution-range, it is considerably reduced. Southwards the extent of the yellow markings gradually increases.

117. CRABRO (CRABRO) SCUTELLATUS (Scheven, 1781)

Fig. 338.

Sphex scutellata Scheven, 1781:82.

Female: 8-11 mm. Vertex evenly and densely punctate, with very fine microsculpture. Facial fovea very indistinct or missing. Anterior margin of clypeus evenly rounded, without any processes, the silvery pubescence very sparse.

Mandibles often with red-yellow or rust-coloured middle. Scapus very rarely with yellow spot. Pubescence of head comparatively short, white. Pronotum with very slight projecting lateral angles, sometimes very faint yellowish lateral spots may occur. Humeral tubercle only seldom with yellow spot. Scutum very densely and rather coarsely punctate. Mesopleuron finely punctate, as a rule with distinct reticulate microsculpture. Occasional specimens have an indistinct tooth in front of coxa 2. Propodeum very coarsely sculptured. Abdomen with white-yellow lateral spots on terga 2-4 and a transverse band on tergum 5. Pygidial area with rather weak longitudinal ribs. Tibiae and tarsi yellow and yellow-brown, tibia 1 with a dark spot ventrally. Metatarsus 1 with 5-6 spines.

Male: 7-11 mm. Vertex in front of ocelli coarsely and densely, but rather superficially punctate. Genae with strong concavities and two large, triangular processes. Clypeus usually black, but may have two yellow spots. Scapus slightly dilated, yellow ventrally, flagellum very slightly dilated, proximal segments without hair fringe. Mandibles with basal tooth-like process. Thorax without yellow markings. Pronotum with well developed lateral angles. Mesopleuron ventrally with silvery pubescence, ventro-laterally with a very coarsely pitted horizontal furrow. Propodeum with strong ribs. Abdomen with yellow markings on terga 2 and 3. In addition, narrow bands may be present on terga 4 and 5. Completely black specimens may occasionally occur. Femur 1 with large, rounded dilation, near the middle with a long slender spine. Dilation on tibiae with long, transparent stripes (Fig. 338). The mesal claw on the pale, strongly flattened tarsus 1 represented by a thin almost membranous lamella. Femur 2 compressed basally, with two broad, yellow, longitudinal bands.

Very few specimens exist from Denmark: EJ, Grejsdalen, Thorsø. - Sweden: rather rare, but locally (Gotland) occurring fairly frequently; northernmost findings in Vrm. and Gstr. - Norway: a few specimens from AK, Lillestrøm, and Bø, Aamot. - Finland: a southern and south-eastern distribution, northwards to Om and Ok. - Soviet Karelia: Ib and Kr. - A fairly rare species. The distribution area covers most of Europe and extends through southern Siberia til Irkutsk.

The species is found nesting in sandy soil, often in aggregations. As prey especially Dolichopodidae are used.

118. CRABRO (CRABRO) INGRICUS (F. Morawitz, 1888)

Fig. 339.

Thyreopus ingricus F. Morawitz, 1888:294.

Female: 9-12 mm. Head dull with fine, granular sculpture, without proper

punctation. Mandibles black with rust-coloured apex. Scapus with a large yellow apical spot, flagellum black. Pronotum black with very slightly projecting lateral angles, but with strong microsculpture - at least anteriorly and laterally - distinct. Scutellum shining, with indistinct microsculpture. Episternal furrow comparatively slightly pitted. Mesopleuron otherwise with weak and sparse punctation, very strongly microsculptured. Propodeum rather shiny, without ribs, dorsally without proper sculpture, with a deep, marginate median furrow. Posterior area of propodeum almost plane, laterally well delimited by sharp carinae. Thorax with long, erect, brownish pubescence. Abdomen with large, yellow, lateral spots on terga 2 and 3. Spots on tergum 4 vestigial or missing. Femora black with a small yellow apical spot. Tibiae yellow with brown apex. Tarsi brown-yellow.

Male: 9-11 mm. Colour pattern and sculpture as in female. Antennae without dilations, excavations or hair-fringe. Last segment slightly curved and depressed. Third antennal segment twice as long as broad. Lateral angles of pronotum rather strongly projecting. Last tergum with distinct pygidial area. Trochanter 1 distally on ventral face rather strongly, triangularly dilated. Femur 1 basally with a long, thin, slightly curved spine. Dilation of tibia 1 with transparent lines (Fig. 339), metatarsus 1 only very slightly dilated and depressed, remaining tarsal segments not depressed or dilated.

The species is recorded from Soviet Karelia from the surroundings of Lake Ladoga and Lake Onega (Ib and Kr.) - Very sporadic occurrence and very rare in Europe: western Russia, Hungary, Roumania and Switzerland.

119. CRABRO (ANOTHYREUS) LAPPONICUS Zetterstedt, 1838

Fig. 335.

Crabro lapponicus Zetterstedt, 1838:433.

Female: 9-11 mm. Head and thorax with strongly developed microsculpture, dull, with long brownish pubescence. Facial fovea and frontal line distinct. Punctation of head indistinct, superficial. Clypeus without teeth or emarginations, anterior margin evenly rounded (Fig. 335), silvery pubescence thin. Mandibles strongly curved, antennae uniformly black. Pronotum with indistinctly indicated lateral angles. Punctation on scutum distinct, but superficial. On scutellum a very effaced yellow transverse spot may be found. Episternal furrow deeply pitted. Dorsally on propodeum a slightly defined area cordiformis with a longitudinal, somewhat irregularly striate sculpture is found. Median furrow deep. The area is surrounded by a weak, semi-circular furrow and carina. Propodeum laterally often with transverse carinae, delimitation of the posterior

area indistinctly marked. Abdomen short and broad, with large yellow lateral spots on terga 2 and 3. Tergum 5 with transverse band, which may be very narrowly interrupted in the middle. Specimens from Central Europe often have yellow lateral spots on terga 1 and 4. Pygidial area with very fine microsculpture, densely punctate. Femora black. Tibia 1 with a broad yellow stripe along anterior face. Tibia 2 with a proximal yellow ring, which may continue in a weak stripe to apex. Basal half of tibia 3 yellow. Wings fuscous.

Male: 9-11 mm. Microsculpture on head and thorax stronger than in female. Antennae uniform black, flagellum filiform, without hair-fringe, with very narrow tyloidea. Pubescence ventrally on thorax white. Sculpture of area cordiformis very irregular, stronger than in female. Abdomen with yellow spots on terga 2 and 3. Sometimes also two small lateral spots are found on tergum 1. Legs without conspicuous secondary sexual characters, coloured as in female.

A rather common species in northern Fennoscandia up to the Barents Sea north of Norway. Southern distribution limit in Sweden in Dlr. and Sdm., in Norway in BØ and TEi. - The species has been found in all Finnish districts except Ka, St, and Oa. - Soviet Karelia: only recorded from Kr. - The species is rare outside Fennoscandia and only recorded from mountainous regions in Germany, Poland and Czechoslovakia.

The nests are often found in aggregations, e.g. on sandy paths. The main tunnel descends about 10 cm into the ground, and thereafter turns almost horizontally. On the latter stretch 2-4 cells are constructed, which are provisioned with e.g. species of Rhagionidae (Diptera).

120. CRABRO (ANOTHYREUS) MAEKLINI A. Morawitz, 1866

Crabro (Anothyreus) maeklini A. Morawitz, 1866:262.

Female: 10-11 mm. Sculpture on head and thorax as in lapponicus, but finer Pubescence long and erect, white or silvery. Pronotum, metanotum and usually also scutellum with white-yellow spots. Abdomen with white-yellow lateral spots on terga 2-4, tergum 5 with transverse band. Femora black, tibiae red-yellow with proximal white-yellow spots.

Male: 9-10 mm. Head in dorsal view only slightly narrowed behind eyes, pubescence whitish. Thorax shining, only on mesopleuron with distinct microsculpture. Scutum with indications of radiate striation. Lateral angles of pronotum white-yellow, protruded in a tooth. Metanotum with yellow double spot. Area cordiformis as in female, with weak longitudinal rugae. Lateral faces of propodeum with irregular striae, with interstitial microsculpture.

Abdomen with white-yellow lateral spots on terga 1-4 and a transverse band on terga 5 and 6. The spots on tergum 1 are often reduced. Tergum 7 with distinct pygidial area. Legs of same colour as in female.

This high-boreal species has a very discontinuous distribution in northern Fennoscandia, eastern Siberia (Okhotsk) and northern Mongolia. In Fennoscandia it is not uncommon, occurring in Sweden in T.Lpm.; in Norway in southern and northern Nordland and in Finmark. - Finland: north of the Arctic Circle in ObN, Lk, Le and Li.- U.S.S.R.: Lr, Petsamo.

The nests are constructed in even slopes with sandy soil (Merisuo, 1932). As distinct from lapponicus, no accumulation of dug out material is found round the entrance. The main tunnel, whose diameter is about 3 mm, descends 10-12 cm into the ground, where it may divide into two short branches, each ending in a cell. The provision consists of flies of the genera Trichopticus, Coenosia and Lophosceles (Dipt., Muscidae).

Genus *Ectemnius* Dahlbom

Crabro (Ectemnius) Dahlbom, 1845:389.

Type-species: Crabro guttatus van der Linden, 1829.

Large to medium-sized, robust species (Fig.340) with black and yellow pattern. Eyes very large, inner orbits strongly converging ventrally so that the antennae are inserted very close to each other. Ommatids of very diverse sizes. Those directed forwards many times larger than those situated near posterior margin of eye. Clypeus with strong silvery or golden pubescence, its anterior margin with species-specific teeth and emarginations. Scapus usually more than four times longer than broad, its yellow colour more or less extensive. Flagellum black, its second segment always longer than the third. In the male these segments may have excavations ventrally or protruding teeth, which are of great taxonomic value. In front of coxa 2 a sharp arcuate or angular carina is always present on mesopleuron (precoxal carina). Forewings with only one cubital and discoidal cell. Abdomen with yellow lateral spots and/or transverse bands. Pygidial area of female usually excavated in a groove posteriorly, bordered by strong, golden bristles. Males with 12 antennal segments. The yellow pattern is only very seldom completely absent, but usually varies considerably within a species. Its value as a key character is therefore limited. In the description of the species this variation is discussed in broad terms. It is mainly influenced by geographical and climatic factors, and specimens from southern Europe have a considerably more extensive

yellow pattern than specimens from Denmark and Fennoscandia. Even within the border of the last mentioned regions the variation is very conspicuous.

The genus is cosmopolitan, but with most species in the Holarctic region.

The species nest in old timber, where the nests are constructed by means of the very well developed mandibles. Males as well as females are often seen foraging in flowering Umbelliferae. The prey consists of Diptera.

Key to species of Ectemnius

Females

1	Scutum without punctures, finely and regularly striate. Entire anterior part regularly, transversely striate. Remaining part with longitudinal striae	2
-	Scutum different, often with fine rugae between punctures	3

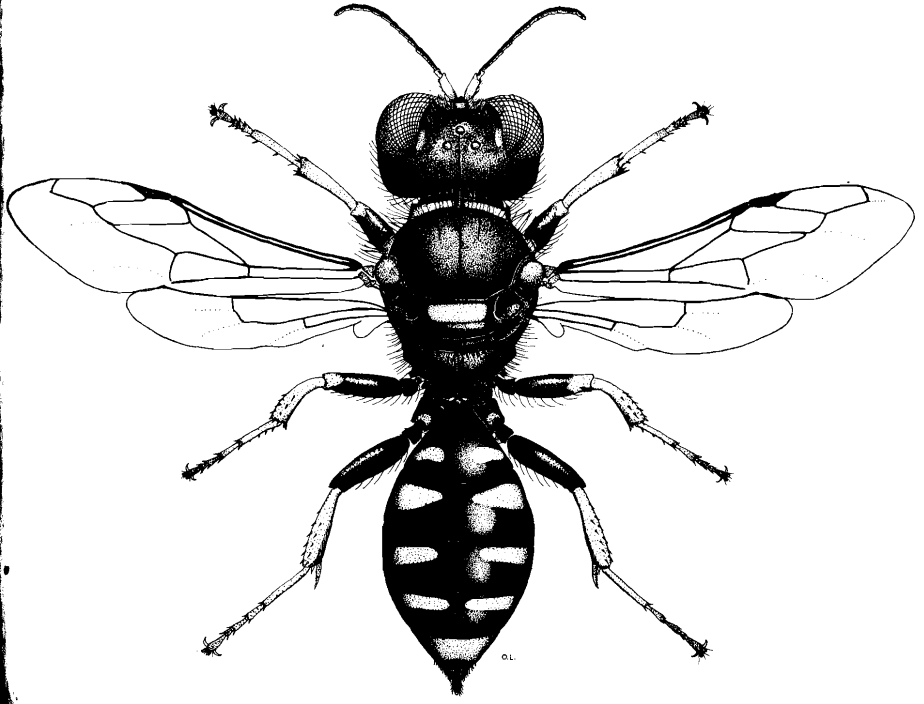


Fig. 340. Female of Ectemnius cavifrons (Thomson). Length: 11-16.5 mm.

2(1) Lateral angles of pronotum strongly projecting as angles or teeth. Lateral faces of propodeum strongly transversely striate. Greatest width of head across mandibular articulations (Fig. 341). ..... 121. fossorius (Linné)

\- Lateral angles of pronotum rounded. Lateral faces of propodeum very densely and finely striate. Greatest width of head across middle of eyes (Fig. 342) ..... 122. cephalotes (Olivier)

3(1) Third antennal segment at least 3 times longer than distal width. Pubescence on clypeus golden shining. 4

\- Third antennal segment less than 3 times as long as distal width. Pubescence of clypeus silvery or pale golden 7

4(3) Head in front view broad and approximately rectangular in outline (Fig. 344). Median lobe of clypeus arcuately or slightly angularly emarginate. Lateral lobes rounded and plump. Third antennal segment 4 times longer than broad distally. Lateral faces of propodeum coarsely striate. Bands on abdomen usually not interrupted in the middle. Venter with yellow markings .. 124. sexcinctus (Fabricius)

\- Head in front view approximately trapezoid. Bands on abdomen interrupted in the middle. Venter black 5

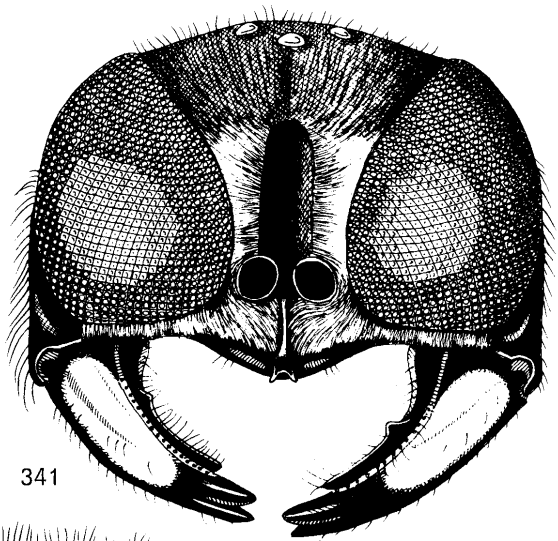
5(4) Ocelli forming an acute angle. Vertex surrounding ocelli depressed like a trough. Lateral lobes of clypeus small (Fig. 345). Lateral faces of propodeum very finely and densely striate, usually with silky lustre. Third antennal segment 4 times longer than broad ..... 125. cavifrons (Thomson)

\- Ocelli forming an obtuse angle. Vertex not or slightly depressed. Third antennal segment 3-3.5 times longer than broad 6

6(5) Lateral lobes of clypeus small, obliquely forwardly-directed, separated from median lobe by distinct emargination (Fig. 347). Posterior face of propodeum forming a more or less distinct-

ly delimited triangular area, which is indistinctly and irregularly, transversely, partly reticulately rugose. Interstices between rugae of area cordiformis shiny ..... 127. lapidarius (Panzer)

- Lateral lobes of clypeus very strong, directed laterally (Fig. 346), the median keel distinct, combining with the anterior margin of the median



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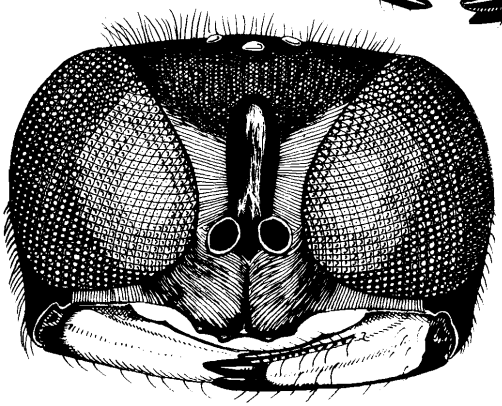

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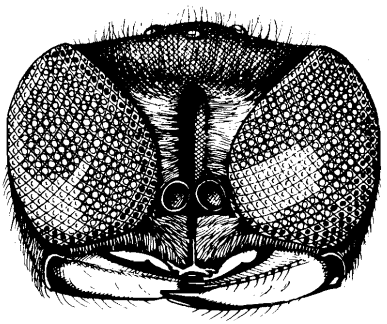

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Figs. 341-343. Heads in frontal view of female Ectemnius. - 341: fossorius (L.); 342: cephalotes (Oliv.); 343: lituratus (Panz.).

lobe to form a shiny T-shape. Posterior face of propodeum very finely punctate with dense, fine striae, continuing laterally. Interstices dull between rugae of area cordiformis ..... 126. ruficornis (Zetterstedt)

7(3) The shiny area above antennal sockets without transverse carina dorsally. Scutum with conspicuous, long, erect pubescence. Posterior face of propodeum not sharply delimited laterally 8

- The shining area above antennal sockets dorsally delimited by a carina. Pubescence on scutum short. Posterior face of propodeum usually laterally delimited by a strong carina, so that a triangular area is formed 11

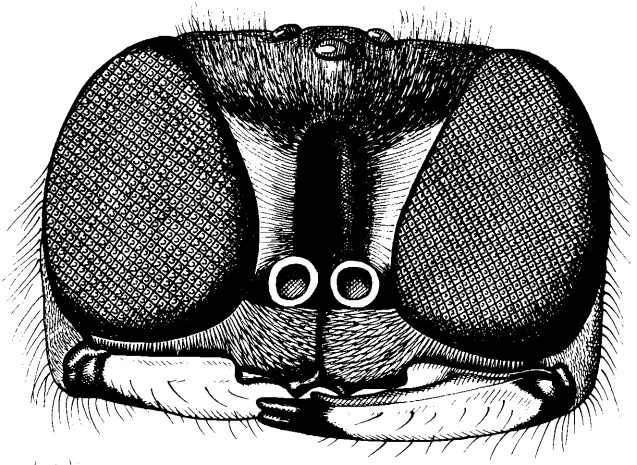
8(7) Thorax without yellow markings. Mesopleuron shiny, without striation ..... nigritarsus (Herrich-Schäffer)

- Pronotum usually with two yellow lateral spots, sometimes almost effaced. Mesopleuron strongly transversely striate 9

9(8) Frons in front of ocelli with shiny interstices between punctures. Distance between the anterior and a lateral ocellus smaller than diameter of ocellus. Pronotum with rounded lateral angles. Terga 1-5 with yellow bands, which may be missing on first and interrupted on third ..... 123. lituratus (Panzer)

- Frons in front of ocelli without shiny areas between punctures. These often form ruga-like rows. Distance between the anterior and a lateral ocellus greater than diameter of an ocellus. Pronotum usually with sharp lateral angles. Terga 1 and 3 usually without yellow markings 10

10(9) Anterior margin of median lobe of clypeus broad, slightly angularly emarginate. Lateral lobes very indistinct (Fig 349). The very regular, fine and dense striation laterally on propodeum continues uninterruptedly on posterior face. Third antennal segment about twice as long as wide ..... 128. continuus (Fabricius)



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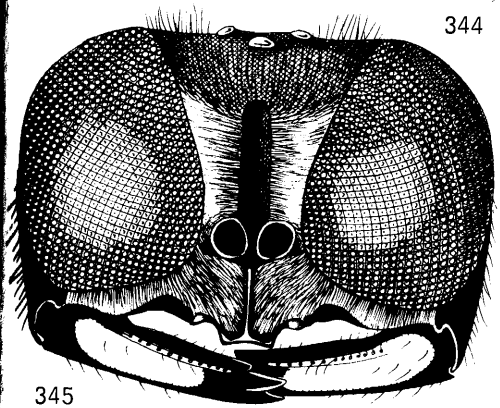

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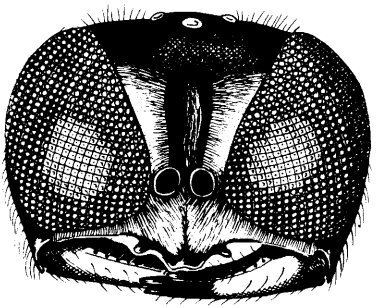

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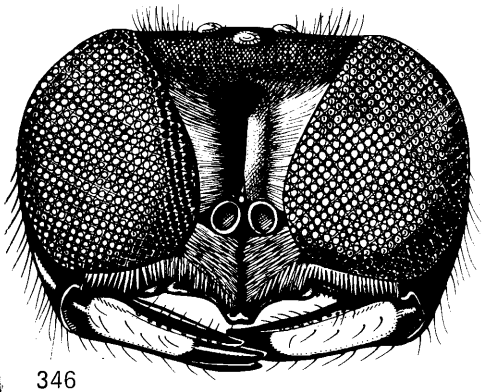

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Figs. 344-347. Heads in frontal view of female Ectemnius.
344: sexcinctus (Fabr.);
345: cavifrons (Thomson);
346: ruficornis (Zett.);
347: lapidarius (Panz.).

- Anterior margin of clypeus with three rounded tubercular processes (Fig. 350). Striae on lateral faces of propodeum not continued on posterior face. Sculpture here consists of very irregular rugae. Third antennal segment not quite 1.5 times longer than broad ..... 129. rubicola (Dufour & Perris)

11(7) Lateral angles of pronotum usually projecting as a strong, forwardly-directed, acute tooth. Third antennal segment distinctly longer than fourth. Pubescence on clypeus faintly golden-shining. Lateral faces of propodeum uniformly, very finely and densely striate ..... 130. dives Lepeletier & Brullé

- Lateral angles of pronotum rounded or with a very small, upwardly directed, obtuse tooth. Clypeus with silvery pubescence. Lateral faces of propodeum interspersed with coarser striae 12

12(11) Carina dorsally delimiting smooth area dorsal to antennal sockets usually angularly bent. Scutellum usually shiny in the middle, without rugae. Tibia 2 brown only on the inner side or entirely brown. Pronotum dorsally usually without yellow pattern. Third antennal segment only slightly longer than fourth ..... 132. borealis (Zetterstedt)

- Carina dorsally delimiting smooth area dorsal to antennal sockets forming an even, shallow arc. Scutellum longitudinally rugose throughout its length. Tibia 2 pure yellow, sometimes with an effaced darker spot on inner side. This spot is larger in Lapland specimens. Pronotum with yellow pattern dorsally ..... 131. guttatus (v.d.Linden)

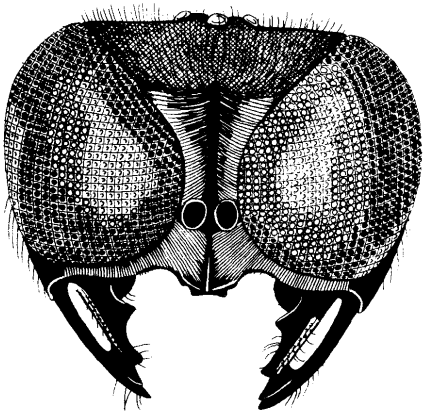
Males

1 Scutum impunctate but very finely and regularly striate. Anterior half of scutum regularly transversely striate. Stripes parallel to posterior margin of pronotum 2

- Scutum punctate with rugose interstices 3

2(1) Third flagellar segment with strong excavation

ventrally, fifth segment also excavate, distally on ventral face produced into a truncate tooth



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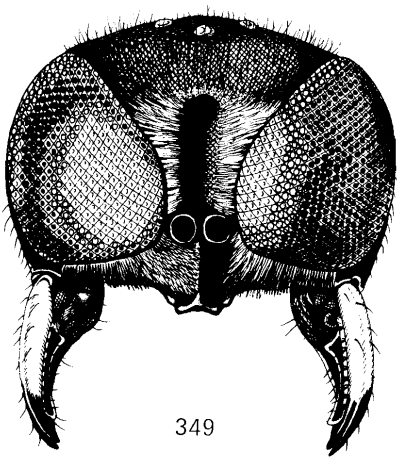

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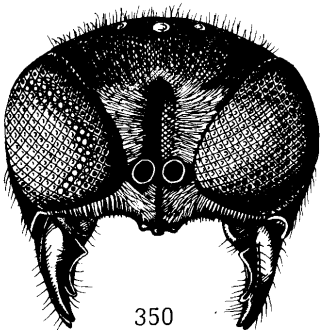

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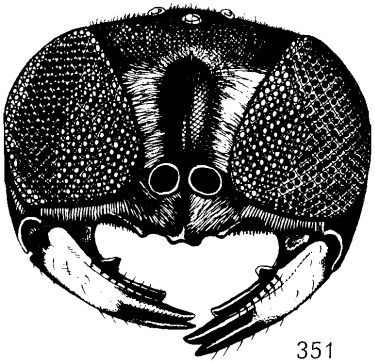

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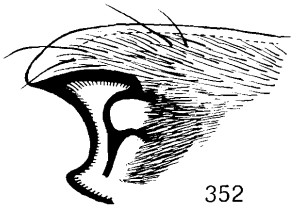

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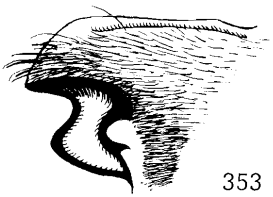

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Figs. 348-351. Heads in frontal view of female Ectemnius. - 348: nigritarsus (Herrich-Schäffer); 349: continuus (Fabr.); 350: rubicola (Duf. & Perris); 351: dives (Lep. & Brullé).
Figs. 352-353. Clypeus in lateral view of female Ectemnius. - 352: dives (Lep. & Brullé); 353: borealis (Zett.).

(Fig. 359). Trochanter 1 with blunt, triangular, ventrally directed dilation ..... 121. fossorius (Linné)

\- All flagellar segments normal. Trochanter 1 without dilation ..... 122. cephalotes (Olivier)

3(1) Metatarsus 1 and second tarsal segment broad, colourless and transparent. Second tarsal segment much larger than third, and differing considerably in colour from that and the following. Third antennal segment in dorsal view at most twice as long as wide apically, ventrally usually strongly excavate, fourth and sixth segments slightly excavate 4

\- Metatarsus 1 and second tarsal segment of normal shape and colour. Tarsal segments 2-4 gradually decreasing in size 6

4(3) Metatarsus 2 asymmetric, short, laterally dilated (Fig. 375). Metatarsus 1 ventrally with 4 strong, broad, flattened spines (Fig. 372). Lateral angles of pronotum produced into very stout, forwardly directed teeth ..... 130. dives Lepeletier & Brullé

\- Metatarsus 2 normal, symmetrical. Metatarsus 1 ventrally with vestigial spines. Lateral angles of pronotum not, or only very slightly produced 5

5(4) Third antennal segment excavate ventrally, distinctly longer than fourth. Lateral angles of pronotum rounded or obtuse ..... 132. borealis (Zetterstedt)

\- Third antennal segment not, or slightly excavate ventrally, as long as fourth. Lateral angles of pronotum acute ..... 131. guttatus (v. d. Linden)

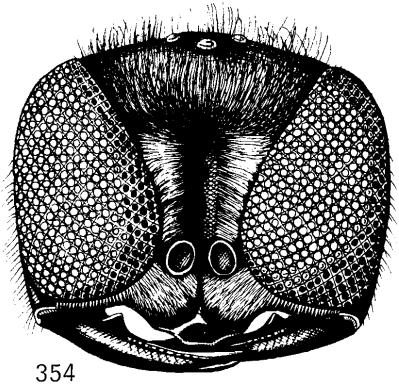
6(3) Third antennal segment in dorsal view at most 3 times longer than thick apically, not excavate ventrally 7

\- Third antennal segment 3-4 times longer than thick apically, ventrally with two excavations .. 10

7(6) Mesopleuron smooth, with fine punctation. Legs mainly black. Abdomen without yellow markings

on terga 1 and 4. Head very strongly narrowed ventrally. Tooth on inner side of mandibles very strongly developed (Fig. 357). Last tergum with pygidial area ..... nigritarsus (Herrich-Schäffer)

- Mesopleuron transversely rugose. Legs with



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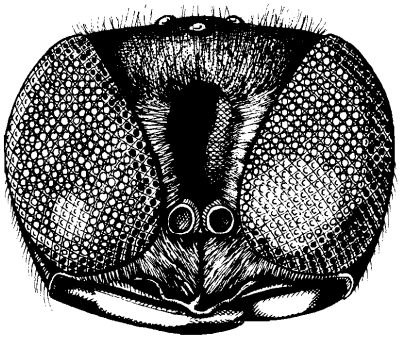

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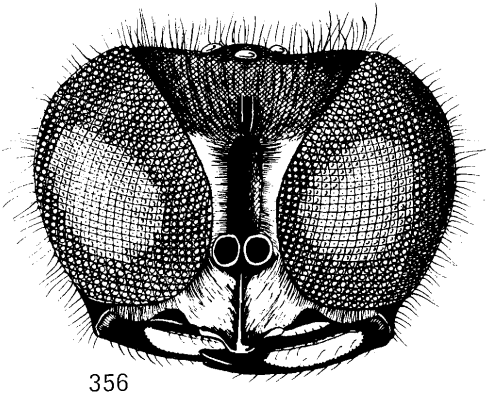

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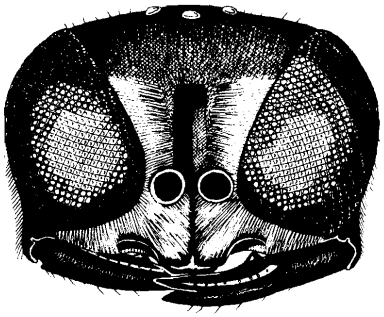

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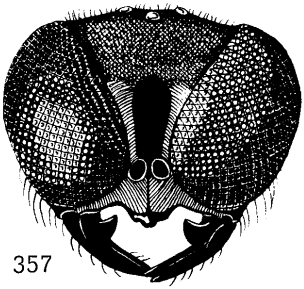


357

Figs. 354-358. Heads in frontal view of male Ectemnius. - 354: fossorius (L.); 355: sexcinctus (Fabr.); 356: cavifrons (Thomson); 357: nigritarsus (Herrich-Schäffer); 358: continuus (Fabr.).

extensive yellow markings. Tergum 4 with yellow lateral spots or a transverse band. Tooth on inner side of mandibles much weaker. Last tergum without pygidial area 8

8(7) No antennal segments excavate ventrally, 3rd-11th with a narrow, pale brown longitudinal pad. Abdomen with very extensive yellow pattern ..... 123. lituratus (Panzer)

- Antennal segment 6 more or less distinctly, fifth often slightly, excavate ventrally. Flagellum without longitudinal pads ventrally. Abdomen usually without yellow pattern on terga 1, 3, 6 and 7 9

9(8) Metatarsus 2 and tarsal segment 3 in lateral view each with a strong tooth-like dilation distally on ventral face (Fig 368). Ventral edge of femur 1 in lateral view evenly curved ..... 128. continuus (Fabricius)

- Metatarsus 2 and tarsal segment 2 normal. Femora proximally with sharp-edged dilation (Fig. 371) ..... 129. rubicola (Dufour & Perris)

10(6) Third antennal segment with a dorsal swelling, proximal tooth slender, distal one broad and thick, cone-shaped. Segments 4 and 5 slightly excavate (Fig. 364). Flagellum except pedicellus ventrally black ..... 127. lapidarius (Panzer)

- Third antennal segment not swollen, teeth almost equal, segments 4 and 5 strongly excavate, with large teeth. Ventral face of flagellum except terminal segments more or less pale 11

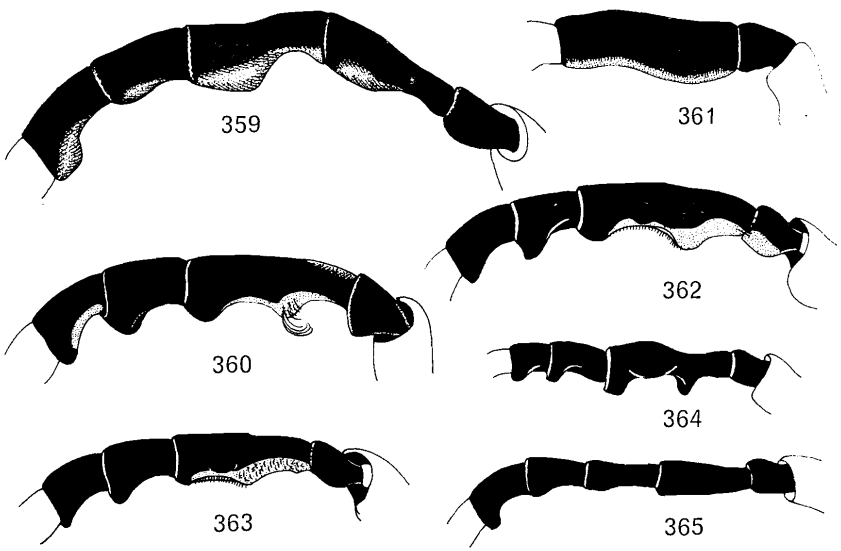
11(10) Proximal tooth on third antennal segment cone-shaped with a small tuft (or a single hair) of light curly hairs apically (Fig. 360). Pubescence of frons brown. Lateral faces of propodeum coarsely striate..... 124. sexcinctus (Fabricius)

- Proximal tooth on third antennal segment without hair tuft. Pubescence of frons black.

Lateral faces of propodeum finely striate 12

12(11) Third antennal segments in dorsal view about four times longer than wide centrally, sides distinctly curved in an S-shape (Fig. 361). Distance between the proximal two teeth ventrally on flagellum greater than distance between 2nd and 3rd (Fig. 362). Vertex distinctly depressed (Fig. 356). Pubescence of clypeus pale golden, seldom silvery ... 125. cavifrons (Thomson)

\- Third antennal segment in dorsal view about three times longer than wide centrally, sides straight, almost parallel. Distance between the proximal two teeth on flagellum almost equal to the distance between the second and the third (Fig. 363) ..... 126. ruficornis (Zetterstedt)



Figs. 359-365. Proximal part of antennae of male Ectemnius. - 359: fossorius (L.); 360: sexcinctus (Fabr.); 361, 362: cavifrons (Thomson); 363: ruficornis (Zett.); 364: lapidarius (Panz.); 365: continuus (Fabr.).

121. ECTEMNIUS (METACRABRO) FOSSORIUS (Linné, 1758)

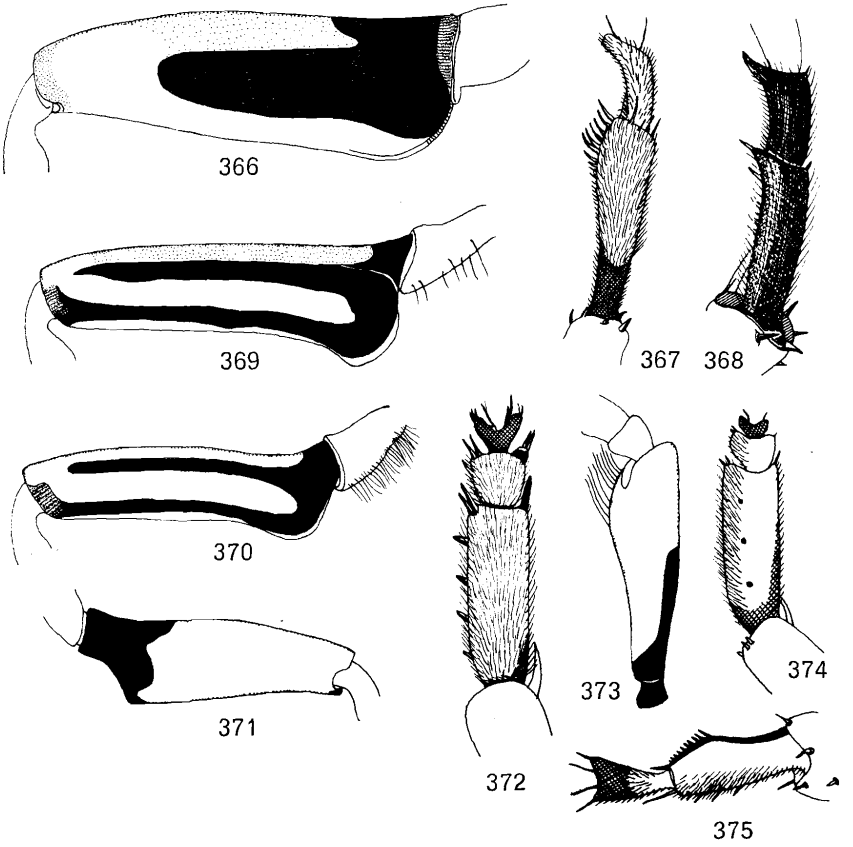
Figs. 341, 354, 359.

Sphex fossorius Linné, 1758:571.

Female: 16-21 mm. Head in front view trapezoid in outline (Fig. 341). Distance across mandibular articulations considerably larger than distance posteriorly across the eyes. Vertex very well developed. Punctation on vertex very fine and dense, ventrally, towards genae, coarser and sparser. Clypeus narrow, the longitudinal median keel especially anteriorly projecting sharply. The thickened anterior margin with two small teeth. Pubescence on clypeus silvery or slightly golden-shining. Mandibles very stout, yellow with black margins, apex and base. Scapus entirely yellow, or proximally with a faint dark spot on posterior face. Pubescence of head dorsally light brown, ventrally white, rather long and erect. Lateral angles of pronotum slightly projecting in an obtuse angle, the surface itself weakly transversely striate. Humeral tubercle black. The two yellow spots uppermost on pronotum very variable in size, usually missing in specimens from the northernmost part of the distribution range. Scutum shiny, its anterior third transversely striate, posterior two-thirds with longitudinal striation. Lateral parts with fingerprint-like sculpture. Scutellum anteriorly shiny and slightly punctate, posteriorly densely striate. Mesopleuron of rather dull appearance, its striation rather strong, ventrally towards the base of midleg gradually changing into an irregularly rugose sculpture. Lateral faces of propodeum also dull with strong, arcuate carinae and ribs. Area cordiformis very indistinctly delimited, its striation weak and irregular. The bottom of the median furrow divided into quadrate pits. A pair of yellow spots ventrally on lateral faces of propodeum are usually found in specimens from Central and South Europe. Pubescence of thorax brownish, white ventrally. Fennoscandian specimens have larger or smaller yellow, triangular, lateral spots on terga 1-4, tergum 5 with transverse band. Central and South European specimens often have complete bands on terga 1-4. Wings darkened, often with a faint violet tinge. Femora black, tibiae usually mainly yellow or brown-yellow. The distal tarsal segments usually brown. Specimens from the central and southern parts of the distribution range have more or less extensive yellow patterns on femora 2-3 and on coxa 3.

Male: 13-16 mm. Head in front view narrowed ventrally, across mandibular articulations distinctly narrower than across eyes (Fig. 354). Head in dorsal view narrowed posteriorly, the sides straight. Frons in front of ocelli very finely, although slightly irregularly, longitudinally striate. Behind ocelli is distinct transverse striation, running parallel to posterior margin of head, disappearing just before the hypostomal carina. Facial fovea distinctly depressed, shiny, with

extremely weak punctation. Median part of clypeus comparatively strongly projecting, anteriorly with a shiny, triangular, hairless area. Median keel weak, shiny. The surface itself with dense, silvery or very faintly golden-shining pubescence. Mandibles black with slightly reddish apex, with a very strong tooth near the base on the internal side. Scapus mainly black, frontal face with a larger or smaller yellow spot. Third flagellar segment basally with a strong excavation with a distal swelling. Fourth and fifth segments with weaker excavation (Fig. 359). Frons, especially in front of ocelli, with long, erect, brownish pubescence.



Figs. 366, 369-371. Femur 1 of male Ectemnius. - 366: lituratus (Panz.); 369: guttatus (v. d. Lind.); 370: borealis (Zett.); 371: rubicola (Duf. & Perris).
Figs. 367, 368, 375. Proximal part of tarsus 2 of male Ectemnius. - 367: lapidarius (Panz.); 368: continuus (Fabr.); 375: dives (Lep. & Brullé).
Figs. 372, 374. Proximal part of tarsus 1 of male Ectemnius. - 372: dives (Lep. & Brullé); 374: borealis (Zett.).
Fig. 373. Scapus of male Ectemnius dives (Lep. & Brullé).

Pronotum black in Nordic specimens. Specimens from Germany and Switzerland with larger or smaller yellow lateral spots. Lateral angles of pronotum almost rectangular. The transverse and longitudinal striation on scutum somewhat stronger, but more irregular (sometimes undulating) than in female. Scutellum and metanotum with irregular, longitudinal rugae. Lateral faces of mesopleuron coarsely striate on almost smooth substrate. Towards the ventral midline of thorax the sculpture becomes very irregular. Lateral and posterior faces of propodeum, as in female, strongly, transversely striate on dull substrate. Dorsally without delimited area cordiformis, irregularly reticulate-rugose, with well delimited median furrow. Whole thorax with erect greyish pubescence. Abdomen with yellow lateral spots on terga 1-4, tergum 5 usually with transverse band. Spots on tergum 1 may be missing. Tergum 7 considerably more strongly punctate than the others, with a broad, smooth, longitudinal furrow. Trochanter 1 distally with a broad, sharp-edged process. Legs mainly black, tibia 1 and tarsi partly yellow-brown. Specimens from Central and South Europe often have five complete yellow transverse bands on abdomen. Band on tergum 3 usually interrupted in the middle.

In Fennoscandia this rather rare species occurs in Central Sweden: Sm. to Jmt. and Ång., south-eastern Norway: AK, and southern and south-eastern Finland, northwards to Ok. - It is unlikely to occur in Denmark. - The distribution pattern in Europe may be boreo-alpine. The species occurs in Central Europe, eastwards to the Urals, Caucasus, Kazakhstan and Uzbekistan in the U.S.S.R. Isolated populations occur in Mongolia and North-East China.

The biology of the species is incompletely known. It is however stated that the nests are constructed in steep, clayey slopes. The prey consists of rather large flies, e.g. Asilidae.

122. ECTEMNIUS (METACRABRO) CEPHALOTES (Olivier, 1792)

Figs. 9, 342.

Crabro cephalotes Olivier, 1792: 513.

Ectemnius quadricinctus auctt.

