ANNALES HISTORICO-NATURALES MUSEI NATIONALIS HUNGARICI
Tomus 68. Budapest 1976.

A Survey of the European Species of Apanteles Först. (Hymenoptera, Braconidae: Microgasterinae) I. The Species-Groups

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Abstract — A historical review of the construction of keys to the European *Apanteles* species. Two keys are prepared to the European species-groups of *Apanteles*; first key based mainly on "traditional" features and applicable to both sexes, second key restricted only to females and compiled by using "modern" features. With 73 figures.

History

The earliest species of the genus *Apanteles* were described to be *Ichneumon* and *Microgaster*. In 1862 A. FÖRSTER, the great German hymenopterist, erected the genus *Apanteles* together with many other Braconid genera. The new genus was characterized by a single but very striking feature, namely, the "open" 2nd cubital cell (Cu_2) of the fore wing with a unique arrangement of the first section of radial (r_1) and transverse cubital veins ($cuqu_1$, Fig 1).

It is well known that FÖRSTER created the higher system of several hymenopterous familes-superfamilies considered to be in this time a very modern conception, and described only a few Braconid species and no *Apanteles* species at all. The first author to accept the new genus was H. REINHARD (1880–1881) who at the same time introduced a series of new European species. Up to FÖRSTER's time some 70–80 *Apanteles* species have been known mainly from Europe. Owing to REINHARD's activity the number of the species of genus *Apanteles* began to grow in Europe and subsequently other specialists increased the knowledge of the genus from farther continents. The accumulation of the species in this genus made *Apanteles* one of the most voluminous Braconid genera known, and, indeed, of the insect world as a whole (SHENEFELT 1972).

FÖRSTER restricted the subfamily Microgasterinae with such features which are recognized ever since and assigned here the genus *Apanteles* also. At present the genera *Cardiochiles* NEES, *Hygroplitis* THOMS., *Hypomicrogaster* ASHM., *Microgaster* LATR., *Microplitis* FÖRST., and *Protomicroplitis* ASHM. represent the subfamily in Europe, and outside our continent 22 further genera belong to this taxon — today 28 genera belong to the subfamily Microgasterinae coming from all over the world (SHENEFELT 1973).

At the beginning of this century SZÉPLIGETI's catalogue (1904) has enumerated 365 species of Microgasterinae in our modern sense of the subfamily. This number is much higher today. The most recent part of the Braconid catalogue comprises Microgasterinae (SHENEFELT 1972, 1973) listing a total of 1506 species. Seventy years ago SZÉPLIGETI knew 212 species while nowadays SHENEFELT lists 1105 *Apanteles* from the world. The biggest genus of Microgasterinae obviously is *Apanteles*, with species coming from every continent except the Antarctics with a quite uniform distribution of number. The majority of the species has been described in this century, and the following authors proved to be most active: ASHMEAD (Americas, East Asia), BHATNAGAR (India), BLANCHARD (South America), GRANGER (Madagascar), MARSHALL (Europe), MUESEBECK (Americas, East Asia), NIXON (five continents), RILEY (North America), RISBEC (Africa) DESAEGER (Africas: Congo), SZÉPLIGETI (Old World), TELENGA (USSR), TOBIAS (USSR), VIERECK (Americas), WATANABE (East Asia), and WILKINSON (Old World). A peculiar fact is that the rate of the descriptions of new *Apanteles* species is so high that SHENEFELT's *Apanteles* catalogue (1972) is partly outdated since some species are missing from this work being due partly because they were left out and partly discovered recently between 1967 and 1973, mainly in the Palaearctic Region (ABDINBEKOVA, ALEXEYEV, JAKIMAVIČIUS, NIXON, PAPP, RAO & CHALIKVAR, TOBIAS, WATANABE). In my opinion, the number of the *Apanteles* species will at least be doubled by the turn of the millenium. Many novelties are expected also in Europe and North America though relatively well explored and the other continents yet conceal perhaps a vast number of new species.

MARSHALL (1885, 1888), ASHMEAD (1900), VIERECK (1914), MUESEBECK (1920), WILKINSON (1928, 1932), TELENGA (1955) and NIXON (1965, 1973) dealt with the classification of the genus *Apanteles*. Marshall's four groups of *Apanteles* species based exclusively on the European species, have become antiquated by now and survive only in keys. Ashmead and Viereck split *Apanteles* into 11 genera relying primarily on the species of the New World and the Far East. Muesebeck synonymized these genera shortly after. Wilkinson was the first who thoroughly studied the *Apanteles* species of nearly all continents, but he practically followed Marshall's classification, and distinguished six groups. Telenga's grouping was based on the host-parasite relation (without striving for completeness), he arranged the *Apanteles* species of the Soviet Union into three groups. His original ideas would be worth developing further.

Wilkinson's activity is significant from another point of view too. He was the first to recognize the urgent need of a revision of the Palaearctic (first of all European) *Apanteles* species, since the knowledge of the classic species described in the 19th century has been become more and more confused (cf. Fahringer 1937). At the same time, the new species described in this century were not separated taxonomically by the most conspicuous characters from the old ones nor were they systematically appropriately arranged within the *Apanteles* system. From the second half of the 1930ies Wilkinson published a series of papers concerning his revisional work. His last work, the most voluminous and the most significant one, was published after his death in 1945. He redescribed 58 mainly classic European *Apanteles* species in an extraordinary painstaking way; each redescription was completed with detailed systematical and nomenclatorial comments and, furthermore, with detailed critical analysis of the host-range. From the introductory note by Nixon attached to Wilkinson's last work we may learn that Wilkinson had been preparing to produce a monograph of the Palaearctic *Apanteles* species. An eternal loss to our science that this work remained unachieved.

Nowadays the most outstanding taxonomist of the *Apanteles* species is G. E. J. Nixon (London) who in a standard monograph of the tribe Microgasterini elaborated the system of this genus with a profound knowledge of the species from the whole world (Nixon 1965, 1973). He devided the *Apanteles* species into 44 species-groups mainly on the basis of his original studies and partly he took into considereation the results attained by his predecessors, like Marshall, Ashmead, Viereck, Muesebeck and Wilkinson.

From among the 44 species-groups 20 are represented in Europe. The system of these groups including chiefly European (or Palaearctic) species was not fully elaborated. Nixon (1972, 1973, 1974, 1976) recently constructed a system of the species-groups accomplishing keys to the species confining his work to NW Europe. Nixon described a number of new species, but some old ones were not entered into his revision though reported from NW Europe.

Obviously, species distributed in other parts of Europe or described in the last two-three decades outside NW Europe were not included either. An important new attempt towards the better understanding of the genus *Apanteles* was to construct a key to the European (or Western Palaearctic) species on the basis of Nixon's system. In view of the fact that some of the specific features are rather problematic and hard to recognize on the basis of the original description, a special stress was laid by me to examine the type (holotype, paratype, syntype) or when it was not possible authentically named specimens of the species considered and keyed. Both the species with old and recent description were re-examined whenever possible. In this way altogether something more than 60% of the *Apanteles* species in Europe were studied by their type or authentic representatives and all were arranged in key by their features condensed.

Characterization of the Apanteles Först. species

Apanteles Förster, 1862, Verh. naturh. Ver. preuss. Rheinl., 19: 245. Type-species: *Microgaster obscurus* Nees, 1834.

Principal and subsidiary features. — Since the erection of the genus *Apanteles* (l. c.) there is only a single feature to delimit the taxon. The number of the *Apanteles* species known from all over the world is enormous, and they are separated with the help of only a few marks. The applicable specific features may be divided into two groups; the principal and subsidiary features. I denominate as principal specific features those which serve to segregate every species from each other (included as a "refrain" in every original description or redescription). The principal features are as follows: 1. sculpture of face; 2. proportional size of antennal joints 15–17; 3. distances and sizes of ocelli from each other and from eye; 4. sculpture of mesonotum, scutellum, and propodeum; 5. relative lenght of r_1, $cuqu_1$, cu_{1-3}, stigma, and metacarp (Figs. 1–2)*; 6. proportional length of the two spurs of 3rd tibia to each others and to 3rd basitarsus; 7. form, measurements, and sculpture of tergites 1–3; 8. size and chitinization of hypopygium, length of ovipositor sheath; 9. colour of body. Subsidiary specific features serve rather to the minority of the species., i. e., these features are occasionally used to distinguish the species. The subsidiary features are as follows: 1. outline of head from above and in front; 2. length of antenna, proportional length of its joints; 3. measurements of oral organs specialized; 4. sculpture of head either entirely or partly; 5. ratio of height to width of compound eye; 6. proportion of the length of cheek (gena) to mandibular width; 7. relative width of head to thorax; 8. sculpture or lack of sculpture on prothorax and on side of thorax (pleura); 9. presence or absence of medio-longitudinal carina of propodeum; 10. areolation of propodeum; 11. measurements of *n. bas.*, d_{1-2}, and *nv* of fore wing (Fig. 1)*; 12. edge of vannal lobe (concave, straight or convex) and measurements of *n. bas.* and *n. med.* of hind wing (Fig. 2)*; 13. spine of 3rd tibia (on its outer surface) and tarsi (chiefly their last joints); 14. length of ovipos

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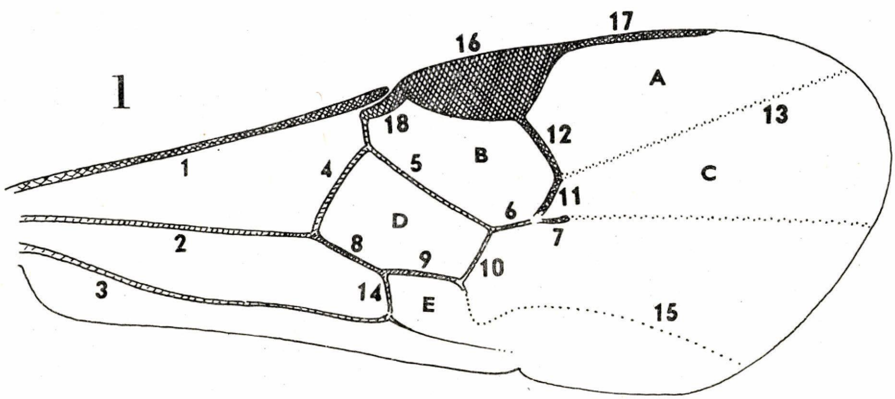

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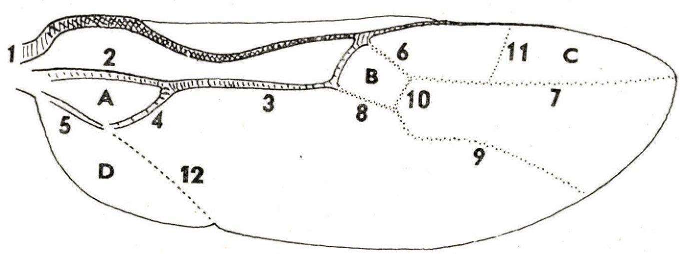


Figs. 1–2 *Apanteles obscurus* (NEES), terminology of fore and hind wings: 1 = fore wing, 2 = hind wing. — Veins (1–18) and cells (A—E) of fore wing: 1 = *n. cost.* (costal vein), 2 = *n. med.* (median vein), 3 = *n. brach.* (brachial vein), 4 = *n. bas.* (basal vein), 5–7 = cu_1, cu_2 and cu_3 or cu_{1-3} (three sections of cubital vein), 8–9 = d_1 and d_2 or d_{1-2} (two sections of discoidal vein), 10 = *n. rec.* (recurrent vein), 11 = $cuqu_1$ (first transverse cubital vein), 12–13 = r_1 and r_2 or r_{1-2} (two sections of radial vein), 14 = *nv* (nervellus), 15 = *n. par.* (parallel vein), 16 = *st* (stigma), 17 = *n. st.* (metacarp or stigmal vein), 18 = *pst.* (parastigma). — A = *R* (radial cell), B—C = Cu_1 and Cu_2 or Cu_{1-2} (first and second cubital cell), D = *D* (discoidal cell), E = *B* (brachial cell). — Veins (1–11) and cells (A—D) of hind wing: 1 = *n. cost.* (costal vein), 2–3 = $n.\ med._1$ and $n.\ med._2$ or $n.\ med._{1-2}$ (two sections of median vein), 4 = *n* (nervellus or „basella"), 5 = *n. anal.* (anal vein), 6–7 = r_1 and r_2 or r_{1-2} (two sections of radial vein), 8–9 = cu_1 and cu_2 or cu_{1-2} (two sections of cubital vein), 10 = cuqu (transverse vein), 11 = *n. r. qu.* (transverse radial vein), 12 = fold of vannal lobe. — A = *c. submed.* (submedian cell), B = *Cu* (cubital cell), C = *R* (radial cell), D = vannal lobe.

*Figs. 1–2 show the terminology of fore and hind wings tor. Altogether 9 + 14, i. e., 23 corporal regions may bear specific features. The features are extraordinarily variable on specific value. In this respect an especially good example is the sculpture of tergites 1–3 and mesonotum-scutellum-porpodeum. The basic two elements of sculpture are, namely, the punctation and rugosity and the mixture of these two. It is practically impossible to differentiate the various punctation and rugosity configurations since there are but a few linguistic expressions to describe them unanimously. The words and expressions used in the customary descriptions and identification keys to depict the degree of sculpture (e. g. punctate, closely punctate, finely punctate, superficially punctate — scrobiculate, roughly rugose, subrugose, weakly rugose, rugulose, subrugulose, etc.) are in most cases rather perceptive and by no means precise denominations of the features in question. Figure designed by a well-trained illustrator may well complete the text and diminish this difficulty in many cases. The perceptibility of the three dimensional sculpture on the paper with only two dimensions meet both with insuperable subjective and objective handicaps by those lacking the ability to prepare good figures.

R e c o g n i t i o n o f s e x e s. — The majority of the *Apanteles* species are to be recognized only by their female sex. Males of many species apparently are so similar to each other as to apprear conspecific. Eidonomically, the specific characters of the males of *Apanteles* (together with that of many other Braconids) are extricated much less than in the case of females, i. e., the males are much more uniform than the females. Of course, the males contribute just as much to the biological (the physiological, biochemical, ethological, etc.) specificity of the species as the females, though the appearance of it is less sharp viewing their external morphology. This sexual difference is a great disadvantage and much hinders the identification of the species, when only males are at hand either netted or reared, even for a specialist naming is usually impossible. Not only in the case of *Apanteles* but in the entire Braconid literature the preference for female sex is obvious both in the original description of a new species or in the redescription of an old species.

I d e n t i f i c a t i o n o f t h e s p e c i e s. — The identification of the *Apanteles* species (similar to a series of further Braconid genera composed of a bulk of species) are difficult. It requires a good deal of special practice to recognize the numerous specific features. The separation of many species is based on slight difference(s) only, or the features are hard to discern. It is advisable, especially for the beginner, to study as many authentically named species as possible, and, in consequence of it, to obtain a solid judgement for the interpretation of the individual specific features.

The species-groups of the genus Apanteles Först.

As I have mentioned above, NIXON (1965) had ranged the *Apanteles* species of the world into 44 species-groups. From among them 20 groups are represented in Europe. In 1973 NIXON added another 2 groups (*fraternus*- and *triangulator*-group, both with a single species as *A. fraternus* REINH. and *A. triangulator* [WESM.], respectively), the 22 groups are follows:

ater-group
butalidis-group
carbonarius-group
circumscriptus-group
falcatus-group
formosus-group
fraternus-group
glomeratus-group
lacteus-group
laevigatus-group
longipalpis-group
metacarpalis-group
merula-group
octonarius-group
pallipes-group
parasitellae-group
popularis-group
triangulator-group
ultor-group
validus-group
vipio-group
vitripennis-group

My arrangement of the European *Apanteles* species into species-groups is based on NIXON's system, but developed in several respects. Except one group (*triangulator*-group) I accepted every species-group erected by NIXON, and I consider them, essentially, as more or less natural units composed of closely related species. My proposed seven new European species-groups also include *mycetophilus*-group which was delimited by NIXON (on the basis of Oriental species, 1965) but it was discovered in Europe only some years ago (PAPP 1972). The separation of my 6 new species-groups is but a rather precise phylogenetic-taxonomic treatment of the *Apanteles* species occurring in Europe without any essential deviation from NIXON's conception. Accordingly the European *Apanteles* species should be ranged in the following 28 species-groups:

ater-group	*merula*-group
brevicornis-group	*metacarpalis*-group
butalidis-group	*mycetophilus*-group
carbonarius-group	*obscurus*-group
circumscriptus-group	*octonarius*-group
falcatus-group	*pallipes*-group
formosus-group	*parasitellae*-group
fraternus-group	*popularis*-group
glomeratus-group	*suevus*-group
lacteus-group	*thompsoni*-group
laevigatus-group	*ultor*-group
lineipes-group	*validus*-group
liparidis-group	*vipio*-group
longipalpis-group	*vitripennis*-group