Female: 12-17 mm. Head in front view almost rectangular in outline, only very slightly narrowing ventrally (Fig. 342). Vertex with very dense punctation, uniformly fine round the ocelli, but anteriorly and posteriorly coarser, with a slight tendency to coalesce into short rugae. Facial fovea large and flattened. Anterior margin of the slightly projecting median lobe of clypeus forms a very obtuse angle. Lateral lobes small and obtuse-angled. Pubescence strongly silvery. Mandibles yellow with black apex, margins and base. Scapus entirely yellow, lateral-

ly with a long, transparent lamella. Pronotum completely devoid of lateral angles, dorsally finely transversely striate. Yellow lateral spots may be absent, and the humeral tubercles in individuals from northernmost localities are without yellow markings. Scutum shiny with distinct transverse striation on anterior third. The posterior two-thirds with longitudinal striae. Scutellum anteriorly with a narrow, shiny punctate area, otherwise strongly, longitudinally striate. Mesopleuron rather dull in Danish and Fennoscandian specimens, shining and smooth in Central and South European specimens. The areas below the base of the forewings have rather uniform ribs, gradually developing into a weaker, more irregular rugosity near the ventral midline. Lateral faces of propodeum mainly with a very fine, dense striation. Area cordiformis distinct, shining, with radiating, longitudinal ribs. Median furrow strong. While Nordic specimens often have completely black thorax (except the spots on pronotum), the scutellum, metanotum and a spot behind the humeral tubercle are usually yellow in specimens from the remaining Europe. Pubescence of thorax rather long and erect, white, dorsally sometimes brownish. Terga 2-4 usually with yellow lateral spots, tergum 5 with transverse band. Specimens from southern Denmark often have a complete transverse band on tergum 2, and, in rare cases, a yellow pattern on terga 1 and 6. Sterna black, often with paler posterior margins. Femora black, sometimes with small distal yellow spots. Tibiae mainly yellow.

Male: 9-14.5 mm. Head in front view more narrowed ventrally than in female. Vertex rather well developed, posteriorly narrowed, with distinctly convex sides. Punctation round ocelli very dense and rather coarse. Towards posterior margin of head, and forwards towards the steeply declining portion, the punctures become less distinct, shallow, and now and then coalesce. Clypeus with a broadly rounded median part, lateral lobes very indistinct. Pubescence silvery, in Central European specimens often faintly golden-shining. Mandibles ventrally with a stout tooth curving towards the base, black in Nordic specimens. Some Danish specimens, however, have a faintly yellowish streak along the dorsal margin. Scapus with a narrow, longitudinal transparent lamella, mainly yellow, on posterior face with a large black or brownish spot. None of the flagellar segments excavated or dilated. Pronotum sculptured as in female, but the yellow lateral spots are often absent. Humeral tubercle with or without yellow spot. Scutum with somewhat coarser sculpture than in female. Scutellum black. Sculpture of mesopleuron as in female, without yellow pattern. Lateral faces of propodeum rather shiny, above with a fairly strong admixture of short ribs. Posterior face of propodeum with strong transverse ribs. Area cordiformis anteriorly with a row of short, strong longitudinal ribs, otherwise with irregular, radiating rugae. Dorsal face of thorax with brownish, ventral face with white pubescence. Abdomen with yellow lateral spots on terga 2-4, terga 5-7 usually

with complete transverse bands. Tergum 7 with a short and rather strong longitudinal depression. Femur 1 generally with a broad, yellow stripe along ventral margin. Femora 2-3 sometimes with a small yellow apical spot. Tibiae yellow, tibiae 1-2 with more or less extensive black pattern. Metatarsi yellow, metatarsus 2 distinctly asymmetrically dilated on the outer side, sometimes with a strong distal spine. Second tarsal segment very slightly dilated.

This species is rare in Fennoscandia and Denmark. Denmark: a southern distribution, - Sweden: from Sk. to Dlr. and Gstr. - Norway: a small material from AK and Bø. - Finland: a few specimens from Ta and Sa. - Soviet Karelia: Ib. - A Holarctic species. In the Palaearctic region it occurs from England in the west to the Urals and Caucasus in the east. The species may have been introduced in North America, where it occurs in South-East Canada and the North-East U.S.A.

The species often breeds in large aggregations. Occasionally several females have been observed to use same nest entrance (Hamm & Richards, 1926). A number of lateral tunnels issue from the short common entrance, corresponding to the number of inhabitants (Fig 9). The prey mainly consists of Diptera: Syrphidae, Muscidae, Calliphoridae and Tabanidae.

Note: The specimen in coll. Fabricius under the name Crabro quadricinctus Fabr. is a female Crossocerus (Acanthocrabro) vagabundus Panzer, possibly originating from southern Europe.

123. ECTEMNIUS (METACRABRO) LITURATUS (Panzer, 1805)

Figs. 343, 366.

Crabro lituratus Panzer, 1805: H. 90, T.13.

Female: 11-14.5 mm. Head in front view very distinctly narrowed ventrally (Fig. 343). Punctation on frons very regular, dense, punctures not coalescing. Facial fovea distinct, shining and usually impunctate. Median part of clypeus rather narrow, raised like a roof, its interior margin emarginate in an obtuse angle. In front view the anterior margin is strongly thickened. Lateral lobes indistinct, rounded. Pubescence strongly silvery. Mandibles yellow with black apex and base, margins brownish. Scapus without longitudinal dilations, uniform yellow. Pedicellus may be partly yellow in South European specimens. Pronotum with rounded lateral angles, without striation. Humeral tubercle and two large dorso-lateral spots yellow. Scutum anteriorly with two, generally strong, longitudinal carinae, the anterior part with transverse sculpture interspersed with more or less coalescing punctures. Between the carinae scutum is very densely punctate anteriorly, posteriorly the punctures fuse into weak longitudinal

rugae, which continue in the extensive longitudinal rugosity on posterior two-thirds of scutum. Scutellum with irregular longitudinal rugae interspersed with punctures. Mesopleuron shiny, laterally with regular, strong ribs, ventrally with sparse and rather coarse punctation. Lateral faces of propodeum shiny with weak striation. Posterior face with sparse punctation, without striation. Area cordiformis very indistinct, only anteriorly with short, radiating ribs. Yellow pattern on thorax (excluding pronotum), in Danish specimens restricted either to a narrow stripe on metanotum and a double spot on scutellum sometimes vestigial. Central and South European specimens have very extensive yellow markings on these sclerites. In addition lateral faces of propodeum and mesopleuron are often provided with yellow spots. In rare cases two yellow spots are found in area cordiformis. Abdomen in Danish specimens usually with complete transverse bands on terga 2-5. The band on tergum 3 may be narrowly interrupted. Tergum 1 with yellow lateral spots. In material from other parts of Europe these yellow spots are usually fused into a transverse band. Sterna 2 and 3 may be provided with round lateral spots or seldom with transverse bands. Metatarsus 1 on the other side with very few (2-3) pale spines. Femora black with a larger or smaller yellow, apical spot. In more southern European specimens this spot is very large on femora 1-2. Tibiae and tarsi yellow.

Male: 9-12 mm. Head ventrally strongly narrowed. Distance across mandibular articulations equals greatest distance between inner orbits on upper frons. Head posteriorly narrowed, with convex sides. Vertex between ocelli very densely and finely punctate, otherwise with coarser and sparser punctation. Distance between punctures on anterior part of vertex on average slightly smaller, but posteriorly greater than diameter of punctures. Median part of clypeus rather strongly projecting, anterior part rounded, lateral lobes slightly projecting. Median part of mandibles yellow or red-yellow, apex and base black. Tooth on inner side weak. Scapus in Danish specimens mainly black. No flagellar segments excavate or dilated. Pronotum usually with slightly projecting lateral angles, with two yellow lateral spots, which are greatly reduced in Danish specimens. Humeral tubercle yellow. Longitudinal and transverse striation on scutum only indicated. Admixture of rather coarse punctation dominates, especially anteriorly. Right in front of the rather strongly, longitudinally rugose scutellum, striation is however very pronounced. Mesopleuron as described in female, but admixture of punctures laterally more conspicuous. The rather strong striation on lateral faces of propodeum is continued onto posterior face. Area cordiformis with strong and usually longitudinal ribs. In the hitherto known Danish specimens thorax is devoid of yellow markings. Abdomen with complete transverse bands, at least on terga 5 and 6, terga 1 and 7 without yellow pattern in Danish specimens. Terga 2-4 with large lateral spots, which in

material from other parts of Europe form complete transverse bands. Tergum 7 without depression. Femur 1 with proximal sharp-edged dilation (Fig 366). Metatarsus 1 flattened ventrally. Tibia 2 slightly compressed, somewhat curved in an S-shape. Metatarsus 2, second and third tarsal segments distally on the ventral side slightly dilated. Legs mainly yellow, but femur 3 usually all black.

In the North only known from Denmark: F, Frederiksgave, and LFM, Toreby and Roden Skov.-Distributed, but not abundant, in Central and South Europe, and in a large area between the Black and the Caspian Seas.

Nests in wood. Remains of flies on external side of cocoon have been found to belong to Anthomyiidae or Cordyluridae.

Note: The external morphology shows several features which place this species in the sub-genus Clytochrysus. These features are most obvious in the secondary sexual characters.

124. ECTEMNIUS (CLYTOCHRYSUS) SEXCINCTUS (Fabricius, 1775)

Figs. 344, 355, 360.

Crabro sexcinctus Fabricius, 1775:374.

Crabro zonatus Panzer, 1797: T.7.

Female: 11-17 mm. Head in front view almost rectangular, in outline considerably broader than long (Fig 344). Entire frons so densely punctate that interstices are smaller than the diameter of the punctures. Ocelli placed in an acute angle. Facial fovea very indistinct. Clypeus with very characteristic anterior margin (Fig 344), and the lower part of the face, and in a certain degree also genae, has a dense, faintly golden, seldom silvery pubescence. Mandibles long, mainly yellow. Scapus entirely yellow. Flagellum, except ventral face of pedicellus, black. Pronotum with two large yellow spots. Humeral tubercle with a large yellow spot. Scutum anteriorly with two rather strong, shiny, longitudinal carinae; punctation anteriorly very dense and regular, rather fine, posteriorly less distinct, forming short, longitudinal rugae. Scutellum, except anterior part, also longitudinally rugose, interstices punctate. Metanotum often, scutellum more seldom, with yellow pattern. Mesopleuron laterally with only weak transverse striation. Propodeum laterally, however, with very sharp, regular ribs, which continue uninterruptedly onto the posterior face. Area cordiformis shiny, very weakly delimited, with irregular, longitudinal rugosity. Pubescence on thorax long and erect, dorsally pale brown, ventrally white. Usually yellow transverse bands are found on all terga. In addition sterna 2-6 often have ex-

tensive yellow markings as does also the basal half of the pygidial area. Femora black with larger or smaller yellow apical spots. Tibiae and tarsi entirely yellow. Coxa 3 often with a small yellow spot ventrally.

Male: 10-13 mm. Head ventrally narrowed much less than in the other species of the subgenus. Distance across mandibular articulations much larger than the least distance between eyes dorsally on frons. Dorsal part of frons very densely punctate, interstices everywhere smaller than diameter of punctures. Vertex strongly developed. Median part of clypeus normally broad, projecting almost like a nose, not quite as broad as scapus. Anterior margin evenly rounded (Fig 355). Lateral lobes very slightly projecting. Mandibles usually with yellow marks, which are generally missing in small specimens. No tooth at the base. Scapus yellow with a larger or smaller black spot on posterior face. Longitudinal carina along anterior margin very weak. Flagellum brown-yellow ventrally. Third antennal segment ventrally with two, fourth and fifth with a single excavation. The tubercular process between the excavations of third antennal segments bears a small tuft, or seldom only a single hair (Fig. 360). Pubescence of head dorsally light brownish, ventrally whitish. Pronotum shiny, slightly punctate, often with indications of lateral angles. The yellow lateral spots may be missing in small specimens. Humeral tubercle always with a yellow spot. Scutum anteriorly with two, rather strong, longitudinal carinae, the surface itself uniformly, densely and rather strongly punctate, only just in front of scutellum with short rugae. Scutellum very weakly longitudinally rugose, black. Metanotum often has a yellow transverse spot. Lateral faces of mesopleuron and propodeum sculptured as in female. Area cordiformis usually somewhat more coarsely and irregularly sculptured than in female. Pubescence on thorax dorsally light brownish, ventrally white. Abdomen in Danish specimens often with interrupted, transverse bands on terga 1-3. The remainder with complete bands. All abdominal transverse bands usually complete in more southerly specimens. Venter with more or less extensive yellow pattern. Femur 1 with two black, a yellow and a brown-yellow longitudinal stripe. Pretarsi with distinct, dark, longitudinal stripe. Femora 2-3 mainly black. All tibiae and tarsi yellow. Metatarsus 2 distally slightly asymmetrically dilated, second segment also with dilation. Tibia 2 slightly curved in an S-shape, with very short apical spur.

The species has a pronouncedly southern and south-eastern distribution in Denmark. It is a common species in several localities on Funen. - From Fennoscandia it is only known from Sk., several localities, in southern Sweden. - The distribution area covers Central and South Europe and extends through southern Siberia to western China.

The species may be found nesting in old timber exposed to the sun, fencing posts and the like. The prey consists of rather large Syrphidae, e.g. Scaeva pyrastri (L.), Syrphus ribesii (L.) and the like, which are captured on leaves and flowers in the sun. The dermestid beetle Megatoma undata L. has been found in a nest of this species. The larva was described by Maneval, 1937.

125. ECTEMNIUS (CLYTOCHRYSUS) CAVIFRONS (Thomson, 1870)

Figs. 340, 345, 356, 361, 362.

Crabro (Solenius) cavifrons Thomson, 1870: 173.

Female: 11-16,5 mm. Head in front view considerably narrower across mandibular articulations than across eyes (Fig. 345). Vertex round ocelli distinctly depressed. Punctation in front of these dense, interstices on average smaller than diameter of punctures. Facial fovea rather distinct, shiny with sparse punctation. Clypeus with rather strongly projecting median lobe, the anterior margin of which is slightly angularly emarginate. Lateral lobes small, directed obliquely forward (Fig. 345). Pubescence strongly golden. Mandibles yellow with black apex and base. Scapus entirely yellow, flagellum black, first and sometimes also proximal part of second flagellar segment yellow in Danish specimens, terminal segments pale ventrally; third segment almost four times longer than broad distally. Head with long, black pubescence on frons, ventrally with slightly brownish pubescence. Pronotum dorsally without distinct sculpture, with two large, yellow lateral spots. Humeral tubercle usually yellow in Danish and South Swedish specimens. Norwegian, Finnish and Central Swedish specimens lack this yellow pattern. The two longitudinal carinae anteriorly on scutum weak. Anteriorly on scutum the sculpture consists of an obliquely outwardly directed, very fine, dense, rugose punctation. Posteriorly the striation becomes stronger, interstices broader and more shiny. Posterior two thirds of scutellum distinctly striate. A large number of the specimens from Fennoscandia lacks the yellow transverse spot on scutellum, in Danish specimens it is usually present. Mesopleuron densely, more or less regularly, transversely striate, striae often of different strength. Lateral and posterior faces of propodeum very finely and regularly striate, sometimes with sateen-like tinge. Area cordiformis very indistinct with weak, obliquely, outwardly directed rugae or irregular striae. Abdomen with yellow lateral spots, which may form a transverse band on tergum 5. Sternum 6 occasionally with two yellow spots. Pygidial area black, narrow, posteriorly deeply excavate in a groove. Sterna shining black, sometimes with yellow posterior margin. Femora black, usually with a very small yellow apical spot, usually missing in Fenno-

scandian material. Tibiae yellow with larger or smaller black spots apically. Tarsi brown, metatarsi yellow.

Male: 8-12.5 mm. Head in front view only very slightly broader than long. Eyes strongly convex, vertex rather strongly depressed. These features, together with the rather projecting clypeus, give the head an almost cordiform outline (Fig. 356). Vertex anteriorly very densely punctate, behind ocelli, on either side is a shiny, weakly punctate area. Ocelli placed in a distinctly acute angle. Pubescence on frons long and erect, black. Clypeus with silvery pubescence, anterior margin of median lobe evenly rounded, rather broad, lateral lobes distinct, rounded. Yellow spot on mandibles often vestigial, or absent. Scapus yellow with a larger or smaller black spot on posterior face . Frontal face with a narrow, transparent, sharp, longitudinal carina. Flagellum black, brown-yellow ventrally. Third antennal segment in dorsal view with distinctly concave margins (Fig. 361), ventrally with two strong excavations between which there is a large, almost truncate cone-shaped process. Segments 4 and 5 also excavated distally, and with a distinct dilation (Fig. 362). Pronotum with or without yellow lateral spots. These are absent - like the spots on the humeral tubercles - in most Fennoscandian specimens. Carinae on anterior scutum very indistinct, sculpture anteriorly densely rugoso-punctate, laterally with very weak, obliquely, outwardly directed rugae; posteriorly distinctly, but somewhat irregularly longitudinally striate. Scutellum black, with longitudinal striae. Striation of mesopleuron less pronounced than in female. Striation on lateral faces of propodeum considerably stronger in male than in female. On posterior face striation becomes very strong (almost as in sexcinctus). Area cordiformis indistinctly delimited, anteriorly with strong but short, longitudinal ribs, otherwise with irregular and weak sculpture. Thorax dorsally with brown, ventrally with white pubescence. Abdomen with yellow lateral spots on terga 1-4, terga 5 and 6 usually with yellow transverse bands, which may however be interrupted on tergum 5. Tergum 7 with a weak longitudinal depression. Femur 1 brown-yellow with two black and a yellow longitudinal stripe. Tibia 1 with only a black longitudinal stripe, which may be absent in rare cases. Tarsal segments 1-4 pale yellow, pretarsus 1 basally on ventral face usually with a strongly blue-violet shining spot, slightly asymmetrical, with a dark spot on the external face. Femur 2 black with brown-yellow, and usually also a yellow stripe along anterior margin. Apical spot on femur 3 considerably smaller. Tibia 2 curved in an S-shape, with black, yellow and brown-yellow pattern. Spur very short. Metatarsus 2 and next segment weak distally, asymmetrically dilated. Tibia 2 with more extensive yellow and yellow-brown pattern.

Common in Denmark and southern Fennoscandia. Found in all districts in Denmark, except SZ, where it undoubtedly also occurs. - Sweden: northern distribution limit in Vrm. and Gstr. - Norway: only found in the southern and south-eastern districts. - Finland: from Al, Ab, N and Ka in the south to Om and Ok in the north. - Soviet Karelia: Ib and Kr. - Widespread in Europe, eastwards to Lake Baikal in southern Siberia, Sakhalin and Japan.

The nests are constructed in decayed wood, often as an enlargement of the nest system of preceding years. The first few centimetres of the entrance are at right angles to the surface. The system branches in several planes. If two or more females use the same entrance, fights may occasionally occur near the entrance. At the end of each short lateral tunnel, a larval chamber is constructed, and provisioned with rather large Syrphidae, of which 6-12 are placed in each cell. Each nest may contain more than a hundred flies. While the females are placing the prey, depositing eggs, constructing the nest system, or are hunting, it often happens that Pemphredon lugubris Latr. tries to force its way into the nest in order to construct its own nest system. The intruder is, however, rapidly chased away by the "furious-looking" owner, which with wide-open mandibles and a deep buzzing from the vibrating wings pursues Pemphredon to the entrance of the nest. Eustalomyia hilaris Fall. (Diptera, Anthomyiidae) is herewith recorded as cleptoparasite. In warm long summers the species may produce two generations in Denmark. The latter may be met with till late in September. The larva was described by Leclercq, 1954.

126. ECTEMNIUS (CLYTOCHRYSUS) RUFICORNIS (Zetterstedt, 1838)

Figs. 346, 363.

Crabro ruficornis Zetterstedt, 1838:443.
Crabro nigrifrons Cresson, 1865:482.
Crabro septentrionalis Packard, 1866:110.
Crabro planifrons Thomson, 1870:173.
Crabro hector Cameron, 1891:147.
Ectemnius (Clytochrysus) nigrifrons taiwanus Tsuneki, 1968:2.

Closely related to cavifrons, but distinguishable from it by the following characters: Ocelli placed in an obtuse angle; distance between the lateral almost twice as great as the diameter of one of them. Vertex without depression.

Female: 10-15 mm. Median lobe of clypeus strongly projecting, lateral lobes very conspicuous, tooth-like, directed outwards at right angles (Fig. 346). Median keel strongly projecting, together with anterior margin forming a shining T-shaped figure. Third antennal segment in dorsal view as long as or slightly

longer than fourth and fifth together. Humeral tubercle entirely black. Scutum anteriorly with two sharp, shining, longitudinal carinae, which are weaker in small specimens. Sculpture on posterior third of scutum weak in the middle, interstices between punctures and rugae broad and shiny. Spots on abdomen somewhat less extensive than in cavifrons.

Male: 7.5-12 mm. Due to the convex shape of vertex, the outline of the head, in frontal view, does not show the cordiform shape characteristic of cavifrons. The tooth between the two excavations on third antennal segment is small and acute (Fig. 363). Scutum anteriorly with two distinct, longitudinal carinae. The depression on tergum 7 weak or absent. The black colour on legs 2-3 considerably more extensive.

Not common in Denmark, but found in most districts. - A very large distribution in Sweden, northwards to Ly. Lpm., Lu. Lpm. and Nb. - Rather widespread in Norway up to Nordland. - Finland: common, occurring in most districts up to Ks and LkW. - Soviet Karelia: Ib and Kr. - A Holarctic species, which has a very wide distribution in the Palaearctic, Nearctic and Neotropic regions. Apparently, it does not occur in southern Europe. Isolated populations in Mexico (ssp. hector Cameron), in Caucasus, Kazakhstan, Sakhalin, Kamchatka, Formosa, and Japan (ssp. taiwanus Tsuneki).

Biologically, the species closely approaches cavifrons. The nests are constructed similarly in old timber, dead trunks, fencing-posts and the like. The prey consists of larger Syrphidae.

127. ECTEMNIUS (CLYTOCHRYSUS) LAPIDARIUS (Panzer, 1804)

Figs. 347, 364, 367.

Crabro lapidarius Panzer, 1804: H.90, T.12.

Crabro chrysostomus Lepeletier & Brullé, 1834:704.

Female: 9-12 mm. A relatively small, robust species. Head in front view rounded (Fig. 347). Vertex distinctly convex, large, very well developed. Ocelli placed in an obtuse angle, distance between the posterior ocelli twice as large as the diameter of one of them. Punctation anteriorly on vertex dense, interstices smaller than diameter of punctures. Facial fovea weak with sparse punctation. Clypeus with rather strongly projecting, narrow median lobe, its anterior margin slightly angularly or arcuately emarginate. Lateral lobes rather small, tooth-like, directed obliquely forward (Fig. 347). Median keel strongly projecting. Scapus entirely yellow. Flagellum black, third antennal segment almost as long as the succeeding three segments combined. Yellow colour of mandibles considerably less extensive than in the other species of

the subgenus. Pubescence of frons brownish. Pronotum usually with two yellow lateral spots, without pronounced lateral angles. Humeral tubercle nearly always without yellow marks in Fennoscandian specimens. Scutum anteriorly with two weak longitudinal carinae, very densely and uniformly punctate, only laterally and posteriorly with rugosity, which right in front of scutellum forms a well-defined striation. Scutellum usually black, but sometimes with yellow marks in specimens from Central and South Europe. Mesopleuron shiny, striation weak (distinctly weaker than in cavifrons), in front of coxa 2 the sculpture consists partly of a weak, sparse punctation, partly of an indistinct, reticulate microsculpture. Lateral faces of propodeum with dull appearance, striation rather strong, slightly undulating. Posterior face dull, without proper striae, laterally delimited by a strong carina. Sculpture in area cordiformis irregular, only anteriorly well-defined by short longitudinal carinae. Median furrow distinct, anteriorly usually twice as broad as posteriorly. Abdomen with elongate yellow lateral spots on terga 2-4, tergum 5 often with transverse band. Specimens from Denmark and Fennoscandia with yellow spots on tergum 1 are rare. Bristles bordering pygidial area pale yellow. All femora black. Tibiae yellow with a larger or smaller black spot on the inner side. Tarsi light brown-yellow, distal segments brown.

Male: 7-11 mm. Width of head across mandibular articulations only very slightly larger than greatest distance between inner margins of eyes when head is seen in front view. Eyes strongly convex. Head distinctly broader than high. Vertex convex. Ocelli placed in an obtuse angle. Punctation anteriorly on vertex very dense, posteriorly with shining interstices. Clypeus with strongly projecting median lobe, lateral lobes weak; pubescence silvery. Flagellum black, proximal segments brown-yellow ventrally. Third antennal segment in dorsal view with a slight concavity on either side, almost as long as combined length of segments 4-6, seen in profile with two deep emarginations and two teeth; dorsally strongly convex (Fig. 364). Ventral emarginations on projecting lateral angles, dorsally with or without yellow lateral spots. Humeral tubercles usually completely black. Longitudinal carinae anteriorly on scutum weak or absent, the sculpture consists of a very dense uniform punctation, but anterior-laterally with distinct transverse rugosity. Just in front of scutellum striation is strong. Scutum distinctly longitudinally rugose. Thorax dorsally with long, erect, brownish pubescence. Mesopleuron shiny, finely transversely rugose with extremely fine punctation. Propodeum laterally with dense, somewhat undulating striae. Transition between lateral portion and posterior face marked by a carina. The dorsal face of propodeum with very irregular carinae or ribs. Posterior face regularly transversely striate. Abdomen with yellow

lateral spots on terga 2-5, tergum 6 with a transverse band. In Fennoscandia specimens with both yellow spots on first and a complete band of fifth tergum are rare. Sterna black. Femur 1 and tibia 1 with the black, yellow and brown-yellow striping which is characteristic of the subgenus. Pretarsus 1 with a dark longitudinal stripe, ventrally with a slightly asymmetrically placed, dark, sometimes slightly bluish, metallic spot. Femora 2-3 black with a small yellow apical spot. Tibia 2 slightly curved, the black colour predominating. Metatarsus 2 only very slightly dilated distally (Fig. 367). Tibia 3 with a large, yellow, longitudinal spot dorsally.

The species is not common in Denmark, where it seems to have a southern and south-eastern distribution. - Widespread in Sweden, from Sk. in the south to Ång. and Vb. in the north. - Rather common in Norway, northwards to Nordland. - Finland: common and widely distributed, northwards to ObN and Ks. - Soviet Karelia: Ib and Kb. - A Holarctic distribution-pattern. In the Palaearctic region the species occurs in Europe, Caucasus, Kazakhstan, Mongolia, Manchuria and Japan.

The species is usually found nesting in decayed wood, e.g. Populus. The anterior section of the main tunnel is very characteristically enlarged to about twice the diameter of the rest of the tunnel. The remaining part of the nest consists of one or several tunnels, from which the larval chambers are constructed as very short lateral branches. The prey consists of Syrphidae, Therevidae, Muscidae or Calliphoridae. Males as well as females are commonly met with on Angelica flowers.

ECTEMNIUS (CAMERONITUS) NIGRITARSUS (Herrich-Schäffer, 1841)

Figs. 348, 357.

Crabro nigritarsus Herrich-Schäffer, 1841:14.

Female: 10-13 mm. Vertex in front of ocelli very densely punctate, interstices equal to or a little less than diameter of punctures. Ocelli placed in a very obtuse triangle, the distance from a lateral ocellus to the median is smaller than the diameter of an ocellus. Facial fovea missing. The shiny area dorsal to antennal sockets very narrow. Median lobe of clypeus narrow, angularly arcuately emarginate, lateral lobes very small, rounded (Fig. 348). Pubescence on clypeus silvery or pale golden. Pubescence of frons long, black or faintly brownish. Mandibles comparatively short, usually with a white-yellow spot. Scapus yellow, with a very small black spot distally. Thorax without yellow markings. Transverse carina of pronotum not forming lateral angles. Scutum with very fine and dense punctation, antero-laterally with transverse, posteriorly

with longitudinal, fine rugae. Pubescence paler than on head. Mesopleuron shiny and smooth, with very sparse punctation. Area cordiformis broad, fairly distinctly delimited. Anterior delimiting furrow deeply pitted. Area itself shining, with fine and somewhat irregular, slightly radiating striae. Posterior propodeal area laterally delimited by a very indistinct, pitted furrow, sometimes missing. Lateral areas with dense and fine undulating striation, posteriorly interspersed with fine punctation. Abdomen with yellow lateral spots on terga 2-4. Spots on first tergum small or missing, transverse band on tergum 5 vestigial. Lateral margins of pygidial area slightly concave, the area itself with coarse punctation. Femora and tarsi black, in European specimens tibia 1 partly, tibiae 2-3 mainly, yellow. Wings rather strongly infuscate.

Male: 8.5-12 mm. Head strongly narrowed ventrally. Distance across mandibular articulations considerably smaller than greatest distance between inner margins of eyes (Fig. 357). Head strongly narrowed behind eyes. Vertex in front of ocelli shining, with sparse and rather coarse punctation. Clypeus with a narrow, truncate median lobe, lateral lobes rounded. The silvery pubescence rather thin. Mandibles with a very stout tooth on the inner side. Scapus with yellow frontal face. Antennal segments 4 and 5 slightly swollen ventrally, segment 6 very slightly excavate. Thorax without yellow markings. Scutum shiny, punctation considerably coarser and sparser than in female. Punctation on mesopleuron as in female. Area cordiformis with rather strong, radiating striation, dorsal and lateral faces sculptured as in female. Terga 2-4 with yellow lateral spots, terga 5 and 6 with transverse bands. Very small lateral spots may occur on tergum 1 in European specimens. Tergum 7 with pygidial area. Legs without secondary sexual characters. Tibia 1 brown-yellow on inner side. Femur 2 may have a small yellow spot distally. Spines on tibiae 2-3 missing on outer side.

The species is not known from Fennoscandia and Denmark, but might be expected to occur in southern Denmark. - It has a very sporadic distribution and is found mainly in mountainous regions in Central Europe, Turkey and southern Siberia. It is also recorded from north-eastern China, Sakhalin, Japan and southern Vietnam.

The species has been found nesting in decayed wood (Tsuneki, 1960), where earlier constructed nests can be used and added to. The prey consists of Diptera, e.g. Muscidae, Anthomyiidae, Therevidae or Syrphidae.

Note: The species is recorded as belonging to the Swedish fauna since the publication of Kohl's monograph in 1915 (Ög., Lärketorp, 17.7.1835, Dahlbom leg.). In Dahlbom's collection 3 females and 4 males are present under the name rubicola. These are all identical with rubicola (Duf. & Perris), and not

as supposed by Kohl, with nigritarsus (Herr.-Sch.). A female specimen from Ratzeburg in Germany completely lacks the sculpture on mesopleuron, and area cordiformis is almost smooth, punctate. An almost identical female specimen from the same locality is kept at the Zoological Museum of Copenhagen (Coll. Wüstnei). It is probable that Dahlbom used the Ratzeburg specimen when he wrote his differential diagnosis. His diagnosis includes, however, characters associated with the morphology of the head, clypeus, and the colour pattern on the abdomen, which are characteristic of rubicola.

128. ECTEMNIUS (HYPOCRABRO) CONTINUUS (Fabricius, 1804)

Figs. 349, 358, 365, 368.

Crabro continuus Fabricius, 1804:312.

Crabro vagus auctt.

Female: 9.5-14.5 mm. Head in front view considerably broader than high (Fig. 349). In dorsal view almost rectangular, only slightly narrowed posteriorly. Ocelli placed in an obtuse-angled triangle, distance between lateral ocelli more than twice as great as the diameter of an ocellus. Punctation in front of ocelli very dense and fine, forming narrow, longitudinal rugae. On vertex punctation becomes stronger and considerably sparser. A weak transverse rugosity is discernible in a few specimens. Facial fovea plane, shining, smooth, punctation extremely weak. Pubescence of head long and erect, brownish, ventrally lighter. Median part of clypeus slightly angularly convex, with a very obtuse-angled emargination anteriorly; median keel strong. Lateral lobes very small, rounded (Fig. 349); pubescence strongly silvery. Mandibles with a stout tooth on the inner side near the base, black with ivory-yellow spot in the middle near the dorsal margin. This spot is considerably larger in South European specimens. Third antennal segment about twice as long as wide. Pronotum with very weak or no lateral angles, the transverse carina also weak. The yellow spots are most frequently found in specimens from the central and southern part of Fennoscandia, being often reduced or absent in specimens from the northernmost parts of the distribution range. Humeral tubercle usually black in Fennoscandian specimens. Anterior part of scutum dull, very densely and coarsely, but rather superficially sculptured, laterally with slight transverse rugosity, posteriorly with shining, even interstices. Scutellum rather coarsely punctate, with shining, posteriorly ruga-forming interstices. Metanotum dull, with irregular and dense, longitudinal rugosity. Mesopleuron shiny, laterally without proper punctation, usually distinctly and regularly transversely striate. Ventrally the striation gradually becomes weaker; close to ventral midline it is replaced by a fine, sparse punctation. Propodeum laterally with

very dense, fine striation, which continues uninterruptedly on posterior face. Area cordiformis without distinct delimitation, with irregular, slightly radiating striation. Median furrow deep, at bottom with several fine, transverse striae. Whole thorax with a thin, rather long and erect light-brown pubescence, becoming gradually paler ventrally. Tergum 1 basally very densely and finely longitudinally striate, with long erect pubescence. Terga 2, 4 and 5 with yellow lateral spots. A rather indistinct spot may occur on tergum 3. Pygidial area black, posteriorly strongly narrowed, excavated in a groove, surrounded by stout, golden bristles. The surface proper proximally coarsely and densely punctate, distally with a row of shallow punctures along the margin. Femora black. Tibiae 1-2 yellow with a large black spot on the inner side, tibia 3 with only a small black apical spot. Tarsi black or brown, The yellow markings on the legs are considerably more extensive in South European specimens which usually also have broad yellow transverse bands on scutellum, metanotum, and on terga 2, 4 and 5. Wings distinctly darkened.

Male: 8-12 mm. Head across eyes distinctly broader than high (Fig 358). Ventrally distinctly narrowed. Frons in front of ocelli, which form a very obtuse triangle, rather weakly sculptured, with densely placed longitudinal rugae, posteriorly gradually disappearing in oblique rugae between ocelli and eyes. Pubescence of frons somewhat darker than in female. Median part of clypeus strongly projecting, anterior margin almost evenly rounded. Lateral lobes only very weakly developed. Mandibles mainly black, usually with a small yellow spot near the middle. The basal tooth very strong. Scapus yellow with a large black spot on posterior face. This spot usually extends throughout the length of the segment. Flagellum black, its second segment twice as long as broad, segments 4 and 5 ventrally with an excavation, strongest on segment 5 (Fig. 365). Segments 2 and 3 ventrally with a narrow, pale brown, longitudinal pad. Pronotum with a small acute tooth on either side. Transverse carina distinct. Yellow lateral spots usually very reduced or even absent. Humeral tubercle black. Scutum dull, with uniformly dense and rather coarsely pitted sculpture, anteriorly without longitudinal carinae. Very robust specimens often have a weak transverse striation anteriorly, while posteriorly, just in front of scutellum, a weak longitudinally rugose sculpture may be present. Mesopleuron shiny, laterally with irregular, coarse striation or rugosity. Ventrally the sculpture consists of only fine, sparse punctures. A very weak transverse striation may occur in rare cases. Propodeum laterally with a mixture of coarser carinae and very fine, dense striation. The latter may almost disappear. The coarser carinae usually continue uninterruptedly on posterior face. Area cordiformis with a very irregular, slightly irregularly,

longitudinal rugosity, posteriorly often joining a transverse carina, which represents the posterior delimitation of the area. Tergum 1 basally with a dense, fine, longitudinal striping, and tergum 4 normally with yellow lateral spots. Tergum 5 generally with a transverse band, which may be separated into spots. The spots on terga 2 and 4 may exceptionally form transverse bands in Danish and Fennoscandian specimens, and a very small lateral spot may occur on tergum 3. Femora 2-3 black, sometimes with a yellow apical spot. Femur 1 yellow-brown with a black-and-yellow longitudinal stripe. Along the ventral margin runs a sharp carina. Tibia 1 also tri-coloured. Metatarsus 1 pale, slightly transparent. Tibiae 2-3 yellow with more or less extensive black pattern. Metatarsus 2 and next tarsal segment with asymmetrical dilation distally (Fig. 368).

The species is distributed all over Denmark and Fennoscandia and is probably the most common sphecid of all. - The distribution area covers subtropical, temperate and subarctic regions in the northern hemisphere. The southermost records originate from Venezuela, the northernmost from northern Finnmark (about 70°N.).

Nests in old timber, e.g. solitary tree stumps, fallen decayed branches and the like. The tunnel system may be branched and consists of up to 10 cells. The species shows great plasticity in its breeding behaviour. The appearance of the nest depends on the material in which it is constructed. There are several observations of apparently "unusable" prey, e.g. of too small-sized flies being thrown out of the nest after some time, or otherwise carried away from the nest. The prey consists of Diptera, e.g. Muscidae, Calliphoridae, Tabanidae, Therevidae and Syrphidae. Each cell contains from 6 to 8 specimens. When the larva is fullgrown, it collects the remains at the bottom of the cell, and then starts spinning the long pear-shaped cocoon, in which it winters as a pre-pupa. The larva was described by Evans, 1964b.

129. ECTEMNIUS (HYPOCRABRO) RUBICOLA (Dufour & Perris, 1840)

Figs. 350, 371.

Solenius rubicola Dufour & Perris, 1840:25.

Crabro larvatus Wesmael, 1852:614.

Female: 7-9.5 mm. Head in front view very broad (Fig. 350). Distance across mandibular articulations only slightly greater than greatest distance between eyes, when the head is seen in front view. Vertex very well developed. Punctation in front of ocelli coalescing to a dense, longitudinal rugose sculpture. Behind ocelli punctures become stronger, with only a slight tendency

to form transverse rugae. Clypeus anteriorly with three rounded tubercles (Fig. 350), its pubescence silvery. Mandibles short and strong, usually with a yellow median spot. Their three teeth almost equally stout. The tooth on the inner side near the base also strong. Scapus short, yellow with a black spot near the base. Flagellum short, segments 2 and 3 at most 1.5 times longer than broad. Pronotum with a sharp, transverse carina and well developed lateral angles. Lateral spots may be absent in rare cases. Humeral tubercle usually black in Fennoscandian specimens. Scutum coarsely sculptured, densely grooved, anteriorly often transversely rugose or striate. Posteriorly punctation becomes considerably sparser and the interstices smooth and flat. Sculpture of scutellum very weak anteriorly, posteriorly consisting of short, strong transverse rugae. Metanotum is always black in Fennoscandian specimens. Mesopleuron shiny, variation in sculpture very great, but usually laterally consisting of an irregular transverse striation. Specimens without any transverse striation occur. Propodeum laterally very densely and finely striate. On the transition to the posterior face a coarsely pitted or very irregularly sculptured zone is often present. The sculpture on posterior face may be more regular, often consisting of transversely or obliquely running carinae. At any rate, the rather coarse sculpture on posterior face of propodeum is distinctly different from the fine regular lateral striation. Area cordiformis often shiny, very slightly sculptured, with indistinct rugosity or only with weak, sparse punctation. Tergum 1 basally with a considerably coarser and more irregular striation than in continuus. Terga 2 and 4 with yellow lateral spots. Tergum 5 usually with a transverse band. Specimens from Central and South Europe usually have bands both on terga 4 and 5, and tergum 3 has large, yellow lateral spots. Pygidial area triangular, its lateral margins very slightly concave, the surface proper almost plane, very weakly punctate, the bordering bristles weak and pale. Femora black. Tibiae 1-2 yellow, in Fennoscandian specimens with extensive black markings throughout the length of the segment. Tibia 3 with black proximal and distal spots. Tarsi black or brown.

Male: 6-9.5 mm. Head ventrally strongly narrowed. Distance across mandibular articulations as great as the greatest distance between eyes, when the head is seen in front view. Frons in front of ocelli with a rather strongly striate or longitudinally rugose sculpture. Frons behind ocelli densely and rather coarsely punctate, in robust specimens with distinct transverse rugosity. Median part of clypeus narrow, rather strongly projecting; anterior margin with only very weak tubercles. Scapus with yellow frontal side, short and strong, at most 3.5 times longer than broad. Fifth flagellar segment ventrally with distinct excavation. Excavation on fourth very weak. Segments 3, 4 and 6-8

ventrally with broad, flat, usually pale brown longitudinal pads. Transverse carina of pronotum strong, laterally obtuse-angled. The yellow lateral spots may be missing in Fennoscandian specimens. Scutum shining, strongly sculptured, anteriorly with very pronounced, but usually irregular, transverse rugosity. Posteriorly the rugae are distinctly longitudinal. Scutellum coarsely pitted,in Fennoscandian specimens without yellow markings. This also applies to metanotum. Mesopleuron laterally with a usually strong, irregular, transverse striation, which gradually disappears towards the ventral midline. Lateral faces of propodeum with distinctly weaker striation, at the transition to the posterior face changing to a row of very coarse vertical pits. The posterior face proper with coarse, irregular carinae and rugae, and the area dorsally is delimited by a strongly projecting carina. Area cordiformis with coarse sculpture, consisting of pits, the margins of which are sharply raised. Tergum 1 basally with irregular, rather dense and strong striation. Fennoscandian specimens lack the yellow lateral spots on terga 1, 3, 6 and 7. Femur 1 basally on ventral face with a strong, obtuse-angled dilation (Fig. 371), yellow with a large yellow distal spot. Femur 3 completely black. All tibiae with yellow frontal face and black posteriorly. Metatarsus 1 flattened, pale yellow-brown like the remaining part of tarsus. The other tarsi brown.

The species is not found in Denmark, but might be expected to occur there.- Northern distribution limit in Sweden: Gstr. - A few records from southern Norway. - Finland: rather common, from Al, Ab and N to Sb and Kb. - Soviet Karelia: Kr. - Widely distributed in Europe, North Africa, Caucasus, Kasakhstan and in north-eastern China and Japan.

The species is the only one in the genus which nests in plant stems, e.g. Rubus and Phragmites. The cells are placed successively in the single tunnel. This method is commonly used by e.g. Trypoxylon, Passaloecus and Psenulus. Rubicola uses material such as plant dust for making partitions between the cells, of which there may be up to 17 in a single stem. Flies belonging to the families Muscidae, Cyrtidae, Syrphidae, Lauxaniidae, Trypetidae etc. represent the prey. Although the same nest may contain representatives of several fly families, it seems as if the provision of each individual cell comprises only a single or very few species. Each cell contains about 8 flies. It is stated that other Hymenoptera, e.g. Trypoxylon and Anchistrocerus trifasciatus (Müll.) (Eumenidae) might be found nesting in the same plant stems as rubicola.

130. ECTEMNIUS (ECTEMNIUS) DIVES (Lepeletier & Brullé, 1834)

Figs.351, 352, 372, 373, 375.

Solenius dives Lepeletier & Brullé, 1834: 716.