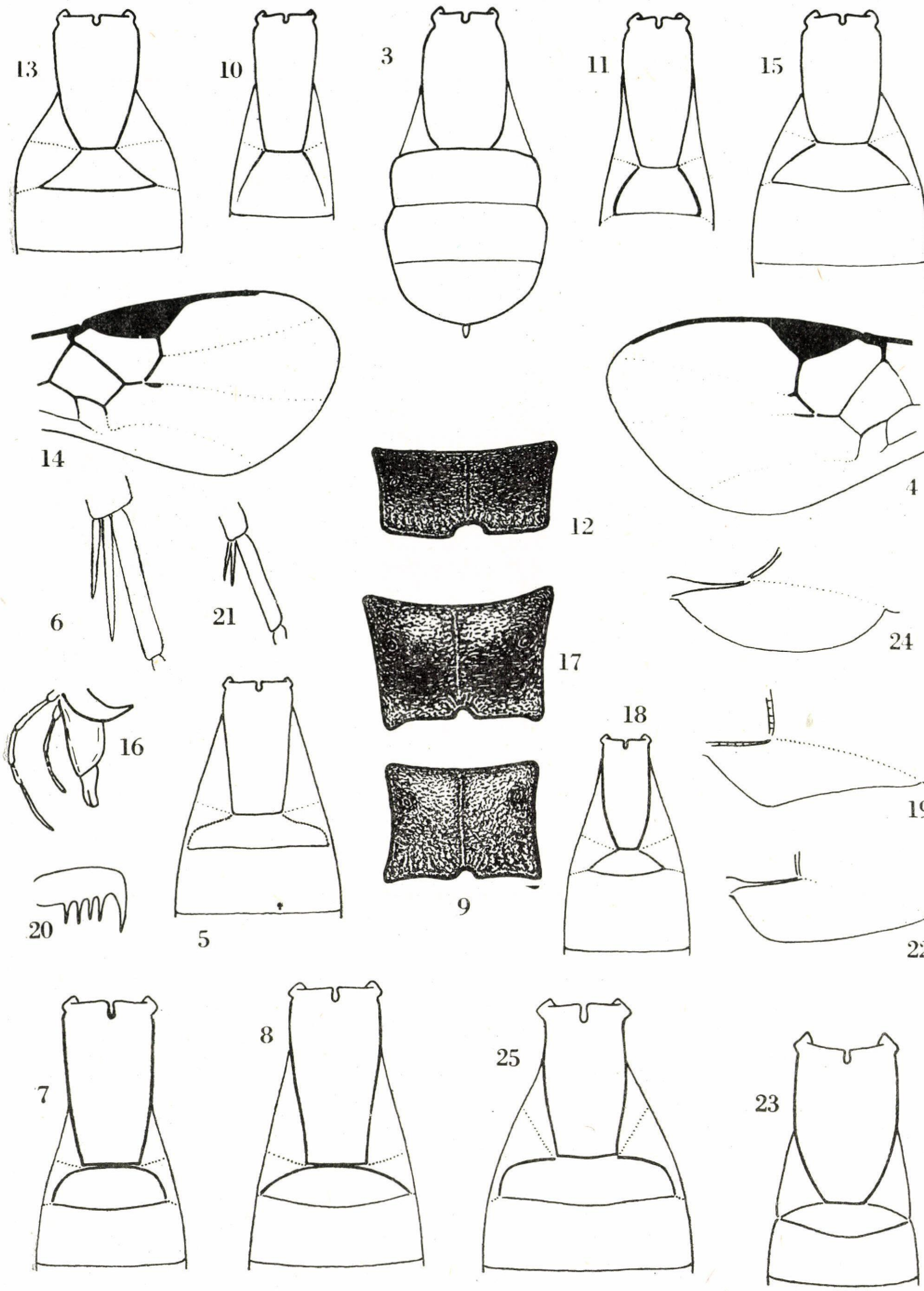
The new species groups are *brevicornis*-, *lineipes*-, *liparidis*-, *obscurus*-, *suevus*- and *thompsoni*-group. They are delimited by the features given in the keys.

Illustration

My keys are amply complemented with illustrations showing the corporal particulars of the species concerned. They follow the style initiated by NIXON (1965–1976) in his works on the systematics of the tribe Microgasterini. His style is an excellent medium for preparing illustrations because its adaptation does not require an artist yet the coporal particulars are expressive and complete well the features difficult (or well-nigh impossible) to describe in words. Sculpture drawing is always a very difficult task, and, e. g., adapting WILKINSON's bright manner of illustrating the manifold sculpture of *Apanteles* species requires a high skin in interpreting. An extraordinarily good procedure is the scanning technique for representing the sculpture on paper including even the extremely minute details. Unfortunately, this technique is, at present, very expensive and needs a specifically equipped laboratory.

Acknowledgement

In completing my survey I enjoyed much help from various people that enabled me to solve several taxonomic problems. I am especially indebted to H. ANDERSSON and R. DANIELSSON (Zoological Institute, Lund), DR. M. FISCHER (Naturhistorisches Museum, Wien), DR. E. HAESELBARTH (Zoologische Staatssammlung, München), Melle KELNER-PILLAUT (Musée d'Histoire Naturelle, Paris), DR. E. KÖNIGSMANN (Zoologisches Museum, Berlin), P. MIKULA (Narodni muzeum, Entomologické oddelenie, Praha), G. E. J. NIXON and T. HUDDLESTON (British Museum, Natural History, London), DR. P. NUORTEVA (Museum Zoologicum, Helsinki), Dr. J. OEHLKE (Deutsches Entomologisches Institut, Eberswalde), Dr. V. I. TOBIAS (Zoological Institute, Leningrad). I wish to express my sincere thanks to all of them.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Key to the European species-groups of Apanteles Först.

I. Key to females and males adopting mainly traditional features

1 (2) Tergites 2+3 much enlarged (but not carapace-like), almost concealing further tergites, clearly notched laterally at 2nd suture (Fig. 3). — Tergites 1–3 rugose, tergite 3 less strongly sculptured than tergites 1–2. Tergite 1 with parallel, or posteriorly somewhat converging sides. Propodeum smooth with a medio-longitudinal keel. Hosts: mainly Bucculatricidae

carbonarius-group

2 (1) Tergites 2+3 of different shape.

3 (20) Tergite 1 twice-thrice as long as its width at hind, from its base to apical end gradually narrowing (Figs. 5, 7, 8, 10, 11, 13, 23). Mesonotum not roughly sculptured, usually with (and disperse) punctation, shiny, or pruinose. Ovipositor sheath short, only in some species and except in *lineipes*-group hardly reaching half abdomen.

4 (5) r_2 stub-like at meeting r_1 and $cuqu_1$ (Fig. 4). Tergite 2 markedly transverse, 3rd tergite 1.5–2 times longer than 2nd tergite (Fig. 5). — Propodeum more smooth, medio-longitudinally either with a line of rugosities suggesting a keel, or with a pronounced keel. Hosts: Pterophoridae, Tineidae, Tortricidae

parasitellae-group

5 (4) Meeting of r_1 and $cuqu_1$ without any stub-like vein. Tergite 2 not strikingly transverse

6 (9) Anterior half of tergite 1 less narrowing than its posterior one. Tergite 2 virtually transverse (and not strikingly as in *parasitellae*-group), 3rd tergite 1.4–1.7 (–2) times as long as 2nd (Fig. 7, 8, 23). Hypopygium laterally with longitudinal creases.

7 (8) Vannal lobe of hind wing beyond its widest point straight (Fig. 22) or slightly concave. Alar veins and stigma usually with yellow or pale yellow pigmentation. Hosts: Tortricidae (in Europe)

mycetophilus-group

8 (7) Vannal lobe of hind wing convex, i. e. not straight or not concave (Fig. 24). Alar vein and stigma usually with dark pigmentation. Hosts: Coleophoridae, Gelechiidae, Gracillariidae, Pterophoridae, Tortricidae

lineipes-group, partim

◀ Figs. 3–25.—Fig. 3. *Apanteles carbonarius* (NEES): abdomen.—Figs. 4–5. *A. parasitellae* (BCHÉ.): 4 = left fore wing (distal half), 5 = tergites 1–3. — Fig. 6. *A. vipio* REINH.: hind two spurs and 3rd basitarsus. — Fig. 7. *A. lineipes* (WESM.): tergites 1–3. — Fig. 8. *A. erdoesi* PAPP: tergites 1–3. — Fig. 9. *A. pallipes* REINH.: propodeum. — Fig. 10. *A. fulvipes* (HAL.): tergites 1–2. — Fig 11. *A. circumscriptus* (Nees): tergites 1–2. — Fig. 12. *A. agilla* NIXON: propodeum. — Figs. 13–14. *A. metacarpalis* THOMS.: 13 = tergites 1–3, 14 = right fore wing (distal half). — Fig. 15. *A. coniferae* (HAL.): tergites 1–3. — Fig. 16. *A. vipio* REINH.: galea with palpi and mandible. — Figs. 17–19. *A. merula* REINH.: 17 = propodeum, 18 = tergites 1–3, 19 = vannal lobe of hind wing. — Fig. 20. *A. validus* THOMS.: fore claw. — Fig. 21. *A. fraternus* REINH.: hind two spurs and 3rd basitarsus. — Figs. 22–23. *A. laspeyresiella* PAPP: 22 = vannal lobe of hind wing, 23 = tergites 1–3. — Figs. 24–25. *A. punctiger* (WESM.): 24 = vannal lobe of hind wing, 25 = tergites 1–3.

9 (6) Tergite 1 narrowing evenly posteriorly (Figs, 10, 11, 13). Tergites 2–3 variable in length. Hypopygium smooth, ovipositor sheath short, at most hardly as long as half abdomen.

10 (11) Inner spur of hind tibia much longer than half basitarsus (0,75–0,85 : 1), legs relatively short, and 3rd femur always somewhat thick. Thorax of female dorso-ventrally flattened, mesonotum, scutellum, metanotum, and anterior half (or two-thirds) of propodeum in the same level (Fig. 69); thorax of male normal, not flattened. H o s t s: Pyraustidae

thompsoni-group

11 (10) Inner spur of hind tibia at most as long as half basitarsus. Thorax of female not flattened.

12 (13) Propodeum evenly, densely (but not roughly) rugose with a very distinct medio-longitudinal keel (Fig. 9). H o s t s: mainly Noctuidae

pallipes-group

13 (12) Propodeum at most with an indistinct keel, weakly and not densely rugose, or smooth.

14 (15) Median and usually trapeziform field (between straight and posteriorly diverging sulci) of 2nd tergite always longitudinally strigose of varying degree. 3rd tergite hardly longer than 2nd (2 : 1.7–1.8). Hypopygium smooth, evenly sclerotized. H o s t s: mainly Noctuidae, but also Arctiidae, Geometridae, Glyphypterygidae, Lymantriidae, Plutellidae

vitripennis-group

15 (14) 2nd tergite smooth, at most finely rugulose. Relative length of tergites 2–3 variable.

16 (17) Very small species, at most 1.8–2 mm long, body gracile. Hypopygium smooth, evenly sclerotized. Hind tibial spurs very short, subequal, inner one shorter than half basitarsus (Fig. 21). H o s t s: mainly Geometridae, but also Elachistidae, Noctuidae

fraternus-group*

17 (16) Larger species, 2–3 mm long, body variable in size. Hypopygium at least with a medio-longitudinal fold.

18 (19) Spines on outer side of 3rd tibia thin and sparse, all of one kind (cf. Fig. 153, in Nixon 1965: 149). Inner spur of middle tibia much longer than outer one. Legs (3rd femur!) mainly light coloured; pale yellow, yellow, or reddish yellow. Hypopygium strongly sclerotized or with rather few and feeble lateral creases. Metacarp usually longer than stigma (Fig. 59). H o s t s: most of the species are parasites of leaf-mining moths, like Elachistidae, Gracillariidae, Lithocolletidae

circumscriptus-group

19 (18) Spines on outer side of 3rd tibia thick and thin, i. e. of two kinds, the former ones more numerous on upper edge of tibia (cf. Fig. 12, in Nixon 1973: 223). Inner spur of middle tibia slightly longer than outer one. Legs mainly dark; yellowish brown, brown, blackish brown, black. Hypopygium

* This species-group was separated by Nixon (1973) and is extremely like *circumscriptus*-group. The differences given in this key are not by far so obvious as is the case in the other groups.

weakly sclerotized, with more or less lateral creases. Metacarp variable in length (Fig. 14). Hosts: Coleophoridae, Cosmopterygidae, Gelechiidae, Gracillariidae, Tortricidae, Yponomeutidae

metacarpalis-group

20 (3) Anterior half of tergite 1 parallel-subparallel sided, either both anteriorly and posteriorly narrowing (Figs. 48, 68), or its posterior half more or less converging (Figs. 8, 15, 18, 23, 25), or continuously parallel-subparallel sided (Figs. 45–47, 49), or entire tergite 1 widening posteriorly from its base or basal half (Figs. 51, 52, 54, 55).

21 (24) Tergite 1 narrowing both anteriorly and posteriorly (Figs. 48, 68).

22 (23) r_1 issuing distally from middle of stigma and directed to distal end of wing, metacarp usually short, not longer than length of stigma (Fig. 42). Hosts: Scythrididae

butalidis-group, partim

23 (22) r_1 issuing medially or rarely distally from middle of stigma and never directing to distal end of wing, metacarp exceptionally short, usually longer than length of stigma. Hosts: see couplet 77(76)

laevigatus-group, partim*

24 (21) Tergite 1 with other sides (cf. couplet 20 [3]).

25 (36) Tergite 1 (nearly) from the middle converging behind, anterior half paralel-sided (Figs. 18, 23, 25).

26 (27) Galea rostriform, and nearly as long as height of head (Fig. 16). Inner spur of hind tibia nearly as long as hind basitarsus (Fig. 6). Body stout, sutures deeply impressed. Wings dark fumous. Metacarp shorter than stigma. Host unknown **vipio**-group

27 (26) Galea not rostriform, normal. Inner spur of hind tibia shorter than hind basitarsus. Body not stout, sutures not deeply impressed.

28 (31) Vannal lobe of hind wing beyond its widest point concave or straight (Figs. 19, 22), never convex. Hypopygium laterally creased.

29 (30) Propodeum usually smooth, with a medio-longitudinal strong keel and along both sides surface shortly-transversely sculptured (Fig. 17). Hosts: Coleophoridae, Gracillariidae, Phycitidae

merula-group

30 (29) Propodeum usually sculptured and without any keel. Hosts: Tortricidae (in Europe)

mycetophilus-group

31 (28) Vannal lobe of hind wing evenly convex (Fig. 24).

32 (33) All tarsal claws pectinate (Fig. 20). Host unknown

validus-group

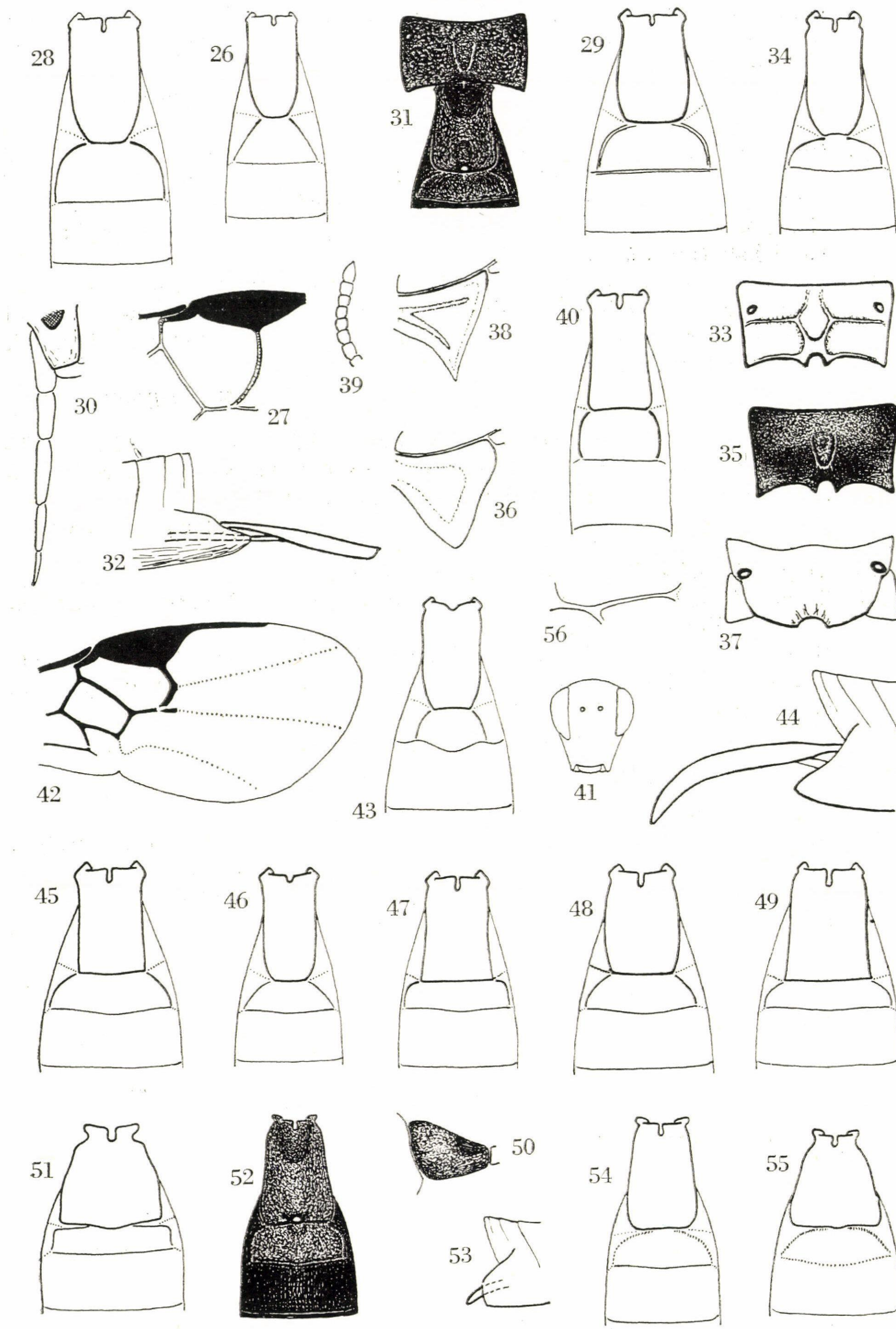
33 (32) Claws not pectinate.

34 (35) Tergite 1 strongly constricted behind. Hosts: see couplet 77 (76)

laevigatus-group, partim*

35 (34) Tergite 1 gradually constricted behind (Fig. 7). Hosts: Coleophoridae, Gelechiidae, Gracillariidae, Pterophoridae, Tortricidae

lineipes-group, partim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36 (25) Tergite 1 either throughout parallel to subparallel sided (Figs. 31, 40, 45–47, 49), or parallel to subparallel sided with rounded/narrowed posterior third/fourth (Figs. 26, 28–29, 43, 46, 65), or posteriorly more of less widening (Figs. 51–52, 54–55).

37 (50) Tergite 1 parallel to subparallel sided, hind third or fourth rounded (Figs. 26, 28–29, 43, 46, 65).

38 (39) r_1 and $cuqu_1$ arched, i. e. meeting each other unangled as if forming a single vein (Fig. 27). Body usually smooth (European species) with satine sheen. Hypopygium large, ovipositor sheath short. Hosts: Arctiidae, Lymantriidae

octonarius-group

39 (38) r_1 and $cuqu_1$ more or less angled at their point of meeting (Figs. 42, 57, 62–63).

40 (41) Tergite 2 not wide, subtriangular and its hind margin sinuate (Fig. 43). Ovipositor sheath broad, evenly arched (Fig. 44). Hosts: Noctuidae

falcatus-group

41 (40) Tergite 2 more transverse and its hind margin straight to subsinuate. Ovipositor sheath of different shape.

42 (43) Metacarp short, usually as long as stigma, and about as long as its distance from apex of radial cell, r_1 oblique to longitudinal axis of stigma (Fig. 42). Hypopygium creased and distinctly extending beyond apex of abdomen (Fig. 66). Hosts: Scythrididae

butalidis-group, partim

43 (42) Metacarp long, usually longer than stigma and also longer than its distance from apex of radial cell; r_1 not oblique to longitudinal axis of stigma (Figs. 57, 63).