Female: 7-10.5 mm. Head in front view distinctly broader than high (Fig.351). Vertex well developed. Ocelli placed in a very obtuse triangle. Punctation of frons very homogeneous, not forming rugae or striae. In front of ocelli the punctation is rather strong and very dense. The carina which dorsally delimits the shiny area dorsal to the antennal sockets is angularly bent. Clypeus with a very faintly golden or brassy pubescence, its anterior margin with a rather narrow, strongly projecting median part. Lateral lobes rounded, directed obliquely forward, seen in profile as Fig.352. Mandibles yellow with black apex and base. On inner side with a stout tooth. Scapus entirely yellow. Second flagellar segment distinctly longer than third. Pronotum usually with large, yellow lateral spots, and strongly developed, obliquely forwardly directed, attenuate lateral angles; the transverse carina on dorsal face of pronotum is not continued into the spines. Humeral tubercle yellow. Scutum anteriorly with two very strong, shining, longitudinal ribs; its sculpture otherwise consisting of partly fused punctures, which are much stronger than the punctation on frons. Scutellum anteriorly shining with sparse punctation, posteriorly with weak longitudinal striation. Two lateral spots on scutellum and metanotum are usually yellow in specimens from Central Europe. Mesopleuron laterally shining, strongly transversely striate, interspersed with distinct punctures. Near the ventral midline the sculpture consists of only a few rather weak punctures. Lateral areas of propodeum with very uniform, very dense and fine, transverse striation. Posterior area laterally without distinct delimitating carina so that the lateral sculpture continues on posterior face. Striation here, however, considerably stronger. Striae in area cordiformis rather weak, somewhat irregular. Abdomen with yellow lateral spots on terga 2-5. Sometimes spots also occur on tergum 1. The spots on tergum 2, and particularly on tergum 5, may form transverse bands. Pygidial area strongly narrowed posteriorly, only slightly excavate, here with rather strong punctation. Femora black, seldom with a small distal spot. Tibiae 1-2 yellow with a large black spot on inner side. Tibia 3 usually entirely yellow. Tarsi yellow-brown, distal segments darker.

Male: 6.5-8 mm. Head in front view very distinctly broader than long, ventrally only slightly narrowed. Punctation on frons in front of ocellus very dense, interstices much smaller than diameter of punctures. Pubescence on clypeus silvery or very slightly golden shining, anterior margin with broad median lobe,

lateral lobes very small and rounded. Mandibles usually with a large yellow median spot. Scapus yellow with a large black spot on posterior face, distally bearing a row of long, pale hairs (Fig.373). Flagellar segments 2 and 5 ventrally with distinct excavation, second segment in dorsal view distinctly longer than third. The strong, obliquely forwardly directed lateral spines of pronotum without connection with the almost lamella-like projecting transverse carina. The yellow-white lateral spots usually well developed. Humeral tubercle also yellow-white. Scutum anteriorly with two very strong, shining longitudinal carinae, the sclerite proper very coarsely and irregularly rugose or striate. Scutellum anteriorly shining, with sparse punctation, posteriorly irregularly, longitudinal rugose. Metanotum usually with a yellow transverse spot. Mesopleuron laterally with strong transverse striation, without interspersed punctures, but with a thin, short, white or slightly silvery pubescence. Ventrally the striation is replaced by a rather dense but fine punctation. Lateral faces of propodeum with dense, regular striation. Admixture of short, coarser striae often occurs. Transition to posterior face not distinctly marked, since the delimiting carina is often very reduced. Sculpture of posterior face consists of a rather coarse transverse striation. Striae in area cordiformis strong. Abdomen with yellow lateral spots on terga 2-6. Spots on tergum 1 may occur in specimens from Central and South Europe, and the comparatively larger spots on terga 2 and 5 may form transverse bands in these specimens. Femur 1 basally with a very weakly developed sharp-edged swelling. Metatarsus 1 slightly dilated, not broader than apex of tibia. Ventrally the metatarsus carries four strong, brown, depressed spines; next tarsal segment almost quadrate (Fig.372). Metatarsus 2 distinctly, somewhat asymmetrically dilated (Fig.375). Femur 1 ventrally yellow-brown, with two equally broad longitudinal yellow or black stripes. Tibia 1 mainly yellow and brown-yellow, with a black longitudinal spot on outer face.

This species has not yet been found in Denmark, but might be expected to occur there. - Widely distributed in Fennoscandia, but not common. Northernmost localities in Sweden: Dlr. and Gstr. - Only a few specimens from Norway: AK, Tøien.-Finland: southern and south-eastern distribution, northwards to Ok. Soviet Karelia: Ib and Kb. - A Holarctic species. The distribution area covers most of Europe (not found in the Iberian Peninsula), Caucasus, Central Asia, Japan and north-eastern China. Also occurs in temperate North America.

Only a very few biological data exist. It is, however, known that the tunnel systems are gnawed in decayed wood, and that the prey consists of Diptera, e.g. Syrphidae and Tachinidae. Each cell contains from five to eight specimens.

131. ECTEMNIUS (ECTEMNIUS) GUTTATUS (Van der Linden, 1829)

Fig. 369.

Crabro guttatus van der Linden, 1829:51.

Crabro borealis Dahlbom, 1838:81.

Crabro spinicollis Herrich-Schäffer, 1841:14.

Closely related to borealis. In many cases a safe identification is only possible by comparison with abundant material of the species, on the basis of which an idea can be formed of the rather great infra-specific variation.

Female: 7-9 mm. The mandibles have a larger or smaller yellow or yellow-white spot in the middle, which is only seldom missing. The yellow colour of scapus is considerably more extensive than in borealis. The transverse carina, dorsally delimiting the shining area dorsal to antennal sockets, forms an even, shallow arch. The yellow spots on pronotum, like the lateral angles, are well developed. Punctation on scutellum is much obscured by the longitudinal rugosity, which covers all the sclerite. The yellow transverse spot on metanotum only seldom absent. Punctation distinct on lateral faces of mesopleuron. The yellow lateral spots on abdomen are largest on terga 2 and 5, where they form transverse bands in many specimens from Central and South Europe. Small spots on tergum 1 may occur in these specimens. The yellow markings on tibia 2, on average, considerably more extensive than in borealis.

Male: 6-8 mm. Mandibles very often with yellow pattern. The yellow colour on scapus occupies more than half the surface of the segment. Second flagellar segment as long as third. Pronotum often with yellow lateral spots. Scutum with rather coarse, irregularly rugose punctation, carinae anteriorly strongly projecting. Scutellum with irregular sculpture, not forming distinct longitudinal rugosity. The yellow lateral spots on terga 2-6 always present, although the last may be strongly reduced. Femur 1 at the base with a strong, protruding, sharp-edged swelling (Fig. 369). Tibiae 2-3 always yellow on outer face. Metatarsus 2 and next tarsal segment rather long and slender, distally with a weak, ventrally directed dilation.

This species is not found in Denmark, but might be expected, particularly in NEZ. - Sweden: a rather common species, occurring from Sk. to Dlr. and Gstr. - Norway: sparse occurrence, found northwards to Troms. - Finland: common and widely distributed, northwards to Ok and Ob. - Soviet Karelia: Ib and Kr. - Found all over Europe, except the Iberian Peninsula and the Balkans, Eastwards the species reaches the Urals and Caucasus.

The biology of the species is very little known. It is recorded that it nests

in old timber, and that the cells are provisioned with flies of the families Syrphidae and Muscidae. The larva was described by Minkiewicz, 1931.

132. ECTEMNIUS (ECTEMNIUS) BOREALIS (Zetterstedt, 1838)

Figs. 353, 370, 374.

Crabro borealis Zetterstedt, 1838:443.
Crabro nigrinus Herrich-Schäffer, 1841:15.

Female: 7-9 mm. Head in front view only slightly broader than long. Punctation of frons dense and regular, never forming rugae or striae. In front of the ocelli, which are placed in a very obtuse triangle, the interstices between the punctures are shining, equal to or a little narrower than the diameter of the punctures. Further anteriorly the punctation becomes denser. The carina, which delimits the shining area dorsal to the antennal sockets, usually distinctly angularly bent. Pubescence on vertex short, missing posteriorly. Median lobe of clypeus comparatively broad, rather strongly projecting, seen in profile as Fig. 353. Lateral lobes strong, rounded, directed obliquely forward. Pubescence strongly silvery. Mandibles black, strong, with a stout basal tooth. Their middle has a yellow-white spot, which in Lappland specimens is usually reduced in size . Scapus yellow with a larger or smaller black spot on posterior face. Second flagellar segment slightly longer than third. Pronotum black, yellow lateral spots are generally absent in Fennoscandian specimens. Danish specimens often have very small lateral spots. The sharp, transverse carina continues directly into the obtuse lateral angles. Humeral tubercle yellow. Scutum anteriorly with three, rather strongly projecting, longitudinal carinae. The sculpture consists mainly of punctation, only slightly stronger than that on frons in front of the ocelli. Interstices form a distinct striation anteriorly and especially posteriorly. Scutellum shining in the middle, with sparse punctation. Anteriorly and posteriorly punctation is considerably stronger and denser, interstices here forming longitudinal rugae. Metanotum in Danish and South Swedish specimens usually strongly and regularly transversely striate, interspersed with a weak punctation, which ventrally becomes dominant. Lateral faces of propodeum finely and densely striate, interspersed with short ribs. Posterior face both laterally and dorsally delimited by a sharp carina. The surface proper regularly transversely striate. Area cordiformis without distinct delimitation, its sculpture consists of irregular and weak, obliquely outwardly directed striae or rugae. Abdomen with yellow lateral spots on terga 2-5. Specimens from Central and South Europe in addition have yellow spots on tergum 1. Pygidial area strongly narrowed posteriorly, bordered by golden bristles. Femora black, femora 1-2 often with a small yellow spot distally. Tibiae yellow with

black inner face. Tibia 2 may be completely black in specimens from Lappland. Tarsi 2-3 dark-brown, tarsus 1 paler.

Male: 6-8 mm. Head in front view slightly broader than high (73:70). Frons in front of ocelli densely punctate with a very fine intermediate microsculpture and rugosity, which is distinctly seen at 100 times magnification. Clypeus with a broad, anteriorly rounded median lobe. Its lateral lobes very small, only distinct if viewed obliquely from below. Mandibles always completely black, at any rate in Danish and Fennoscandian specimens, with a large tooth near the base. The yellow spot on scapus usually very reduced. Segments 2, 4 and 5 ventrally distinctly excavated. Second segment seen from above only slightly longer than third. Pronotum very seldom with yellow lateral spots, its transverse carina continues direct into the obtuse lateral angles. Humeral tubercle yellow. Carinae on anterior part of scutum, compared with the remaining species of the subgenus, slightly developed, which also applies to the remaining sculpture of scutum. Interstices between punctures form fine, regular rugae, especially posteriorly. Scutellum densely, longitudinally rugose, black like metanotum. Lateral faces of mesopleuron with a mixture of coarse and finer carinae, ventrally replaced by a fine and rather dense punctation. Striation on lateral faces of propodeum usually slightly stronger. Area on posterior face surrounded by a carina, strongly transversely striate. Area cordiformis with oblique outwardly directed irregular rugosity or striation. Yellow pattern of abdomen very variable. Lateral spots are usually found on terga 2-6, but these may be missing in small specimens, but only exceptionally are the spots on tergum 2 missing. Femur 1 basally on ventral face with a slightly projecting, sharp-edged dilation (Fig. 370), dorsally mainly yellow-brown, ventrally yellow with two black or slightly brownish longitudinal streaks. Tibia 1 yellow with a broad, black, longitudinal stripe. Metatarsus 1 strongly depressed, broader than apex of tibia, transparent like second tarsal segment (Fig. 374), ventral spines very weak, pale. Femora 2-3 black, often with a distinct yellow streak along dorsal face, joining a larger or smaller distal spot. Yellow colour of tibiae very reduced. Metatarsus 2 not dilated distally.

Sparse occurrence in Denmark. - Sweden: rather common, extensive distribution northwards to T. Lpm. and Nb. - Norway: found in the south-eastern districts, southern and northern Nordland, and in Troms. - Finland: rather common, northwards to Ks. - Soviet Karelia: Ib and Kr. - Distributed in Central and East Europe, western U.S.S.R., around Lake Baikal, north-eastern China, Korea, Kamchatka, Sakhalin and Japan. Possibly occurs in southern Siberia, but is not recorded.

As regards the biology of the species, it is only known that males as well as females have a marked preference for Umbellifers, e.g. Angelica, when foraging. It is, however, supposed that its breeding biology does not differ considerably from that of dives and guttatus.

Genus *Lestica* Billberg

Lestica Billberg, 1820:107

Type-species: Crabro subterraneus Fabricius, 1775.

Medium-sized species with pronounced yellow markings (Fig. 376). Head and thorax with very dense punctation or pitted sculpture. Head large, usually well developed behind the eyes. Ocelli generally forming an obtuse angle. Clypeus and inner orbits with dense, silvery pubescence. Inner orbits strongly converging ventrally, antennae inserted very close to each other. Facial fovea well developed, frontal line absent. Mandibles bidentate (tridentate in female Clypeocrabro), without tooth on inner side. Antennae 12-segmented in both sexes. Pronotum with a sharp transverse carina, laterally usually projected into sharp lateral angles. Mesopleuron with sharply projecting

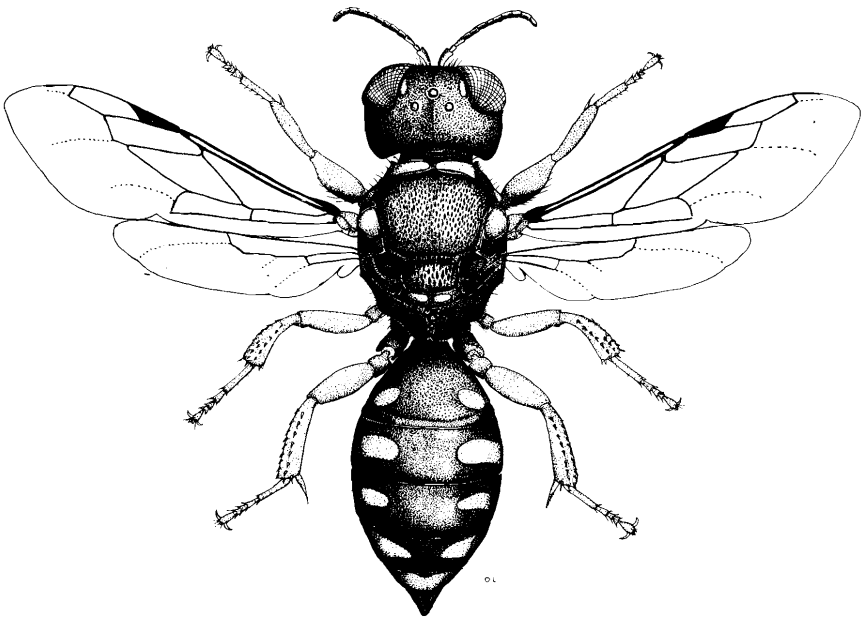


Fig. 376. Female of Lestica subterranea (Fabr.). Length: 9-12 mm.

carina in front of coxa 2. Propodeum without well delimited area cordiformis. Abdomen strongly punctate. Females with pygidial area. Tarsus 1 in males often strongly depressed and dilated. Forewings with a single cubital and discoidal cell.

The genus is distributed in all zoogeographical regions and comprises over 30 species. Most of these occur in the northern hemisphere.

The nest is constructed either in the soil or in wood (Clypeocrabro). The prey consists of adult Lepidoptera, often Crambidae.

Key to species of Lestica

Females

1 Median keel on clypeus broad, strongly projecting, continued into a narrow nose-like median lobe. Lateral lobes also strongly projecting (Fig. 380). Pygidial area apically considerably narrowed ..... 135. clypeata (Schreber)

\- Median lobe of clypeus slightly projecting, abruptly truncate, lateral lobes small. Pygidial area plane, triangular 2

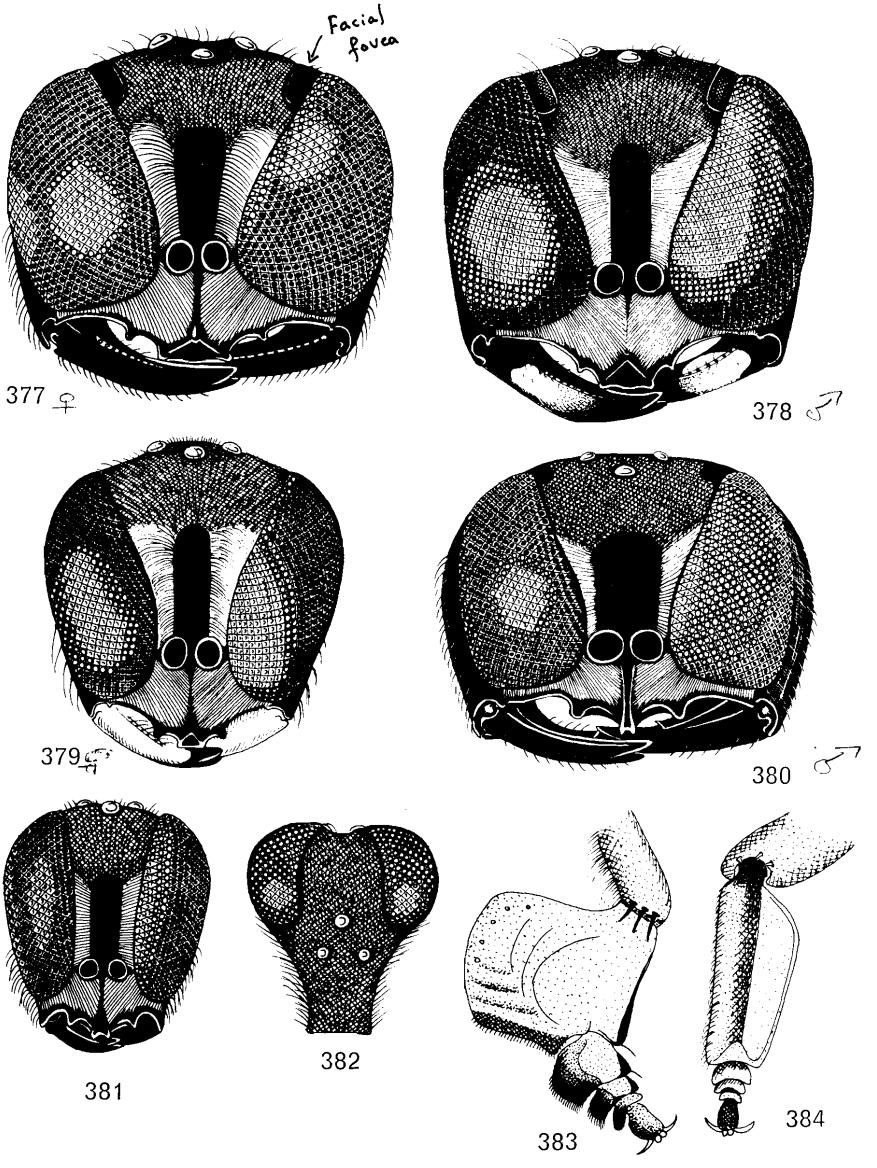
2(1) Mesopleuron very coarsely pitted and rugoso-punctate, dorsally with interrupted, rather strong, transverse ribs. Median furrow in area cordiformis anteriorly at most twice as broad as posteriorly ..... 134. alata (Panzer)

\- Mesopleuron shiny with sparse, coarse punctures, dorsally with only indications of transverse striae. Median furrow in area cordiformis anteriorly more than twice as broad as posteriorly .....133. subterranea (Fabricius)

Males

1 Head behind eyes very strongly constricted like a neck (Fig. 382). Pronotum prolonged in a cone. Metatarsus 1 dilated to an almost quadrate, partly transparent shield (Fig. 383). .....135, clypeata (Schreber)

\- Head and pronotum not strikingly constricted or prolonged. Metatarsus 1 with at most a



Figs. 377-381. Heads in frontal view of Lestica. - 377: subterranea (Fabr.), ♀; 378: same, ♂; 379: alata (Panz.), ♀; 380: same, ♂; 381: same, ♂.
Fig. 382. Head in dorsal view of male Lestica clypeata (Schreber).
Figs. 383, 384. Tarsus 1 of male Lestica. - 383: clypeata (Schreber); 384: alata (Panz.).

rather weak, transparent dilation 2

2(1) Metatarsus 1 dilated on outer side (Fig. 384). Mandibles yellow with red-brown apex. Mesopleuron coarsely and densely rugoso-punctate, with weak transverse striation ..... 134. alata (Panzer)

- Metatarsus 1 completely devoid of dilation. Mandibles uniform black. Mesopleuron shining, with sparse punctures ..... 133. subterranea (Fabricius)

133. LESTICA (LESTICA) SUBTERRANEA (Fabricius, 1775)

Figs. 376, 377.

Crabro subterraneus Fabricius, 1775:374.

Female: 9-12 mm. Head in front view considerably broader than long (Fig. 377). Vertex rather well developed, sides only slightly converging posteriorly. Punctation in front of ocelli rather sparse and irregular, interstices shining. Behind ocelli punctation is considerably denser and more irregular. Frontal fovea almost as broad as scapus with extremely fine punctation. Clypeus anteriorly with three rounded tubercles, between which a shining triangular area is found. Mandibles black, often with a faint reddish portion subapically. Scapus yellow with a large black spot posteriorly. Flagellum black, sometimes weakly yellow proximally, median segments broader than long. Pronotum dorsally with a sharp, transverse carina, laterally projected into small, often acute, lateral angles. Danish specimens usually have white-yellow lateral spots on pronotum; these are usually missing in Fennoscandian material. Humeral tubercle with a large white-yellow spot. Scutum with coarse sculpture. Punctation dense, interstices forming short, longitudinal rugae. Scutellum anteriorly shining, even, posteriorly with sharp longitudinal carinae. Mesopleuron shining, with sparse and rather coarse, slightly irregular punctures, only immediately below the base of forewings with transverse rugosity. Lateral faces of propodeum dull, with dense and rather coarse, irregular striation, continuing uninterruptedly on posterior face. Area cordiformis with slightly radiating striation, median furrow very broad, at the bottom with transverse carinae. Abdomen shining, smooth. Tergum 1 with very dense and rather coarse punctation. Punctures slightly stronger than on vertex. Succeeding terga gradually more weakly punctate. Terga 1-4 with white-yellow lateral spots, tergum 5 usually with a transverse band. Pygidial area black, plane, densely punctate, with rather strongly concave lateral margins, distally with a dense, slightly golden shining pubescen-

ce. Legs red-yellow, femur 1 with a black, basal spot. Tibia 1 often with a yellow stripe along anterior face.

Male: 8.5-11 mm. Head in front view slightly longer than broad. Vertex well developed, slightly narrowed posteriorly. Punctation of frons dense and coarse. Facial fovea narrow, rather deep. Pubescence of frons, especially anteriorly, long, slightly grey-golden. Clypeus with a slight median projection, anterior margin as in female, but the area between the rounded processes somewhat more shining and as a rule slightly smaller. Scapus yellow with a larger or smaller spot posteriorly. Flagellum black, median segments ventrally with yellow-brown swelling. Mandibles chiefly black, but often with paler distal markings. Pronotum usually without yellow lateral spots, lateral angles weak. Humeral tubercle yellow. Scutum very coarsely sculptured, punctures large, partly coalescing longitudinally, interstices forming distinct longitudinal rugae. Scutellum somewhat more weakly sculptured. Metanotum in some Danish and South Swedish specimens with two yellow spots. Lateral parts of mesopleuron shining with sparse but coarse punctation. In front of coxa 2 the punctation becomes very dense, while the size of the punctures decreases slightly. Lateral faces of propodeum shining with regular and rather strong striation. Striation in area cordiformis coarse and very irregular, reticulate. Abdomen shining, punctation, especially on tergum 1, rather coarse, on succeeding terga gradually weaker. Terga 1-3 and 6 with yellow lateral spots, terga 4 and 5 usually with transverse bands. Metatarsus 1 very slightly pigmented, not dilated, slightly depressed. Legs 2-3 with red-yellow femora and more or less uniform coloured tibiae and tarsi.

Widely distributed, but not common in Fennoscandia and Denmark. - Denmark: only recorded from Jutland and North Zealand. - Sweden: found from Sk. in the south to Nb. in the north. - Norway: a few specimens from AAy, Dømmesmoen, and SFi, Skjolden. - Finland: found in all districts except St up to Kb and Sb. - Soviet Karelia: Ib and Kr. - The distribution area covers most of Europe. In the east the species occurs in South-East Kazakhstan.

The nests are usually constructed in sandy, strongly sunexposed localities. The unbranched tunnel, upwards of 20 cm long, descends into the soil. The cells are built at the end of 4-10 cm long lateral tunnels, at right angles to the tunnel. The number of cells varies between 2 and 11. The prey consists of smaller adult Lepidoptera, generally of the families Crambidae, Zygaenidae and Tortricidae. Each cell contains from 8-12 specimens, whose heads always point towards the bottom of the cell. The uppermost cells are provisioned first. The egg hatches in 1-2 days, and after 8-10 days the larva is full-grown. The surface of the cocoon is covered with wings, legs and other food remains.

134. LESTICA (CERATOCULUS) ALATA (Panzer, 1797)

Figs. 378, 379, 384.

Crabro alatus Panzer, 1797: T.6.

Crabro basalis Smith, 1856:415.

Female: 9-12 mm. Head ventrally considerably narrowed (Fig. 378). Punctation in front of ocelli coarse, interstices broad, slightly convex. Behind ocelli punctation becomes considerably finer and denser. Facial fovea strongly impressed, as broad as scapus, extremely finely punctate. Clypeus with distinct, projecting median lobe, anterior margin with a shining triangular area, whose corners consist of three rounded processes, of which the median one is vestigial. Mandibles with a larger or smaller central yellow spot, apex red-brown. Scapus entirely yellow like the first segment on flagellum. Pronotum dorsally with a sharp transverse carina, laterally projecting into acute, almost tooth-like spines. The two white-yellow lateral spots large. Humeral tubercle also white-yellow spotted. Scutum very coarsely rugose, punctation almost pit-like. Scutellum somewhat more weakly punctate. Sutures between scutellum and metanotum and between metanotum and propodeum laterally white-yellow. Mesopleuron coarsely and densely pitted with indications of transverse striation. Lateral faces of propodeum shining, with very regular transverse striation, interstices with very fine granular microsculpture. Posterior face with similar sculpture. Area cordiformis with coarse, irregular, radiate striation, with numerous transverse connections between striae. Median furrow often indistinct, only slightly broader anteriorly. Punctation on abdomen very distinct, especially on tergum 1. Terga 1-4 with yellow lateral spots, tergum 5 with transverse bands. Pygidial area densely punctate, plane, with concave lateral margins and slightly golden shining apical pubescence. Legs red-yellow. Anterior face of tibia 1 yellow.

Male: 8.5-11 mm. Head distinctly longer than broad (Fig. 379). Vertex short, rather strongly narrowed posteriorly. Punctation of frons in front of ocelli rather weak, behind these stronger and denser. Facial fovea narrow, distinctly marked. Where the occipital carina joins the hypostomal carina a rather strong concavity is found. The shining, triangular area anteriorly on clypeus small, indistinct. Right behind the anterior margin a yellow transverse line is often present. Mandibles mainly yellow, apex reddish. Scapus entirely yellow, flagellum proximally yellow, distally gradually darker. Segments longer than broad, ventrally with double, narrow tyloidea. Pronotum densely and strongly punctate, with yellow lateral spots and usually projecting lateral angles. Humeral tubercle yellow. Scutum and scutellum with very coarse pitted-rugose

sculpture. The area just in front of coxa 2 shining, smooth with only very sparse punctation. Lateral faces of propodeum coarsely striate, interstices shining, with microscopically fine sculpture. Posterior face of similar appearance, but with somewhat weaker striation. Area cordiformis coarsely pitted or reticulate-rugose. Punctation on tergum 1 very strong, on succeeding ones gradually weaker. Terga 1-3 with yellow lateral spots, but those on first may be missing. Terga 4-6 with transverse bands, but that on fourth may be interrupted. Metatarsus 1 with a long lamella-like and transparent dilation, the breadth of which hardly exceeds that of the metatarsus. Tarsal segments 2-4 distinctly depressed, slightly dilated (Fig. 384). The whole tarsus very faintly pigmented. Tibiae yellow. Femora yellow with extensive yellow pattern. Femur 1 with fringes and tufts of long, white hairs. Femur 2 basally on ventral face with a small swelling, the metatarsus very slightly asymmetrically dilated. Tibia 2 very slightly curved in an S-shape. Hindlegs without secondary sexual characters.

The species has an eastern occurrence in Fennoscandia; it is found in Sweden: Vg. (Aurivillius), south-eastern Finland: Ka, Sa, and in Soviet Karelia: Ib and Kr. - Widely distributed in Europe, through southern Siberia to Mongolia, and further through China and Japan to the Pacific Ocean.

The nests are constructed in the soil. The tunnel is often long, descending in a spiral (Tsuneki, 1960). Each nest contains up to 7 cells, which are provisioned with adult Lepidoptera, e.g. Crambidae, Tortricidae, Pyralidae and Noctuidae. When the female has located her prey, she stays hovering for a moment, whereafter she approaches it slowly. With a sudden movement she seizes the prey, grasping it with her legs and injects the poison. Number of prey per cell varies from 4 to 9.

Note. Kohl (1915), Pulkkinen (1931), Merisuo (1946), Romanova (1969), Tsukeni (1947, 1971) and Mocsar (1959) mention the "aberration" basalis Smith, 1856, which in Fennoscandia is restricted to south-eastern Finland. The name of this aberration is due to the more or less extensive red colour of first, and partly also of second abdominal segment in female. Specimens of this appearance seem to have a pronounced eastern occurrence, since specimens deriving from Hungary, Asia Minor, Ukraine, Caucasus, North China, Manchuria and Mongolia show this feature. From Japan and Korea the subspecies japonicus Schulz is recorded. The taxonomic status of basalis Smith is open to discussion, but it is not probable that it should be regarded as a subspecies, since apparently it occurs sympatrically with the nominate form both in eastern Finland and in northern Caucasus.

135. LESTICA (CLYPEOCRABRO) CLYPEATA (Schreber, 1759)

Figs. 380-383.

Apis clypeata Schreber, 1759:14.

Female: 9-12 mm. Head in front view broader than long (Fig. 380). Vertex rather well developed, its margins running almost parallel for a comparatively long distance. Punctation behind ocelli strong, irregular, with shining interstices. The area in front of ocelli with densely placed, rather shallow pits. Facial fovea distinct, narrower than scapus. Clypeus with very strongly convex median keel, anteriorly slightly bifid. Lateral lobes well developed, rounded. Mandibles black with slightly reddish apex. Scapus yellow, in Danish and Fennoscandian specimens with a larger or smaller brown spot posteriorly. Along the anterior margin a sharp, lamella-like dilation is found. Flagellum black, the proximal segments often yellowish basally. Pronotum generally completely black, coarsely and densely punctate, with sharp, partly forwardly directed angles. Humeral tubercle with a yellow spot. An almost entirely yellow pronotum may occur in specimens from Central and South Europe. Scutum anteriorly densely and coarsely pitted with weak longitudinal rugosity, posteriorly the sculpture becomes sparser. Mesopleuron laterally dense and coarsely pitted, ventrally near the mid-line and usually also in front of coxa 2 the sculpture and the interstices become wider. Lateral faces of propodeum with dull sateen-like lustre, extremely finely and densely striate. Posterior face with a fine, granular sculpture. Area cordiformis only marked by its more shiny appearance and somewhat coarser and more irregular sculpture. Tergum 1 very densely and coarsely punctate. Interstices in many places smaller than diameter of the punctures. On the succeeding terga punctation becomes gradually weaker. Pygidial area apically strongly narrowed into a smooth, groove-like part. The area is surrounded by stiff golden bristles. All terga with yellow spots, which in Danish and Fennoscandian specimens may form transverse bands on terga 4 and 5. In South European specimens the abdomen may be mainly yellow dorsally, and also the sterna may have yellow markings. Ventral face of femur 1 plane, surrounded by a carina. Femora are mainly black in specimens from Denmark and Fennoscandia, while tibiae, except for a few black spots on tibia 3, are pure yellow. Specimens with entirely yellow legs frequently occur in South Europe.

Male: 8-11 mm. The external morphology is extremely striking. Head in front view very narrow, considerably longer than broad (Fig. 381), seen from above strongly constricted behind the eyes (Fig. 382). Lateral ocelli are placed far behind the compound eyes. Occipital carina projecting like a collar.

Sculpture of frons consists of a coarse and dense punctation, slightly rugose behind the ocelli. Clypeus displays only a slight longitudinal keel, which is characteristic of the female, and the small lateral teeth. Mandibles black with slightly reddish apex. Scapus about twice as long as broad, yellow with a larger or smaller black or brownish spot posteriorly. Flagellum long, ventrally brown-yellow, with double longitudinal tyloidea. Pronotum conical, strongly narrowed anteriorly, without yellow pattern or protruding angles. Humeral tubercles yellow spotted. Scutum strongly pitted, centrally and posteriorly with shining interstices, anteriorly and laterally the interstices are smaller than the diameter of the punctures. Scutellum shining with sparse, rather pronounced pits. Mesopleuron shining, laterally with very coarse, sparse pits, ventrally with a fine, granular sculpture and sparse shallow pits. Pilosity laterally very long, ventrally short, felty, silvery. Lateral faces of propodeum with dense slightly undulating striae. The transition to the posterior face marked by a narrow, coarsely and irregularly pitted region, medially delimited by a more or less distinct undulating carina. Area cordiformis without distinct delimitation, coarsely, reticulately pitted. Tergum 1 with dense, strong punctation, succeeding terga finely and sparsely punctate. Last tergum with a rather sharp, longitudinal impression. All terga with yellow markings, usually forming transverse bands on the last three or four terga. Sterna 2 and 3 usually with a large, yellow, median spot. The legs, especially the forelegs, with several, very conspicuous secondary sexual characters. Trochanter 1 with a sharply projecting, transparent, lamella-like dilation. Femur 1 on the outer face with dense, long, silvery pubescence. Tibiae slightly dilated, metatarsus 1 with a shield-like dilation, the other tarsal segments more weakly dilated (Fig 383). Femur 2 at the base of the ventral face with a strong, triangular, spine-like dilation, which continues into a fine, longitudinal carina on ventral face of femur. The femur with a distinct brown longitudinal band. Tibia 2 smooth, without spines. Metatarsus 2 distally slightly asymmetrically dilated. Trochanter 3 with backwardly directed spine. Femur 3 dark with a broad, yellow, longitudinal stripe.

The species is very rare in Fennoscandia and Denmark. - A single female specimen from Denmark: LFM, Keldskov on Lolland. - Sweden: very sparse occurrence from Sk. to Dlr. and Gstr. in the north. - Norway: no records, and the species is unlikely to maintain populations in the country. - Finland: a rare southern and south-eastern species; northernmost records from Kb and Ok. - Soviet Karelia: Ib and Kr. - The distribution area covers Europe, North Africa, Asia Minor, the near Orient and expands through southern Siberia to Lake Baikal.

In contrast to the two preceding species, clypeata nests in wood. Abandoned tunnel systems of Ectemnius or xylophagous insect larvae are often used. These are however first cleaned. The prey consists of adult Lepidoptera, e.g. Crambidae, Sesiidae and Sterrhidae.

Genus *Entomognathus* Dahlbom

Entomognathus Dahlbom, 1844:295.

Type-species: Crabro brevis van der Linden, 1829.

Small, stout species, in habitus (Fig. 385) similar to Lindenius. Mandibles end in a single tooth, ventral margin with a deep emargination, proximally delimited by a broad tooth, as e.g. Tachysphex (Fig. 388). On the inner side one or two tiny teeth. Clypeus convex, anteriorly with a shining, more or less lens-shaped area; silvery pubescence thin. Eyes hairy. Between posterior border of eyes and the lateral ocelli are distinct frontal markings. Ocelli placed in an obtuse-angled triangle. Thorax short and broad, shining, smooth. Epicnemium and epicnemial carina well developed. Propodeum very short, dorsally with distinct area cordiformis, surrounded by a strongly pitted furrow. Abdomen broad, ovoid. Both sexes with pygidial area. Legs short and stout, females with extremely weak pecten on metatarsus 1. Tibiae 2-3 with short, dark spines on the outer side.

The genus comprises about 30 species, which occur in Holarctis as well as in tropical Africa and South America. In Denmark and Fennoscandia only a single species occurs.

The nest is constructed in the soil, often in slopes. The prey consists of small Chrysomelidae (Coleoptera).

136. ENTOMOGNATHUS BREVIS (Van der Linden, 1829)

Figs. 385-388.

Crabro brevis van der Linden, 1829:72.

Female: 4-6 mm. Head in front view broader than long, with thin, grey-yellow erect pubescence (Fig. 386). Anterior border of clypeus without special emarginations or teeth. Mandibles brown or red-brown, without yellow markings. Antennae black, scapus with either yellow distal and proximal spots or with completely yellow anterior face. Frons shining with rather sparse punctation. Humeral tubercle usually with a yellow spot. Thorax otherwise without yellow pattern, shiny, with very fine scattered punctation. Area cordiformis shining, without

sculpture. Lateral faces of propodeum also smooth, with extremely fine punctation. Pygidial area red-brown or red-yellow, plane, triangular, with dense and rather coarse punctation. Coxa 1 distally with a small downwardly directed spine. Femur 1 triangular in cross section. Tibiae 1-2 yellow, tibia 3 black with yellow proximal ring.

Male: 3-5 mm. Head strongly narrowed ventrally. Clypeus with rather dense silvery pubescence, anterior border with a usually truncate median lobe and two rather strong, lateral teeth (Fig. 387). Eyes densely hairy. Mandibles basally with a larger or smaller yellow area, distally red-yellow or red-brown. Scapus often entirely yellow, flagellum ventrally with yellow spots on distal segments. Thorax and propodeum as in female, but slightly more strongly punctate. Pygidial area with broadly rounded apex, red-yellow. Legs with very extensive yellow markings, but femur 3 completely black. Femur 1 with two narrow, black, longitudinal stripes, femur 2 with basal black spot, extending upwards.

The species is relatively common in Fennoscandia and Denmark. Its northern distribution limit in Sweden runs through Vrm., Nrk. and Upl. - Rather little material is known from Norway: AK, On. - The species seems to have a south-eastern distribution pattern in Finland, the most northern records from Kb

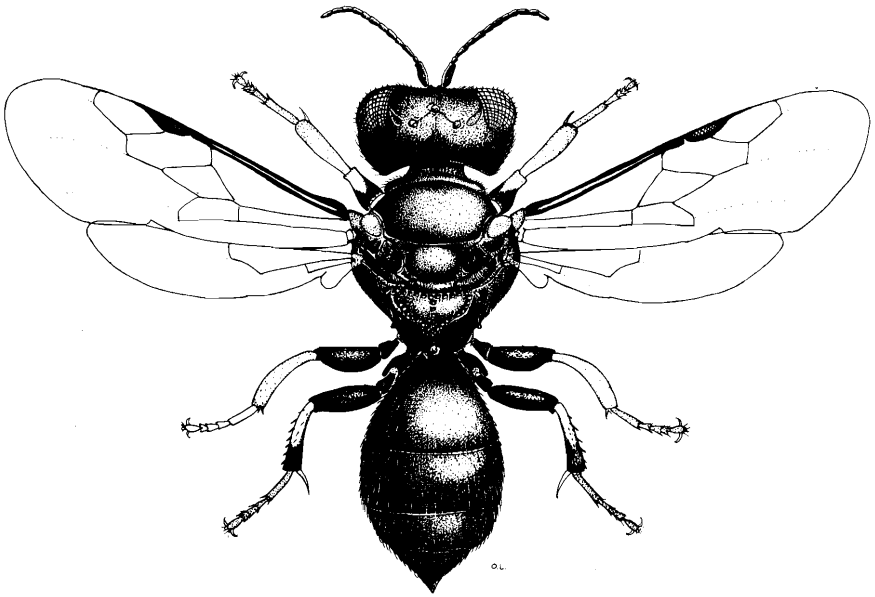
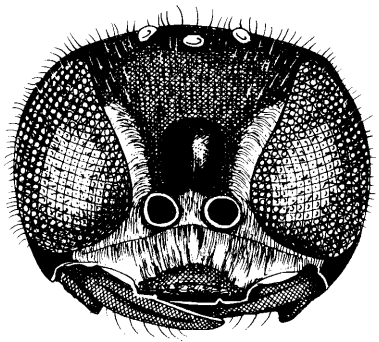


Fig. 385. Female of Entomognathus brevis (v. d. Linden). Length: 4-6 mm.

and Sb. - Soviet Karelia: Ib and Kr. - The distribution area of this species covers large areas of the Palaearctic region. It is recorded from England and Spain in the west, through Central Asia to Northern China and Japan in the east. Towards the south it is recorded from Tunisia and Egypt.

The species often nests gregariously in slopes, where the soil is sandy and gravelly (e.g. gravel pits). As is the case of Lindenius panzeri v.d. Lind. (no. 138) the number of cells in the nest is considerably smaller in Denmark (maximally 3) compared with the conditions in France (maximally about 10) (Abrahamsen, 1951). Branching of the nest is racemose. Provision consists of Coleoptera, Chrysomelidae, Halticinae, e.g. species of Chaetocnema, Crepidodera and Longitarsus, but also smaller species of Cryptocephalinae (Cryptocephalus) are used. In each cell are placed 16-26 specimens. The larva was described by Grandi, 1925 and 1961. When full-grown, it spins a compact cocoon covered on the outer side with sand grains.



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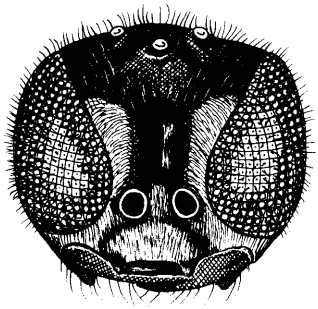

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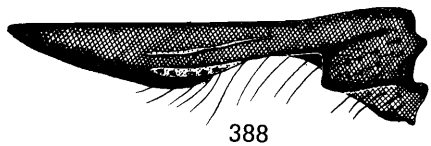

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Figs. 386-388. Entomognathus brevis (v. d. Linden). - 386: female head in frontal view; 387: male head in frontal view; 388: left mandible of female.

Genus *Lindenius* Lep. & Brullé

Lindenius Lepeletier & Brullé, 1835:791.

Type-species: Crabro albilabris Fabricius, 1793.

Comparatively small, strongly built species (Fig. 389). Clypeus often with very characteristic emarginations and teeth in anterior border, observable

when the dense silvery pubescence is partly removed or studied from below, when mandibles are opened. Mandibles ending in a single tooth, on the inner side with a larger or smaller tooth. Ocelli always placed in a very obtuse-angled triangle. Labial palps with four segments, maxillary palps with six segments. Antennae in female with twelve, in male with thirteen segments. On mesopleuron there is always a well delimited epicnemium, the epicnemial carina being very well developed. Thorax broad, robust. Propodeum short, dorsally with a usually well delimited area cordiformis, whose sculpture differs considerably from the surrounding areas. Abdomen short, non-petiolate. Both sexes with pygidial area. Tarsus 1 of females with a very short, transparent tarsal pecten.