44 (45) Vannal lobe of hind wing concave (Fig. 72). Propodeum finely rugose to rugose, with a median impression bordered with U-shaped and more or less strong rugae (Fig. 35). Hosts: see couplet 62(61)

ater-group, partim

◀ Figs. 26–56. — Figs. 26–27. *Apanteles inclusus* (RATZ.): 26 = tergites 1–3, 27 = stigma + + r_1 + $cuqu_1$. — Fig. 28. *A. liparidis* (BCHÉ.): tergites 1–3. — Fig. 29. *A. immunis* (HAL.): tergites 1–3. — Fig. 30. *A. longipalpis* REINH.: maxillar palpus and cheek. — Figs. 31–32. *A. obscurus* (NEES): 31 = propodeum and tergites 1–2, 32 = hypopygium and ovipositor sheath. — Fig. 33. *A. ultor* REINH.: propodeum. — Figs. 34–35. *A. ater* (RATZ.:) 34 = tergites 1–3, 35 = propodeum. — Figs. 36–37. *A. formosus* (WESM.): 36 = side of pronotum, 37 = propodeum. — Fig. 38. *A. longicauda* (WESM.): side of pronotum. — Figs. 39–40. *A. brevicornis* (WESM.): 39 = antennal joints 12–18, 40 = tergites 1–3. — Fig. 41. *A. lacteus* (NEES): head (in front). — Fig. 42. *A. butalidis* MARSH.: right fore wing (distal half). — Figs. 43–44. *A. falcatus* (NEES): 43 = tergites 1–3, 44 = hypopygium + ovipositor sheath. — Fig. 45. *A. infimus* (HAL.): tergites 1–3. — Fig. 46. *A. coniferoides* PAPP: tergites 1–3. — Fig. 47. *A. laevigatus* (RATZ.): tergites 1–3. — Fig. 48. *A. agilla* NIXON: tergites 1–3. — Fig. 49. *A. albipennis* (NEES): tergites 1–3. — Fig. 50. *A. tibialis* (CURT.): 3rd coxa (outer side). — Fig. 51. *A. suevus* REINH.: tergites 1–3. — Figs. 52–53. *A. glomeratus* (L.): 52 = tergites 1–3, 53 = hypopygium + ovipositor sheath. — Fig. 54. *A. sericeoneesi* PAPP: tergites 1–3. — Fig. 55. *A. glabratus* TEL.: tergites 1–3. — Fig. 56. *A. formosus* (WESM.): d_{1-2}.

45 (44) Vannal lobe of hind wing convex. Propodeum smooth to rugulose without any impression.

46 (47) Hypopygium creased, ovipositor sheath at least as long as 3rd basitarsus. 2nd tergite transverse, visible shorter than 3rd (Fig. 46). Hosts: see couplet 77(76)

laevigatus-group, partim*

47 (46) Hypopygium smooth, ovipositor sheath short, shorter than 3rd basitarsus, frequently almost concealed.

48 (49) Body polished, mesonotum and tergite 1 at most with a weak and superficial punctation. Tergite 1 at least 1.6 times as long as its width basally (Fig. 28). Hosts: Lymantriidae, Notodontidae

liparidis-group

49 (48) Body not polished, pruinose, at least face, mesonotum and tergites 1–2 punctate, this punctation may be crowded giving an impression of a special rugulosity or rugosity. Tergite 1 at most 1.2–1.4 times as long as its width basally (Fig. 29). Hosts: mainly Geometridae, but also Arctiidae, Plusiidae

popularis-group, partim

50 (37) Tergite 1 entirely parallel to subparallel sided (Figs. 31, 40, 45–47, 49), or (weakly) widening posteriorly (Figs. 51–52, 54–55).

51 (78) Tergite 1 either parallel sided (Fig. 45), or subparallel sided, i. e., usually from middle with (slightly) converging (Fig. 46) or diverging sides (Figs. 40, 47, 49). Propodeum smooth, or nearly smooth, or variable in sculpture but never scrobiculate except in *glomeratus*-group partim, *obscurus*-group and *ultor*-group partim. Hypopygium laterally creased, i. e. feebly sclerotized (Fig. 32) excepting *brevicornis-*, *falcatus-*, *formosus-*, *glomeratus-* and *popularis*-group.

52 (53) Maxillar palpi conspicuously lengthened, as long as height of head (Fig. 30). Malar space twice as long as base of mandible. Hosts: Psychidae

longipalpis-group

53 (52) Maxillar palpi not lengthened, much shorter than height of head. Malar space short except in *lacteus*-group.

54 (63) On middle of propodeum (above lunule) either a pentagonal and carinated areola (Fig. 33), or a hollow-like impression bordered with U-shaped rugae (Figs. 31,35). Areola or impression frequently deep; if areolation feeble (or indistinct) then propodeum with a medio-longitudinal cristula.

55 (60) Propodeum scrobiculate, either with a deep impression (Fig. 31), or with areolation (Fig. 33).

56 (57) Propodeum areolated, i. e. with a pentagonal areola delimited with carinae (Fig. 33). Thorax not strongly punctate. Hosts: see couplet 61(62)

ultor-group, partim

57 (56) Propodeum never areolated, either with deep and hollow-like impression, or with a cristula. Thorax usually strongly punctate, rugo-punctate.

* The species of *laevigatus*-group are characterized by their throughout parallel-subparallel sided 1st tergite excepting some species like *A. agilla* Nixon, *A. artissimus* Papp, A. *coniferoides* Papp, *A. phaola* Nixon.

58 (59) Propodeum with a deep and hollow-like median and transversely crenulated impression bordered with U-shaped strong rugae (Fig. 31). Hypopygium creased (Fig. 32). Mesonotum with dense, coarse and rather confluent punctation. H o s t s: Tortricidae, Pyraustidae

obscurus-group

59 (58) Propodeum scrobiculate or coarsely rugose, at most with a medio-longitudinal cristula and around lunule with rugae-rugulae. Hypopygium never creased. Mesonotum with weak to strong and more or less confluent punctation. 1st tergite feebly widening posteriorly. H o s t s: see couplet 84(83)

glomeratus-group, partim

60 (55) Propodeum at most rugose, usually with weak rugosity/rugulosity, or punctate, or smooth, its median impression not deep.

61 (62) Vannal lobe of hind wing convex (Fig 73). Mesonotum usually with strong (and never confluent) punctation. Propodeum areolated, smooth, at least along carinae with short wrinkles. Areola entirely carinated (Fig. 33). H o s t s: Coleophoridae, Gelechiidae, Tortricidae, Lymantriidae

ultor-group

62 (61) Vannal lobe of hind wing concave (Fig. 72). Mesonotum never with strong but with rather confluent punctation. Propodeum rugose, usually finely rugose, with a median impression bordered with U-shaped and more or less strong rugae (Fig. 35). H o s t s: mainly Tortricidae, but also Tineidae, Gracillariidae

ater-group

63 (54) Propodeum without any areola or deep impression in its middle, at most and rarely with a feeble impression.

64 (65) Propodeum scrobiculate or coarsely rugose, sometimes with a medio-longitudinal cristula. Hypopygium never creased. At most antennal joints 16–17 cubic to subcubic. H o s t s: see couplet 84 (83)

glomeratus-group, partim

65 (64) Propodeum not scrobiculate, at most rugose, usually more or less rugulose to a variable extent, or smooth with restricted (weak) sculpture.

66 (67) Sulcus on lateral side of pronotum absent (Fig. 36), if distinct in any size then diverging, not bifurcate. Hind corner of propodeum not produced and rather rounded (Fig. 37). H o s t s: Geometridae, Lymantriidae