The genus is mainly Holarctic. A little over 40 species are described, of which 35 are Palaearctic. Of these 21 occur in Europe. The number of species decreases considerably to the north, and in Denmark and Fennoscandia the genus is represented by only two species.

The species are gregarious and breed in dry, horizontal areas fully exposed

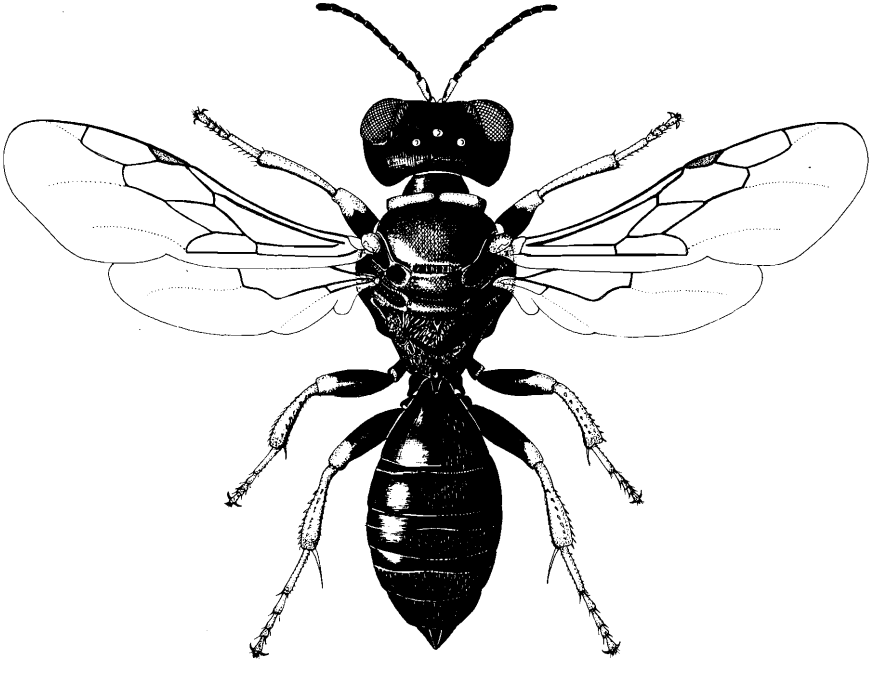


Fig. 389. Female of Lindenius albilabris (Fabr.). Length: 5-8 mm.

to the sun, where the nests are constructed in the ground. The prey consists of small Diptera, Heteroptera and Hymenoptera.

Key to species of Lindenius

1 Mandibles without yellow marks, on the inner side with very small tooth (Fig. 390). Frons without spine. Male without spines ventrally on head ..... 137. albilabris (Fabricius)

- Mandibles usually with extensive yellow markings, on the inner side with stout, triangular tooth (Fig. 391). Frons with a small spine above antennal sockets. Males have a larger or smaller spine ventrally on head 2

2 Area cordiformis with strong, radiating sculpture. Lateral faces of propodeum finely and densely striate ..... 138. panzeri (v.d. Linden)

- Area cordiformis shining, smooth, without sculpture, surrounded by a broad, strongly pitted furrow. Lateral faces of propodeum without or with very weak striae ..... pygmaeus (Rossi)

137. LINDENIUS (LINDENIUS) ALBILABRIS (Fabricius, 1793)

Figs. 389, 390, 392.

Crabro albilabris Fabricius, 1793:302.

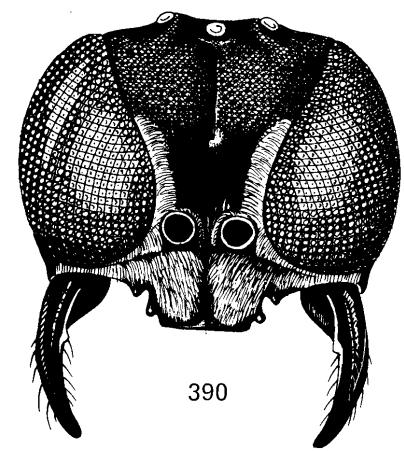
Female: 5-8 mm. Head and thorax, and usually also abdomen, with slight bronze sheen. Clypeus large, median area broad, evenly rounded or squarely truncate, lateral teeth small, rounded (Fig. 390). Facial fovea shining, slightly swollen. Mandibles and antennae black or slightly brownish, completely without yellow markings. Tooth on inner side of mandibles very weak (Fig. 390). Frons without tooth. Thorax black, without yellow pattern. Scutum and mesopleuron with a fine, rather shallow punctation. Area cordiformis framed by a broad, often pitted furrow, with a weak, often very irregular sculpture. Pygidial area rather coarsely and densely punctate, posteriorly with golden pubescence. Legs mainly black, tibia 1 along anterior border with yellow longitudinal stripe, tibiae 2 and 3 with proximal yellow spot. Wings strongly darkened.

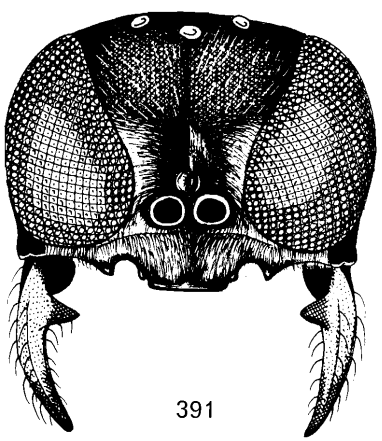
Male: 5-7 mm. On average with stronger bronze sheen. Clypeus short, lateral teeth rather well developed. Mandibles black, sometimes with lighter median area. Antennae black, scapus usually paler distally and proximally. Flagellum

ventrally with pale swellings. Head ventrally without spines. Pronotum and usually also humeral tubercle with yellow pattern. Femora black with yellow spot apically. Tibiae mainly yellow, with larger or smaller dark spot on the inner side. Tibia 2 distally with loose tuft of pale, curly hairs (Fig. 392), metatarsus 2 distinctly curved. Pygidial area pale distally, with faintly red-yellow pubescence.

A very common species in Fennoscandia and Denmark. - Denmark: known from all districts except SZ, where it most probably occurs. - Sweden: common, especially in Sk., Sm. and Öl. Found towards the north to Hls. and Med. - Norway: only known from the southern districts. - Finland: common from Al, Ab, N and Ka in the south to Ok and ObS in the north. - Soviet Karelia: Ib and Kr. - The distribution area covers most European countries, North Africa and extends far towards the east in Central Asia (Mongolia and Manchuria).

The tunnel at first descends about 10 cm vertically into the ground, then continues horizontally. From the vertical tunnel several side branches may





Figs. 390, 391. Heads in frontal view of female Lindenius. - 390: albilabris (Fabr.); 391: panzeri (v. d. Lind.).
Fig. 392. Tibia 2 and proximal part of tarsus of male Lindenius albilabris (v. d. Lind.).

issue, each ending in a single cell. In Denmark and Fennoscandia the prey usually consists of Hemiptera, mainly of the family Miridae. Each cell may contain up to about 20 specimens. When returning to the nest, the female flies with the prey directly into the entrance. At least two well separated ecopheno-types seem to occur, of which one - as mentioned above - uses Hemiptera as provision, while the other, apparently a more southerly distributed type, uses smaller Diptera, e.g. Chloropidae, Empididae or Dolichopodidae. According to Adlerz (1910), both types are represented in Sweden, but not sympatrically. Adlerz (l.c.), in addition, describes a population using both Diptera and Hemiptera as provision. As parasitoid is especially known Myrmosa melanocephala Fabr. (Hym., Myrmosidae).

138. LINDENIUS (TRACHELOSIMUS) PANZERI (van der Linden, 1829)

Fig. 391.

Crabro panzeri van der Linden, 1829:70.

Female: 5-7 mm. Head in front view very broad. Clypeus short, its silvery pubescence dense and strong. Mandibles and scapus mainly yellow, mandibles on the inner side with very stout tooth (Fig. 391). Frons above base of antennae with small spine. Facial fovea very indistinct, slightly concave. Pronotum with yellow transverse band interrupted in middle. Humeral tubercle yellow. Often there is also a yellow spot on scutellum. Danish specimens often lack yellow pattern on thorax. Only specimens from SJ are of same colour as those from Central Europe. Scutum densely punctate. Propleuron laterally with sharp, oblique carina. Area cordiformis strongly radiately sculptured. Lateral faces of propodeum with dense and fine transverse striation. Pygidial area rather narrow, slightly red-brown, lateral faces concave, apex with weak, slightly golden pubescence. Femora black, sometimes with a very small apical spot. Tibiae mainly yellow, with larger or smaller brownish spot on the inner side.

Male: 4-6 mm. Yellow pattern not quite so extensive as in female, often absent from humeral tubercle and pronotum. Specimens with yellow markings on scutellum are very rare. Tibiae partly black. Sculpture as in female. Flagellum without swellings ventrally. Head, especially in robust individuals, with downwardly directed spine on ventral face of head, right in front of end of occipital carina. Tibia 2 without hair tuft, metatarsus straight. Pygidial area shining with short, sparse pubescence.

A southern and rather rare species in Denmark, met with in SJ, EJ, F, NEZ and NWZ. - Not found in Fennoscandia. - The species is widely distributed in Europe, but has a rather sparse occurrence. The distribution area also

covers North Africa and extends towards the east to the Urals and Kazakhstan. The subspecies mongolicus Tsuneki occurs in Mongolia.

The nest is often constructed in compact, clayey soil in edge of woods (Abrahamsen, 1950). In northern regions apparently fewer nests are constructed (max. 3) than in southern localities (max. 9) (Bouwman, 1911). Construction of nest very similar to that described in albilabris. The prey consists of Diptera Chloropidae, but species of Trypetidae and Simuliidae are also used.

LINDENIUS (TRACHELOSIMUS) PYGMAEUS (Rossi, 1794)

Crabro pygmaeus Rossi, 1794:124.

Close to panzeri, from which it is separated by the following characters: frontal markings distinct, very finely and densely punctate. Head and scutum with considerably finer sculpture. Clypeus laterally with a small tooth. Area cordiformis shining, smooth. Lateral faces of propodeum with or without weak sculpture. Oblique carinae on propleuron missing. In the male the tooth on ventral face of head may be very reduced. Clypeus of male in the middle, just behind anterior border, with strong depression.

The species is distributed in Central and south-eastern Europe, northwards to England, Holland, and Holstein in North Germany. It may occur in southern Denmark. Not found in Fennoscandia.

Note. The species occurs with two distinct subspecies (Beaumont, 1956), of which armatus van der Linden, 1829 has the northernmost occurrence.

The prey consists of small Hymenoptera, e.g. Chalcidoidea, Braconidae, Ophioninae and Formicidae. Exceptionally Diptera are taken (Grandi, 1961; Maneval, 1937). The larva was described by Grandi, 1961.

Genus *Rhopalum* Stephens

Rhopalum Stephens, 1829:34.

(Euplilis Risso, 1826, sensu American authors).

Type-species: Crabro rufiventris Panzer, 1799 (=Sphex clavipes Linné, 1758).

Small, slender, elongate species (Fig. 393). Head large, seen from above approximately rectangular. Ocelli placed in right-angled or obtuse-angled triangle. Pubescence of face silvery. Mandibles bidentate in both sexes. Labial palps with three segments, maxillary with five. Females with 12 antennal seg-

ments, males with 13. Antennal segments of males often with pronounced secondary sexual characters, i.e. dilations and/or excavations. Thorax shining, smooth, with weak sculpture. Mesopleuron anteriorly with strongly pitted vertical furrow, without carina in front of coxa 2. Propodeum shining, without distinct cordiform area. First abdominal segment strongly elongate, forming a petiolus, dilated distally. Abdomen without yellow pattern. Females usually with distinct pygidial area. Foretarsi often dilated and depressed in males. Tibia 3 clavate.

The genus is widely distributed in all zoogeographical regions, but mainly in the tropics, numbering more than 60 species, of which five occur in Europe.

The species nest in hollow or pith-filled plant stems, e.g. Phragmites, Rosa and Sambucus, in which the cells are either arranged in a row, or placed at the end of short side tunnels in wider stems. The species is often found nesting in the same localities as Passaloecus, Trypoxylon, Psenulus and Crossocerus (Coelocrabro). Diptera, Homoptera and Psocoptera constitute the prey.

Key to species of Rhopalum

1 An obtuse, horn-like process is found between antennal sockets. Abdomen entirely black. Antennal segments of males with strong excavations and dilations. Pygidial area of females shining, surrounded by distinct carina 2

\- Frons without process. Abdomen with more or less extensive red pattern. Antennae of males simple. Pygidial area of females dull, indistinct ..... 139. clavipes (Linné)

2 (1) Female: clypeus in middle with a very sharp, triangular tooth; lateral lobes small, directed obliquely laterally (Fig. 395). Propleuron with strong tooth. Male: foretarsi asymmetrically dilated, as Fig. 399. Occipital carina ending in an acute tooth ..... 140. coarctatum (Scopoli)

\- Female: midpart of clypeus broad, truncate, lateral lobes very small, indistinct (Fig. 397). Propleuron with swelling. Male: foretarsi slightly dilated. Occipital carina abruptly truncate ..... 141. nigrinum (Kiesenwetter)

139. RHOPALUM (RHOPALUM) CLAVIPES (Linné, 1758)

Fig. 394.

Sphex clavipes Linné, 1758:569.

Female: 5-6 mm. Clypeus with strong, silvery pubescence, anterior border in middle with narrow truncate projection, whose width does not exceed width of scapus (Fig. 394). Scapus uniform white-yellow, flagellum black, proximal segments pale ventrally. Mandibles white-yellow with rust-coloured apex. Ocelli placed in a right-angled triangle. Distal part of humeral tubercle yellow or white-yellow. Propodeum short, shining dorsally, sometimes with fine lateral microsculpture. Petiolus thick, 3.5 times longer than its maximum breadth. Abdomen with very extensive red-yellow or red-brown pattern, at least on terga 3 and 6. Pygidial area dull, with distinct microsculpture, slightly concave, only distally surrounded by a weak carina. Legs with extensive white-yellow pattern on coxa 1, trochanter 1, apex of femora 1-2, tibiae 1-2 and tarsi 1-2.

Male: 4-5 mm. Anterior border of clypeus evenly rounded, without conspicuous excavations or teeth. Antennae as in female, but flagellum paler. Segment 6 ventrally slightly excavate. Mandibles distally slightly dilated. Colour pattern as in female, but mandibles may be completely dark, and the red-brown pattern on abdomen absent. Propodeum dull, with fine, longitudinal microsculpture. White-yellow colour pattern on legs best developed in specimens from Central and South Europe.

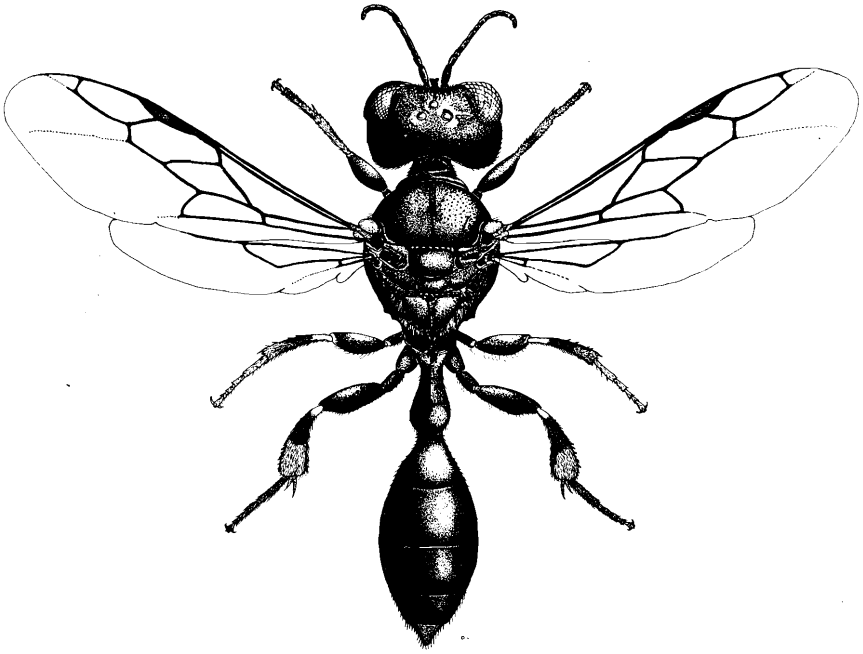


Fig. 393. Female of Rhopalum coarctatum (Scop.). Length: 6-8 mm.

The species is known from most Danish districts, and probably occurs throughout the country. - Sweden: common, known from Sk. in the south to Lu. Lpm. in the north. - In Norway the species has a southern and south-eastern distribution; northernmost localities in HEn. - In Finland the northern distribution limit runs through Ok and ObS. - Soviet Karelia: Kr. Holarctic distribution. In the Palaearctic region the distribution area covers Europe, except the Mediterranean. Additional material from Caucasus, Mongolia and Japan.

The species has been found nesting in the stems of a large number of plants, e.g. Rubus, Sambucus, Fraxinus, Spiraea, Ficus and Phragmites, but empty galls of Cynips kollari Htg. (Hym., Cynipidae), Lipara (Dipt., Chloropidae) and Saperda (Col., Cerambycidae) may also be used. Abandoned xylophagous larva-tunnels in wood are often used. Nielsen (1900) observed that the species - when space is sufficient - gnaws larger cavities in one or several places at the main entrance, from which several short side tunnels are constructed, each ending in a single cell. Each nest may contain up to 13 cells. The prey consists of small Diptera, e.g. Mycetophilidae, Chironomidae, and Culicidae as well as Homoptera, Psocoptera and Psyllidae. According to Danks (1971), the main part of the provision is represented by Psocidae (9 species) in England, whereas Maréchal (1929) from France states that the prey consists mainly of Diptera. In Finland (Merisuo, 1943) the species appears exclusively to use Psocidae as prey. Such ecological (ecophenotypic) variation is also found in Lindenius albilabris. Recorded parasitoids are Diomorus armatus (Hym., Torymidae), Omalus auratus (Hym., Chrysididae), Chaenocryptus macilentus and Ischnurgops fragilis (Hym., Ichneumonidae) and Ptychoneura melaleuca and Pt. rufitarsis (Dipt., Sarcophagidae). The larva was described by Maréchal, 1929.

140. RHOPALUM (CORYNOPUS) COARCTATUM (Scopoli, 1763)

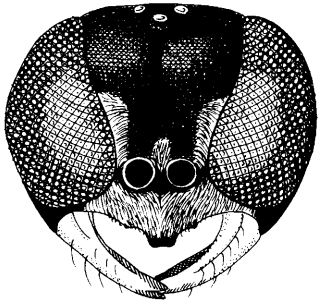
Figs. 393, 395, 396, 399, 400.

Sphex coarctatum Scopoli, 1763:293.

Crabro tibialis Fabricius, 1798:271.

Female: 6-8 mm. Head in front view as Fig. 395. Clypeus with stout central tooth and two weaker lateral teeth. Mandibles black proximally, median area red-brown or red-yellow, apex rusty-coloured. Process between base of antennae truncate. Antennae brown, scapus distally and proximally with larger or smaller yellow spots, which may be yellow-white in Central European specimens, segments 2-7 ventrally often with triangular yellow spots. Ocelli placed in an obtuse triangle. Propleuron on either side with strong, obliquely outwardly directed spine-like dilation. Humeral tubercle distally whitish or slightly yellow-

brown, only exceptionally completely black. Propodeum slightly convex, dorsally shining, smooth, with strong median furrow. Petiolus basally carinate, about 2.3 times longer than broad distally. Abdomen black, but segment 6 usually red-



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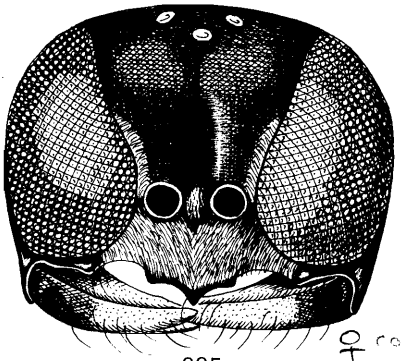

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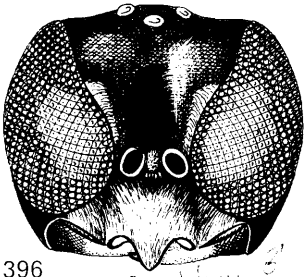

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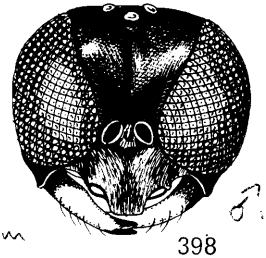

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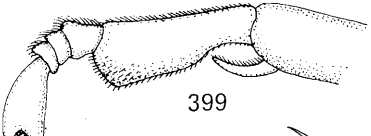

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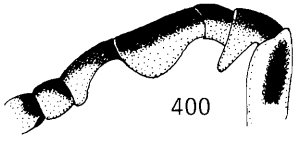

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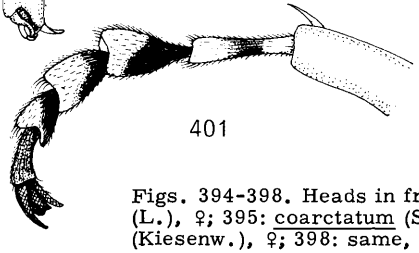

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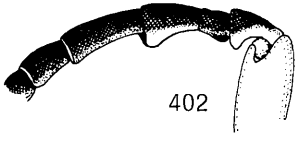

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Figs. 394-398. Heads in frontal view of Rhopalum. - 394: clavipes (L.), ♀; 395: coarctatum (Scop.), ♀; 396: same, ♂; 397: nigrinum (Kiesenw.), ♀; 398: same, ♂.

Fig. 399. Tarsus 1 of male Rhopalum coarctatum (Scop.).
Fig. 400. Proximal part of flagellum of male Rhopalum coarctatum (Scop.).
Fig. 401. Tarsus 2 of male Rhopalum nigrinum (Kiesenw.).
Fig. 402. Proximal part of flagellum of male Rhopalum nigrinum (Kiesenw.).

yellow. Pygidial area shining, smooth, framed by well developed carinae. Legs mainly black. Femora 1-2 distally with small yellow spot. Tibia 1 white-yellow with larger or smaller brown spot on the inner side. Tibiae 2-3 with a dark central area, a proximal white-yellow ring and a distal red-brown pattern. Trochanter 3 usually white-yellow.

Male: 5-7 mm. Clypeus strongly convex, median lobe rounded, triangular, anterior border strongly double-arcuate (Fig. 396). Base of mandibles black, middle white-yellow to pale brown-yellow, apex rust-coloured. Antennae very characteristically shaped and coloured: scapus with larger or smaller yellow spot ventrally. Pedicellus with large, downward-directed tooth. Segments 4 and 5 with strong basal emargination (Fig. 400). Segments 7, 9, 11 and apex of 13 white-yellow. Occipital carina anteriorly ending in an acute tooth (almost as in Crossocerus quadrimaculatus Fabr. (Fig. 425). This character may be vestigial or absent in small individuals. Humeral tubercle usually with yellow pattern posteriorly. Tarsus 1 white-yellow, asymmetrical (Fig. 399). Metatarsus 2 also white-yellow, with a basal cavity with long hairs at the bottom. Metatarsus 3 brown with red-brown base, slightly curved. Knees and trochanters with white-yellow markings. Tibia 3 distally red-yellow. Last abdominal segment red-yellow or red-brown.

The species is common in Fennoscandia and Denmark. Northern distribution limit runs through central Norway (On), Sweden (Jmt. and Ly. Lpm.). - In Finland the northernmost recorded localities are in Ok and ObS. - Soviet Karelia: Ib and Kr. A Holarctic Taiga species, common in Europe except in the Mediterranean region. The distribution area expands eastwards through Central Asia to Japan.

The nests are constructed in sites similar to those of clavipes. A characteristic feature (Danks, 1971) is that the nests are often very long, sometimes containing up to 29 cells. The average number, however, is about six. Where space allows the nest is branched. Old nests are often re-used. The prey consists of smaller Diptera, e.g. Tipulidae, Culicidae, Chironomidae, Mycetophilidae, Empididae, Agromyzidae or Psychodidae. Only exceptionally Psocoptera or even Neuroptera are used. The larva was described by Micheli, 1929 and Evans, 1964. Known parasitoids are Ischnurgops and Demopheles (Hym., Ichneumonidae), Diomorus armatus (Hym., Torymidae), Eurytoma (Hym., Eurytomidae) and Omalus auratus (Hym., Chrysididae). In addition, Ptychoneura rufitarsis (Dipt., Sarcophagidae).

141. RHOPALUM (CORYNOPUS) NIGRINUM (Kiesenwetter, 1849)

Figs. 397, 398, 401, 402.

Crabro nigrinum Kiesenwetter, 1849:91.

Crabro Kiesenwetteri A. Morawitz, 1866:267.

Considerably more slender than coarctatum. Female: 5-6 mm. Clypeus anteriorly broadly truncate, lateral lobes very small, rounded (Fig. 397). Between antennal sockets there is a small, compressed spine. Mandibles almost uniformly brown-yellow. Ocelli placed in right-angled triangle. Antennae brownish, scapus distally and proximally paler. Propleuron laterally with rounded swellings. Humeral tubercle black, posteriorly a little paler. Propodeum dorsally shining, smooth, median furrow broad. Petiolus basally carinate and slightly rugose, about 2.5 times longer than maximum breadth. Pygidial area shining, smooth, very broad, surrounded by distinct carinae. Femora black. Tibia 1 and tarsus 1 mainly white-yellow to brown-yellow. Tibiae 2-3 with pale, basal ring. Tibia 3 only slightly thickened.

Male: 4-6 mm. Anterior part of clypeus strongly convex, median lobe squarely truncate (Fig. 398). Mandibles mainly white-yellow. Scapus entirely yellow. Pedicellus with weak, downwardly directed tooth. Antennae otherwise as Fig. 402, without pale segments. Occipital carina abruptly truncate anteriorly. Propodeum very weakly rugose and punctate, median furrow very deep. Tarsus 1 very slightly dilated, metatarsus with almost parallel sides, transparent. Tarsus 2 rather strongly dilated, bicoloured (Fig. 401). Colour pattern of legs very variable, but usually with the following areas pale yellow: trochanter, femur 1 distally, tibiae 1-2 and tibia 3 basally.

The species seems to maintain isolated populations in Denmark: WJ, round Ringkøbing Fjord; EJ, Anholt, 1 ♀, 8.viii.1975 (E.S. Nielsen); F, Langeland, Keldsnor, 1 ♀, 6.viii.1975 (L.L., O.M. & V.M.). - Sweden: scattered occurrence in Sk., Og., Nrk., and Upl. - Not found in Norway. - Finland: widely distributed, locally, i.e. Ab, Rymättylä, in very large populations. Northernmost findings in Kb and ObS. - Widely distributed in the Palaearctic region, eastwards to Japan. Not recorded from Siberia, but may occur there.

The species is very sporadic and local; it seems mainly to occur near fresh and brackish water. The apparently very scattered occurrence may be due to the fact that it has been overlooked owing to its very narrow ecological niche. It is found nesting in Phragmites (Merisuo, 1968). In addition, it is stated (Valkeila, in litt.) that the species may be found breeding in stems of Elymus arenarius or Solidago occidentalis (Usuba in Tsuneki, 1952). The provision consists of small

Diptera (Chironomidae, Psychodidae, Dolichopodidae and Trypetidae) or Psocoptera. Chrysis cyanea L. (Chrysididae) is a probable parasite.

Genus *Crossocerus* Lep. & Brullé

Crossocerus Lepeletier & Brullé, 1834:763.

Type-species: Crabro scutatus Fabricius, 1787 (=Crossocerus palmipes (Linné, 1767)).

Small to medium-sized species (Fig. 403), often entirely black. Inner orbits very strongly converging ventrally, so that antennal sockets are separated by only a very thin wall. Distance from antennal sockets to inner orbits less than diameter of sockets. The forward-directed ommatids considerably larger than those placed dorsally in the eyes. Ocelli placed in a right or an acute angle. Facial fovea usually weakly marked or missing. Mandibles with or without a weak tooth on the inner side, and bi- or tridentate distally, only in females of Hoplocrabro ending in a single truncate tooth. Clypeus always with a dense, silvery pubescence, anterior border with characteristic teeth and/or emarginations. Antennae in female with 12 segments, in males with 13. Antennae of males often with a row of short, densely placed hairs ventrally. Head and thorax usually very finely sculptured. Mesopleuron generally smooth, but may have a small spine in front of coxa 2 (precoxal carina). Propodeum usually with distinct, shining, smooth area cordiformis, which is surrounded by a coarsely pitted furrow. Last tergum in females always with pygidial area; such an area also occurs in single males (section Stenocrabro Ashmead). Legs rather short and stout, frequently with conspicuous secondary sexual characters in males.

The genus comprises about 140 species, of which the majority is found in the Palaearctic and Nearctic regions. The species occurring in Denmark and Fennoscandia are separated into six subgenera.

The species nest in the soil (Crossocerus s.str. and Hoplocrabro) or in hollow or pith-filled plant stems, old timber, or abandoned larval tunnels of xylophagous insects (Blepharipus, Cuphopterus, Acanthocrabro and Ablepharipus). The prey consists of small Diptera, except in walkeri, which uses Ephemeroptera, and annulipes Hemiptera.

Key to subgenera of Crossocerus

1 Abdomen with yellow markings. These may occasionally be missing in males of quadrimaculatus, which are easily recognizable by the tooth ventrally on the head ... 2

- Abdomen without yellow markings. Head never with ventral tooth 4

2(1) Occipital carina on either side drawn out into a sharp tooth. Mandibles of female with one tooth, of male with two ..... Hoplocrabro Thomson

- Occipital carina of normal shape. Apex of mandibles bidentate (male) or tridentate (female)..... 3

3(2) Tergum 1 longer than wide. Mesopleuron in front of coxa 2 without tooth. Female: pygidial area plane, triangular. Male: sternum 7 with two small spines. Coxa 3 with a larger or smaller tooth ..... Cuphopterus A. Morawitz

- Tergum 1 wider than long. Mesopleuron with a tooth in front of coxa 2. Female: pygidial area concave posteriorly. Male: sternum 7 and coxa 3 without spines or teeth, respectively ..... Acanthocrabro Perkins

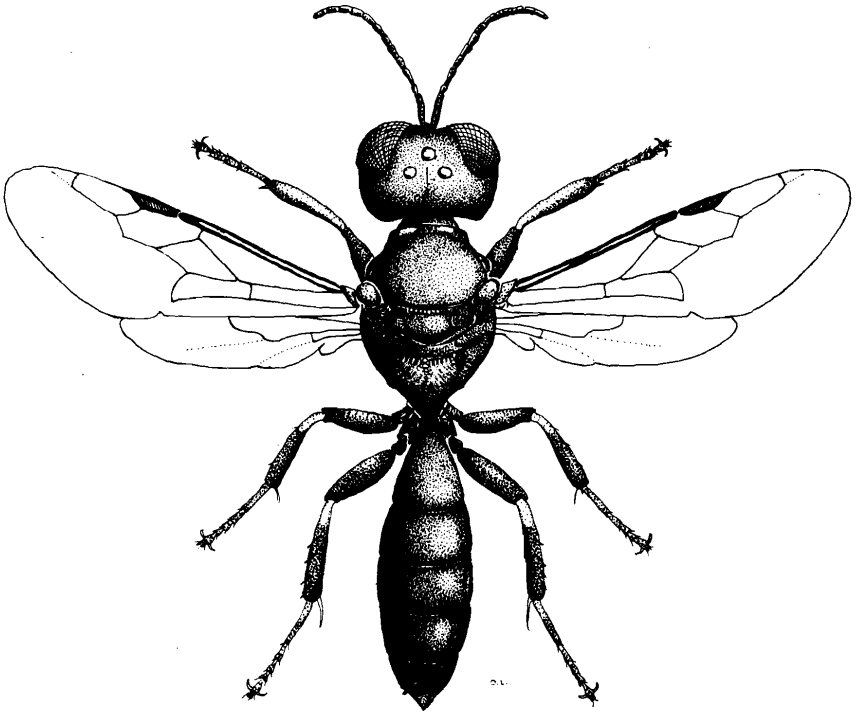


Fig. 403. Female of Crossocerus elongatulus (v.d. Lind.). Length: 5-6.5 mm.

4(1) Integument dull due to the well developed microsculpture. Punctation very weak or missing. Female: pygidial area dull, with a trifoliate or broad T-shaped depression ..... Ablepharipus Perkins

- Integument usually smooth, shining, with distinct punctation. Female: pygidial area shiny, differently shaped .. 5

5(4) Propodeum with distinct area cordiformis. Female: pygidial area plane, triangular, punctate. Male: tergum 7 with distinctly stronger punctation than tergum 6 ..... Crossocerus s. str.

- Propodeum often without well delimited area cordiformis. Female: pygidial area with concave margins, posteriorly excavated in a groove, anteriorly with elevated, strongly sculptured area. Male: punctation on tergum 7 equal to that of tergum 6 ..... Blepharipus Lepeletier & Brullé

Key to species of Crossocerus

Females.

1 Abdomen with yellow markings 2

- Abdomen without yellow markings 6

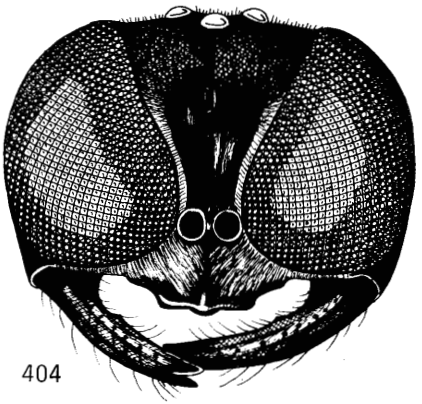
2(1) Occipital carina on either side produced into a stout tooth (Fig. 425). Apex of mandibles simply pointed. Facial fovea slightly convex ..... 142. quadrimaculatus (Fabricius)

- Occipital carina of normal shape. Apex of mandibles tridentate. Facial fovea depressed 3

3(2) Tergum 1 as long as wide. Mesopleuron with small spine in front of coxa 2. Pygidial area convex proximally, coarsely and densely punctate, smooth apically, narrowing into a groove. Facial fovea deeply impressed 168. vagabundus (Panzer)

- Tergum 1 longer than wide. Mesopleuron without tooth in front of coxa 2. Pygidial area plane, triangular. Facial fovea slightly depressed 4

4(3) Longitudinal convexity between lateral ocelli slightly punctate, even. Spines on the outer side of tibia 3 strong, usually not placed in two rows, varying in number between 10 and 15, most often 13. Tibiae 2-3 with brown pattern ..... 169. dimidiatus (Fabricius)



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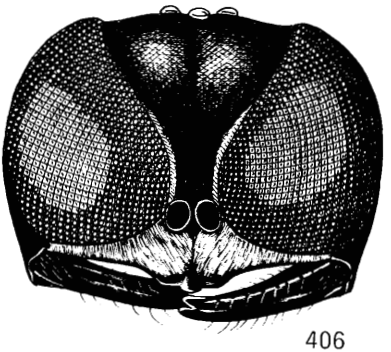

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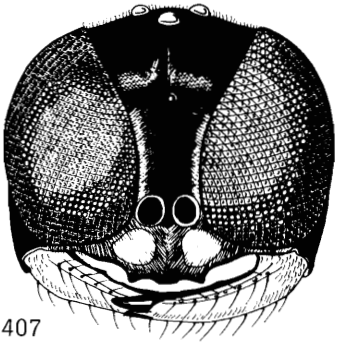

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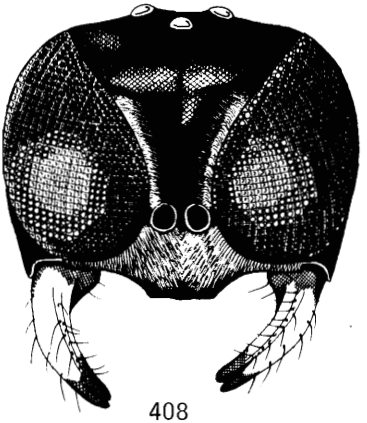

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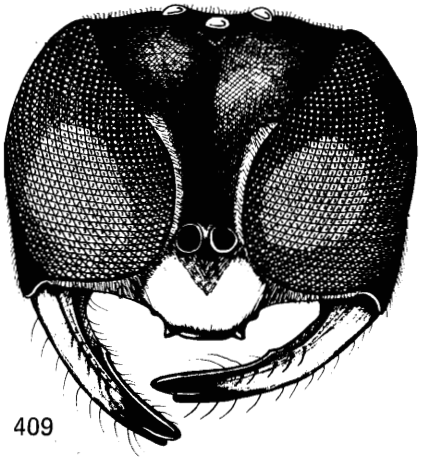

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Figs. 404-409. Heads in frontal view of female Crossocerus. - 404: pusillus Lep. & Brullé; 405: tarsatus (Shuckard), outline of clypeus; 406: lundbladi (Kjellander); 407: imitans (Kohl); 408: denticrus Herr.-Schäffer; 409: palmipes (L.).

- Longitudinal convexity between lateral ocelli densely punctate, posteriorly with a small, attenuate tubercle or tooth. Spines on outer side of tibia 3 weak, often forming paired rows, number varying between 7 and 11, most often 9. Tibiae 2-3 often without brown markings 5

5(4) Inner side of tibia 3 comparatively flattened, distally with a slight swelling proximally to the spur. Hind margin distinctly emarginate (Fig. 461). Area cordiformis often limited by a distinct pitted furrow ..... 171. subulatus Dahlbom

- Tibia 3 rounded, distally without thickening or emargination (Fig. 460). Area cordiformis posteriorly indistinctly delimited ..... 170. binotatus Lep. & Brullé

6(1) Pygidial area dull, with trifoliate or broadly T-shaped depressed figure. Integument dull due to the microsculpture 7

- Pygidial area shining, with or without punctation, always without microsculpture, differently shaped. Integument usually smooth, without microsculpture 9

7(6) Propleuron with an attenuate, tooth-like process. Humeral tubercle black. Area cordiformis very narrowly extended posteriorly (Fig. 430). ..... 156. assimilis (Smith)

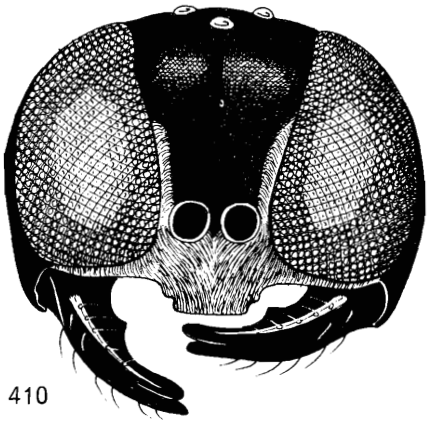
- Propleuron evenly rounded or with small swelling. Humeral tubercle with yellow spot. Area cordiformis posteriorly evenly rounded 8

8(7) Area cordiformis over its whole extent distinctly delimited by a pitted furrow. Occipital carina anteriorly truncate ..... 154. podagricus (v.d. Linden)

- Area cordiformis only anteriorly delimited by a pitted furrow. Occipital carina weak, anteriorly gradually disappearing ..... 155. congener (Dahlbom)

9(6) Lateral margins of pygidial area concave, the surface itself excavated in a groove apically, impunctate, proximally with a punctate, rather sharply delimited elevation (this often concealed by tergum 5) 10

- Pygidial area plane, triangular, with distinct punctation and pubescence 21



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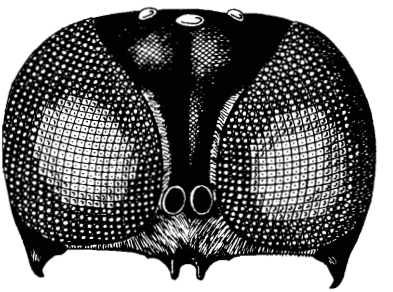

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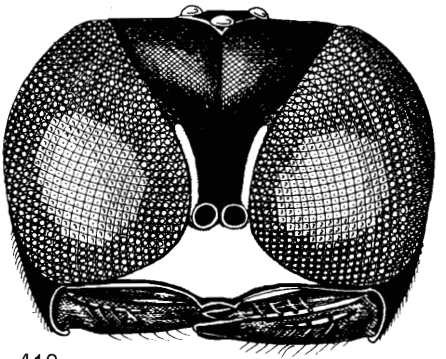

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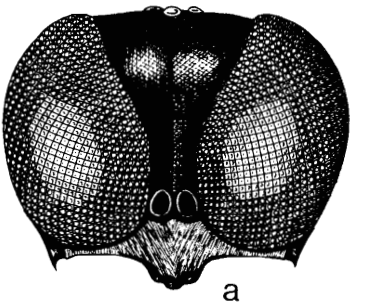

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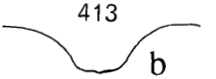

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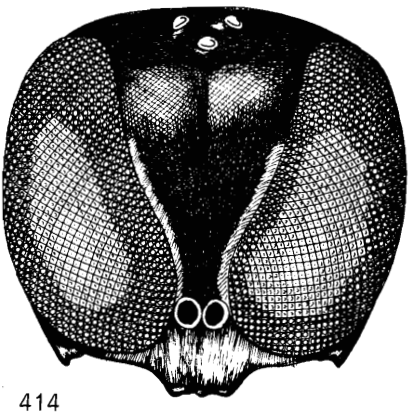

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Figs. 410-414. Heads in frontal view of female Crossocerus. - 410: assimilis (Smith); 411: annulipes (Lep. & Brullé); 412: walkeri (Shuckard); 413: heydeni Kohl; 414: styrius (Kohl).

10(9) Mesopleuron with a small, attenuate tubercle or tooth in front of coxa 2 11

\- Mesopleuron evenly rounded, smooth, without tooth ... 15

11(10) Area cordiformis posteriorly delimited by distinct, pitted furrow 12

\- Area cordiformis posteriorly without delimiting furrow 13

12(11) Furrow surrounding area cordiformis very strong, divided into very large, quadrate pits, median groove very broad (Fig. 431). Lateral margins of pygidial area distinctly concave ..... 162. leucostomus (Linné)

\- Furrow surrounding area cordiformis weak, sometimes rather indistinct, especially laterally; median furrow narrow. Pygidial area very narrow, margins almost straight (Fig. 438) ..... 159. heydeni Kohl

13(11) Scapus with or without very weak longitudinal keel. Lateral faces of propodeum very finely and densely transversely striate. Sternum 2 on either side with a round, dull spot. Occipital carina truncate anteriorly.. 163. cetratus (Shuckard)

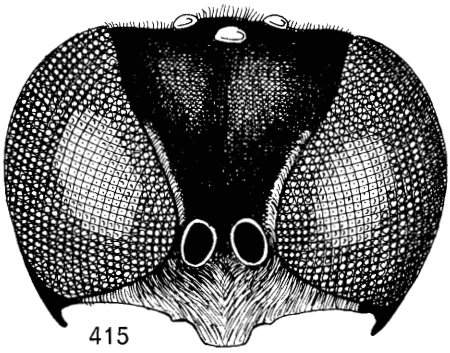
\- Scapus with sharp longitudinal keel anteriorly. Lateral faces of propodeum shining, without rugae, at most with very fine, sparse punctation. Spots on sternum 2 shining. Occipital carina gradually disappearing anteriorly 14

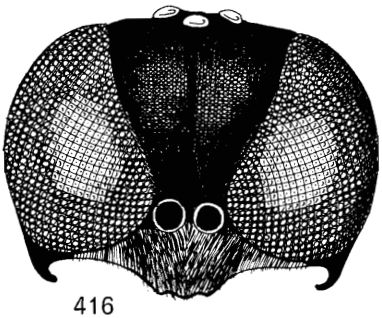
14(13) Median lobe of clypeus centrally and on either side with a small, rounded tubercle. Lateral lobes very small, rounded (Fig. 418). Keel on scapus a little more than half as long as scapus. Tibia 3 usually with a yellow proximal spot ..... 164. nigritus (Lep. & Brullé)

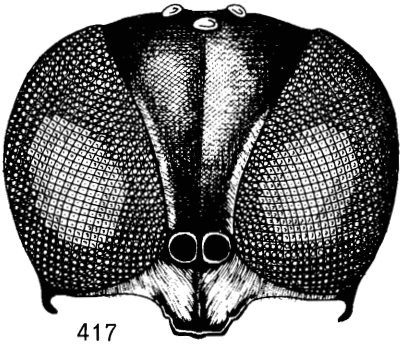
\- Median lobe of clypeus forming a very obtuse angle; lateral lobes distinct (Fig. 419). Keel as long as scapus. Tibia 3 completely black or with distal yellow spot ..... 165. megacephalus (Rossi)

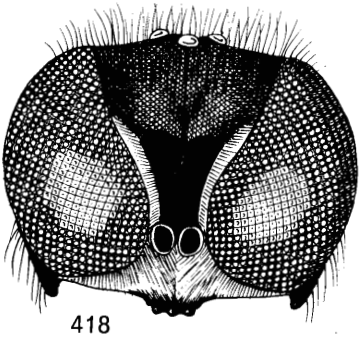
15(10) Clypeus yellow, only anterior margin black (Fig. 412). Inner orbits, scapus, pronotum, humeral tubercle and tibiae 1-2 and tarsi 1-2 also with yellow pattern. Pygidial area narrow, its lateral margins thickened like a pad. Apex with a narrow groove, apically directed upward (Fig. 437) ..... 157. walkeri (Shuckard)

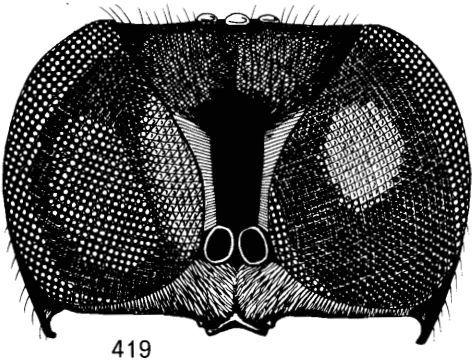
\- Clypeus, inner orbits, pronotum, humeral tubercles

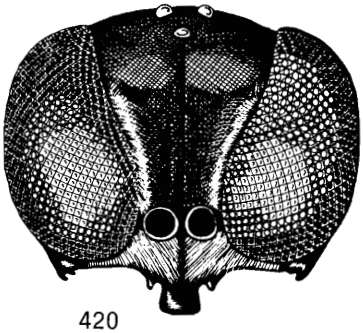












Figs. 415-420. Heads in frontal view of female Crossocerus. - 415: barbipes (Dahlbom); 416: leucostomus (L.); 417: cetratus (Shuckard); 418: nigritus (Lep. & Brullé); 419: megacephalus (Rossi); 420: cinxius (Dahlbom).

and legs black. Apex of pygidial area not upward-directed 16

16(15) Area cordiformis delimited by a complete furrow. Metatarsus 1 with stout, coloured pecten 17

- Area cordiformis only anteriorly delimited by a pitted furrow. Metatarsus 1 usually without true pecten, with only a few longer and pale hairs 18

17(16) Anterior border of clypeus with a deep, semi-circular emargination, on either side bordered by a strong tooth (Fig. 411). Propleuron with downward-directed tooth ..... 158. annulipes (Lep. & Brullé)

- Clypeus with a projecting, truncate median lobe (Fig. 415). Propleuron with at most a swelling ....161. barbipes Dahlbom

18(16) Clypeus with a narrow, almost nose-like projecting median lobe. Tibia 3 strongly clavate, without spines .. 19

- Median lobe of clypeus broad, not strongly projecting. Tibia 3 not strongly clavate, with conspicuous spines on the outer side..... 20

19(18) Vertex very well developed (Fig. 426). Median lobe of clypeus as broad as scapus (Fig. 446). Tibia 1 with yellow stripe anteriorly ..... 167. capitosus (Shuckard)

- Vertex considerably shorter. Median lobe of clypeus almost twice as broad as scapus (Fig. 420). Tibia 1 completely black ..... 166. cinxius (Dahlbom)

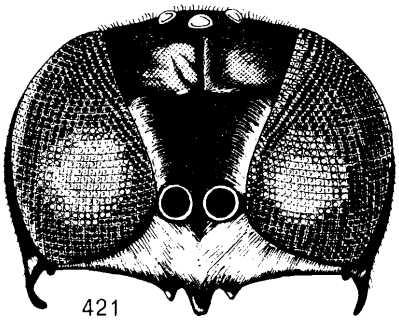
20(18) Median lobe of clypeus with three small rounded tubercles (Fig. 414). Metatarsus 1 with 5-6 pale, weak spines. Vertex relatively well developed (Fig. 424) .... 160. styrius (Kohl)

- Median lobe of clypeus with at most an indication of rounded tubercles (Fig. 417), usually evenly rounded. Metatarsus 1 with 4 very narrow and pale spines. Head evenly narrowed behind eyes ..... 163. cetratus (Shuckard)

21(19) Mesopleuron with a small, attenuate tooth or tubercle in front of coxa 2 22

- Mesopleuron evenly rounded, without tooth 25

22(21) Clypeus yellow, median part slightly arcuately convex, lateral lobes small, directed obliquely outwards (Fig. 409). Facial fovea distinct. Frons densely and finely punctate. Mandibles mainly yellow ..... 153. palmipes (Linné)



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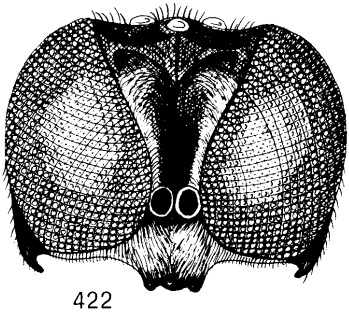

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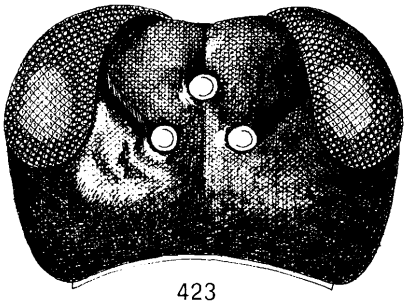

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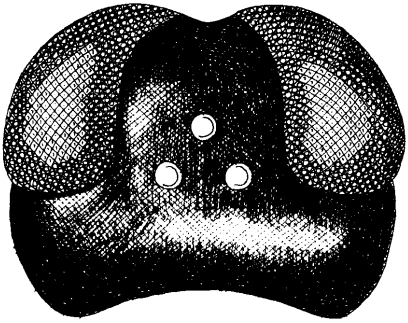

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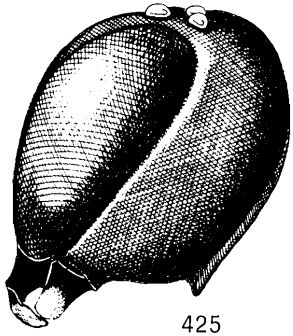

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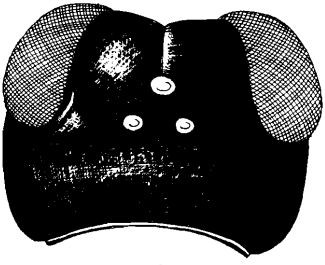

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Figs. 421, 422. Heads in frontal view of female Crossocerus. - 421: capitosus (Shuckard); 422: demidiatus (Fabr.).
Figs. 423, 424, 426. Heads in dorsal view of female Crossocerus. - 423: elongatulus (v.d. Lind.); 424: styrius (Kohl); 426: capitosus (Shuckard).
Fig. 425. Head in lateral view of female Crossocerus quadrimaculatus (Fabr.).

- Clypeus black 23

23(22) Distal third or more of pygidial area of paler colour. Median part of mandibles rust-coloured or red-yellow. Furrow delimiting area cordiformis strong throughout, also in front of the area (Fig. 427) ..... 143. ovalis Lep. & Brullé

- Apex of pygidial area not, or hardly paler than remaining part of area. Mandibles black, with at most paler apex. Furrow delimiting area cordiformis anteriorly less distinct or disappearing 24

24(23) Apical spur of tibia 1 black-brown. Scutellum usually black. Frons in front of ocelli evenly convex ..... 145. tarsatus (Shuckard)

- Apical spur of tibia 1 yellow. Scutellum usually with yellow pattern (small specimens from northern Fennoscandia often have completely black scutellum). Frons in front of ocelli strongly and abruptly convex ..... 144. pusillus Lep. & Brullé

25(21) Scutum smooth posteriorly, without rugae. Facial fovea absent. Facial line from median ocellus vestigial or absent 26

- Scutum posteriorly with short, dense rugae. Facial fovea always distinct. Frontal line distinct 27

26(25) Punctation on lateral faces of mesopleuron of same strength as punctation on scutum. Longitudinal median groove of posterior face of propodeum excavated almost like a pit ..... 151. denticrus Herrich-Schäffer

- Punctation on lateral faces of mesopleuron considerably finer and sparser than on scutum. Longitudinal median furrow of propodeum shallow..... 152. exiguus (v.d.Linden)

27(25) Clypeus with two large grey-yellow spots (Fig. 407). Scutum shining, smooth, with very sparse and fine punctation ..... 149. imitans (Kohl)

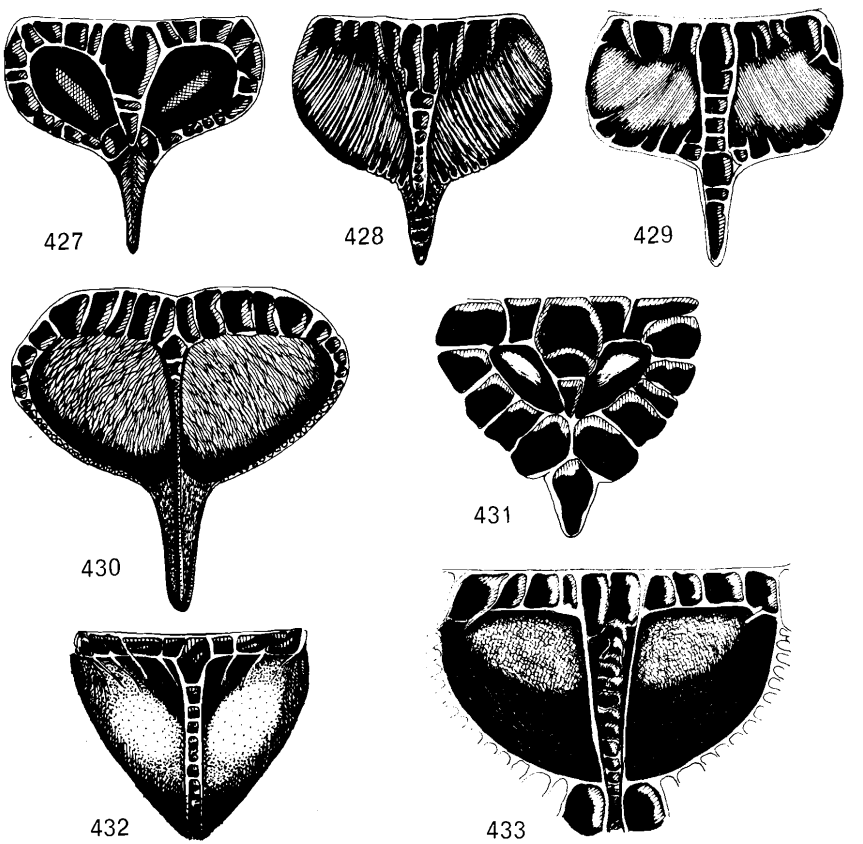
- Clypeus entirely black. Scutum rather dull, densely punctate 28

28(27) Distal half of pygidial area usually red-brown. Femur 1 with a very large, yellow apical spot. Tibia 2 mainly yellow. Scutellum, humeral tubercles and a stripe on pronotum yellow .....147. wesmaeli (v.d.Linden)

- Pygidial area black, only its extreme apex reddish. Femur 1 with or without a very small yellow apical spot. Tibia 2, except in lundbladi, mainly dark. Scutellum usually black. Pronotum often with two yellow spots... 29

29(28) Facial fovea distinctly convex. Frons shining, without microsculpture ..... 146. elongatulus (v.d.Linden)

- Facial fovea entirely flat on level with remaining part of frons. Interstices between punctures on the anterior part of frons with microsculpture (only visible at times



Figs. 427-433. Area cordiformis of female Crossocerus. - 427: ovalis Lep. & Brullé ; 428: pusillus Lep. & Brullé; 429: tarsatus (Shuckard); 430: assimilis (Smith); 431: leucostomus (L.); 432: nigritus (Lep. & Brullé); 433: dimidiatus (Fabr.).

100-150 magnification) 30

30(29) Tibiae 2+3 with large yellow proximal spot, on tibia 2 covering two-thirds on the outer side and on tibia 3 about half of it. Femur 1 often with a yellow apical spot ..... 148. lundbladi (Kjellander)

- Tibiae 2+3 usually each with a small proximal yellow ring. Femur 1 without yellow apical spot ..... 150. distinguendus (A. Morawitz)

Males

1 Abdomen with yellow markings. These may exceptionally be missing in quadrimaculatus, which in that case is easily recognizable by the ventral tooth-like projections on the head 2

- Abdomen entirely black 6

2(1) Occipital carina on either side produced into a tooth (Fig. 425). Last antennal segment truncate. Facial fovea swollen like a blister. Anterior border of clypeus with 4-6 regularly placed teeth, and usually with two yellow spots (Fig. 439). Abdomen in small specimens often entirely black ..... 142. quadrimaculatus (Fabricius)

- Occipital carina of normal shape. Last antennal segment rounded apically. Facial fovea flattened or slightly depressed. Anterior border of clypeus with or without very small, rounded teeth 3

3(2) Tergum 1 as long as broad. Femur 1 with a flat, triangular tooth ventrally (Fig. 456). Mesopleuron with an often indistinct tooth in front of coxa 2 ..... 168. vagabundus (Panzer)

- Tergum 1 considerably longer than broad. Femur 1 without tooth. Tibia 1 flattened ventrally. Mesopleuron without tooth 4

4(3) Femur 3 without tooth. Tooth of coxa 3 very strong (Fig. 464). Tibia 2 on the outer side with a long, transparent dilation. Vertex behind lateral ocelli without attenuate tubercle ..... 169. dimidiatus (Fabricius)

- Femur 3 basally on the inner side with a small, obtuse tooth (Fig. 463). Coxa 3 also with a small tooth. Vertex behind lateral ocelli usually with a small attenuate tubercle 5

5(4) Tibia 3 strongly excavated on the inner side; with two stout teeth apically (Fig. 462) ..... 171. subulatus Dahlbom

\- Tibia 3 normal, without teeth ..... 170. binotatus Lep. & Brullé

6(1) Last tergum with pygidial area (section Stenocrabro) 7

\- Last tergum without pygidial area 9

7(6) Median furrow in area cordiformis anteriorly very deep and wide. Metatarsus 1 rounded, not bicoloured ..... 143. ovalis Lep. & Brullé

\- Furrow in area cordiformis anteriorly shallow and narrow. Metatarsus 1 dilated and flattened, bicoloured ... 8

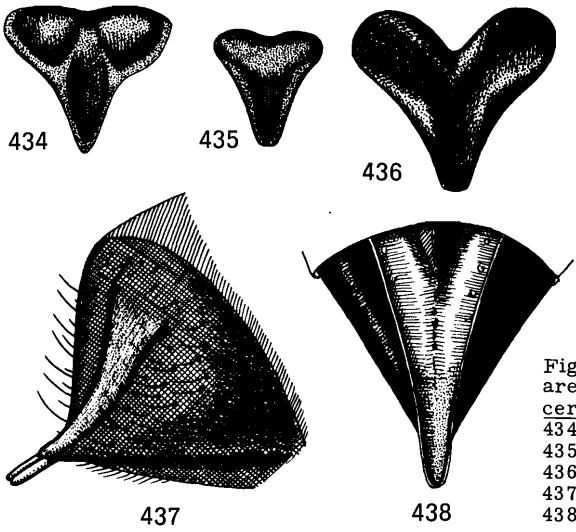
8(7) Metatarsus 1 more than twice as long as wide, yellow with dark transverse band (Fig. 448) ..... 144. pusillus Lep. & Brullé

\- Metatarsus 1 only slightly longer than broad, remaining tarsal segments also dilated, entirely pale (Fig. 447) ..... 145. tarsatus (Shuckard)

9(6) Tibia 1 and metatarsus 1 strongly flattened and dilated 10

\- Tibia 1 not flattened or dilated 11

10(9) Tibia 1 mainly yellow, the dilation with a black V-shaped apical spot (Fig. 452). Clypeus, lower part of head, coxae and epicnemium with very extensive yellow pattern ..... 153. palmipes (Linné)



Figs. 434-438. Pygidial areas of female Crossocerus.
434: podagricus (v. d. Lind.);
435: congener (Dahlbom);
436: assimilis (Smith);
437: walkeri (Shuckard);
438: heydeni Kohl.

- Tibia 1 mainly black, with only narrow, yellowish-white, translucent fringe along the border (Fig. 451). Head and thorax entirely black ..... 163. cetratus (Shuckard)

11(9) Metatarsus 1 flattened and dilated 12

- Metatarsus 1 not flattened or dilated 14

12(11) Metatarsus 1 very wide, pale translucent, with three dark spots. Following segments except pretarsus also pale and flattened (Fig. 450). Tibia 1 slightly obtusely dilated on the inner side. Area cordiformis distinctly delimited ..... 158. annulipes (Lep. & Brullé)

- Metatarsus 1 differently shaped. Tibia 1 not dilated .. 13

13(12) Forelegs with very extensive yellow pattern; metatarsus only slightly longer than wide, remaining tarsal segments pale, distinctly dilated (Fig 447). Trochanter of forelegs and mesopleuron anteriorly with long, white, woolly pubescence ..... 145. tarsatus (Shuckard)

- Forelegs black, metatarsus 1 very slightly dilated, distally usually with a pale zone (Fig. 449). Trochanter 1 and mesopleuron with short pubescence ..... 162. leucostomus (Linné)

14(11) Tibia 2 distally broadly truncate, without spur, length c. 2/3 of femur 2 (Fig. 455) ..... 154. podagricus (v. d. Linden)

- Tibia 2 of normal length, spur present (very short in congener 15

15(14) Last tergum with rather strong punctation, very different from the very weak punctation on tergum 6 16

- Punctation of last tergum weak, not differing in strength from punctation on tergum 6 22

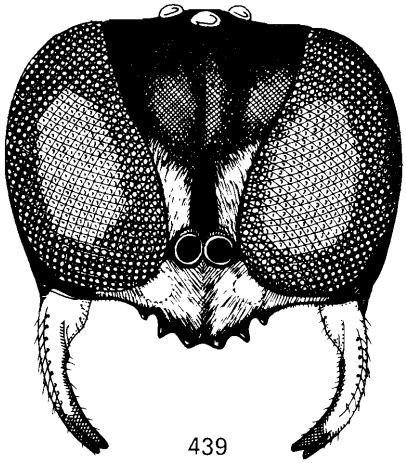
16(15) Femur 2 proximally with a strong tooth (Fig. 454). Mandibles yellow with darker apex. Frontal line weak ..... 151. denticrus Herrich-Schäffer

- Femur 2 without tooth 17

17(16) Clypeus and a larger or smaller area near mandibular articulations yellow 18

- Clypeus and rest of head entirely black 19

18(17) Antennal segment 7 distally with stout, downward-directed tooth (Fig. 458). Whole clypeus yellow, spots on



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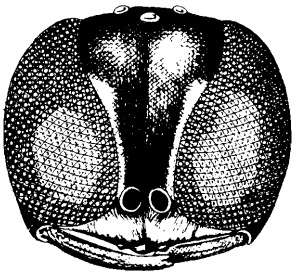

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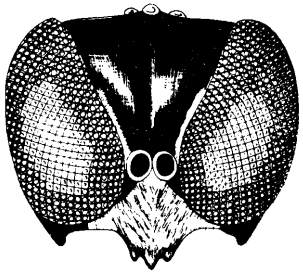

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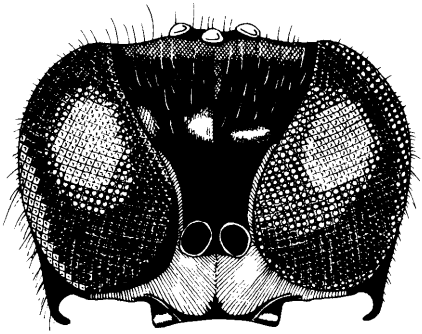

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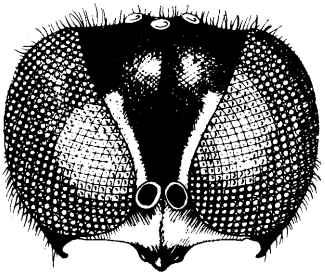

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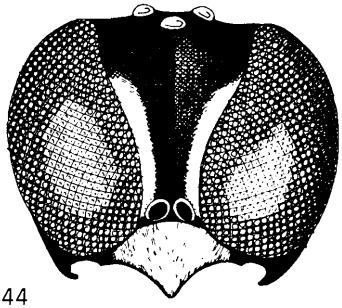

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Figs. 439-444. Heads in frontal view of male Crossocerus. - 439: quadrimaculatus (Fabr.); 440: lundbladi (Kjellander); 441: styrius (Kohl); 442: nigritus (Lep. & Brullé); 443: megacephalus (Rossi); 444: walkeri (Shuckard).

ventral face of head large. Scutum densely punctate ..... 152. exiguus (v.d.Linden)

- No antennal segments dentate. Clypeus with two large, circular spots. Spots ventrally on head small. Scutum shining, smooth, very sparsely punctate ..... 149. imitans (Kohl)

19(17) Basal part of femur 2 swollen (Fig. 453). Frons between eyes with dense, coarse punctation ... 146. elongatulus (v.d.Linden)

- Basal part of femur 2 not dilated 20

20(19) Mesopleuron laterally and in front of cavity with long, woolly pubescence. Flagellar segments somewhat thickened. Metatarsus 1 dark. Frons between eyes with fine and less dense punctation ..... 150. distinguendus (A. Morawitz)

- Pubescence of mesopleuron short. Flagellar segments not thickened. Metatarsus 1 usually yellow (dark in very small specimens) 21

21(20) Mesopleuron laterally with very fine and sparse punctation. Flagellum ventrally with distinct fringe of hairs, last segment rounded apically. Spines on tibia 3 distinct ..... 147. wesmaeli (v.d.Linden)

- Mesopleuron laterally more strongly punctate, with indication of transverse, rugose sculpture. Flagellum ventrally with only extremely short hairs, last segment truncate apically. Spines on tibia 3 very short and indistinct ..... 148. lundbladi (Kjellander)

22(15) Clypeus on either side with strong, obliquely outward-directed triangular dilation (Fig. 443). Mesopleuron usually with a small tooth in front of coxa 2 ..... 165. megacephalus (Rossi)

- Clypeus without such teeth 23

23(22) Area cordiformis delimited by a distinct, pitted furrow 24

- Area cordiformis very indistinctly delimited, furrow missing posteriorly 27

24(23) Clypeus yellow, with a single, triangular projection centrally (Fig. 444). Inner orbits, pronotum, scutellum, metanotum, and the legs with extensive yellow markings ..... 157. walkeri (Shuckard)

- Clypeus black, differently shaped. Head, thorax and legs black 25

25(24) Mesopleuron with a small tooth or attenuate tubercle in front of coxa 2 26

- Mesopleuron without tooth, smooth and evenly rounded. Femur 1 and tibia 1 with very long pubescence ..... 161. barbipes (Dahlbom)

26(25) Head and scutum dull, due to the very pronounced microsculpture. Punctation very fine and sparse. Head ventrally, coxa 1, trochanter 1, and mesopleuron ventrally with long, white pubescence ..... 156. assimilis (Smith)

- Head and scutum shining smooth. Ventral pubescence of normal length ..... 159. heydeni Kohl

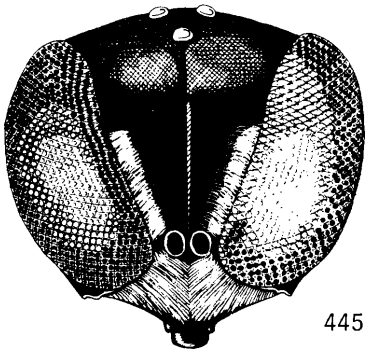
27(23) Sternum 7 with median longitudinal elevation. Tergum 7 with two ventro-lateral, clavate projections, pointing towards the median longitudinal elevation (Fig. 459) ..... 164. nigritus (Lep. & Brullé)

- Tergum 7 normal, without projections 28

28(27) Coxa 1 and mesopleuron ventrally with rather dense, long, woolly pubescence. Tibiae 1+2 almost entirely yellow. Proximal half of femur 1 brown-yellow. Head and thorax dull due to the well developed microsculpture. ..... 155. congener (Dahlbom)

- Coxa 1 and mesopleuron with normal, dense pubescence. Head and thorax at most with weak microsculpture 29

29(28) Anterior border of clypeus with three teeth (Fig. 441).



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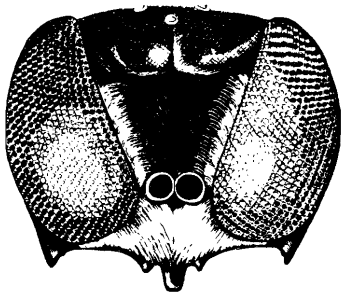

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Figs. 445, 446. Heads in frontal view of male Crossocerus. - 445: cinxius (Dahlbom); 446: capitosus (Shuckard).

Scapus 2.5 times longer than shortest distance between eyes. Tergum 1 1.5 times longer than wide ..... 160. styrius (Kohl)

- Anterior border of clypeus with a projecting median lobe. Scapus at most twice as long as shortest distance between eyes. Tergum 1 shorter 30

30(29) Median lobe of clypeus wide, lateral lobes small and indistinct (Fig. 445). Thorax rather dull due to the fine microsculpture. Tibia 1 with yellow proximal spot ..... 166. cinxius (Dahlbom)

- Median lobe of clypeus narrow, strongly projecting, lateral lobes distinct (Fig. 446). Thorax with at most indicated microsculpture. Tibia 1 with yellow stripe along anterior margin ..... 167. capitosus (Shuckard)

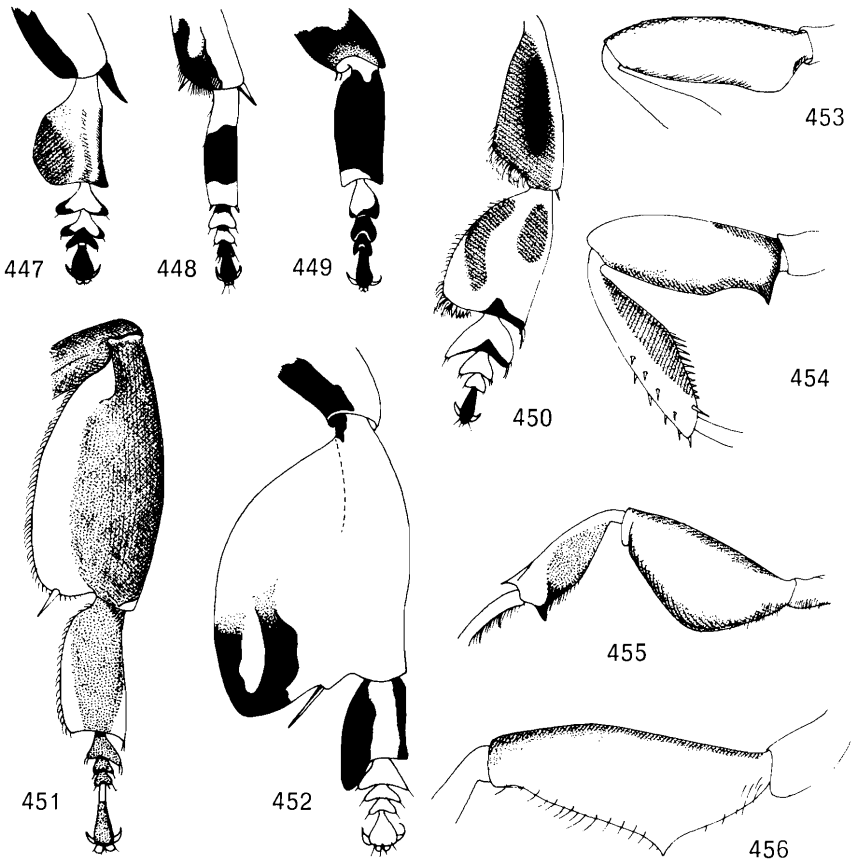
142. CROSSOCERUS (HOPLOCRABRO) QUADRIMACULATUS (Fabricius, 1793)

Figs. 425, 439.

Crabro quadrimaculatus Fabricius, 1793:194.

Female: 7-10 mm. Clypeus with very weak, slightly silvery pubescence. Specimens with a well developed, dense, silvery pubescence on clypeus are known from the Alps and southern Siberia. In a few of these a very weak spine in front of coxa 2 is also found . Clypeus with strong longitudinal keel. Anterior border very variable in outline, but always with two stout median, obliquely outward-directed and two lateral, usually rounded, teeth. Between the two stout teeth the anterior border is either truncate or with a more or less deep emargination, whereby two additional teeth appear (Fig. 439). Proximally on clypeus two yellow spots may be found, whose size varies much. Mandibles simple attenuate, their colour varying from entirely black-brown to pale yellow-brown with darker apex and base. Occipital carina on either side produced into a sharp tooth (Fig. 425). Antennae black, scapus often with a proximal spot. Specimens with almost entirely yellow scapus may occur in Denmark. Frons very densely punctate, interstices between punctures with dense microsculpture. Ocelli placed in right-angled triangle. Facial fovea distinctly convex. Pronotum often with two yellow lateral spots of very variable extent, only in rare cases forming a continuous, transverse band. Humeral tubercle with or without yellow spot. Metanotum usually with yellow markings, either as lateral spots or a transverse band. Propleuron with distal swelling. Area cordiformis shining, sometimes with weak radiating sculpture, surrounded by a strong, pitted furrow. Abdomen with two pairs of yellow lateral spots on terga 2 and 3 and a transverse band on tergum 5. Spots of vary-

ing size may also occur on terga 1 and 4. Pygidial area plane, triangular, dull due to the well developed reticulate microsculpture, with sparse but rather strong punctation. Coxa 1 seen in profile ventrally with a flattened, forward-directed spine. Femora black or brown-black. Tibiae and tarsi pale brown with more or less extensive yellow markings. Tibia 3 on the outer side with strong, dark spines.



Figs. 447-452. Tarsus 1 of male Crossocerus. - 447: tarsatus (Shuckard); 448: pusillus Lep. & Brullé; 449: leucostomus (L.); 450: annulipes (Lep. & Brullé); 451: cetratus (Shuckard); 452: palmipes (L.).
Figs. 453-455. Proximal part of midleg of male Crossocerus. - 453: elongatulus (v.d. Lind.); 454: denticrus Herr.-Schäffer; 455: podagricus (v.d. Lind.).
Fig. 456. Femur 1 of male Crossocerus vagabundus (Panz.).

Male: 5-8 mm. Anterior margin of the somewhat projecting clypeus usually with six teeth, the median lobe generally divided by an obtuse emargination (Fig. 439). Posteriorly on clypeus yellow spots may be present, which only in isolated cases reach the anterior margin. Occipital carina considerably more raised than in female, often almost like a collar, the teeth very well developed. Mandibles bidentate apically, their colour varying from pale brown-yellow to almost black. Scapus usually entirely black, but may have a yellow, longitudinal stripe. Flagellum along ventral margin with a fringe of long, light hairs. Last segment distinctly curved, truncate apically. Frons shining, with rather sparse punctation, without microsculpture. Thorax often without yellow markings, but generally spots are present on pro- and metanotum, and the humeral tubercle may also have a yellow spot. Abdomen generally with yellow lateral spots on terga 2 and 3 and a larger or smaller median spot on tergum 6. Occasional specimens may have yellow markings on tergum 1. Especially small individuals may lack the yellow pattern on the abdomen. Femora mainly black, femora 1+2, however, often with a pale yellow-brown area on the inner side. Tibiae 1+2 with a yellow stripe along anterior margin, tibia 3 with a larger or smaller yellow, proximal ring.

The species is very common in Denmark, occurring in all districts. - Sweden: rather sparse occurrence, but common in the southern districts. Northernmost records in Gstr. - Norway: a few specimens from the south-eastern districts. - Finland: only found on Al. Not known from Soviet Karelia. - The distribution area covers large parts of West and South Europe, and extends eastwards through southern Siberia to a little east of Lake Aral. The populations around Lake Bajkal and in Mongolia seem to be completely isolated, and the populations in these areas possibly constitute distinct subspecies.

The species breeds gregariously in sandy slopes or the like, often near streams. It regularly has its nests in similar localities as e.g. Diodontus tristis (no. 25) and Mimesa lutaria (no. 46). The variation in choice of prey is considerable, and an investigation will probably reveal a number of ecophenotypes. Usually representatives of Diptera: Nematocera and Brachycera are used, but small Trichoptera and Lepidoptera may also be taken (Hamm & Richards, 1926; Maneval, 1939). It seems probable that the species occurs in two generations (Adlerz, 1910). The former is found from the beginning of July till the beginning of August, and the latter in the last half of August. The larva was described by Maneval, 1939.

Note. Variation of expansion and distribution of the yellow pattern appears to be geographically-climatically conditioned in a very small degree. The spe-

cies has a conspicuous polymorphy, and extremes of variation may occur even within very restricted populations.

143. CROSSOCERUS (CROSSOCERUS) OVALIS Lepeletier & Brullé, 1834

Fig. 427.

Crossocerus ovalis Lepeletier & Brullé, 1834:780.

Female: 4.5-6 mm, male: 4-4.5 mm. Frons around ocelli convex, both longitudinally and transversely, punctation very fine, microsculpture distinct, sur-

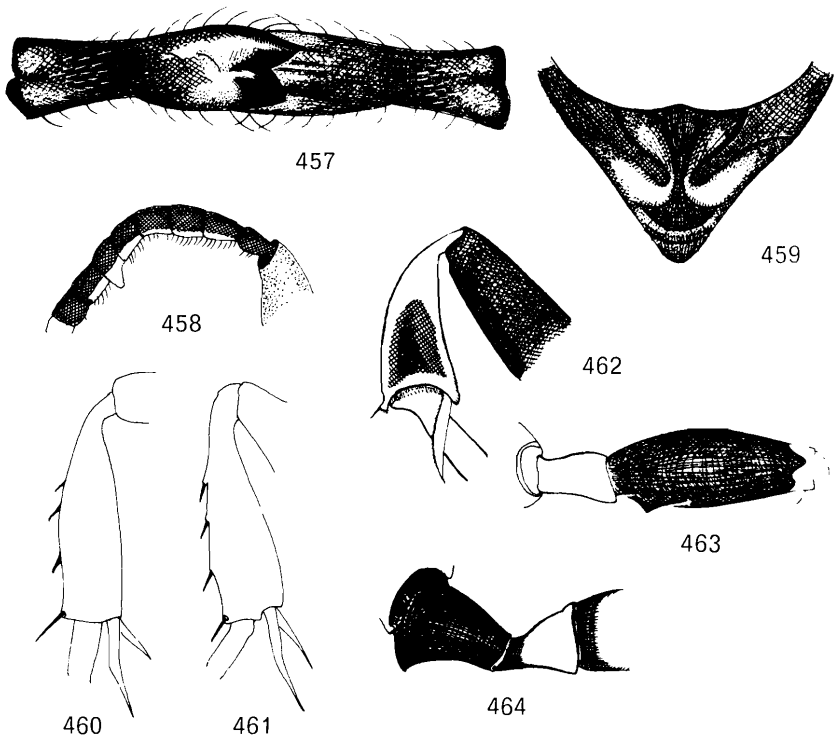


Fig. 457. Mandibles of male Crossocerus elongatulus (v.d. Lind.).
Fig. 458. Proximal part of antenna of male Crossocerus exiguus (v.d. Lind.).
Fig. 459. Ventral view of apex of abdomen of male Crossocerus nigritus (Lep. & Brullé).
Fig. 460, 461. Tibia 3 of female Crossocerus. - 460: binotatus (Lep. & Br.); 461: subulatus (Dahlbom).
Fig. 462. Tibia 3 of male Crossocerus subulatus (Dahlbom).
Fig. 463. Femur 3 of male Crossocerus binotatus (Lep. & Brullé);
Fig. 464. Proximal part of hindleg of male Crossocerus dimidiatus (Fabr.).

face often slightly dull. Facial fovea distinct, dull. Mandibles often with red-yellow middle part. Thorax usually entirely black, but occasional specimens with two small, yellow lateral spots on pronotum occur. Specimens with effaced yellowish spot on scutellum are very rare. Scutum shining, at most with indicated microsculpture. Mesopleuron with a quite small tooth in front of coxa 2, which may be missing in males. Area cordiformis shining, smooth, the surrounding furrow, especially in the males, strong, divided into very coarse pits (Fig. 427). Median furrow widened anteriorly. Pygidial area in female red-yellow or red-brown apically. Tibiae 1+2 with yellow stripe along anterior margin. Basal half of tibia 3 yellow. Males without conspicuous secondary sexual characters. Morphology of forelegs as in females.

The species is widely distributed, but rather rare in Fennoscandia and Denmark. Northern distribution limit in Sweden in Ly. Lpm. - Norway: a few specimens from AK. - Finland: northern distribution limit in Lk and Ks (well north of the Polar Circle). - Soviet Karelia: Ib, Kr. - A Central and North European species. Also recorded from Kazakhstan (Kazenas, 1972).

The species often breeds in sandy localities, but may also be found nesting in very clayey soil near human habitations. The nest, whose tunnel is about five cm long, consists of a single cell. The prey consists of small Diptera, most frequently species of Platypalpus Macq. (Empididae). Only exceptionally of Heteroptera, e.g. Plagiognathus chrysanthemi (Wolf) (Miridae) (Adlerz, 1903, 1910).

144. CROSSOCERUS (CROSSOCERUS) PUSILLUS Lepeletier & Brullé, 1834

Figs. 404, 428, 448.

Crossocerus pusillus Lepeletier & Brullé, 1834:778.

Crossocerus varius Lepeletier & Brullé, 1834:775.

Female: 5.5-6.5 mm. Frons shining, smooth, microsculpture very indistinct, vertex round ocelli almost plane. Facial fovea slightly depressed. Between lateral ocelli a sharp, linear impression is found. Frontal line well developed. Clypeus with rounded median, slightly projecting tooth and two obtuse lateral teeth (Fig. 404). Antennae black, scapus with white-yellow stripe along anterior margin. Mandibles dark, often with a paler area subapically. Pronotum with two yellow lateral spots, which may be fused into a transverse band. Scutum rather densely punctate with very fine intermediate microsculpture. Humeral tubercle as a rule without yellow pattern. Scutellum with larger or smaller median spot usually missing in specimens from northern Fennoscandia. Mesopleuron shining, finely punctate, with a distinct tooth in front of coxa 2. Area cordiformis with dense,

fine, radiating striation. The surrounding pitted furrow may be weak laterally or even missing. Median furrow very wide anteriorly, strongly pitted (Fig. 428). Abdomen with silky, dull lustre with very fine microsculpture. Pygidial area entirely black, rather densely and coarsely punctate, proximally slightly convex; microsculpture indistinct, apically with short, adpressed silvery pubescence. Tibia 1 with a yellow longitudinal stripe. Tibia 2 with a proximal yellow ring and a distal spot. Tibia 3 with proximal yellow ring. Whitish-yellow colour of metatarsi more or less extensive.

Male: 4.5-5.5 mm. Microsculpture of head very variable in strength, usually distinctly reticulate. Punctation sparse, rather shallow. Anterior margin of clypeus with three distinct lobes, stronger than in female. Scapus with a yellow longitudinal stripe, which may be reduced in specimens from the northernmost districts of the distribution range of the species. Mandibles black with slightly reddish apex. Thorax with yellow markings on pronotum, in rare cases on humeral tubercles. Usually a yellow spot on scutellum. The spots on pronotum may form a transverse band or be very reduced. The tooth in front of coxa 2 distinct, mesopleuron anteriorly with fairly long, white pubescence. Area cordiformis dull, with rather strong, dense, radiating striation, the surrounding furrow and the median furrow well developed. On tergum 7 is found a distinct, but short pygidial area. Forelegs of characteristic shape and colour: trochanter and femur ventrally plane, yellow-brown with a fairly long pale, curly pubescence. Femur 1 with also a black and a yellow longitudinal stripe. Metatarsus 1 slightly flattened and dilated, white-yellow with a dark transverse band (Fig. 448). Femur 2 and tibia 2 with yellow longitudinal lines, which, however, may be reduced on femur in Swedish and Finnish specimens. Tibia 3 usually with a proximal yellow ring and a distal spot. These may be connected with each other in Danish specimens. Apical spurs of tibia 3 usually black-brown.

A rather common species in Fennoscandia and Denmark, distributed far towards the north, in Sweden to Ång, in Norway to Nnø, and in Finland to Ks and Ob. - In Soviet Karelia the species is known from Kr. - The species is distributed all over Europe, also recorded from Mongolia, North Japan and Sakhalin. May occur in southern Siberia.

Construction of nest described by Abrahamsen, 1951. The main tunnel descends 10-12 cm into the soil, often undulating. From short side branches on lower part of tunnel up to 9 cells are constructed, which are provisioned with small Diptera, e.g. Empididae, Drosophilidae, Dolichopodidae, Simuliidae and Trypetidae. The larva was described by Maneval, 1939.

145. CROSSOCERUS (CROSSOCERUS) TARSATUS (Shuckard, 1837)

Figs. 405, 429, 447.

Crabro tarsatus Shuckard, 1837:133.