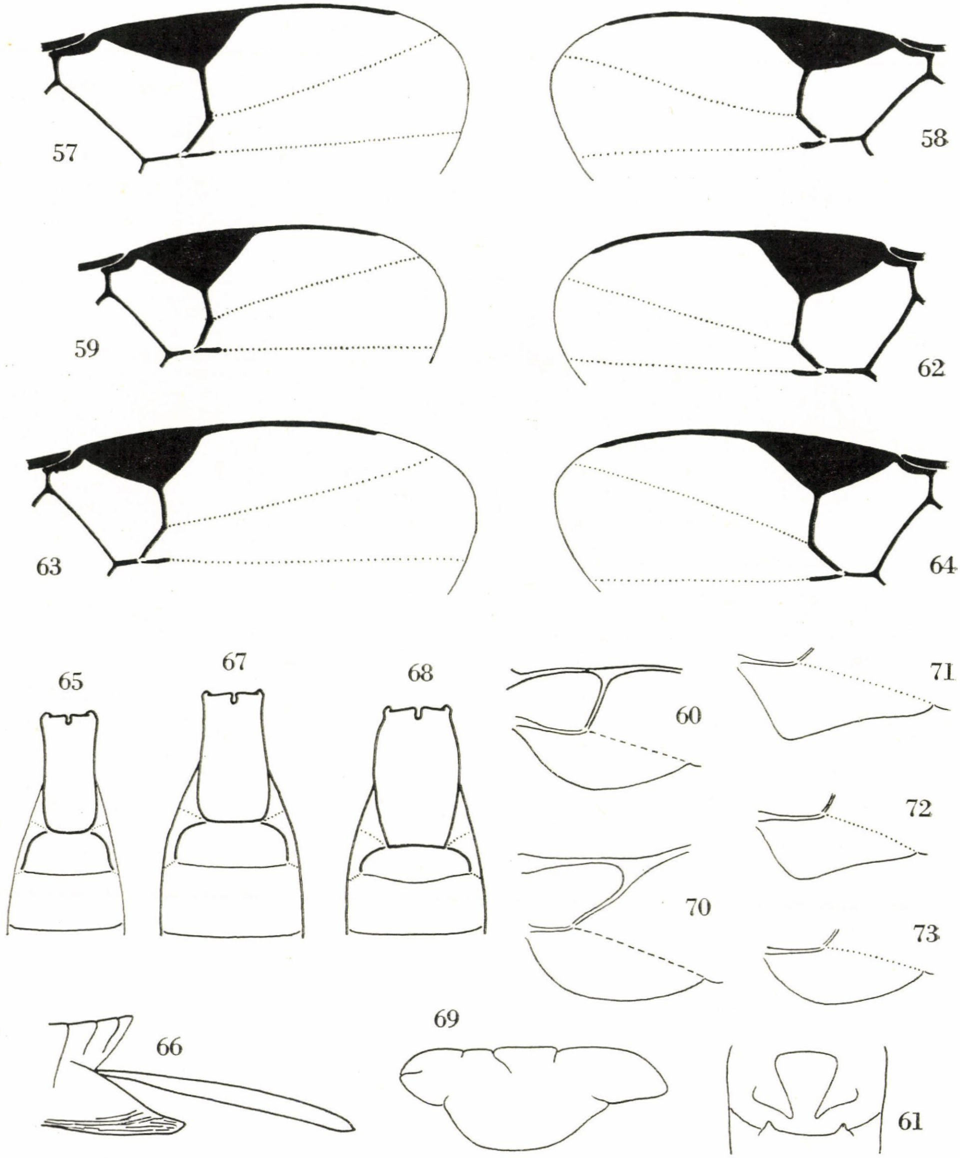
formosus-group

67 (66) Sulcus on lateral side of pronotum present (as normal) (Fig. 38). Hind corner of propodeum more or less angled (as normal).

68 (69) Antennal joints 13–17 cubic to subcubic (Fig. 39), antenna short, at most as long as head, thorax and abdominal segments 1(–2) (♀). H o s t s: Geometridae, Lycaenidae, Noctuidae

brevicornis-group, partim

69 (68) Antennal joints 13–17 not cubic, at least 1.2–1.3 times longer than broad, antenna about length of body (♀) or longer (♂) as normal.



Figs. 57–73. — Fig. 57. *Apanteles liparidis* (BCHÉ.): distal part of right wing. — Fig. 58. *A. glomeratus* (L.): distal part of left fore wing. — Figs. 59–61. *A. cirsumscriptus* (NEES): 59 = distal part of right fore wing, 60 = vannal lobe with anal vein and fold, 61 = scutellum and postcutellum (or metanotum) with forward pointing small projection. — Fig. 62. *A. falcatus* (NEES): distal part of left fore wing. — Fig. 63. *A. immunis* (HAL.): distal part of right fore wing. — Fig. 64. *A. lineipes* (WESM.): distal part of left fore wing. — Figs 65–66. *A. butalidis* MARSH.: 65 = tergites 1–3, 66 = hypopygium + ovipositor sheath. — Fig. 67. *A. praepotens* (HAL.): tergites 1–3. — Fig. 68. *A. cloelia* NIXON: tergites 1–3. — Fig. 69. *A. thompsoni* LYLE: thorax (in lateral view). — Fig. 70. *A. metacarpalis* THOMS.: vannal lobe with anal vein and fold. — Fig. 71. *A. lacteus* (NEES): vannal lobe. — Fig. 72. *A. ater* (RATZ.): vannal lobe. — Fig. 73. *A. lacteicolor* VIER.: vannal lobe.

70 (71) Cheek long, twice as long as basal width of mandible (Fig. 41). Vannal lobe of hind wing concave (Fig. 71). Hosts: Phycitidae

lacteus-group

71 (70) Cheek short, usually shorter than basal width of mandible. Vannal lobe of hind wing convex or, sometimes, straight.

72 (73) Metacarp short, usually as long as stigma, and about as long as its distance from apex of radial cell, r_1 oblique to longitudinal axis of stigma (Fig. 42). Hypopygium creased and distinctly projecting beyond apex of abdomen (Fig. 66). Hosts: Scythrididae

butalidis-group

73 (72) Metacarp long, usually longer than stigma, and also longer than its distance from apex of radial cell; r_1 not oblique to longitudinal axis of stigma (Figs. 62–64). If metacarp as short as stigma (or shorter) then r_1 perpendicular to stigma.

74 (75) Tergite 2 not wide, subtriangular and its hind margin sinuate (Fig. 43). Ovipositor sheath broad, evenly arched (Fig. 44). Hosts: Noctuidae

falcatus-group

75 (74) Tergite 2 more transverse and its hind margin straight to subsinuate. Ovipositor sheath of different shape.

76 (77) Hind one-third to one-fifth of tergite 1 rounded (Fig. 29), tergites 2–3 nearly equal in length. Hypopygium smooth, ovipositor sheath short, not longer than 3rd basitarsus. Hosts: mainly Geometridae, but also Arctiidae, Plusiidae

popularis-group, partim

77 (76) Tergite 1 either parallel to subparallel sided or (hardly) widening/narrowing posteriorly (Figs. 45–47, 49). Tergites 2–3 unequal, 2nd tergite always shorter than 3rd. Hypopygium creased, ovipositor sheath long, at least as long as half or two-thirds of hind tibia. Hosts: Cochylidae, Coleophoridae, Gelechiidae, Pterophoridae, Tortricidae

laevigatus-group

78 (51) Tergite 1 either in any degree, usually throughout, widening posteriorly, or, less usually, beyond its middle scarcely widening (Figs. 51–52, 54–55); tergite 1 of female usually more strongly widening behind than that of male. Propodeum scrobiculate, or rugose. Hypopygium smooth, i. e. evenly and strongly sclerotized, ovipositor sheath short, about length of 3rd basitarsus, except in *laevigatus*-group partim.

79 (80) Tergite 1 narrowing both anteriorly and posteriorly (Fig. 48), or parallel-subparallel sided. Propodeum at most on its declivous hind half rugose-rugulose (Fig. 12). Hypopygium creased and ovipositor sheath long, longer than 3rd basitarsus. 2nd tergite shorter than 3rd. Hosts: see couplet 77 (76)

laevigatus-group, partim

80 (79) Tergite 1 always widening behind (Figs. 51–52, 54–55) and propodeum always entirely scrobiculate or coarsely rugose. Hypopygium never creased,

ovipositor short. Tergites 2–3 subequal, 3rd one slightly longer than 2nd, except in *suevus*-group.

81 (82) 2nd tergite very narrow, 3rd tergite usually twice as long as 2nd. 1st tergite strongly diverging behind (Fig. 51). Wing (dark) fumous, its venation like in *butalidis*-group (cf. Fig. 42). 3rd coxa yellowish red, other coxae black. Hosts: Psychidae

suevus-group

82 (81) 2nd tergite less narrow, 3rd tergite usually (1.1–) 1.2–1.4 times longer than 2nd. 1st tergite widening behind moderately. Wing hyaline to subfumous, rarely fumous, its venation not like in *butalidis*-group (Fig. 58). 3rd coxa usually black, if not then all coxae yellowish red.

83 (84) Antenna with 13–17 joints cubic to subcubic (Fig. 39), antenna short, at most as long as head + thorax + abdominal segments 1–2. Tergite 3 usually 1.1–1.2 times as long as tergite 2 (Figs. 40, 67). Hosts: Geometridae, Lycaenidae, Noctuidae

brevicornis-group

84 (83) Antenna with 16–17th joints subcubic (or cubic), however, last joints of antenna usually visibly longer than broad. Antenna normally as long as body (♀), or longer (♂). 3rd tergite 1.2–1.4 times as long as 2nd or frequently even slightly longer (Figs. 52, 54–55). 3rd coxa sometimes rugose (Fig. 50): *tibialis*-subgroup. 3rd tergite (more or less) rugose – rugulose: *melanoscelus* – subgroup. Hosts: mainly Pieridae, Lycaenidae, Geometridae, Nymphalidae, but also Arctiidae, Hylophilidae, Lasiocampidae, Lymantriidae, Noctuidae, Notodontidae, Pyraustidae, Satyridae, Sphingidae, Thyatiridae, Zygaenidae

glomeratus-group

II. Key to females only, adopted „modern" features

(somewhat modified, after NIXON, 1973)

1 (8) Propodeum either with a single median areola (Figs. 31, 35) or with a median and two postero-lateral areolae bordered with costulae or carinae (Fig. 33).

2 (3) Edge of vannal lobe of hind wing beyond its widest point more or less concave, and here without any hairs (Fig. 72). 1st tergite normally parallel-subparallel sided and rounded or constricted at its posterior third to fourth (Fig. 34), hind (horizontal) surface of it with a characteristic longitudinal trough. Propodeum with a single and usually U-shaped areola (or trough) (Fig. 35). Hosts: mainly Tortricidae, but also Tineidae, Gracillariidae

ater-group

3 (2) Edge of vannal lobe beyond its widest point at least straight, usually more or less convex (Fig. 22, 24) and here with different hairfringe.

4 (5) Propodeum scrobiculate, tergites 1–2 rugose to scrobiculate, with U-shaped median areola. 1st tergite feebly widening posteriorly (Fig. 31). Mesonotum with dense, coarse, and confluent punctation, notauli (behind) more or less distinct. Metacarp short, r_1 directed somewhat to distal end of wing (Fig. 1). Hosts: Tortricidae, Pyraustidae

obscurus-group

5 (4) Propodeum never scrobiculate, at most rugose with smooth fields. 1st tergite usually widening posteriorly. Mesonotum with fine sculpture or nearly smooth. Metacarp usually not short, r_1 not directed to end of wing.