Crossocerus palmipes auctt., nec Linné.

Female: 5-6.5 mm. Vertex round ocelli slightly, but distinctly convex, microsculpture very variable in strength, most conspicuous in robust individuals. Facial fovea shining, distinct. Frontal furrow very well developed, strongly impressed. Lateral teeth on clypeus rather strongly projecting (Fig. 405). Antennae and mandibles as in pusillus. Thorax often entirely black, but yellow markings may occur on pronotum, especially in Danish and South Swedish specimens. Occasionally an effaced yellowish spot may occur on scutellum. Scutum rather densely punctate, often shining, smooth without microsculpture. Mesopleuron with a distinct tooth in front of coxa 2. Area cordiformis with a weak, often partly missing, radiating striation, median furrow very coarsely pitted anteriorly (Fig. 429). Abdomen dull. Lateral margin of pygidial area very slightly concave, the area itself densely punctate, with distinct microsculpture; especially apically with short, silvery pubescence. Tibia 1 with a broad yellow stripe along anterior margin, apical spur dark, usually black-brown. Tibia 2 with a proximal, sometimes also a distal yellow spot. These may be connected in occasional specimens. Tibia 3 with a proximal yellow ring. Metatarsi wholly or partly white-yellow.

Male: 4-4.5 mm. Apart from the morphology of the foretarsi, very similar to pusillus. The yellow pattern on thorax is, however, generally more extensive, and there is often a yellow spot on the humeral tubercles. The spine in front of coxa 2 may be very weak, especially in small individuals. Metatarsus 1 strongly depressed, almost quadrate, with a large, black median spot, second and third segments of tarsus 1 white-yellow, considerably broader than long (Fig. 447). Apical spur of tibia 1 black. Pubescence on anterior ventral part of mesopleuron and on trochanter 1 long and dense.

The northern distribution limit of this species in Fennoscandia lies far towards the south compared with the two preceding species. - Denmark: common throughout the country. - Sweden: found from Sk. in the south to Vrm. and Gstr. in the north. - Norway: a few specimens from Ø and AK. - Finland: a single record from N, Helsingfors. - Not known from Soviet Karelia. - The total distribution pattern resembles that of the two preceding species. Also recorded from Japan. A subspecies, richardsi Beaumont, 1950 occurs in Algeria and Morocco.

The species may be found nesting, often gregariously, on sandy forest paths fully exposed to the sun, but also near human habitations, e.g. in gardens. It is

stated (Hamm. & Richards, 1926) that it may even be found nesting in loose mortar in walls. Abrahamsen (1951) recorded a find of two males in beetle tunnels in a wooden post. Only in a single case (Abrahamsen, l.c.) was a fully provisioned nest described. The main tunnel runs almost vertically to about 5 cm depth. Here 1-3 cells are constructed, of which two may be placed in a row. Each cell contains from 16-21 Diptera, e.g. of the families Empididae, Dolichopodidae, Chloropidae and Agromyzidae.

146. CROSSOCERUS (CROSSOCERUS) ELONGATULUS (van der Linden, 1829)

Figs. 403, 423, 453, 457.

Crabro elongatulus van der Linden, 1829:64.

Crabro sulcus Fox, 1895:187.

Female: 5-6.5 mm. Head well developed, seen from above approximately rectangular (Fig. 423). Frons in front of ocelli shining, very densely and strongly punctate. Interstices equal to or less than diameter of punctures. Facial fovea shining, distinctly convex. Frontal line weak. Anterior margin of clypeus with rather broad, truncate or rounded median lobe and two obtuse lateral teeth. Antennae black, scapus often with a continuous yellow stripe on the frontal side. Mandibles slightly dilated distally, their colour pattern very variable, from almost uniform black-brown to yellow with dark apex and base. Pronotum with rather sharply raised, transverse carina or pad, with two small white-yellow or slightly greenish-yellow lateral spots, which may be absent, especially in specimens from Sweden and Finland. Specimens with yellow pattern on humeral tubercles only very seldom occur in Fennoscandia and Denmark. Scutum shining, densely and finely punctate, posteriorly with dense, shortly striate sculpture. Scutellum always without yellow pattern. Area cordiformis distinctly delimited by a coarsely pitted furrow, median furrow strongly widened anteriorly. The area itself either shining and smooth or with radiately striate sculpture of varying strength. Pygidial area plane, triangular, shining, smooth, with sparse, rather coarse punctation. Inner side of forelegs yellow. Tibia 2 with a proximal and sometimes also a small distal yellow spot. Tibia 3 with a proximal yellow or white-yellow ring.

Male: 5-6 mm. Punctation in front of ocelli as described in female, but a weak microsculpture may occur. Frontal line indistinct. Teeth on anterior margin of clypeus very variable, lateral teeth often sharply projecting, obtuse. Mandibles distally strongly dilated and somewhat flattened (Fig. 457), their colour varying from almost entirely black to completely yellow. Last antennal segment rounded apically. Palps pale yellow. Thorax usually entirely black, but small

white-yellow lateral spots on pronotum may occur. Humeral tubercle pale posteriorly, occasionally bearing an effaced yellowish spot. Thorax sculptured as in female. Mesopleuron ventrally with short pubescence (see note). Sculpture of area cordiformis varying, but usually consisting of a dense and rather strong radiating striation. Tergum 7 truncate. Femur 1 with a broad yellow stripe on the inner side, basally not depressed, with a very thin tuft of light hairs. Tibia 1 extensively yellow. Femur 2 basally swollen (Fig. 453), usually with a somewhat effaced yellow spot on the inner side. Tibia 2 with or without yellow longitudinal stripe. Tibia 3 usually with a small proximal yellowish spot.

Found in most districts in Denmark. - Sweden: a rather common species, especially in the southern districts. Northernmost records from Lu. Lpm. - Norway: a very few records from AK, Tøien. - Finland: not common but widespread northwards to Kb and ObS. - Soviet Karelia: Ib, Kr. - A Holarctic species (Crossocerus sulcus Fox of American authors). The species is rather common all over Europe, towards the east to the Urals, Caucasus and south-eastern Kazakhstan in the U.S.S.R. , towards the south to North Africa. In north-eastern U.S.A.

The natural breeding habitat of the species is in the soil, but in recent decades it has also been found nesting in cavities in brickwork (Spooner, 1946; Leclercq, 1964). This adaptation to urbanization has also been observed in Denmark, where the species has been found breeding in several places in the city of Copenhagen. It is also stated that the species may be found nesting in old timber, see e.g. Leclercq, 1954. Several females may use the same nest entrance. The prey consists of small Diptera, e.g. Chloropidae, Lauxaniidae, Stratiomyidae, Empididae, Dolichopodidae and Agromyzidae. According to Tetens Nielsen, 1933, the prey is brought home impaled on the sting, but this is probably exceptional. As cleptoparasite Macronychia polyodon Meig. (Diptera, Sarcophagidae) is recorded.

Note. In Europe, at least in three distinct subspecies. The Fennoscandian and Danish populations belong to Cr. elongatulus propinquus (Shuckard) together with the English and part of the German and Italian material. This subspecies is recorded also from Argentina, where it was probably introduced (Leclercq, 1968). The nominate subspecies elongatulus s.str. (= berlandi Richards, 1928) is distributed mainly in Central Europe, Holland and Belgium. Cr. elongatulus trinacrius Beaumont, 1959 was described from Sicily. Elongatulus s.str. is separated from propinquus by the following characters:

Female: mesopleuron usually denser and more strongly punctate, often the punctation may change to partly rugose dorsally. Tibia 2 without distal yellow spot.

Male: mesopleuron, especially ventro-laterally, and femur 2 basally with long woolly pubescence (almost as in distinguendus A. Mor.)

147. CROSSOCERUS (CROSSOCERUS) WESMAELI (van der Linden, 1829)

Crabro wesmaeli van der Linden, 1829:65.

Female: 5-6 mm. Head seen from above strongly narrowed behind the eyes. Frons distinctly convex, shining, at most anteriorly with microsculpture. Punctation fine and sparse. Frontal line and line between lateral ocelli weak. Facial fovea shining, rather wide, with extremely fine sculpture. Anterior margin of clypeus evenly rounded or with indistinct very rounded teeth. In a single specimen from Denmark (F, Enebærodde, 4.7.1971) two yellowish spots are found proximally on clypeus. Mandibles with black base, red-yellow or brown-yellow centre and rust-coloured or red-brown apex. Frontal face of scapus yellow. The following area of thorax have yellow markings: pronotum dorsally, humeral tubercles and scutellum. Distribution of pattern very constant, but specimens with reduced pattern occur. Scutum shining, finely, but distinctly punctate, posteriorly densely striate. Pubescence short, greyish. Punctation of mesopleuron finer, pubescence slightly silvery. Area cordiformis shining, sometimes with a very weak, radiately striate sculpture. The surrounding furrow strong, divided into large, almost quadrate pits. Pygidial area broadly triangular, shining, with strong and variable punctation, the extreme third or more usually red-brown or red-yellow. Femora 1+2 with a larger or smaller yellow distal spot. Tibiae 1+2 usually mainly yellow. Tibia 3 with a broad proximal ring, which may extend to the apex of tibia.

Male: 4-4.5 mm. Head in anterior view strongly narrowed ventrally. Interstices between punctures on frons usually without microsculpture. Frontal line very weak. Shape of teeth on anterior margin of clypeus very variable. The colour pattern of the mandibles varies considerably, just as in the female. Flagellum with a row of short, downward-directed hairs ventrally. Last segment rounded apically. Thorax often without yellow spots; if such are present they occur mainly on the humeral tubercles. Specimens from Central and South Europe often have yellow spots on scutellum and dorsally on pronotum. Sculpture on thorax as described in female. Pubescence of mesopleuron ventro-laterally only slightly longer than normal. Furrow surrounding the often radiately or somewhat irregularly rugose area cordiformis very coarsely pitted. Last tergum shining, smooth, rather strongly convex, apex usually pale red-brown, rounded, the surface itself strongly punctate, posterior punctures often coalescing longitudinally. Femur 1 with a large yellow spot on the inner side and also often with an oblong distal spot on the outer side. Femur 2 often without yellow markings, but

may distally have an oblong spot on the inner side. Tibiae 1+2 with extensive yellow markings, tibia 3 with a broad proximal yellow ring, which on the inner side may reach apex of tibia.

The species is very common in Denmark, especially in sandy localities along the coasts. - Northern distribution limit in Fennoscandia in Sweden passes through Nb., and in Finland through Lk. - Norwegian records from AK, HEs, On and Bø. - Soviet Karelia: Ib and Kr. - Like several other species of Crossocerus, this species is distributed in Europe, Caucasus, Kazakhstan, Turkestan, Mongolia, Japan and Sakhalin.

The biotope preference of the species is not particularly well defined, since it may be found nesting both in white dunes very close to the sea, in inland dunes, sandy margins and more or less clayey slopes exposed to the sun, e.g. in gravel pits. It is, however, most often met with in sandy localities, often abundantly. The nest is of simple construction, normally containing 1-2 cells, but may contain up to nine (Tsuneki, 1960). The prey consists of small Diptera, e.g. of the families Chironomidae, Tipulidae, Ceratopogonidae, Agromyzidae, Empididae and Chloropidae, of which about 20 are placed in each cell, depending on size. It is stated that the species, in addition, might also use small Homoptera or Heteroptera as prey.

148. CROSSOCERUS (CROSSOCERUS) LUNDBLADI (Kjellander, 1954)

Figs. 406, 440.

Crabro (Crossocerus) lundbladi Kjellander, 1954:239.

Female: 4-6 mm. More slender than distinguendus. Head in front view as Fig. 406. Mandibles dark red-brown to brown-black. Scutum shining, distance between punctures considerably larger than diameter of the latter, interstices with at most indicated microsculpture. Pronotum and humeral tubercles black, scutellum occasionally with a weak yellow pattern. Area cordiformis without radiating striation. Median furrow anteriorly only slightly excavate. Lateral faces of propodeum with a large median, shining, smooth, completely impunctate area. Tergum 1 extremely finely punctate, seen from above comparatively shorter and wider than in distinguendus. Punctation of pygidial area variable, usually as in distinguendus and elongatulus, but in small specimens the number of punctures may be very reduced. Femur 1 with a small distal yellow spot on the inner side. Tibia 2 dorsally yellow for more than two-thirds of its length. Tibia 3 with a very broad, proximal, yellow ring.

Male: 5.5 mm. Head in front view as Fig. 440. Punctation in front of ocelli very sparse, interstices with very distinct microsculpture. Frontal line and

facial fovea weak. Clypeus with broad, rounded, median lobe. Scapus with yellow anterior face, flagellum yellow-spotted ventrally, without hair fringe, last segment truncate apically. Mandibles brown with slightly paler median area. Thorax without yellow pattern, humeral tubercles distally slightly paler. Scutum and scutellum with shining surface, punctation fine and sparse, anteriorly shallow. Microsculpture missing. Mesopleuron laterally with very slightly rugose sculpture, punctation well developed, ventrally with short pubescence. Area cordiformis shining with very fine striation. Both the surrounding furrow and the median line well developed, strongly pitted. All femora black. Tibiae 1+2 mainly yellow. Tibia 3 with a yellow mark covering its proximal half.

The species seems to be endemic to Fennoscandia, but might also occur in Siberia. - Sweden: Hrj. and Vb. - Finland: Ta, Kb, Om and ObN.

149. CROSSOCERUS (CROSSOCERUS) IMITANS (Kohl, 1915)

Fig. 407.

Crabro (Crossocerus) imitans Kohl, 1915:267.

Female: 5-6 mm. Head shining, smooth, with very fine and sparse punctation, completely devoid of microsculpture. Frontal line and line between lateral ocelli missing or only weakly indicated. Clypeus proximally with two large, grey-yellow spots, anterior margin with obtuse lateral teeth (Fig. 407). Mandibles slender, pale white-yellow with red-brown apex, the upper tooth longer and stouter than lower. Antennae rather long and slender, scapus with green-yellow or white-yellow frontal face. Pronotum with a yellow transverse spot, very narrowly interrupted in the middle. Humeral tubercles and scutellum with yellow markings. Punctation of scutum very fine and sparse, punctation on mesopleuron still finer, hardly visible at 50 x magnification. Episternal scrobe very large, deeply impressed. The oblique suture, issuing ventrally to base of forewings and joining the epicnemial carina, especially coarsely pitted. Area cordiformis shining, smooth, surrounded by a strong, coarsely pitted furrow; median line very narrow, divided into very fine pits. Pygidial area black, distally slightly reddish transparent. Punctation coarse and sparse. Femora 1+2 with a large distal green-yellow spot. Tibiae 1+2 mainly white-yellow with a dark brown spot on the inner side. Tibia 3 with a broad proximal white-yellow ring, like tibia 2 strongly spiny. Metatarsi mainly pale white-yellow, remaining tarsal segments black-brown.

Male: 4.5-5.5 mm. Most of clypeus covered by two large, bright yellow spots. Lateral teeth projecting more than in female. Mandibles as in female. Head ventrally near articulations of mandibles with a triangular, yellow spot. Flagellum

ventrally bicoloured, yellow and brown-yellow, with a row of downward-directed pale hairs. Last segment truncate apically. Transverse spot on pronotum broadly interrupted in the middle. Humeral tubercles with yellow spot, scutellum without. Thorax otherwise as described in female, but the oblique suture on mesopleuron more strongly pitted. Last tergum rather densely and coarsely punctate, distally rounded, often reddish transparent. Femur 1 slightly dilated, almost plane ventrally, tri-coloured, as the dorsal face is almost entirely black. Ventrally with a large yellow spot. Between these markings brown-yellow areas are found. Tibia 1 mainly white-yellow, ventrally brown-yellow with irregularly shaped distal black spot. Fore- and midlegs with same colour as in female, but femur 2 is often brownish on the inner side.

Denmark: WJ, Skallingen. - Not in Fennoscandia. - The species occurs very locally in north-western Europe. The distribution area covers the coastal regions of Germany, Poland and the Friesian Islands. The record from south-eastern Kazakhstan by Kazenas (1972) has proved to refer to another species (Kazenas in litt.).

A pronouncedly littoral species in Europe, which may be found nesting in white dunes among tufts of Elymus and Ammophila. The prey is unknown, but probably does not consist of Diptera, but of Heteroptera (Lomholdt, 1973).

150. CROSSOCERUS (CROSSOCERUS) DISTINGUENDUS (A. Morawitz, 1866)

Crabro (Crossocerus) distinguendus A. Morawitz, 1866:260.

Crabro mucronatus Thomson, 1870:167.

Female: 5-6.5 mm. Close to elongatulus, from which it is distinguished by the following characters: punctation of frons fine and rather sparse, interstices between punctures anteriorly with distinct microsculpture, creating a dull appearance. Facial fovea shining, level with remaining part of frons. Pronotum usually entirely black, but two yellow lateral spots are sometimes present. These spots very seldom coalesce into a transverse band. Furrow surrounding the usually completely smooth area cordiformis strong, extremely pitted. Mesopleuron ventrally with fine microsculpture.

Male: 4-5.5 mm. Easily recognizable by the morphology, pubescence and colour-pattern of forelegs, and pubescence of mesopleuron. Last segment of flagellum truncate apically. Mandibles often almost entirely black, not dilated distally. Mesopleuron ventrally with a long, white woolly pubescence as on the proximal part of forelegs. Last tergum evenly, densely and rather strongly punctate. The basal part of femur 1 plane ventrally, the femur tricoloured,

black with a yellow stripe dorsally and brown-yellow ventrally. Tibia 1 also tricoloured. Femur 2 without basal dilation.

Widespread in Denmark, locally rather common. - Sweden: not common, occurring from Sk. in the south to Gstr. and Ång. in the north. - Apparently absent from Norway, Finland and Soviet Karelia. - The species is rather sporadic in Europe, Japan, China, and on Formosa.

The species is found nesting in dry slopes and the like, but is also associated with human habitations, e.g. gardens and parks, or even in old timber like elongatulus. The construction of the nest is unknown. The prey consists of Diptera, e.g. Dolichopodidae.

151. CROSSOCERUS (CROSSOCERUS) DENTICRUS Herrich-Schäffer, 1841

Figs. 408, 454.

Crossocerus denticrus Herrich-Schäffer, 1841:T.20.

Female: 4-5 mm. Head in front of ocelli evenly convex, frontal line reduced, very indistinct. Frons shining, punctation rather sparse, without indication of microsculpture. Facial fovea missing. Anterior margin of clypeus with strongly rounded lateral angles (Fig. 408). Mandibles pale, usually yellow with red-brown apex. Thorax without yellow pattern, humeral tubercles paler posteriorly. Scutum posteriorly without striate sculpture. Punctation on mesopleuron almost as strong as on scutum. Area cordiformis shining and smooth, surrounding furrow well developed, especially anteriorly. Pygidial area strongly punctate. Femora 1+2 with a distal yellow spot. Tibiae 1+2 mainly yellow, tibia 3 with proximal yellow ring.

Male: 3.5-4.5 mm. Head almost as in female, but punctation on frons somewhat better developed. Median part of clypeus somewhat projecting, anterior margin itself evenly rounded, without teeth. Mandibles yellow with reddish apex. Flagellum ventrally with a row of long, pale hairs, last segment with rounded apex. Thorax as in female, without yellow pattern. Femur 1 basally somewhat dilated, plane ventrally. Femur 2 with stout proximal tooth (Fig. 454), tibia 2 slightly swollen subapically, distal to this dilation with a row of short spines. Fore- and midlegs mainly yellow. Hindleg with a yellow proximal ring on tibia.

Two old specimens from Denmark: SJ, Sønderborg. - Sweden: Sk., Arrie near Malmö. - Not recorded from Norway and Finland. - Widespread, but very rare in Europe. Also known from Manchuria, Korea and Japan.

Only a single observation is available on the breeding biology of the species in Scandinavia (Adlerz, 1912). It was found nesting in a stone wall. The prey

consisted of very small Diptera. Yamada (1973) states that in Japan the species has been found breeding in level as well as in sloping ground. The nest contains a single cell. The entrance is surrounded by the material dug out, in the same way as Lindenius, and the returning female flies directly down into it. The prey consists of Diptera: Lauxaniidae and Dolichopodidae.

152. CROSSOCERUS (CROSSOCERUS) EXIGUUS (van der Linden, 1829)

Fig. 458.

Crabro exiguus van der Linden, 1829:74.

Female: 4-5 mm. Very similar to denticrus. Frons in front of ocelli usually with distinct microsculpture. Facial fovea very small. Mesopleuron shining, punctation considerably finer and sparser than on scutum. Line surrounding area cordiformis less well developed than in denticrus. Tibia 3 with a proximal yellow ring, and a broad, anterior yellow stripe.

Male: 3.5-4 mm. Clypeus almost entirely yellow. Head ventrally near articulation of mandibles with a large yellow spot. Scapus with at most a quite small proximal dark spot. Flagellum with a row of downward-directed pale hairs, the proximal segments yellow ventrally. Antennal segment 7 with a strong, downward-directed projection (Fig. 458). Thorax may have yellow pattern consisting of a spot on epicnemium, and a smaller one just in front of coxa 2. Mesopleuron ventrally with long, white pubescence. Femur 1 almost entirely yellow, slightly dilated, with plane, sharp-edged ventral face, with dense, short, white pubescence. Femur 2 yellow with two brown longitudinal stripes. Tibia 3 with yellow proximal ring and a broad stripe on the outer side.

Two specimens are known in south-eastern Finland: Sa, Salmis. - Soviet Karelia: Ib and Kr. - A very rare and sporadic species. Distributed in Central and East Europe. Additional records from Mongolia.

Nest construction and prey not known in this species. Lepeletier & Brullé (1834), however, state that the species uses small Homoptera as prey.

153. CROSSOCERUS (CROSSOCERUS) PALMIPES (Linné, 1767)

Figs. 409, 452.

Sphex palmipes Linné, 1767:994.

Crabro (Crossocerus) palmarius Kohl, 1915:248.

Female: 6-8 mm. Clypeus with extensive pale yellow pattern, only anterior margin dark. Median lobe on either side with rounded tooth, lateral lobes distinct (Fig. 409). Frons finely punctate, microsculpture vestigial or absent.

Frontal line and line between lateral ocelli weakly developed. Mandibles yellow with red-brown apex, the upper tooth considerably stouter than the lower. Pronotum narrow and short, dorsally often with yellow lateral spots or a transverse band. Humeral tubercles usually pale brownish, but may have a pale yellowish spot. Scutum shining, smooth, usually without microsculpture, punctation fine. Scutellum may have an irregularly-shaped yellow spot. Metanotum generally with a large yellow transverse spot. Mesopleuron very finely punctate, with a distinct tooth in front of coxa 2. Area cordiformis finely radiately striate, the surrounding furrow weakly developed laterally. Median furrow narrow, at the bottom finely pitted. Pygidial area plane, triangular, apically sometimes slightly reddish. Punctation especially well developed laterally. Femora 1+2 may have a small distal yellow spot. Tibiae 1+2 yellow-black on the inner side. Tibia 3 with a broad, yellow, proximal ring. Metatarsus 1 white-yellow, with three short colourless spines. Metatarsi otherwise white-yellow, remaining tarsal segments progressively darker.

Male: 5-6.5 mm. Clypeus entirely yellow. Antennae long and slender, scapus mainly yellow, flagellum pale ventrally, with a fringe of long, strong, downward-directed hairs. Last segment with rounded apex. Mandibles, except apex, and two very large spots on ventral face of head round mandibular articulation, yellow. Pronotum, humeral tubercles, scutellum and metanotum yellow. Mesopleuron has yellow markings on the epicnemium. In addition, a greenish-yellow spot is often found right in front of coxa 2. Mesopleuron laterally with very thin pubescence, ventrally with dense, well developed silvery pubescence. Spine in front of coxa 2 distinct. Area cordiformis with somewhat irregular striation, the surrounding furrow well developed, strongly pitted. Last sternum with a dense, slightly curved golden-brown pubescence, and two lateral, more or less spoon-shaped processes. Penultimate sternum with a small, median thickening and a loose lateral tuft of long, pale, obliquely outward-directed hairs. Forelegs of very striking appearance: coxa yellow, distally with dense, almost felty, white pubescence; femur and trochanter somewhat dilated, plane ventrally, mainly yellow; tibia and tarsi very strongly dilated, as Fig. 452. Coxae 2+3 and trochanter 2+3 with extensive yellow or slightly green-yellow pattern. Femur 2 and tibia 2 mainly yellow. Tibia 3 with yellow proximal ring and usually also with a broad yellow stripe along the inner side, spines on the outer side few and weak.

Uncommon in Fennoscandia and Denmark. In Sweden in Sm., Vg. and Hall. A single record from Dlr. - Norway: a few specimens from AK. - Finland: a southern and south-eastern distribution, northwards to Kb. - Soviet Karelia: Ib. - Widely distributed in Central and East Europe. Additional records from

the surroundings of Lake Baikal in southern Siberia and from North China.

The nests are constructed in sandy ground, level or sloping, e.g. on sandy forest paths. As far as is known, each nest contains only a single cell. The prey consists of Diptera, e.g. Muscidae, Dolichopodidae, Chloropidae or Lauxaniidae. Myrmosa melanocephala (Hym., Myrmosidae) is recorded as a possible parasite.

154. CROSSOCERUS (ABLEPHARIPUS) PODAGRICUS (van der Linden, 1829)

Figs. 434, 455.

Crabro podagricus van der Linden, 1829:62.

Female: 4-6 mm. Head well developed behind the eyes, seen from above approximately rectangular, dull, with distinct, reticulate microsculpture. Punctation very variable, usually fine and very sparse. Distance between lateral ocelli much larger than diameter of one of these. Occipital carina ventrally abruptly truncate. Facial fovea and frontal line well developed. Clypeus with broadly truncate median lobe and very small lateral teeth. Antennae short, scapus with yellow frontal face. Mandibles mainly black, upper tooth larger than lower, tooth on inner side distinct. Pronotum may have two yellow lateral spots, especially in robust individuals. Humeral tubercles only exceptionally without yellow spots. Scutum and scutellum dull, microsculpture finer than on head, punctation dense and very fine. Suture between scutum and scutellum very coarsely pitted. Scutellum usually black, but specimens with yellow median spot are known from Denmark and southern Sweden. Mesopleuron with well developed microsculpture, punctation fine and sparse. In front of coxa 2 is a distinct tooth. Area cordiformis rather shining, its microsculpture usually weakly developed. The surrounding furrow well developed, especially anteriorly. Median furrow very narrow, not divided by transverse rugae. Posterior face of propodeum with irregular, superficial punctation and transverse striation. Lateral areas on propodeum with dense, finely striate sculpture. Pubescence on thorax and propodeum very sparse. Abdomen dull, segments apically with more shining transverse bands. Pygidial area as Fig. 434. Coxa 1 proximally with outwardly directed sharp spine. Femur 1 approximately triangular in cross section, like femur 2 with a small, distal, yellow spot. Tibiae 1+2 yellow with larger or smaller dark spot on the inner side. Tibia 3 with proximal yellow ring, distinctly clavate, spines on the outer side very short.

Male: 4-6 mm. Head and thorax sculptured as in female. Flagellum with strong hair fringe ventrally, last segment truncate distally. Spine in front of coxa 2 may be very weak. Thorax devoid of yellow markings except on humeral tubercles. Mesopleuron strongly excavate ventrally, especially ventro-laterally with long, dense,

whitish pubescence, also ventrally on base of forelegs. Midlegs basally with short, dense, almost felty pubescence. Forelegs mainly yellow, femur 1, however, with a broad, black stripe on the outer side. Femur 2 strongly thickened. Tibia 2 very short, distally somewhat dilated, without apical spur (Fig. 455). Metatarsus 2 slightly curved and depressed. Femur 3 and tibia 3 thickened, spines on tibia very weak. Last tergum with a fairly strong subapical concavity, punctation very indistinct.

The species has a typical southern and south-eastern distribution in Denmark. - Sweden: not uncommon in Svealand, seems to be absent from Sk., Bl. and Sm. - Norway: a few specimens from AAy and HOi. - Finland: rather common on Al. Otherwise only found in Ab. - Soviet Karelia: Ib and Kr. - The species is widely distributed, but uncommon in Europe, eastwards to the Urals, Caucasus and Kazakhstan in the USSR. Southwards to North Africa. It also occurs in Japan.

The nest is constructed in decayed wood, often in connection with abandoned tunnel systems of xylophagous insects. The prey consists of small Diptera, e.g. Chironomidae, Ceratopogonidae, Sciaridae and Scatophagidae. The larva was described by Goidanich, 1928.

155. CROSSOCERUS (ABLEPHARIPUS) CONGENER (Dahlbom, 1845)

Fig. 435.

Crabro (Crossocerus) congener Dahlbom, 1845:335.

Female: 4-5 mm. Very similar to small specimens of podagricus, but may be distinguished from these by the following characters: head seen from above strongly rounded posteriorly, its punctation very reduced. Facial fovea very small and indistinct. Occipital carina anteriorly gradually disappearing. Distance between the lateral ocelli equal to or scarcely larger than the diameter of an ocellus. Lateral lobes on clypeus vestigial. The tooth on the inner side of the mandibles very indistinct. Thorax, except the humeral tubercles, without yellow markings. Area cordiformis only anteriorly delimited by a distinctly pitted furrow. Propodeum laterally with shining and smooth areas. Pygidial area with brown-yellow margins (Fig. 435). Outer side of tibia 3 often with a pale touch.

Male: 4-5 mm. Head, thorax and propodeum sculptured as described in female. The yellow spot on humeral tubercles may be missing. The spine in front of coxa 2 occasionally vestigial. Last tergum with a slight subapical concavity. Mesopleuron without distinct concavity, ventral pubescence uniformly distributed. Midlegs normal, tibia with apical spur.

In Fennoscandia this species is known from Finland, where it has a very

sparse occurrence in the southern districts. - In Sweden it has only been found in Ög. and Upl. - Soviet Karelia: Ib and Kr. - Locally the species may occur in large numbers, but it is rare in Central, East and North Europe. It is fairly widely distributed in Japan.

The nests are constructed in hollow plant stems (Tsuneki, 1960) and the cells are placed in a line. Partitions between them are made of fine sawdust. The prey consists of small Diptera, e.g. Mycetophilidae and Empididae, of which from 22 to 27 are placed in each cell. The number of cells may vary between 5 and 12.

156. CROSSOCERUS (ABLEPHARIPUS) ASSIMILIS (Smith, 1856)

Figs. 410, 430, 436.

Crabro assimilis Smith, 1856:413.

Crossocerus socius Dahlbom, in Thomson, 1870:164.

Crossocerus tirolensis Kohl, 1877:709.

Female: 6-7.5 mm. Head in dorsal view very well developed behind the eyes, rectangular. Punctation dense and very fine, microsculpture well developed, considerably finer than in the two preceding species. Frontal line and facial fovea indistinct. Occipital carina gradually disappearing anteriorly. Clypeus with very broad median lobe, lateral lobes weak (Fig. 410). Mandibles black, tooth on inner side strongly developed. Scapus with yellow front side. Thorax always entirely black, the humeral tubercles may, however, be slightly brownish posteriorly. Sculpture on pronotum and scutellum as on head, microsculpture on mesopleuron weaker. Tooth in front of coxa 2 strong. Propleuron with distal spine. Area cordiformis tapering posteriorly, the delimiting furrow in front of the area divided into coarse pits, which are considerably longer than broad. The remaining part of the furrow narrow, divided into small quadrate pits. The area itself with very fine radiating striae (Fig. 430). Abdomen rather shining. Pygidial area as Fig. 436. All femora black. Tibia 1 with a broad yellow stripe on the frontal side. Tibia 2 with a proximal yellow ring and a shorter or longer yellow stripe on the front side. Tibia 3 with a broad yellow proximal ring, spines on the external side short, dark.

Male:6-7 mm. Punctation of head very sparse and weak, microsculpture distinct. Ventral hairs on flagellum very short, only slightly longer than remaining pubescence. Last segment rounded apically. Head ventrally, as also ventral side of mesopleuron, propleuron and basal part of forelegs, with long, woolly pubescence. Thorax entirely black, sculptured as in female. Mesopleuron without ventral concavity. Last tergum also without concavity. Midlegs without secondary

sexual characters. Metatarsus of hindlegs rounded, slightly thickened.

A single male from Fennoscandia, Norway: AK, Helgø. - The species is rare in mountainous regions in Central Europe. Also recorded from the Caucasus, Mongolia and Japan.

The species has been found nesting in dry twigs of Morus in Japan. Cells provisioned with Diptera.

157. CROSSOCERUS (BLEPHARIPUS) WALKERI (Shuckard, 1837)

Figs. 412, 437, 444.

Crabro walkeri Shuckard, 1837:170.

Female: 5.5-8 mm. Clypeus mainly yellow, only anterior margin black. Median lobe convex, lateral lobes missing (Fig. 412). Occipital carina very weak. Scapus and two bands along inner orbits yellow. Pattern on thorax very variable, even within very restricted geographical areas. However, yellow markings dorsally on pronotum and on humeral tubercles fairly constant. The spot on scutellum may be divided into two lateral spots, in which case transverse spots on metanotum are usually missing. Mesopleuron without tooth in front of coxa 2. Area cordiformis shining, often with a slightly raised, radiately striate sculpture. The delimiting furrow weak. Lateral faces of propodeum shining, smooth, without sculpture. Tergum 1 slightly longer than broad. Pygidial area apically somewhat reflexed, lateral margins proximally thickened (Fig. 437). Propleuron with two truncate projections. Coxa 1 with sharp lateral spine. Femora 1+2 with a larger or smaller distal yellow spot. Tibiae 1+2 mainly yellow. Tibia 3 with a broad, proximal, yellow ring.

Male: 5-6.5 mm. Head in front view as Fig.444.Clypeus yellow, its median part produced into a triangular figure. Two yellow carinae along the inner orbits. Mandibles yellow or red-yellow with darker apex. Scapus entirely yellow. Flagellum without hair fringe ventrally, last segment rounded apically. Pronotum, humeral tubercles and frequently also scutellum and metanotum with yellow pattern. Delimiting furrow of area cordiformis usually stronger developed than in female. Last tergum pale apically. Femur 1 tri-coloured, yellow-brown with a brown longitudinal stripe along upper side and a yellow apical spot. Femur 2 brown with yellow or yellow-brown inner side and a yellow longitudinal stripe along the dorsal side. Coxae 2+3 and trochanters with larger or smaller yellow spots. Femur 3 brown, lighter ventrally, and occasionally with a yellow proximal spot. Tibia 3 with a very broad proximal ring, on the inner side often extending to the apex of the tibia.

From Denmark the species is hitherto only known from NEZ and EJ. - In Sweden it has been found northwards to Upl. and Gstr. - From Finland isolated specimens derive from Ab, Ta, Sa and Kb. - The species is rare. Its area of distribution covers Central, South and East Europe. In addition, it is distributed in Mongolia, eastern China and in Japan.

The nest is constructed in dead branches, stumps and the like, e.g. of Quercus, Fagus, Alnus, Malus or Fraxinus. The tunnel system may be simple or branched. The number of cells varies considerably; a single nest may contain up to 16 cells. The prey consists of Ephemeroptera, often Baëtidae, of which 4 to 7 are placed in each cell. The orientation of the prey is the same as that of the Lepidoptera-collecting Lestica, i.e. the heads pointing towards the bottom of the cell. Often the legs and sometimes even the head of the prey are amputated. It is interesting to note that first a large number of prey is collected, after which they are divided into batches in the cells. Such behaviour is also known in Astata and certain species of Cerceris. The larva was described by Baudot, 1929.

158. CROSSOCERUS (BLEPHARIPUS) ANNULIPES (Lepeletier & Brullé, 1834)

Figs. 411, 450.

Blepharipus annulipes Lepeletier & Brullé, 1834:729.

Crabro ambiguus Dahlbom, 1842:14.

Female: 5-7 mm. Head large, in front view as Fig. 411. Clypeus with semicircular emargination, on either side delimited by a small tooth. Lateral teeth indistinct. Frons shining, punctation very sparse and fine behind ocelli, denser and coarser in front of these. Facial fovea usually distinct, shining and impunctate. Mandibles very strong, tridentate apically. Colour pattern of these very variable, often with an ivory-white spot dorsally. Scapus with white-yellow front side. Occipital carina strongly projecting on either side, abruptly truncate. Thorax completely devoid of yellow markings. Propleuron on either side with a rather sharp, downward-directed tooth. Punctation on scutum and scutellum distinct, sparse and rather fine. Scutum posteriorly with few short rugae. A weak microsculpture may occur. Mesopleuron with very fine, sparse punctation; very robust individuals may have indication of a tooth in front of coxa 2. Area cordiformis shining, delimited by a pitted furrow. Pygidial area slightly depressed like a groove, the proximal, raised and punctate portion very weakly developed. Femur 1 subapically with a slightly concave marginate area ventrally. Tibia 1 with a (sometimes very reduced) yellow stripe along anterior margin, the metatarsus with about five strong spines. Tibia 2 often entirely black, but may

have a small, proximal, yellowish spot. Tibia 3 with a proximal, white-yellow ring.

Male: 4.5-6 mm. Head strongly narrowed ventrally. Anterior margin of clypeus without emarginations, median part projecting, with three small, blunt teeth. Mandibles bidentate, their colour varying from completely black to pale brownish, the white or yellowish spot of the female is usually missing. Scapus generally with a white-yellow longitudinal stripe along the frontal side. Flagellum with a row of light hairs ventrally. Occipital carina strongly projecting anteriorly, ending in a tooth (almost as in quadrimaculatus). Punctation of frons superficial. Punctation on scutum weaker than in female, right in front of the posterior margin there are two to four deep pits, separated by short, sharp carinae. Punctation of mesopleuron hardly visible. Area cordiformis surrounded by a distinctly pitted furrow. The downwardly directed teeth on propleuron well developed. Forelegs (Fig. 450) strongly modified: trochanter with a triangular dilation ventrally; femur with an obtuse proximal dilation; tibia distally slightly depressed, with a rather broad, rounded dilation,ventrally with dense and fairly long pubescence; tarsus strongly depressed, transparent, black-spotted. Metatarsus 2 whitish, very slightly depressed on inner side.

The species is rather sporadic in Denmark and Fennoscandia. Denmark: only found in Jutland and NEZ. - Sweden: very sparse in Götaland and Svealand, northwards to Gstr. - Norway: a few specimens from AK. - Finland: rare, only distributed in the southern districts, Ab, N, Ka and Sa. - Soviet Karelia: Ib and Kr. - It is widely distributed in Europe. From the U.S.S.R. and Asia recorded from Kazakhstan, Mongolia, north-eastern China and Japan. Occurrence in North America: north-eastern U.S.A. and south-eastern Canada.

The species is gregarious. The nests are usually constructed in decayed, deciduous wood, but coniferous wood is also used. Each nest contains up to 20 cells (Hamm & Richards, 1926). These are provisioned with Homoptera, usually Typhlocybidae, but Psyllidae or even small Miridae (Heteroptera) are used. In each cell are placed about 25 specimens. The larva was described by Evans, 1957.

159. CROSSOCERUS (BLEPHARIPUS) HEYDENI Kohl, 1880

Figs. 413, 438.

Crossocerus heydeni Kohl, 1880:216.

Crabro (Coelocrabro) hedgreni Kjellander, 1954:238.

Female: 5.5-7 mm. Head strongly narrowed ventrally (Fig. 413). Frons shining, rather finely punctate, without microsculpture. Facial fovea sharply marked,

small and narrow. Scapus with a sharp, longitudinal keel throughout its length. Clypeus with strongly projecting and rather narrow median part (Fig. 413). Occipital carina weakly developed, anteriorly gradually disappearing. Mesopleuron very finely and sparsely punctate, spine in front of coxa 2 well developed. Area cordiformis shining, often with an indication of reticulate microsculpture. Surrounding furrow rather weakly developed laterally. Median furrow distinctly pitted. Pygidial area very narrow, almost as in cetratus (Fig. 438). Tibiae 2+3 with a weak proximal yellow spot.

Male: 4.5-5.5 mm. Morphology of head almost as described in female, but the face is more strongly narrowed ventrally, and the facial fovea often vestigial. Keel of scapus strong. Flagellum ventrally with light brown-yellow tyloidea, and fringe of very short hairs. Last segment truncate apically. The pitted furrow surrounding area cordiformis very well developed, also laterally. Spine in front of coxa 2 may be indistinct in small specimens. Legs without conspicuous secondary sexual characters, metatarsus 1 with a dark spot on the inner side.

Fron Fennoscandia there are sparse records from Central Sweden: Nrk., Sörby, Örebro; Upl., Björkö; Dlr., Råberga; and southern Finland: Ab, Pargas, Rymättylä; N, specimen lost during the last war; and Ta, Pälkäne, Vanaja. - Soviet Karelia: Ib. - The species is widely distributed in Central and eastern Europe, but very rare. Additional occurrence in Japan.

The biology of the species is unknown. A single specimen has been collected under the bark of a spruce (Picea) stump in Sweden: Nrk., Sörby, 26.VI.1918 (A. Jansson).

160. CROSSOCERUS (BLEPHARIPUS) STYRIUS (Kohl, 1892)

Figs. 414, 424, 441.

Crabro (Coelocrabro) styrius Kohl, 1892:198.

Female: 5.5-6.5 mm. Head large, seen from above as Fig. 424. Facial fovea very small or vestigial. Behind the lateral ocelli two, rather strong, impunctate depressions, between ocelli a short but distinct longitudinal furrow. Anterior margin of clypeus almost as in nigritus (Fig. 414). Frons shining with fine, rather dense punctation and very short pubescence. Humeral tubercles light brown. Scutum shining, with finer and denser punctation than in cetratus, the double median line anteriorly rather strongly impressed. Mesopleuron with very fine sparse punctation, without tooth in front of coxa 2. Area cordiformis shining, only anteriorly delimited by a pitted furrow, median furrow narrow and indistinct. First abdominal segment much longer

than wide. Tibiae 1+2 brownish, tibia 3 rather strongly thickened distally, with a yellowish proximal ring, spines on outer side rather stout.

Male: 4.5-5.5 mm. Head strongly narrowed ventrally, anterior border of clypeus with three rather stout teeth (Fig. 441). Scapus very long, pale brown, slender, without longitudinal keel. Flagellum short, ventrally with well developed hair fringe and tyloidea. Last segment truncate apically. Thorax sculptured as in female. Mesopleuron without tooth in front of coxa 2. First abdominal segment about 1.5 times longer than wide. Tibia 3 strongly clavately dilated distally, on outer side with very weak spines. Metatarsus 3 slightly thickened.

Very few specimens are known from Fennoscandia. - Sweden: Öl. and Upl. - Finland: N. - A very rare and scattered species in Central, East and South Europe. Recorded from England. - Biology unknown.

161. CROSSOCERUS (BLEPHARIPUS) BARBIPES (Dahlbom, 1845)

Fig. 415.

Crabro barbipes Dahlbom, 1845:521.

Female: 6.5-8.5 mm. Frons dull, very finely and densely punctate, anteriorly with distinct microsculpture. Frontal line weak, only slightly impressed. Median part of clypeus rather strongly projecting, broad and rounded (Fig. 415). Lateral lobes present as very small, almost vestigial tubercles. Scapus without yellow markings and longitudinal keel. Thorax dull, finely and very densely punctate. Interstices equal to or slightly greater than diameter of punctures. Mesopleuron shining, smooth, without microsculpture, without spine in front of coxa 2. Thorax without yellow markings, humeral tubercles at most slightly paler posteriorly. Area cordiformis distinctly delimited by a pitted furrow, median furrow broad. The area itself rather dull, with irregular radiate striation. Lateral faces of propodeum with very weak, reticulate microsculpture. Lateral margins of pygidial area strongly concave, area red-brown distally. Legs without yellow markings.

Male: 6-8 mm, considerably more slender than female and easily recognizable by following characters: last segment of flagellum truncate, with a rather weak tooth-like dilation. Ventrally flagellum has a distinct hair fringe. Femur 1 and trochanter brown-yellow ventrally and a stripe dorsally; with long, whitish woolly pubescence. Metatarsus 1 not dilated, white-yellow. Sculpture as in female.

A rare, but widely distributed species in Fennoscandia. - Sweden: known from Bl. in the south to Vb. in the north. - Norway: very sparse occurrence in AK,

Nsi and Nnø. - Finland: rare and very sparse occurrence in Ab, Ta, Ks and Li. - The species seems to have a boreo-montane distribution in Europe. Rare in Central and East European mountainous regions. The species also occurs in Kazakhstan, Mongolia and Japan.

162. CROSSOCERUS (BLEPHARIPUS) LEUCOSTOMUS (Linné, 1758)

Figs. 416, 431, 449.

Sphex leucostoma Linné, 1758:571.

Crabro carbonarius Dahlbom, 1838:34.

Female: 6-8 mm. Frons shining, with fine, sparse punctation; a weak microsculpture may occur on the foremost part. Frontal line rather weakly developed. Median part of clypeus broadly projecting, evenly rounded or with three very indistinct lobes (Fig. 416). Antennae black, scapus without longitudinal keel, proximally paler. Thorax uniform black. Scutum and scutellum shining, smooth, with rather dense punctation. Occasionally a weak microsculpture on anterior part of scutum. Mesopleuron with a strong tooth in front of coxa 2. Pubescence on head and thorax very short. Propodeum dorsally with very characteristic, but strongly varying sculpture (Fig. 431). Often the area cordiformis itself is reduced to a narrow portion between the surrounding, extremely coarsely pitted furrow and the median furrow. Propodeum laterally with transverse striation, which may be only indicated in small specimens. Posterior face with rather strong, transverse ribs. Apical half of pygidial area light red-brown. The basal, strongly punctate area considerably raised.

Male: 5.5-7.5 mm. Head strongly narrowed ventrally. Frons with rather superficial punctation. Median part of clypeus strongly projecting, anterior margin tri-lobate. Antennae entirely black, but flagellum with light brown tyloidea. Hair fringe very short. Last segment truncate apically, with a weak, downward-directed, rounded tooth. Sculpture on thorax as in female, only somewhat more superficial. Tooth in front of coxa 2 may be difficult to discern. Area cordiformis as described in female (Fig. 431). Tibia 1 with strong, distal concavity on inner side. Metatarsus 1 flattened or very slightly dilated, distally as a rule with a whitish spot of same colour as second tarsal segment (Fig. 441).

The species is rare in Denmark, but seems to be more common in the Fennoscandian countries. In Sweden the species has been found from Sk. in the south to Nb. and T.Lpm. in the north. - The records from Norway are very scattered, the northernmost deriving from TR and F. - Finland: found in most districts, from Al, Ab, N and Ka in the south to Lk and Li in the north. - Soviet Karelia:

Kr. - Widespread in Europe, but seems to avoid the Mediterranean region. Also recorded from Kamchatka and Japan.

There are very few records on the biology of the species (see e.g. Adlerz, 1910 and Grömblom, 1925). It breeds in dead wood, e.g. of Betula, Picea and Pinus. The nest is often constructed in abandoned larval tunnels of Scolytus ratzeburgi Jansson (Coleoptera, Scolytidae). The nest tunnel is 3-6 cm long and ends in a single cell, which is provisioned with small Diptera. The nest tunnel is sealed with sawdust, packed together with the apex of the abdomen.

163. CROSSOCERUS (BLEPHARIPUS) CETRATUS (Shuckard, 1837)

Figs. 417, 451.

Crabro cetratus Shuckard, 1837:131.

Female: 7-8 mm. Punctation in front of ocelli fine and sparse, interstices without microsculpture. Frontal line and facial fovea distinct. Occipital carina strongly projecting anteriorly, abruptly truncate. Clypeus in the middle broadly projecting, with or without very weak lobes. Lateral teeth almost vestigial (Fig. 417). Scapus entirely black, with or without indistinct longitudinal keel, Scutum densely punctate, along posterior margin a row of short, dense rugae. Mesopleuron with very fine and sparse punctation. Tooth in front of coxa 2 very small or missing. Pubescence on head and thorax very sparse and short. Area cordiformis marked only by the anterior, coarsely pitted furrow and median line. The latter continues uninterruptedly in the deep furrow on the posterior face of the propodeum. Propodeum dorsally and posteriorly with fine punctation, laterally with dense, fine striation, which may be missing centrally. Pygidial area very narrow, distally pale, proximally with a strongly raised, heavily punctate area. Legs without yellow markings.

Male: 6.5-7.5 mm. Easily recognizable by the morphology of the forelegs (Fig. 451). Femur 1 ventrally strongly flattened, slightly concave, often brown-yellow. Tibia 1 strongly flattened and dilated, with whitish margins. Metatarsus 1 only slightly longer than broad, also with whitish margins. Flagellum with broad, brown-yellow tyloidea, hair fringe very reduced, last segment truncate apically. Mesopleuron with rather strong, ventral concavity. Spine in front of coxa 2 only distinct in very robust specimens.

Denmark: NEZ, Tisvilde Hegn, 1♀, 18.vi.1975 (O. Lomholdt); NEZ, Jægerspris Nordskov, 1♀, 11.vi.1975 (O. Martin); new to Denmark. - Sweden: not common, occurring mainly in the central districts in Svealand and Götaland. - Norway: a few specimens from HOi and SFi. - Finland: rare, found in Al, Ab, N, Ta, Sa, and ObS. - Not found in Soviet Karelia. - Distributed in Central, East and North Europe and in Caucasus, Kazakhstan, eastern China and Japan.

The nest is constructed in similar sites to that of the following species. Diptera, e.g. Stratiomyidae and Bibionidae, are used as prey.

164. CROSSOCERUS (BLEPHARIPUS) NIGRITUS (Lepeletier & Brullé, 1834)

Figs. 418, 432, 442, 459.

Blepharipus nigrita Lepeletier & Brullé, 1834:729.
Crabro pubescens Shuckard, 1837:165.
Crabro (Crossocerus) inermis Thomson, 1870:162.

Female: 6-7.5 mm. Punctation in front of ocelli rather coarse, but superficial and somewhat irregular. Between punctures very weak rugae may be found. Microsculpture at most indicated. Frontal line and facial fovea well developed. The projecting median part on clypeus with three rounded teeth (Fig. 418). Scapus with an often reduced longitudinal carina, on the front side with a larger or smaller pale, longitudinal spot. Head with long pubescence. Punctation dorsally on thorax weak, scutum often with slight microsculpture. Mesopleuron with very fine, sparse punctation laterally, ventrally punctation gradually becomes considerably denser. In front of coxa 2 is a small spine. Pubescence on thorax long and erect. Area cordiformis ill-defined; of the delimiting lines only the anteriormost is present. This, together with the median line, forms a T-shaped figure (Fig. 432). Propodeum otherwise very indistinctly sculptured, almost smooth. Lateral margins of pygidial area strongly concave; a sharp longitudinal keel is found proximally. Legs usually entirely black, proximally on tibia 3 a small white-yellow spot may be present.

Male: 5.5-7 mm. Head with very long pubescence, both dorsally and ventrally. Clypeus strongly projected in the middle, the median lobe very well developed (Fig. 442). Scapus without longitudinal keel, but with a large yellow longitudinal spot. Flagellum with a strong hair fringe ventrally, last segment with rounded apex. Thorax with long pubescence, punctation weaker than in female. Spine in front of coxa 2 very reduced or missing. Propodeum as in female, but sculpture dorsally, on average, somewhat better developed. Sternum 7 with a median convexity. Tergum 7 with two ventrolateral clavate processes, which meet near the convexity on sternum 7 (Fig. 459). Femur 1 and tibia 1 brown-yellow ventrally, tibia in addition with an effaced, yellow, longitudinal spot. On tibia 1, especially distally ventrally, there is a long, slightly curly pubescence. Tarsus without secondary sexual characters. Femur 2 often with brown-yellow pattern on the inner and outer sides. Tibia 3 often with a yellowish proximal spot.

This species is not common in Denmark and only known from a few localities in Jutland and North Zealand. - Distribution in Sweden very sparse, from Sk.

in the south to Ly. and Lu. Lpm. in the north. - Norway: rare and sparse. - Finland: rare, found from Ab and N in the south to Ks in the north. - Soviet Karelia: Kr. - The distribution area covers Europe, and extends eastwards to the Caspian Sea. Additional occurrence in Mongolia, China and Japan.

The nests may be constructed in dead wood or branches, trunks and stems of e.g. Fagus, Quercus, Prunus, Populus, Alnus, Sambucus or Typha, and often associated with old human habitations. The species has also been found nesting in abandoned larval tunnels of Saperda populnea L. and Ceuthorrhynchidius lapathi L. (Coleoptera, Cerambycidae and Curculionidae, respectively). The structure of the nest may be rather complicated (Tsuneki, 1960), since branching may be considerable. The cells are made either at the end of the lateral tunnels or in a row. A single nest may contain up to 11 cells. As provision is used rather small Diptera, e.g. of the families Ceratopogonidae, Mycetophilidae, Empididae, Pipunculidae, Dolichopodidae, Chloropidae and Phoridae. The prey is attacked on leaves in the sun and paralyzed by a sting in the neck region (for details see Tsuneki, l.c.). The larva was described by Baudot, 1934. Diomorus armatus Boh. (Hymenoptera, Torymidae) is recorded as parasite.

165. CROSSOCERUS (BLEPHARIPUS) MEGACEPHALUS (Rossi, 1790)

Figs. 419, 443.

Crabro megacephalus Rossi, 1790:94.
Coelocrabro leucostomoides Richards, 1935:166.
Crabro leucostoma auctt., nec Linné.

Female: 7-9 mm. Large, very robust species. Head large, well developed behind eyes, in front view as Fig. 419. Frons with fine, sparse punctation in front of ocelli, without microsculpture. Frontal line and facial fovea well developed. Occipital carina slightly projecting, anteriorly gradually disappearing. Median part of clypeus not projecting, shallowly convex and very obtusely emarginate. Lateral teeth small (Fig. 419). Mandibles stout, black, with paler apex. Scapus with sharp, longitudinal keel and a larger or smaller yellow longitudinal spot on the inner side. Pubescence of head rather long, light brownish. Thorax entirely black, also with rather long and erect pubescence. Scutum with a somewhat superficial, irregular punctation. Mesopleuron without silvery pubescence, spine in front of coxa 2 well developed, but may be difficult to discern in very small specimens. Propodeum with very reduced sculpture, mainly shining and smooth with very fine punctation. Area cordiformis, however, lacking punctation, but may have a very fine radiating sculpture. Of the delimiting furrows only the anteriormost is present. As in nigritus this, together with the median line, forms

a T-shaped figure. Margins of the pygidial area strongly concave, apex red-brown. Proximally a sharp, longitudinal keel. Legs without yellow markings.

Male: 6-8 mm. Very easily recognizable by the two big, triangular dilations on clypeus (Fig. 443). Scapus with indistinct longitudinal keel, with yellow longitudinal spot. Flagellum entirely black, hair fringe well developed. Last segment with rounded apex. Head and thorax with long pubescence. Sculpture as in female. Sternum 7 with a median convexity. Tergum 7 with two ventro-lateral clavate processes which meet at the convexity. Legs without yellow markings, forelegs without secondary sexual characters.

The species is rather common in Fennoscandia and Denmark. Northern distribution limit in Sweden in Upl. and Vrm. A few specimens from Nb. - Norway: a little material exists from AK, VE and HO. - Finland: not common, distributed northwards to Om and Sb. - Soviet Karelia: Ib. - Widespread and rather common in Europe, eastwards to the Urals and Kazakhstan in the Soviet Union. It seems to be missing from the Iberian Peninsula, the Balkans and Asia Minor. In the south it is recorded from Tunisia. In Asia the species is found in Persia, around Lake Baikal and in northern Japan.

The species nests gregariously. The nests may be found in many kinds of deciduous trees, but also in conifers or in abandoned larval tunnels (galls) of Saperda populnea L. (Coleoptera, Cerambycidae). It seems to be normal for several females to use the same entrance, but the nest system of each individual is usually kept separate. There is evidence that the tunnel systems may join up, since in the discarded saw dust one may find paralyzed Diptera as well as larvae of the species (Abrahamsen, in litt.). The species uses prey from a very large number of dipterous families (Leclercq, 1954). In a single case a specimen of Tenthredinidae (Hymenoptera, Symphyta) (Hamm & Richards, 1926) was found. As parasites were found Endasys analis Grav., Habritys brevicornis (Hymenoptera, Ichneumonidae and Pteromalidae, respectively) and Eustalomyia festiva Zett. (Diptera, Anthomyiidae).

166. CROSSOCERUS (BLEPHARIPUS) CINXIUS (Dahlbom, 1838)

Figs. 420, 445.

Crabro cinxius Dahlbom, 1838:38.

Female: 5.5-7.5 mm. Head and thorax dull, with distinct reticulate microsculpture, which is vestigial on mesopleuron. Punctation on head extremely fine and rather sparse. Clypeus very characteristically shaped, the median lobe considerably broader than scapus, lateral teeth well developed (Fig. 420). Antennae entirely black, scapus without keel. Mesopleuron without tooth in

front of coxa 2, shining. Area cordiformis very indistinct, also anteriorly. Median furrow weak. The area itself shining, with a fine, dense striate sculpture; microsculpture vestigial. Propodeum otherwise very weakly sculptured, posterior and lateral faces only separated by a very strong carina. Lateral faces with a fine, dense, but somewhat superficial striate sculpture. The pygidial area is simple, margins are almost straight, the raised, strongly sculptured part of other species is missing. Legs black, tibia 3 strongly dilated, with indistinct spines, and a white-yellow, proximal ring.

Male: 5-6 mm. Head in front view considerably narrowed ventrally, distance between mandibular articulations smaller than maximum distance across eyes. Frons with rather weak microsculpture, punctation very fine and sparse. Median lobe of clypeus broad, strongly projecting, almost as in female but with more parallel margins (Fig. 445). Median segments on flagellum with sharp-edged tyloidea. Hair fringe very short. Last segment with rounded apex. Scutum with very well developed microsculpture, anteriorly with rather strong longitudinal carinae. Area cordiformis usually with weak striation. Lateral faces of propodeum distinctly striate. Legs black. Tibiae 1+2 usually with a small, yellow, proximal spot, which may be extended to a stripe on tibia 1. Tibia 3 with a yellowish, basal ring.

Not known from Denmark. - In Sweden it is found in Sm., Vg., Dlr., Med., Jmt., Vb. and in "Norrland and Lapland" (Dahlbom, 1840). - A few specimens from Norway: On and NTi. - The species seems to be somewhat more frequent in Finland, where it is distributed from Ab and N in the south to Kb and Ok in the north. - Soviet Karelia: Ib and Kr. - The species has a boreo-montane distribution pattern in Europe. It is also recorded from Kazakhstan, Formosa and Japan.

The species prefers a habitat similar to capitosus, i.e. pith-filled stems and twigs of Sambucus, Symphoricarpus, Spiraea, Rubus and the like. The cells are placed in rows, and each nest may contain up to 17 cells. Mixed nests of Passaloecus singularis (no. 35) and cinxius occur. The choice of food of the species is less restricted than that of capitosus, since rather small Diptera, e.g. Chironomidae, Empididae and Anthomyiidae, Homoptera, e.g. Psyllidae and rather small Heteroptera may all be used. The larva was described by Micheli, 1930. As parasites have been found Diomorus armatus Boh. and Perithous mediator Fabr. (Hymenoptera, Torymidae and Ichneumonidae, respectively) and Oebalia cylindrica Fall. (Diptera, Sarcophagidae).

167. CROSSOCERUS (BLEPHARIPUS) CAPITOSUS (Shuckard, 1837)

Figs. 421, 426, 446.

Crabro capitosus Shuckard, 1837:159.

Female: 5.5-7 mm. Head very large, well developed behind the eyes (Fig. 426). Microsculpture on head rather fine, whereby the surface becomes somewhat more shining than in cinxius. Punctation extremely fine, sometimes hardly visible. Clypeus as Fig. 421, median lobe about equally broad as scapus, lateral lobes distinct, tooth-like. Ventrally on head between the two branches of the occipital carina there is a concave, strongly transversely striate area. Antennae black, scapus without keel. Microsculpture dorsally on thorax more strongly developed than on head, punctation distinct, but sparse. Mesopleuron shining, smooth; microsculpture very indistinct, the tooth in front of coxa 2 missing. Area cordiformis very indistinct, the pits in the anterior delimiting furrow shallow, merging with the surface of the area itself. Median furrow weak, sometimes vestigial. Whole propodeum with uniform, very finely striate or slightly reticulate sculpture. Transition between posterior and lateral faces marked by a short keel on either side of the articulation of the abdomen. Abdomen dull, with transversely striate microsculpture. Pygidial area dull, lateral margins rather strongly projecting, almost linear. The proximal part of the area itself slightly convex, distinctly punctate. Tibia 1 with a yellow, longitudinal stripe. Tibia 2 often with a small proximal yellowish spot. Tibia 3 strongly dilated, spines on outer side very weak, and a broad white-yellow ring is found proximally.

Male: 4.5-6 mm. Median part of clypeus projecting like a narrow nose (Fig. 446). Flagellum ventrally with broad, yellow-brown tyloidea, hair fringe extremely short. Sculpture as described in female, but somewhat weaker.

The species is not common, but widely distributed within Fennoscandia and Denmark. Northern distribution in Sweden in Dlr. and Gstr. - In Finland the species occurs northwards to Sb and Kb. - Soviet Karelia: Ib and Kr. - Like most species of Crossocerus (Blepharipus), this species has a very disjunct distribution in Central, East and North Europe and in Japan.

The species usually nests in pith-filled stems and branches, e.g. of Sambucus, Symphoricarpus, Fraxinus, Syringa and the like, in which the cells are constructed in a linear fashion. Number of cells varies considerably (1-18). In very large nests it seems usual for the number of male cells to considerably exceed that of female ones. Often mixed nests of Rhopalum clavipes (no. 139) and capitosus occur. The partitions between the cells consist of fine pithdust. The prey comprises fairly small Diptera, e.g. Chironomidae, Tipulidae, Empididae, Dolichopodidae and Agromyzidae, and exceptionally Homoptera Psyllidae. The larva was described by Marechal, 1927. As parasites have been found species of Macronychia and Oebalia (Diptera, Sarcophagidae) and Diomorus armatus Boh.

(Hymenoptera, Torymidae). The species very often occurs as distributor of large numbers of Acarina, e.g. Tyroglyphidae (Phoresy).

168. CROSSOCERUS (ACANTHOCRABRO) VAGABUNDUS (Panzer, 1798)

Fig. 456.

Crabro vagabundus Panzer, 1798:H.53, T.16.

Female: 8-12 mm. Frons densely and rather strongly punctate, with indistinct microsculpture. Frontal line slightly depressed, facial fovea large, dull, strongly depressed. Projecting median part of clypeus with a weak, very rounded median tooth, lateral teeth vestigial. Occasionally there are two yellow spots on clypeus. Mandibles usually black with reddish apex, tridentate with obtuse process on the inner side. Frontal face of scapus yellow. Colour pattern on thorax very variable. Danish specimens usually have two yellow lateral spots on pronotum and often a transverse spot on scutellum; these are often missing in Fennoscandian specimens. Humeral tubercle may have a slightly yellowish spot. Scutum with dense and strong punctation, the punctures in robust specimens often having a tendency to fuse longitudinally. Mesopleuron smooth with sparse and rather fine punctation, with a sharp tooth in front of coxa 2. Area cordiformis shining, smooth, sometimes with a very weak radiate-striate sculpture. The area surrounded by a very strongly pitted furrow, median furrow deep. Lateral faces of propodeum shining, with a more or less extensive, finely striate sculpture interspersed with fine punctures. Abdomen with large yellow lateral spots on terga 2 and 3 and a yellow transverse band on tergum 5. In addition often a weak irregular transverse band on tergum 1 and lateral spots on tergum 4. Pygidial area sharp-edged, distally slightly depressed in a furrow-shape, shining, with a few punctures, proximally strongly and rather densely punctate, with a distinct median longitudinal carina. Tibiae 1+2 with yellow front side, tibia 3 may be entirely yellow, but generally a brown area is found distally.

Male: 7-10.5 mm. Median tooth on clypeus well developed, varying from being evenly rounded to having an obtuse emargination. Punctation of head as described in female, only somewhat sparser. Facial fovea rather weak. Mandibles bidentate, distally slightly dilated, tooth on the inner side rather well developed. Colour of mandibles varying from black with reddish apex to predominantly yellow. Scapus with yellow frontal side. Flagellum yellow-brown or yellow-spotted ventrally, hair-fringe very well developed, last segment rounded apically. Pronotum and scutellum only seldom with yellow pattern, as in Danish and Fennoscandian specimens. On the other hand, humeral tubercles and epicnemium often have extensive yellow markings. Tooth in front of coxa 2 often missing. Thorax with finer and

sparser punctation than in female. Sculpture on propodeum on the other hand better developed. Abdomen with yellow lateral spots on terga 2 and 3. Usually also a transverse band on tergum 6. Occasional specimens from Denmark have yellow markings on terga 1, 4 and 5. Sternum 7 with a convexity subapically. Tergum 7 with two ventro-lateral, short, clavate processes which meet at the convexity. Coxa 1 laterally with a sharp spine. Femur 1 with an obtuse tooth (Fig. 456), mainly yellow or yellow-brown. Tibiae 1+2 yellow on the front side. Femur 2 with extensive yellow markings, sometimes with a small distal yellow spot. Tibia 3 either entirely yellow or with a larger or smaller dark-coloured, distal spot.

The species has a southern and south-eastern occurrence in Denmark. - In Sweden it is distributed from Sk. in the south to Dlr. and Ång. in the north. - Only a little material was collected in Norway: AK, AAy and HOi. - A southern distribution in Finland, northwards to Oa and Sb. - Soviet Karelia: Kr. - The distribution of this species follows the taiga belt through Siberia to the Pacific Ocean. It is not recorded from the Iberian Peninsula.

The species constructs its nests in dead wood, often in connection with abandoned larval tunnels of Coleoptera. The nest system is a combination of the linear and the branched type, but only where permitted by space; if not, the cells are constructed in rows. As prey are usually used Diptera, Tipulidae and Limoniidae, also certain Rhagionidae, or even Lepidoptera Tortricidae (Tsuneki, 1960) may be used. It seems to be a common feature that the extremities of the prey animals are amputated.

169. CROSSOCERUS (CUPHOPTERUS) DIMIDIATUS (Fabricius, 1781)

Figs. 422, 433, 464.

Crabro dimidiata Fabricius, 1781:471.

Female: 8-11.5 mm. Frons in front of ocelli with a very large, broad concavity (Fig. 422), which has a very weak and sparse punctation, strongest medially. Punctation between the lateral ocelli dense, but not stronger than on the remaining part of frons, and only very seldom with a small, compressed spine posteriorly. The median projecting part of clypeus with three, more or less distinct, rounded teeth (Fig. 422), two yellow spots proximally may occur. Mandibles tridentate apically, on the inner side is a very obtuse tooth. Their colour pattern varies considerably, often with a large yellow spot, but it is seldom the predominating colour. Specimens from the northernmost regions of the species' range may lack the yellow on the mandibles. Antennae long and slender. Scapus often entirely yellow, but usually a dark spot is found on the inner side. Flagel-

lum may have yellow markings on second and third segments. The variation in the extent of the yellow pattern on thorax seems only in a small degree to be geographically (climatically) conditioned. It is, however, usual to find yellow markings on pronotum, humeral tubercles and metanotum in specimens from Denmark. Sometimes also two small yellow spots occur on scutellum. In a very few cases these may coalesce. Specimens from Fennoscandia may have thorax entirely black. Scutum rather dull, with very dense punctation, interstices equal to or slightly larger than diameter of punctures. Mesopleuron without tooth in front of coxa 2; shining and smooth in that area. Punctation laterally very fine and sparse. Area cordiformis shining, the delimiting furrow indistinct apically and laterally. Median furrow rather narrow (Fig. 433). Propodeum laterally shining, smooth, very weakly sculptured. Yellow pattern on abdomen very variable. Tergum 3 and 4 always with large yellow lateral spots, which may be coalesced. Terga 1 and 5 often with yellow transverse band. Yellow colour on tergum 1 may cover the entire sclerite, except two rounded black spots. Lateral spots on tergum 2 may be present in Danish and South Swedish specimens. Pygidial area yellow, broadly triangular, plane, with sparse and rather strong punctation. Tibiae 1+2 with yellow pattern on the outer side. Tibia 3 with yellow markings of very variable extent.

Male: 7.5-9.5 mm. Median part of clypeus rather narrow, strongly projecting. Just ventral to the mandibular articulations there is a strong, downward-directed spine. Upper margin of mandibles strongly arcuately dilated. Antennae long and slender. Scapus with a yellow longitudinal spot on the posterior face. Flagellum with a strong hair fringe, especially proximally. Thorax shining, smooth, sometimes with a bluish-waxy sheen. Pronotum and humeral tubercles with or without yellow markings. The spots on pronotum only occasionally form a complete transverse band. Punctation on scutum and scutellum considerably sparser than in female. A weak yellow pattern may sometimes occur on metanotum. Mesopleuron sculptured as in female, ventrally with a rather dense, silvery pubescence. The variation in extent of the yellow pattern on abdomen very pronounced. In particular small specimens from the northernmost districts of the range of the species may have two small, lateral spots only on tergum 3. Usually there are also more or less extensive markings on terga 2, 4, 6 and 7. Danish and Fennoscandian specimens often lack the spots on tergum 2. Medially on sternum 7 there is a swelling or a tubercle, bordered by two sharp teeth projecting from tergum 7. Trochanter 1 with a narrow, lamella-like dilation. Femur 1 flattened ventrally, distally sharp-edged and slightly dilated. Tibia 1 also flattened ventrally, with sharply projecting edges. Tibia 2 with a long, transparent, lamella-like dilation on the outer face. Trochanter 3 with a large, sharp tooth (Fig. 464).

Colour pattern of legs very variable. Femora 1+2 with a yellow-brown stroke on inner side. Tibiae 1+2 with a yellow stripe along the outer side. Tibia 3 may be mainly black, but often has a proximal and yellow spot.

The species is common and widespread in Fennoscandia and Denmark. Northern distribution limit in Sweden passes through Lu. Lpm.; in Norway through Nnø; and in Finland through Ob and Ks. - In Soviet Karelia known from Ib and Kr. - Dimidiatus has a northern distribution in Europe. Eastwards it is recorded from the Urals and Kazakhstan. A subspecies, sapporoensis Tsuneki, occurs in Japan.

The nest is constructed in decayed wood. On a single occasion the species was found nesting in Polyporus sulphureus (Wissmann, 1849). The prey consists of Diptera, e.g. of the families Anthomyiidae, Muscidae, Calliphoridae, Stratiomyidae, Syrphidae and Rhagionidae.

Note. Peters (1973) published some biological observations which strongly indicate a display of social behaviour comparable to that of Microstigmus comes, i.e. division of labour among females. This is the first record of true sociality in the Crabronini.

170. CROSSOCERUS (CUPHOPTERUS) BINOTATUS (Lepeletier & Brullé, 1834)

Figs. 460, 463.

Crossocerus binotatus Lepeletier & Brullé, 1834:771.
Crabro monstrosus Dahlbom, 1845:525, syn. n.
Crabro (Blepharipus) confusus Schulz, 1906:207.

Female: 9-11.5 mm. Frons between lateral ocelli very often with a small, acute tooth or tubercle. Median part of clypeus rather narrow, anterior margin with three rather distinct teeth. Two pale yellow spots may occur on clypeus. Mandibles and scapus often with very extensive yellow markings. Pronotum usually with two yellow lateral spots. On metanotum a yellow, transverse band may occur, and scutellum may have two lateral spots. Area cordiformis rather broad, median furrow broad, pits in the anterior delimiting furrow gradually merge with the area itself. The distribution of the yellow markings on abdomen as in dimidiatus. Pygidial area comparatively narrower, lateral margins generally slightly concave. Tibiae usually entirely yellow, tibia 1 generally with effaced brownish spot on inner side. Spines of tibia 3 weak (Fig. 460).

Male: 7-10 mm. Spine at mandibular articulation small, usually acute. Mandibles, clypeus and scapus with very extensive yellow pattern, often entirely yellow. Morphology of forelegs almost as in dimidiatus, but tibia are somewhat more

dilated about the middle. The transparent lamella on the outer side of tibia 2 is weakly developed. Tibia 3 shorter than femur 3, distally slightly dilated, spines on the outer side very reduced or missing. Coxa 3 with a very small proximal tooth. Femur 3 often almost entirely yellow. Femur 3 black or brownish, trochanter and tibia mainly yellow.

The species is not uncommon in Denmark, but seems to have a southern and south-eastern distribution. - Sweden: only known from a few localities in Sm., Hall., Nrk. and Upl. - Not recorded from Norway or Finland. - The distribution area covers Central Europe and Caucasus.

The nests are found in old timber, also in human habitations. The prey consists of Diptera, e.g. Rhagionidae and Lauxaniidae.

171. CROSSOCERUS (CUPHOPTERUS) SUBULATUS (Dahlbom, 1845)

Figs. 461, 462.

Crabro (Blepharipus) subulatus Dahlbom, 1845:525.
Crabro monstrosus Kohl, 1915:214.

Closely related to binotatus, from which it can only be distinguished by the characters mentioned in the key. A few males have a small tooth in front of coxa 2.

A few specimens are known from Denmark: NEJ, Faurholt Hede, and NEZ: Tisvilde. - Sweden: Sk., Nosaby; Öl., Glömminge; Gtl., Ljungarn; Ög., Simonstorp; Upl., Grisslehamn, Värmsdö, Svartsjö. - Not recorded from Norway. - Finland: recorded as Cr. binotatus (=confusus) by Pulkkinen, 1931 and Leclercq, 1954 from Al, Ab, N, Ka, Ta, and Sa. - Not recorded from Soviet Karelia. - The species has a very pronounced disjunct distribution in Fennoscandia, the Urals and in eastern Asia and Japan.

Nests in old timber and use Diptera, e.g. Muscidae, Calliphoridae, Anthomyiidae or Sarcophagidae as provision for the larvae.