6 (7) Propodeum with a median and two postero-lateral areola carinated fully (Fig. 33). 1st tergite parallel-sided or widening slightly behind. Mesonotum with a characteristic strong and not confluent punctation. H o s t s: Coleophoridae, Gelechiidae, Tortricidae, Lymantriidae

ultor-group

7 (6) Propodeum at most with a U-shaped median areola (cf. Fig. 35). 1st tergite normally parallel-subparallel sided, in exceptional cases slightly widening behind. Mesonotum with weak sculpture or punctation rather confluent. H o s t s: see couplet 39 (38)

laevigatus-group, partim

8 (1) Propodeum without any areola, at most with a median trough- or areola-like impression (above lunule) lacking any costulation or carination.

9 (18) Vannal lobe of hind wing beyond it widest point distinctly concave (Figs. 19, 71) or straight (Fig. 22) and without any hairs.

10 (11) Lower part of head lengthened, i. e. cheek twice as long as basal width of mandible (Fig. 41). Propodeum without any medio-longitudinal keel. Stigma and venation of wings mostly milky-white. H o s t s: Phycitidae

lacteus-group

11 (10) Lower part of head not lengthened, head (in front and in outline) rather circular, i. e. cheek short, at most as long as basal width of mandible.

12 (13) Galea large and rostriform, distinctly twice as long as wide and nearly as long as height of head (Fig. 16). Inner spur of hind tibia nearly as long as basitarsus (Fig. 6). Body rather stout, sutures distinctly impressed. H o s t unknown

vipio-group

13 (12) Galea small, not rostriform. Inner spur of hind tibia much shorter. Body not stout, sutures normally impressed.

14 (15) Propodeum more transverse than usually, its lateral spiracle situated in middle or slightly anterior to middle of it (Fig. 37). Side of pronotum without any dorsal sulcus (Fig. 38). d_1 distinctly shorter than d_2 (Fig. 56). Vannal lobe of hind wing beyond its widest point rather straight. H o s t s: Geometridae, Lymantriidae

formosus-group

15 (14) Propodeum less transverse, normal in shape, its lateral spiracle situated before its middle. Pronotum with dorsal sulcus, except in *pallipes*-group. d_1 not distinctly shorter than d_2. Vannal lobe convex.

16 (17) Propodeum without any medio-longitudinal keel, either smooth or sculptured. Tergite 1 wedge-shaped, anteriorly broad, usually only one-third to one-fourth times longer than its width at base, apically strongly constricted (Fig. 23). Hypopygium long, distinctly projecting beyond apex of abdomen. Vannal lobe eventually straight (Fig. 22) or hardly concave. H o s t s: Tortricidae (in Europe)

mycetophilus-group

17 (16) Propodeum with a (sometimes strong) medio-longitudinal keel, surface along keel rugose-rugulose (Fig. 17). Tergite 1 anteriorly not broad, usually twice longer than its width at base, apically gradually constricted (Fig. 18). Hypopygium not long, at most scarcely projecting beyond apex of abdomen. H o s t s: Coleophoridae, Gracillaridae, Phycitidae

merula-group

18 (9) Vannal lobe of hind wing more or less convex (Fig. 24) with hairfringe.
19 (20) Tergites 2+3 much enlarged (but not carapace-like), almost concealing further tergites, clearly notched laterally at 2nd suture (Fig. 3). Tergites 1–3 rugose, tergite 3 less strongly sculptured than previous ones. Tergite 1 with parallel or posteriorly with somewhat converging sides. Propodeum smooth with a medio-longitudinal keel. Length: 1.5–2 mm. H o s t s: Bucculatricidae

carbonarius-group

20 (19) Tergites 2+3 of other shape.
21 (24) Oral part modified, either galea (Fig. 16) or maxillar palpi (Fig. 30) greatly lengthened.
22 (23) Galea distinctly twice as long as wide, somewhat rostriform, nearly as long as height of head (Fig. 16). Palpi of normal length. Metacarp shorter than stigma. Inner spur of hind tibia longer than outer one (Fig. 6). Cheek short. Vannal lobe not always distinctly concave, see also couplet 12 (13). H o s t unknown

vipio-group

23 (22) Maxillar palpi very long, as long as height of head (Fig. 30). Galea of normal size. Metacarp longer than stigma. Inner spur of hind tibia slightly longer than outer one. Cheek twice as long as basal width of mandible. H o s t s: Psychidae

longipalpis-group

24 (21) Oral part normal not modified.
25 (40) Hypopygium weakly sclerotized, along medio-longitudinal line more or less tightly folded (in dead specimens), and laterally from middle line with rather longitudinal creases (Figs. 32, 66), creased surface variable in extent. Ovipositor sheath usually long, at least as long as 3rd basitarsus. If hypopygium with weak sclerotization and ovipositor sheath short, then postscutellum with a lateral and small projection pointing forward (cf. *circumscriptus*-group, Fig. 61).
26 (27) Tergite 1 wedge-shaped, its anterior (excavated) half broad, usually one-third to one-fourth times longer than its width at base, apically strongly constricted (Fig. 23). Vannal lobe usually straight (Fig. 22) to faintly concave (cf. couplet 16[17]). H o s t s: Tortricidae (in Europe)

mycetophilus-group

27 (26) Tergite 1 not wedge-shaped.
28 (29) Tergite 1 strongly widening posteriorly (Fig. 51). Hypopygium usually strongly sclerotized, sometimes with few (and weak) creases. Propodeum rugose. 2nd tergite, often conspicuously, transverse. Wings fumous, venation like that of *butalidis*-group (cf. Fig. 42). H o s t s: Psychidae

suevus-group

29 (28) Tergite 1 never widening posteriorly.

30 (33) Tergite 1 narrowing gradually from its base or anterior half to apical end (Figs. 13, 15).

31 (32) Spines on outer surface of 3rd tibia of two kinds: thick and thin, thick spines often numerous on proximal part of tibia (cf. Fig. 12, in NIXON 1973: 223). Postscutellum rarely with a forward-pointing (and hardly distinct) projection. Anal vein of hind wing usually very short, as long as one-fifth of fold of vannal lobe (Fig. 70); if anal vein longer similar to *circumscriptus*-group (cf. Fig. 60), then spines of hind tibia very tipical of group and hind femur entirely blackish. Two spurs of middle tibia subequal, outer one somewhat shorter than inner one. Hypopygium with distinct and weak sclerotization (i. e. laterally creased); ovipositor sheath and hypopygium variable in size. Metacarp variable in length (Fig. 14). Mesonotum only in some species with more or less satin-like and dull sheen. Sulci of tergite 2 strongly diverging backwards, usually straight, evenly deep, and extending over entire length of tergite (Fig. 13). Hosts: Coleophoridae, Cosmopterygidae, Gelechiidae, Gracillariidae, Tortricidae, Yponomeutidae

metacarpalis-group*

32 (31) Spines on outer surface of 3rd tibia of one kind, thin and sparse (cf. Fig. 153, in NIXON 1965: 149). Postscutellum with a forward-pointing projection (Fig. 61). Anal vein of hind wing usually of average length, as long as two-fifths of fold of vannal lobe (Fig. 60). Two spurs of middle tibia unequal, outer one much shorter than inner one. Hypopygium usually with hardly distinct, weak sclerotization (i. e. lateral few creases hardly seen), but tight fold along middle line distinct; ovipositor sheath and hypopygium characteristic in size and form (cf. Fig. 156, in NIXON 1965: 149). Metacarp usually much longer than stigma and its length from tip of radial cell (Figs. 59). Almost all species with a characteristic satinlike and dull sheen on mesonotum. Sulci of tergite 2 variable in size and depth (Fig. 11). Hosts: most of the species are parasites of leafmining moths, like Elachistidae, Gracillariidae, Lithocolletidae

circumscriptus-group*

33 (30) Tergite 1 usually more or less parallel-subparallel sided (Figs. 45, 47–49); if narrowing apically, then not so strongly, or narrowing in other form (Figs. 5, 7, 8, 25), or ovipositor sheath very long (at least about length of 3rd tibia), or in exceptional cases, subparallel sides rather arched (Figs. 48, 68).

34 (35) Metacarp short to very short, usually shorter than length of stigma, and always shorter than its distance from tip of radial cell; r_1 directing towards distal end of wing (i. e. r_1 never perpendicular to length of stigma), normally issuing distally from middle of stigma and shorter than width of stigma (Fig. 42). Alar venation pigmented: brown or blackish brown, stigma normally without pale basal spot. Propodeum normally rugose,

*The two groups (*circumscriptus*- and *metacarpalis*-group) are not easily distinguishable, therefore I give more features to help separation.

lacking any median keel or U-shaped rugae above lunule. Tergite 1 either (hardly) narrowing posteriorly (Fig. 65), or broadest at middle (Fig. 68). H o s t s: Scythridae

butalidis-group

35 (34) Metacarp as long as or longer than stigma, and (much) longer than its distance from tip of radial cell (Figs. 4, 64); if metacarp shorter than stigmia, then propodeum smooth to almost smooth. Alar venation variable in pigmentation, basal veins (i. e. veins proximal to $r_1 + cuqu_1$) rather light. Propodeum rather smooth, or rugose, punctated to different degrees. Tergite 1 variable in form, either parallel-subparallel sided (Figs. 45–49), or narrowing mostly at its posterior half (Figs. 5, 7, 8, 25).