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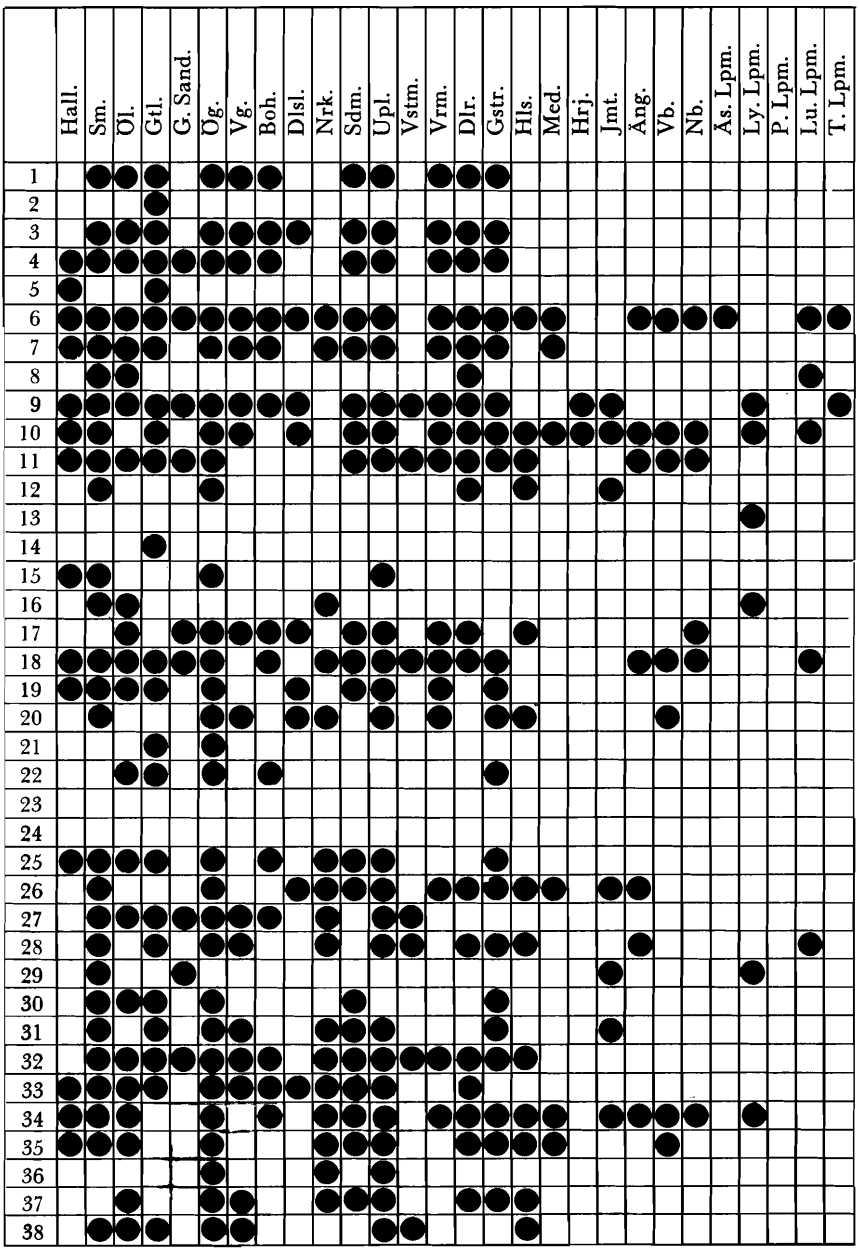
				DENMARK													
		N. Germany	G. Britain	SJ	EJ	WJ	NWJ	NEJ	F	LFM	SZ	NWZ	NEZ	B	Sk.	Bl.
Dolichurus corniculus (Spin.)	1	●			●	●		●	●			●	●		●	●
Sphex rufocincta Brullé	2															
Podalonia hirsuta (Scop.)	3	●	●	●	●	●	●	●	●			●	●	●	●	●
P. affinis (Kirby)	4	●	●	●	●	●	●	●	●	●		●	●	●	●	●
P. luffii Saunders	5	●	●			●	●							●	●	
Ammophila sabulosa (L.)	6	●	●	●	●	●	●	●	●	●		●	●	●	●	●
A. pubescens Curtis	7	●	●	●	●	●	●	●		●		●	●	●	●	●
A. campestris Latr.	8	●		●	●	●	●	●		●			●		●	
Pemphredon (P.) lugubris (Fabr.)	9	●	●	●	●			●	●	●		●	●	●	●	●
P. (P.) montanus Dahlbom	10	●													●	●
P. (P.) lugens Dahlbom	11	●													●	●
P. (P.) flavistigma Thomson	12															
P. (P.) fennicus Merisuo	13															
P. (P.) beaumonti Hellén	14															
P. (P.) balticus Merisuo	15															
P. (Cemonus) mortifer Valkeila	16	●			●				●				●		●	
P. (C.) wesmaeli (A. Morawitz)	17	●	●										●		●	
P. (C.) inornatus Say	18	●	●	●	●	●	●	●	●	●		●	●	●	●	●
P. (C.) lethifer (Shuckard)	19	●	●	●	●			●	●	●		●	●		●	
Ceratophorus morio (v. d. Lind.)	20	●	●		●							●	●			
C. clypealis (Thomson)	21	●	●	●					●				●		●	
Diodontus minutus (Fabr.)	22	●	●	●	●	●	●	●	●				●		●	
D. insidiosus Spooner	23		●													
D. luperus Shuckard	24	●	●													
D. tristis (v. d. Lind.)	25	●	●	●	●	●	●	●	●			●	●		●	
D. medius Dahlbom	26	●			●											
Passaloecus gracilis (Curt.)	27	●	●	●	●	●	●	●		●		●	●		●	●
P. turionum Dahlbom	28	●				●			●				●		●	●
P. borealis Dahlbom	29												●			
P. brevilabris Wolf	30															
P. eremita Kohl	31	●	●										●			
P. corniger Shuckard	32	●	●		●		●		●	●		●	●		●	●
P. insignis (v. d. Lind.)	33	●	●	●	●			●	●		●	●	●	●	●	●
P. monilicornis Dahlbom	34	●	●												●	●
P. singularis Dahlbom	35	●	●	●	●				●	●		●	●		●	●
P. clypealis Fæster	36	●	●			●			●		●					●
Stigmus solskyi A. Morawitz	37	●	●		●				●	●	●	●	●		●	
S. pendulus Panzer	38	●														●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Dolichurus corniculus (Spin.)	1															
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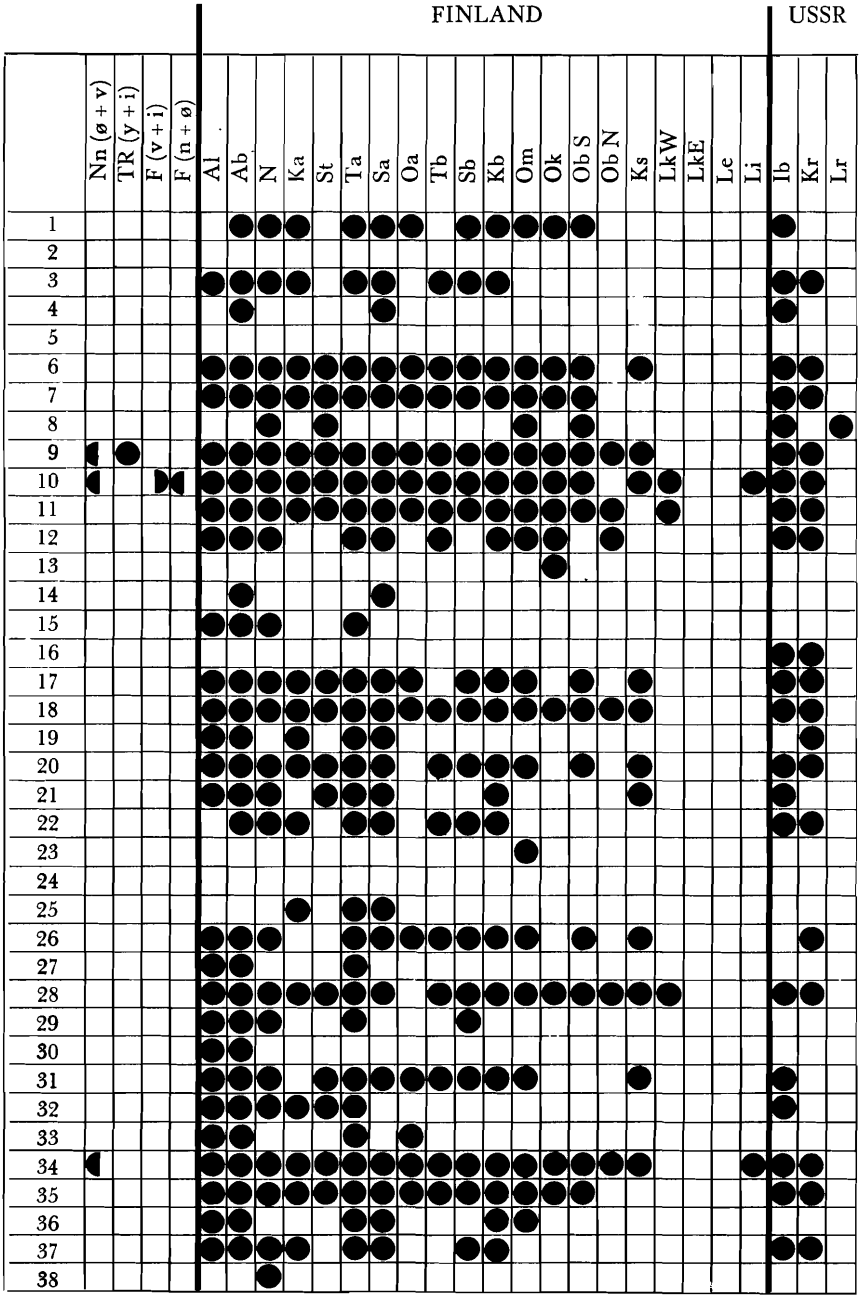
S. pendulus Panzer	38															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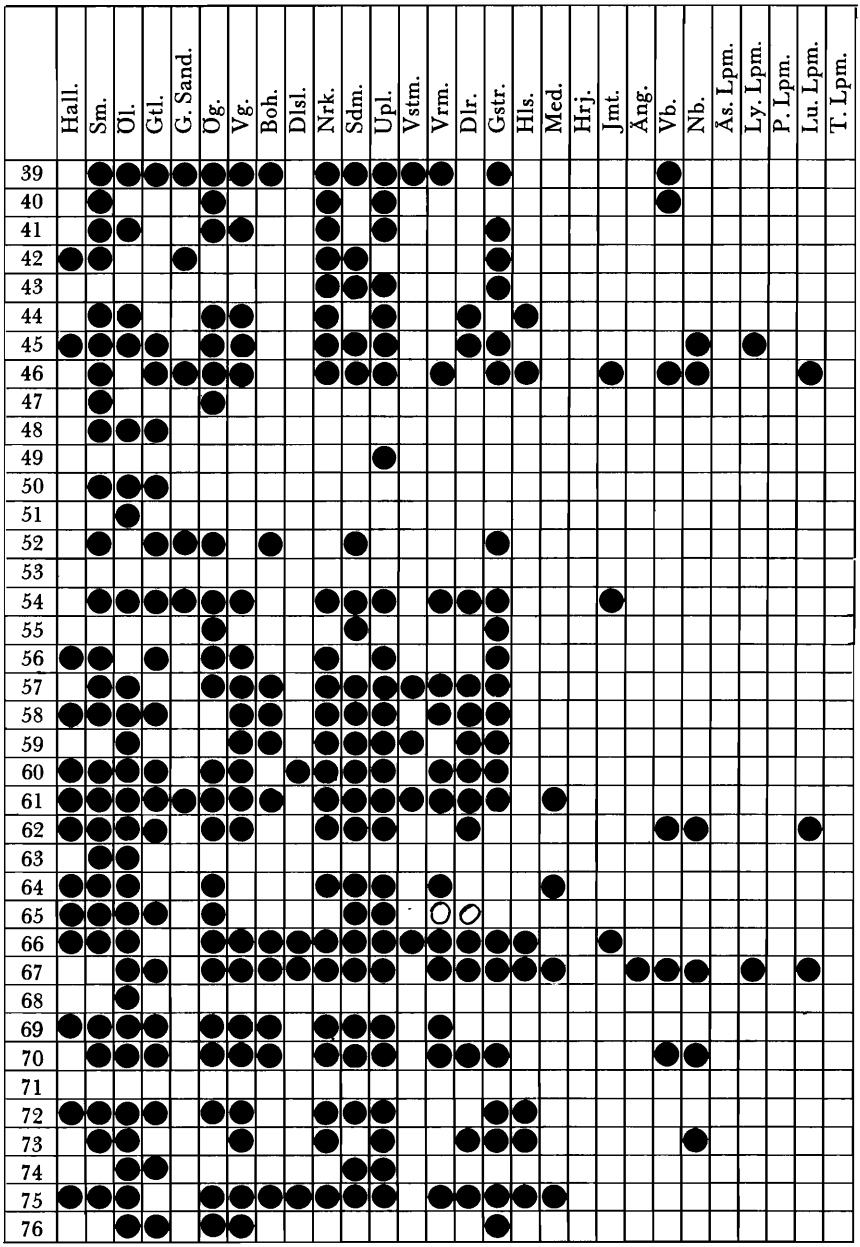
		N. Germany	G. Britain	SJ	EJ	WJ	NWJ	NEJ	F	LFM	SZ	NWZ	NEZ	B	Sk.	Bl.
Spilomena differens Blüthgen	39	●	●						●		●		●	●	●	●
S. curruca (Dahlbom)	40															
S. enslini Blüthgen	41		●										●			
S. exspectata Valkeila	42				●										●	●
S. troglodytes (v. d. Lind.)	43	●	●										●		●	
S. vagans Blüthgen	44	●	●		●					●			●		●	●
Mimesa equestris (Fabr.)	45	●	●	●	●	●	●	●	●	●		●	●		●	
M. lutaria (Fabr.)	46	●	●		●	●	●	●	●			●	●	●	●	
M. bruxellensis Bondroit	47	●	●													
M. rufa (Panz.)	48	●	●	●	●	●	●	●	●			●	●		●	
Psen ater (Olivier)	49	●	●													
Mimumesa unicolor (v. d. Lind.)	50	●		●						●		●	●			
M. littoralis (Bondroit)	51		●			●		●								
M. atratina (F. Morawitz)	52	●	●												●	
M. spooneri (Richards)	53		●						●							
M. dahlbomi (Wesmael)	54	●	●	●	●	●	●		●			●	●	●	●	
M. beaumonti (van Lith)	55	●											●			
Psenulus concolor (Dahlbom)	56	●	●	●	●								●		●	●
P. fuscipennis (Dahlbom)	57	●													●	●
P. pallipes (Panzer)	58	●	●	●	●			●	●	●	●	●	●	●	●	●
P. schencki (Tournier)	59	●	●													
Cerceris rybyensis (L.)	60	●	●	●	●				●	●		●	●	●	●	●
C. arenaria (L.)	61	●	●		●	●		●	●				●	●	●	●
C. quadrifasciata (Panzer)	62	●		●	●	●		●				●	●		●	
C. quinquefasciata (Rossi)	63	●	●		●			●					●		●	
C. ruficornis (Fabr.)	64	●	●	●	●	●							●		●	
Philanthus triangulum (Fabr.)	65	●	●		●				●	●	●	●	●	●	●	●
Argogorytes mystaceus (L.)	66	●	●	●	●			●	●	●	●	●	●	●	●	●
A. fargei (Shuckard)	67	●	●	●	●			●		●		●	●		●	●
Gorytes quinquecinctus (Fabr.)	68															
G. laticinctus (Lep.)	69	●	●	●		●	●	●	●	●		●	●		●	
G. quadrifasciatus (Fabr.)	70	●	●	●	●	●	●	●	●	●		●	●	●	●	●
G. neglectus Handlirsch	71															
Dienoplus tumidus (Panzer)	72	●	●	●	●					●			●	●	●	●
D. lunatus (Dahlbom)	73	●		●	●		●						●	●	●	
Bembix rostrata (L.)	74	●											●	●	●	●
Nysson spinosus (Forster)	75	●	●	●	●				●	●		●	●	●	●	
N. interruptus (Fabr.)	76	●	●	●	●					●			●		●	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Spilomena differens Blüthgen	39															
S. curruca (Dahlbom)	40															
S. enslini Blüthgen	41															
S. exspectata Valkeila	42															
S. troglodytes (v. d. Lind.)	43															
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Mimesa equestris (Fabr.)	45															
M. lutaria (Fabr.)	46															
M. bruxellensis Bondroit	47															
M. rufa (Panz.)	48															
Psen ater (Olivier)	49															
Mimumesa unicolor (v. d. Lind.)	50															
M. littoralis (Bondroit)	51															
M. atratina (F. Morawitz)	52															
M. spooneri (Richards)	53															
M. dahlbomi (Wesmael)	54															
M. beaumonti (van Lith)	55															
Psenulus concolor (Dahlbom)	56															
P. fuscipennis (Dahlbom)	57															
P. pallipes (Panzer)	58															
P. schencki (Tournier)	59															
Cerceris rybyensis (L.)	60															
C. arenaria (L.)	61															
C. quadrifasciata (Panzer)	62															
C. quinquefasciata (Rossi)	63															
C. ruficornis (Fabr.)	64															
Philanthus triangulum (Fabr.)	65															
Argogorytes mystaceus (L.)	66															
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G. laticinctus (Lep.)	69															
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Dienoplus tumidus (Panzer)	72															
D. lunatus (Dahlbom)	73															
Bembix rostrata (L.)	74															
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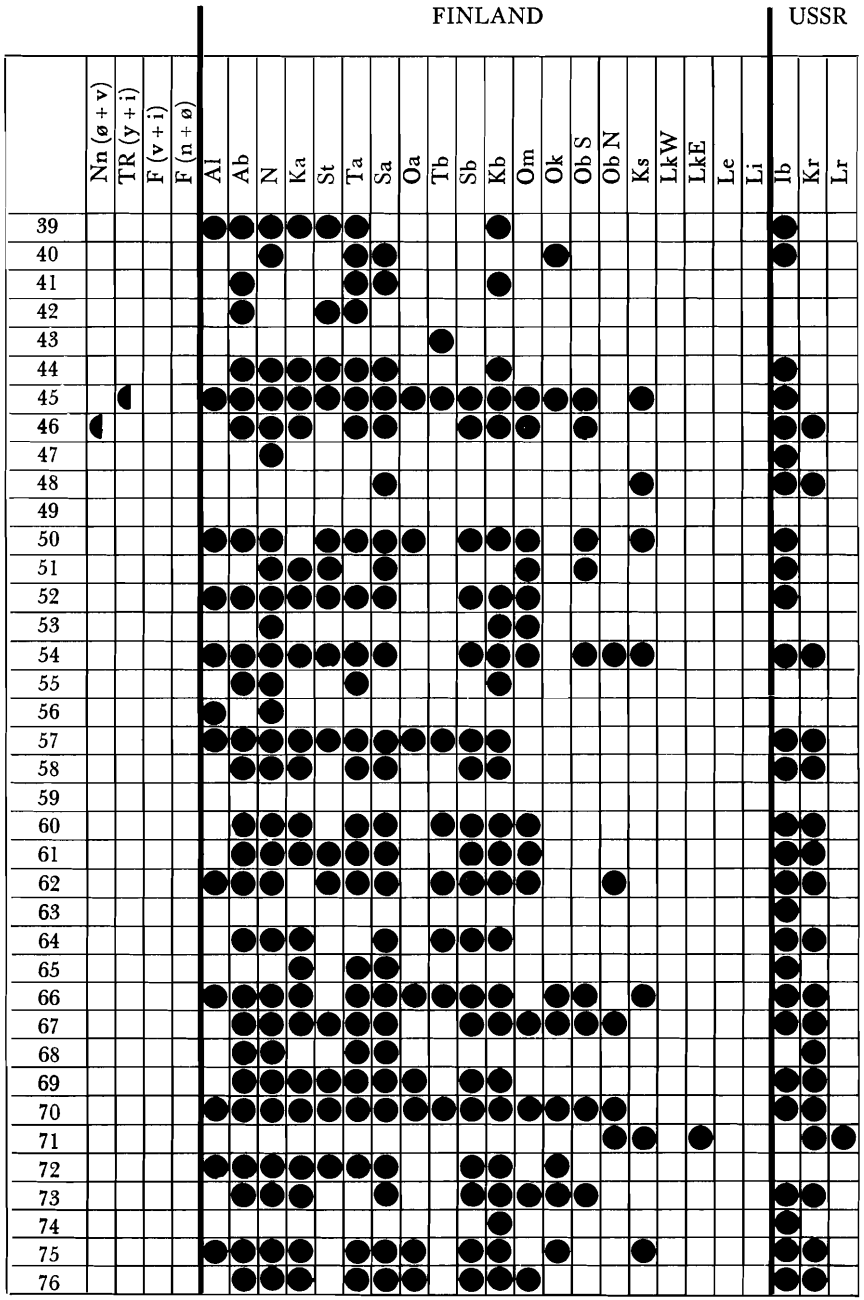
N. interruptus (Fabr.)	76															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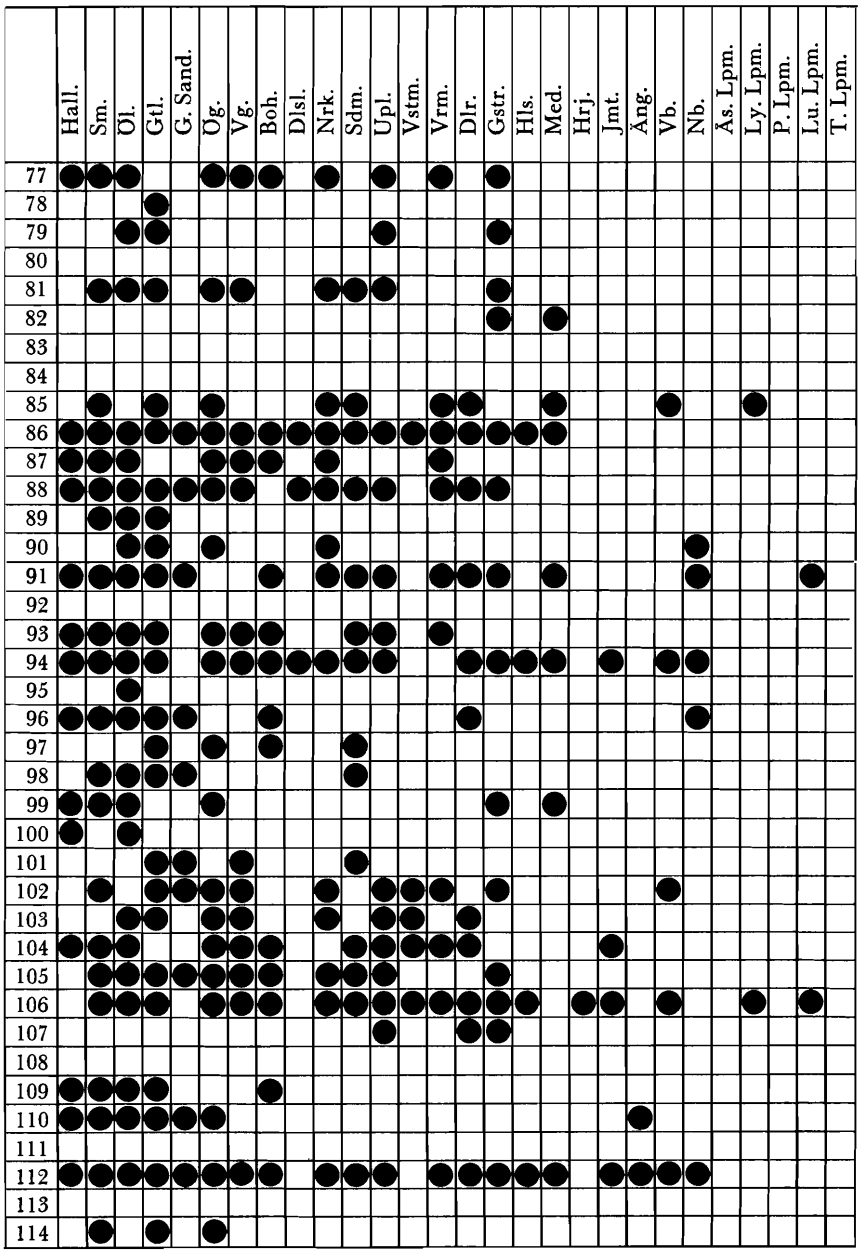
		N. Germany	G. Britain	SJ	EJ	WJ	NWJ	NEJ	F	LFM	SZ	NWZ	NEZ	B	Sk.	Bl.
Nysson trimaculatus (Rossi)	77	●	●										●		●	
N. niger Chevrier	78															
N. maculosus (Gmelin)	79	●		●	●		●	●	●	●		●	●		●	
N. tridens Gerstäcker	80	●		●	●					●			●		●	
N. dimidiatus Jurine	81	●	●	●	●		●			●	●	●	●		●	
N. mimulus Valkeila	82															
Didineis lunicornis (Fabr.)	83	●	●	●	●						●					
Alysson spinosus (Panz.)	84	●							●							
A. ratzeburgi Dahlbom	85															
Mellinus arvensis (L.)	86	●	●	●	●	●	●	●	●	●		●	●	●	●	●
M. crabronea (Thunberg)	87	●	●	●	●	●	●	●	●			●	●		●	
Astata boops (Schrank)	88	●	●												●	●
A. minor Kohl	89	●												●		
A. stigma (Panz.)	90	●						●							●	
A. pinguis (Dahlbom)	91	●	●		●	●	●	●	●			●	●	●	●	
Dinetus pictus (Fabr.)	92	●	●													
Tachysphex obscuripennis (Schenck)	93	●	●												●	
T. pompiliformis (Panz.)	94	●	●	●	●	●	●	●	●	●		●	●	●	●	●
T. fulvitarsis (Costa)	95	●													●	
T. nitidus (Spinola)	96	●	●		●	●	●	●	●			●	●	●	●	●
T. helveticus Kohl	97	●														●
Miscophus concolor Dahlbom	98	●	●		●	●		●					●		●	
M. spurius (Dahlbom)	99				●			●		●			●		●	
M. ater Lep.	100	●	●		●	●	●	●	●					●	●	
M. niger Dahlbom	101														●	
Nitela borealis Valkeila	102												●		●	
N. spinolae Latr.	103														●	●
Trypoxylon clavicerum Lep.	104	●	●		●			●	●			●	●		●	●
T. attenuatum Smith	105	●	●		●	●	●	●	●			●	●	●	●	
T. figulus (L.)	106	●	●	●	●	●	●	●	●	●		●	●		●	●
Belomicrus borealis Forsius	107															
Oxybelus lineatus (Fabr.)	108	●			●											
O. argentatus Curtis	109	●	●	●	●	●	●	●	●	●		●	●	●	●	
O. mandibularis Dahlbom	110	●	●	●	●	●	●	●				●	●		●	
O. latidens Gerst.	111	●			●								●			
O. uniglumis (L.)	112	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
O. bipunctatus Oliv.	113	●		●					●							
O. trispinosus (Fabr.)	114	●									●	●			●	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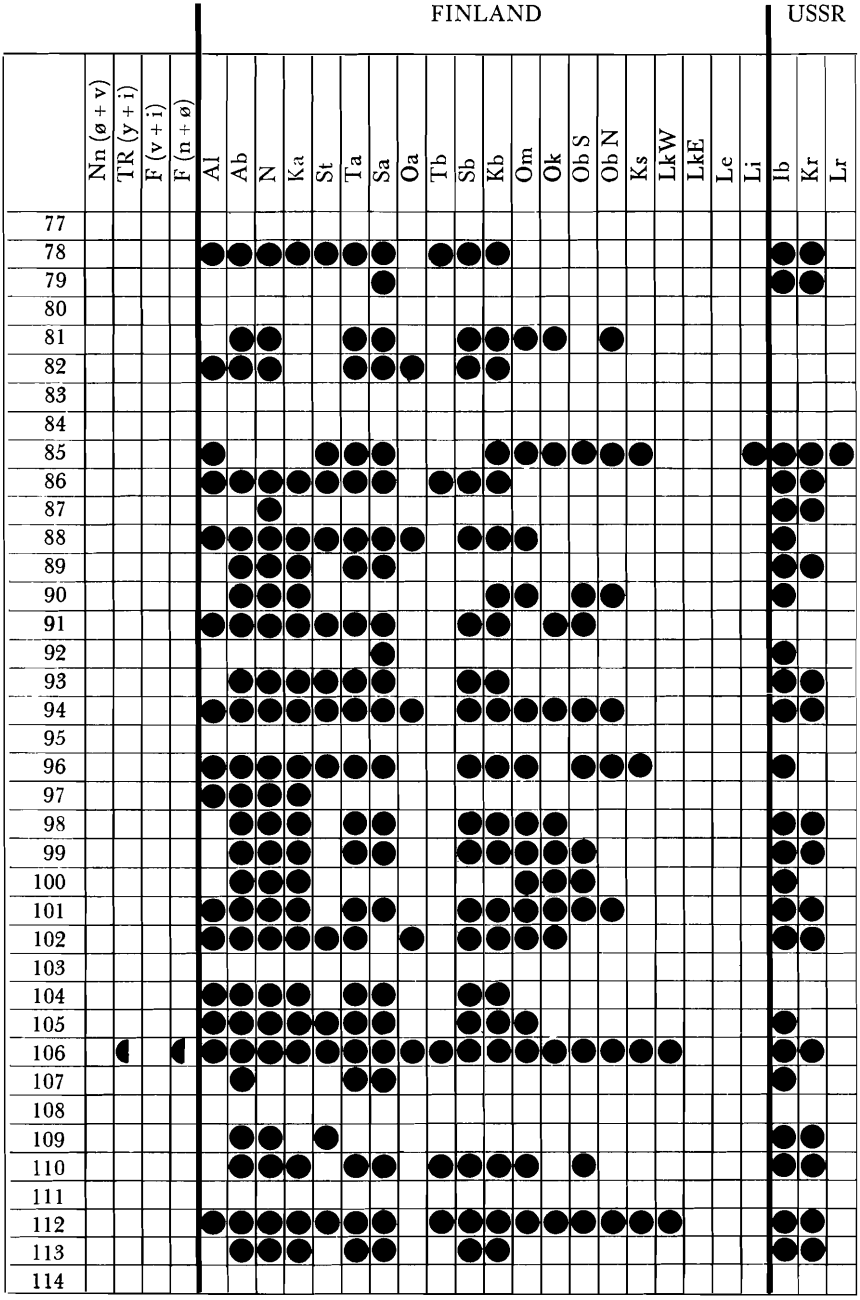
Nysson trimaculatus (Rossi)	77	◗				●		◖								
N. niger Chevrier	78															
N. maculosus (Gmelin)	79															
N. tridens Gerstäcker	80															
N. dimidiatus Jurine	81	◗		◗												
N. mimulus Valkeila	82															
Didineis lunicornis (Fabr.)	83															
Alysson spinosus (Panz.)	84															
A. ratzeburgi Dahlbom	85	◗														
Mellinus arvensis (L.)	86	●	◖	●	◑	●		◖	◖	●	●	●	◖			
M. crabronea (Thunberg)	87	◗				●										
Astata boops (Schrank)	88	◗					◖									
A. minor Kohl	89															
A. stigma (Panz.)	90					●			◗							
A. pinguis (Dahlbom)	91								◗							
Dinetus pictus (Fabr.)	92															
Tachysphex obscuripennis (Schenck)	93															
T. pompiliformis (Panz.)	94	◗		◗				◖		◗	●					
T. fulvitarsis (Costa)	95															
T. nitidus (Spinola)	96															
T. helveticus Kohl	97															
Miscophus concolor Dahlbom	98															
M. spurius (Dahlbom)	99															
M. ater Lep.	100															
M. niger Dahlbom	101															
Nitela borealis Valkeila	102	◗														
N. spinolae Latr.	103															
Trypoxylon clavicerum Lep.	104	●								◗	◗	◗				
T. attenuatum Smith	105	◗														
T. figulus (L.)	106	◗		◖	●			◖			◗	◗				
Belomicrus borealis Forsius	107															
Oxybelus lineatus (Fabr.)	108															
O. argentatus Curtis	109															
O. mandibularis Dahlbom	110															
O. latidens Gerst.	111					●										
O. uniglumis (L.)	112	●	◑	◗	●		◖	◖	◖	◖	◗					
O. bipunctatus Oliv.	113															
O. trispinosus (Fabr.)	114															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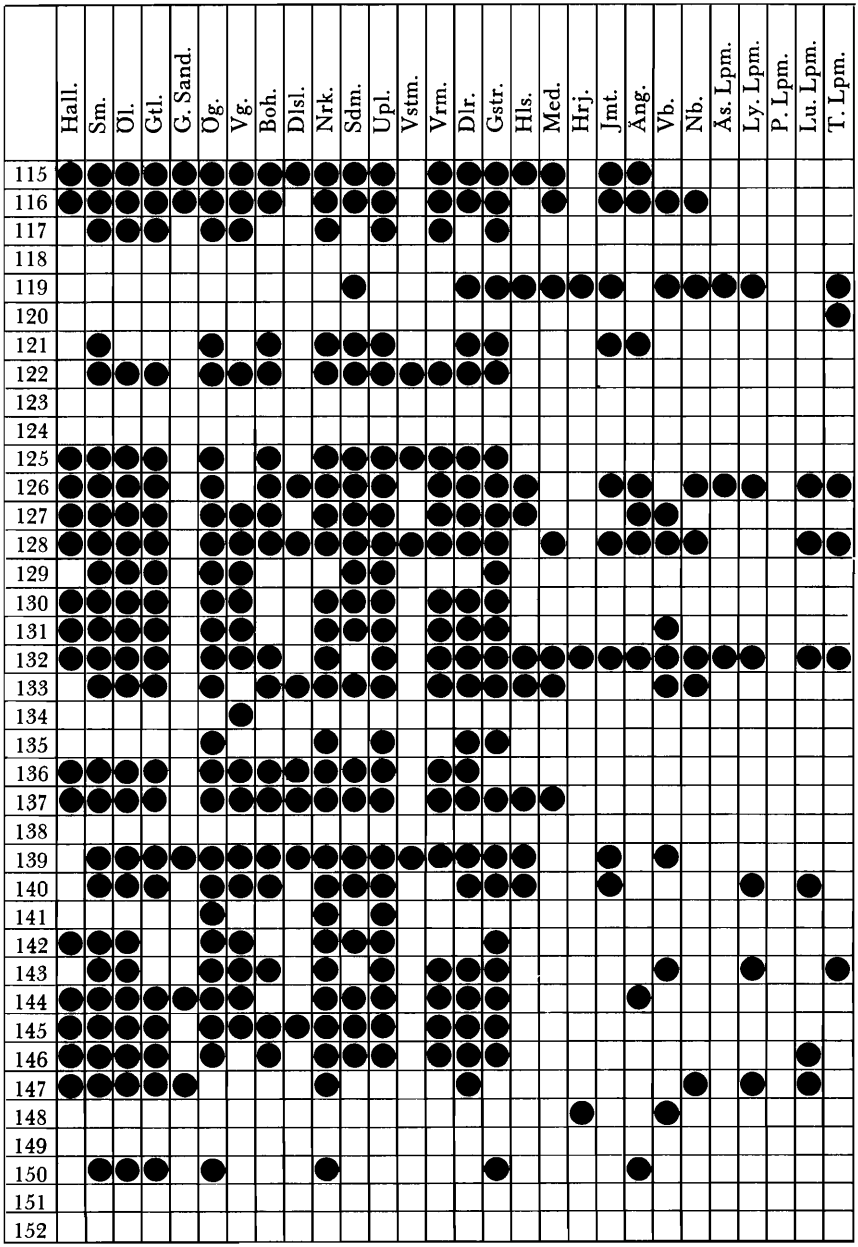
				DENMARK													
		N. Germany	G. Britain	SJ	EJ	WJ	NWJ	NEJ	F	LFM	SZ	NWZ	NEZ	B	Sk.	Bl.
Crabro cribrarius (L.)	115	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
C. peltarius (Schreber)	116	●	●	●	●	●	●	●	●			●	●	●	●	●
C. scutellatus (Scheven)	117	●	●		●										●	
C. ingricus (F. Morawitz)	118															
C. lapponicus Zett.	119															
C. maeklini A. Morawitz	120															
Ectemnius fossorius (L.)	121	●														
E. cephalotes (Oliv.)	122	●	●						●		●		●		●	
E. lituratus (Panz.)	123	●	●						●	●						
E. sexcinctus (Fabr.)	124	●	●	●	●				●	●			●		●	
E. cavifrons (Thomson)	125	●	●	●	●	●	●	●	●	●		●	●	●	●	●
E. ruficornis (Zett.)	126	●	●		●	●			●	●		●	●	●	●	●
E. lapidarius (Panz.)	127	●	●	●	●					●		●	●		●	●
E. continuus (Fabr.)	128	●	●	●	●	●	●	●	●	●		●	●	●	●	●
E. rubicola (Duf. & Perris)	129	●	●													
E. dives (Lep. & Br.)	130	●	●												●	
E. guttatus (v. d. Lind.)	131	●													●	
E. borealis (Zett.)	132	●	●		●				●	●	●		●		●	
Lestica subterranea (Fabr.)	133	●		●	●	●	●					●	●		●	●
L. alata (Panz.)	134	●														
L. clypeata (Schreber)	135		●							●					●	
Entomognathus brevis (v. d. Lind.)	136	●	●	●	●	●	●	●	●	●		●	●	●	●	
Lindenius albilabris (Fabr.)	137	●	●	●	●	●	●	●	●	●		●	●	●	●	●
L. panzeri (v. d. Lind.)	138	●	●	●	●				●			●	●			
Rhopalum clavipes (L.)	139	●	●	●	●	●	●		●	●		●	●	●	●	
R. coarctatum (Scop.)	140	●	●	●	●		●		●	●		●	●	●	●	●
R. nigrinum (Kiesenwetter)	141	●	●		●	●									●	
Crossocerus quadrimaculatus (Fabr.)	142	●	●	●	●	●	●	●	●	●		●	●	●	●	●
C. ovalis Lep. & Br.	143	●	●	●	●							●	●	●	●	
C. pusillus Lep. & Br.	144	●	●	●	●	●		●		●		●	●		●	
C. tarsatus (Shuckard)	145	●	●	●	●	●	●	●	●		●		●		●	
C. elongatulus (v. d. Lind.)	146	●	●	●	●	●		●	●			●	●	●	●	
C. wesmaeli (v. d. Lind.)	147	●	●	●	●	●	●	●	●	●			●	●	●	
C. lundbladi (Kjellander)	148															
C. imitans (Kohl)	149	●				●										
C. distinguendus (A. Morawitz)	150	●		●	●	●		●	●		●	●	●		●	●
C. denticrus Herrich-Schäffer	151			●											●	
C. exiguus (v. d. Lind.)	152	●	●													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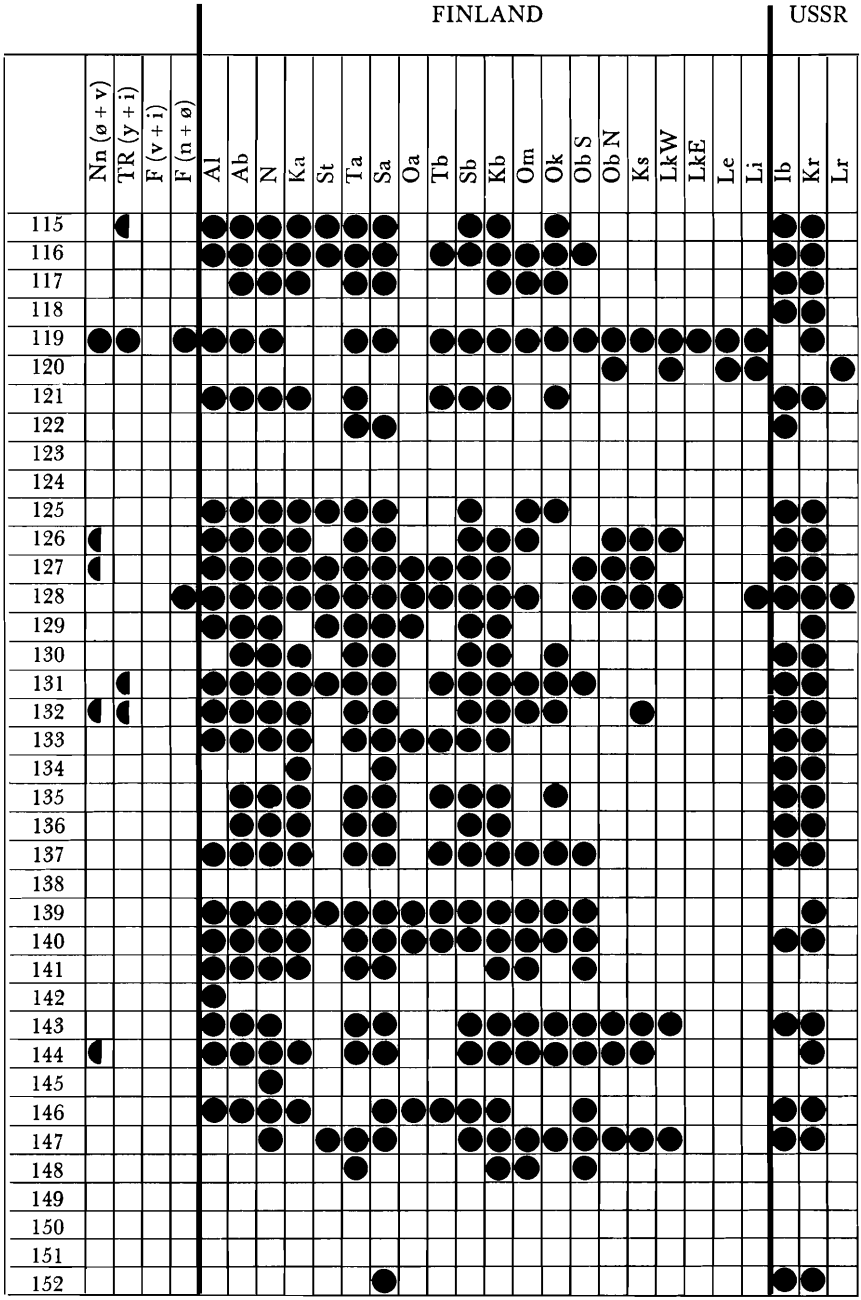
Crabro cribrarius (L.)	115	●		●	◑	●		◖	◖	●	●	◗◖	◗◖			
C. peltarius (Schreber)	116		◖		◖			◖	◖	◖						
C. scutellatus (Scheven)	117	◗			◑											
C. ingricus (F. Morawitz)	118															
C. lapponicus Zett.	119				◖		◗			◗	◗			◗		●
C. maeklini A. Morawitz	120															
Ectemnius fossorius (L.)	121	◗														
E. cephalotes (Oliv.)	122	◑			◖											
E. lituratus (Panz.)	123															
E. sexcinctus (Fabr.)	124															
E. cavifrons (Thomson)	125	●							◖	●	◗					
E. ruficornis (Zett.)	126	◗	●	◗	◗						●	◗				◗
E. lapidarius (Panz.)	127	◗	◖		◑	●	◖			◗	●	●				◗
E. continuus (Fabr.)	128	●	◖	◖	◑	●	◖	◖	◖		●	◗	◗◖			
E. rubicola (Duf. & Perris)	129	◗		◖	◖	●										
E. dives (Lep. & Br.)	130	◗														
E. guttatus (v. d. Lind.)	131	◗		◗					◖							
E. borealis (Zett.)	132	◗	●	◖	◖											●
Lestica subterranea (Fabr.)	133							◖				◗				
L. alata (Panz.)	134															
L. clypeata (Schreber)	135															
Entomognathus brevis (v. d. Lind.)	136	◗		◗												
Lindenius albilabris (Fabr.)	137	●		◖				◑			◗					
L. panzeri (v. d. Lind.)	138															
Rhopalum clavipes (L.)	139	◗	◗						◖	●	●					
R. coarctatum (Scop.)	140	◗		◗					◑		◗			◗		
R. nigrinum (Kiesenwetter)	141															
Crossocerus quadrimaculatus (Fabr.)	142				◖			◖	◖							
C. ovalis Lep. & Br.	143	◗														◗
C. pusillus Lep. & Br.	144	●	◗	●	◑		◑			●	●	◗	◗◖	◗		
C. tarsatus (Shuckard)	145	●														
C. elongatulus (v. d. Lind.)	146	◗														
C. wesmaeli (v. d. Lind.)	147	◗	◖		◗	◖										
C. lundbladi (Kjellander)	148															
C. imitans (Kohl)	149															
C. distinguendus (A. Morawitz)	150															
C. denticrus Herrich-Schäffer	151															
C. exiguus (v. d. Lind.)	152															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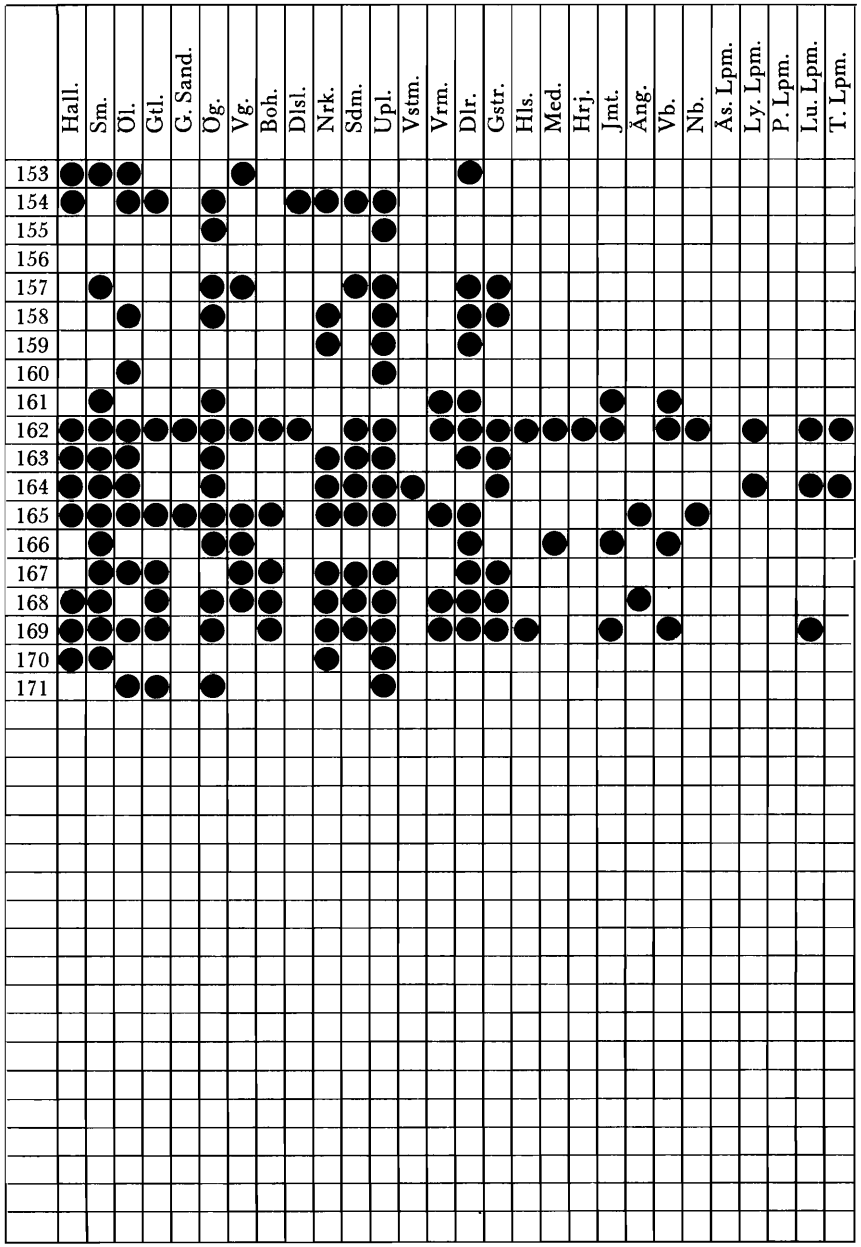
		N. Germany	G. Britain	SJ	EJ	WJ	NWJ	NEJ	F	LFM	SZ	NWZ	NEZ	B	Sk.	Bl.
Crossocerus palmipes (L.)	153	●		●	●	●			●	●			●		●	●
C. podagricus (v. d. Lind.)	154	●	●	●	●				●	●		●	●		●	
C. congener (Dahlbom)	155															
C. assimilis (Smith)	156															
C. walkeri (Shuckard)	157	●	●		●								●		●	
C. annulipes (Lep. & Br.)	158	●	●		●	●		●				●	●		●	
C. heydeni Kohl	159															
C. styrius (Kohl)	160		●													
C. barbipes (Dahlbom)	161	●														●
C. leucostomus (L.)	162	●	●	●	●		●						●		●	
C. cetratus (Shuckard)	163	●	●										●		●	
C. nigritus (Lep. & Bl.)	164	●	●	●	●							●	●		●	●
C. megacephalus (Rossi)	165	●	●		●		●	●	●	●		●	●		●	
C. cinxius (Dahlbom)	166	●														
C. capitosus (Shuckard)	167	●	●	●	●		●						●		●	
C. vagabundus (Panzer)	168	●	●		●				●		●	●	●	●	●	●
C. dimidiatus (Fabr.)	169	●	●	●	●	●		●			●	●	●		●	●
C. binotatus Lep. & Br.	170	●	●	●	●				●	●		●	●			
C. subulatus Dahlbom	171							●					●		●	●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Crossocerus palmipes (L.)	153	◗														
C. podagricus (v. d. Lind.)	154						◖	◖			◗					
C. congener (Dahlbom)	155															
C. assimilis (Smith)	156	◗														
C. walkeri (Shuckard)	157															
C. annulipes (Lep. & Br.)	158	◗														
C. heydeni Kohl	159															
C. styrius (Kohl)	160							◖								
C. barbipes (Dahlbom)	161	◗			◖											◗
C. leucostomus (L.)	162	◗			◖				◖		●					
C. cetratus (Shuckard)	163										◗	◗				
C. nigritus (Lep. & Br.)	164		●		◖						◗					
C. megacephalus (Rossi)	165	◗				●					●					
C. cinxius (Dahlbom)	166			◗											◗	
C. capitosus (Shuckard)	167	◗									◗					
C. vagabundus (Panzer)	168	◗						◖			◗					
C. dimidiatus (Fabr.)	169	●		●	◗	●			◖	●	●	◗				●
C. binotatus Lep. & Br.	170															
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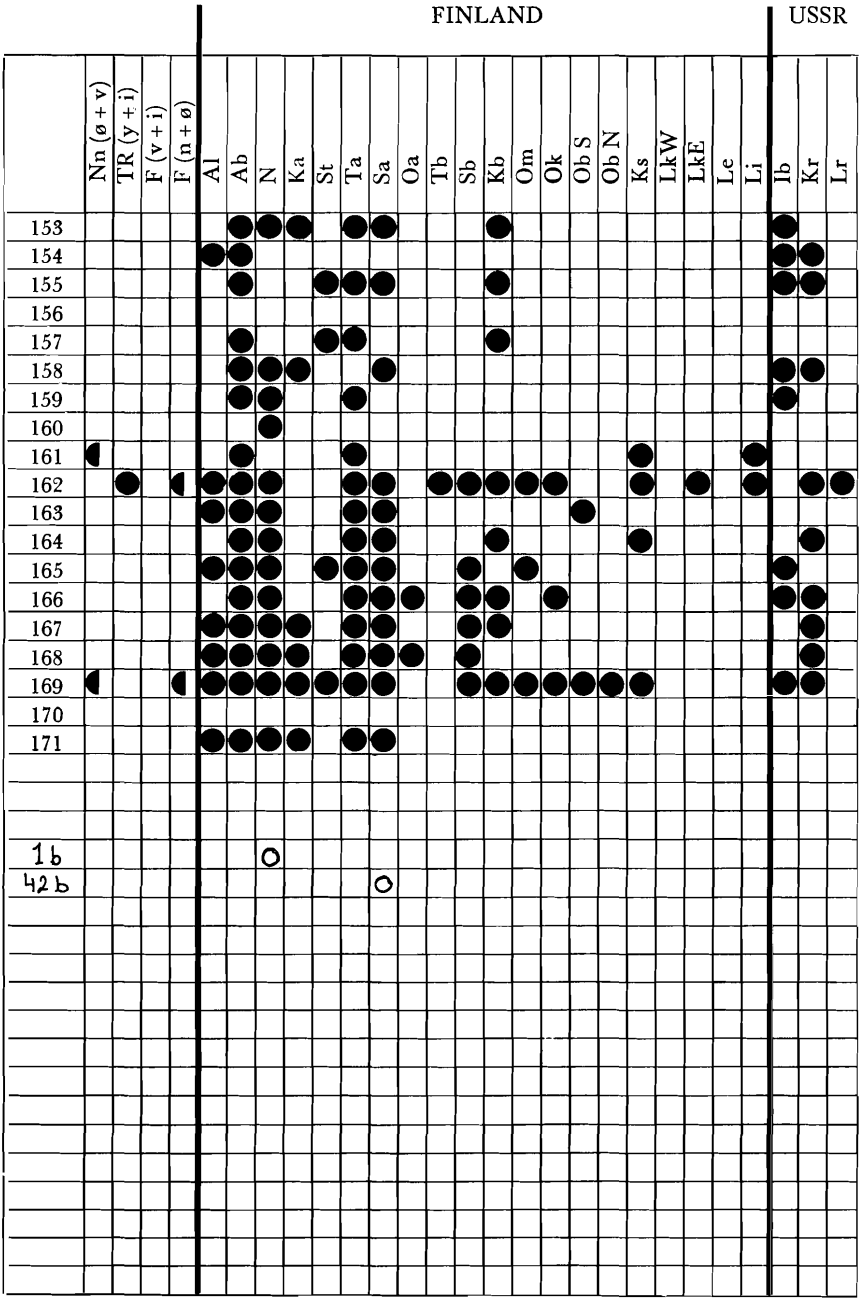
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The valid names, and also the page-numbers giving the main entrance to the taxa, are underlined.

Additional records from Norway:

58. Psenulus pallipes. Ø, Dypeklo, Onsøv, 1 ♀, 7.vii.1958 (A. Løken). New to Norway.

143. Crossocerus ovalis. Nsi, Saltdal, Vensmoen, 2 ♀, 8.viii.1955 (A. Løken).

160. Crossocerus styrius. AAy, Birkenes, 2 ♂, 4.v.1961 (A. Bakke). New to Norway.

Author's address:
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Pygidial area

petiolated

sessile

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