36 (37) r_2 stub-like at meeting of r_1 and $cuqu_1$ (Fig. 4). Propodeum either with an incomplete and rather feeble keel or with vermiculate and linear rugosities in place of keel, otherwise smooth. Tergite 1 gradually narrowing apically, tergite 2 conspicuously transverse (i. e. at least 3.5–4 times wider at rear than long at middle (Fig. 5). H o s t s: Pterophoridae, Tineidae, Tortricidae **parasitellae**-group

37 (36) r_2 never present as a stub-like vein at meeting of r_1 and $cuqu_1$. Propodeum without any indication of a keel, smooth or sculptured to different degrees. Tergite 1 parallel-subparallel sided, or narrowing at its posterior half. Tergite 2 more or less transverse, always (much) shorter than tergite 3.

38 (39) Tergite 1 on its anterior half (or third) parallel-subparallel sided, at its posterior (or horizontal) half narrowing (Figs. 7, 8, 25). H o s t s: Coleophoridae, Gelechiidae, Gracillariidae, Pterophoridae, Tortricidae

lineipes-group

39 (38) Tergite 1 either parallel-subparallel sided (Figs. 45, 47, 49), or, in exceptional cases, subparallel sides rather arched (Fig. 48), or constricted at rear (Fig. 46). H o s t s: Cochylidae, Coleophoridae, Gelechiidae, Pterophoridae, Tortricidae

laevigatus-group

40 (25) Hypopygium strongly sclerotized, along medio-longitudinal line not folded at all, and laterally without any creases (Fig. 53). Ovipositor sheath short, about length of 2nd hind tarsal joint, in some species somewhat longer (but never longer than hind tibia).

41 (42) Propodeum more transverse than usually, its lateral spiracle situated at middle or slightly anterior to middle (Fig. 37). Side of pronotum lacking any dorsal sulcus (Fig. 36). d_1 considerably shorter than d_2 (Fig. 56). Vannal lobe of hind wing beyond its widest point straight. H o s t s: Geometridae, Lymantriidae

formosus-group

42 (41) Propodeum less transverse, normal, its lateral spiracle situated before middle. Pronotum with dorsal sulcus (Fig. 38), except in *pallipes*-group. d_1 not considerably shorter than d_2. Vannal lobe convex.

43 (54) Propodeum (more or less evenly) rugose, or scrobiculate.

44 (45) Propodeum with a distinct medio-longitudinal keel, rugosity rather ver-

miculate and not scrobiculate (Fig. 9). Pronotum on its side without any dorsal sulcus (cf. Fig. 36). H o s t s: mainly Noctuidae

pallipes-group

45 (44) Propodeum without any keel, rugosity rather scrobiculate. Pronotum with dorsal sulcus (Fig. 38).

46 (47) 1st tergite characteristically broadening as far as before its distal end where roundly narrowing; sulci of 2nd tergite also characteristically directed either to its side or hind margin (Fig. 29). H o s t s: mainly Geometridae, but also Arctiidae, Plusiidae

popularis-group

47 (46) 1st and 2nd tergites other in shape.

48 (49) 1st tergite narrowing gradually from base to apex, normally wedge-shaped; 2nd tergite frequently as long at middle as wide behind, between its two and backwards diverging sulci surface more or less rather longitudinally rugulose to rugose (Fig. 10). H o s t s: mainly Noctuidae, but also Arctiidae, Geometridae, Glyphipterygidae, Lymantriidae, Plutellidae

vitripennis-group, partim

49 (48) 1st and 2nd tergites other in shape and sculpture.

50 (51) Antennal joints 13–17 cubic (Fig. 39), antenna (♀) short, at most as long as head, thorax, and 1st abdominal segment together; males undeterminable. 1st tergite often only slightly widening backwards. H o s t s: Geometridae, Lycaenidae, Noctuidae

brevicornis-group

51 (50) Last antennal joints longer than broad, at most 16–17th joints cubic-subcubic; antenna normally as long as (♀) or longer (♂) than body. Male more difficult to determine. 1st tergite distinctly widening posteriorly.

52 (53) 2nd tergite, often conspicuously, transverse, 3rd tergite at least twice as long as 2nd; 1st tergite rather strongly widening backwards (Fig. 51). Wings fumous, venation similar to that of *butalidis*-group (cf. Fig. 42). Propodeum always rugose. H o s t s: Psychidae

suevus-group

53 (52) 2nd tergite less transverse, 3rd tergite only (1.1–)1.2–1.4 times as long as 2nd; 1st tergite gradually widening backwards (Figs. 52, 54–55). Wings hyaline or subhyaline, venation other (Fig. 58). Propodeum scrobiculate to rugose, rarely weakly rugose, rugulose or subrugulose. 3rd coxa sometimes rugose (Fig. 50): *tibialis*-subgroup. 3rd tergite (more or less) rugose-rugulose: *melanoscelus*-subgroup. H o s t s: mainly Pieridae, Lycaenidae, Geometridae, Nymphalidae, but also Arctiidae, Hylophilidae, Lasiocampidae, Noctuidae, Notodontidae, Pyraustidae, Satyridae, Sphingidae, Thyatiridae, Zygaenidae

glomeratus-group

54 (43) Propodeum polished, smooth, or feebly (and not evenly) sculptured.

55 (56) r_1 and $cuqu_1$ forming together an arched vein, i. e. not meeting each other in an angle (Fig. 27). Propodeum and tergites 1–2 polished or with faint satin sheen. H o s t s: Arctiidae, Lymantriidae

octonarius-group

56 (55) r_1 and $cuqu_1$, as normal, meeting each other in an angle and not arched (Figs. 57, 58, 62).

57 (58) 2nd tergite subrectangular or weakly transverse, at most 1.7 times wider than long, its hind margin markedly sinuate (Fig. 43). Ovipositor sheath about length of 3rd tibia, relatively broad, evenly falcate (Fig. 44). Hosts: Noctuidae

falcatus-group

58 (57) 2nd tergite transverse, at least twice wider than long, its hind margin not hardly sinuate. Ovipositor sheath other in shape.

59 (60) All claws finely pectinate (Fig. 20). Ovipositor sheath as long as two-thirds of 3rd tibia. Flagellum with unusually long pubescence. Areolet ($r_1+cuqu_1+cu_3$) faintly *Microgaster*-like. Host unknown

validus-group

60 (59) Claws without any pectination. Ovipositor sheath short. Flagellum with short pubescence. Areolet not *Microgaster*-like.

61 (66) 1st tergite narrowing gradually (in highly variable size) from base to apex, usually more or less wedgeshaped (Fig. 10).

62 (63) Thorax of female dorso-ventrally flattened: mesonotum, scutellum, metanotum and anterior half of propodeum in the same level (Fig. 69). Antenna very short, not longer than head and thorax together, three preapical joints cubic to subcubic. Body polished. Thorax of male less or hardly flattened. Hosts: Pyraustidae

thompsoni-group

63 (62) Thorax of female not flattened. Antenna not short.

64 (65) Body gracile and very small, at most 1.8–2 mm long. Hind tibial spurs very short, inner spur slightly longer than outer one and not reaching middle of basitarsus (Fig. 21). Body smooth to polished, legs rather dark, Hosts: mainly Geometridae, but also Elachistidae, Noctuidae

fraternus-group*

65 (64) Body normal, not small, at least 2.3–2.5 mm long. Hind tibial spurs usually unequal, inner spur distinctly longer than outer one and reaching at least middle of basitarsus. Body smooth or variable in sculpture, legs rather light. Hosts: mainly Noctuidae, but also Arctiidae, Geometridae, Glyphyipterygidae, Lymantriidae, Plutellidae

vitripennis-group

66 (61) 1st tergite either parallel to subparallel sided and rounded-constricted at its distal half to quarter, or widening distally in variable size (Figs. 28–29, 52, 54–55).

67 (70) 1st tergite parallel-subparallel sided and before its hind end rounded (Figs. 28–29).

68 (69) Body polished to smooth, mesonotum and 1st tergite at most with fine and superficial punctation. 1st tergite parallel-sided, rounded at its hind third to quarter (Fig. 28). Hosts: Lymantriidae, Notodontidae

liparidis-group

* This species-group was separated by Nixon (1973) and much resembles *circumscriptus*-group. The differences given in the key are by far not so obvious as is the case in the other groups.

69 (68) Body never polished, more dull or pruinose, at least face, mesonotum and tergites 1–2 punctate, this punctation may tend to be crowded giving a rugose impression. 1st tergite subparallel-sided, characteristically broadening as far as before its distal end where rounded (Fig. 29). Hosts: mainly Geometridae, but also Arctiidae, Plusiidae

popularis-group

70 (67) 1st tergite always widening backwards to different degrees. (Figs. 52, 54–55). Face, mesonotum, scutellum, tergites 1–2 rugose, propodeum normally scrobiculate to rugose, only in some species tending to weaker sculpture. 3rd coxa sometimes rugose (Fig. 50): *tibialis*-subgroup. 3rd tergite (more or less) rugose-rugulose: *melanoscelus*-subgroup. Hosts: mainly Pieridae, Lycaenidae, Geometridae, Nymphalidae, but also Arctiidae, Hylophilidae, Lasiocampidae, Lymantriidae, Noctuidae, Notodontidae, Pyraustidae, Satyridae, Sphingidae, Thyatiridae, Zygaenidae

glomeratus-group

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