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The Aphidiidae of Italy

(HYMENOPTERA ICHNEUMONOIDEA) (*)

(Studi del Gruppo di ricerca del C.N.R.
per la lotta integrata contro i nemici delle piante: V.)

[Nel quadro della collaborazione scientifica del Consiglio Nazionale delle Ricerche italiano sul piano internazionale, questo nuovo esempio di indagini e studi strettamente concordi tra l'Istituto di Entomologia dell'Accademia Cecoslovacca delle Scienze di Praga e il Centro di Entomologia alpina e forestale di Torino del C.N.R. stesso è altamente significativo. Lo specialista afidiidologo di fama più che europea PETR STARY ha accolto l'invito a servirsi dei materiali biologici da noi già accumulati negli studi biocenotici e di venire a completare personalmente le indagini nel nostro Paese e con la nostra guida. Gli Imenotteri Apocriti Terebranti della famiglia degli *Aphidiidae* (prossima sistematicamente e già unita ai *Braconidae*) rappresentano un complesso elemento biotico negli equilibri faunistici degli Afidi o *Aphidoidea* della maggiore importanza scientifica e pratica. Così l'opera del Centro suddetto, emanazione dell'Istituto di Entomologia dell'Università di Torino, può includere all'attivo del « Gruppo di ricerca del C.N.R. per la lotta integrata contro i nemici animali delle piante » uno studio fondamentale sopra la tassonomia, la ecologia e la corologia degli *Aphidiidae* italiani, base di partenza per le ulteriori ricerche biologiche sull'argomento. L'ospitalità accordata a questo scritto nel periodico dell'Istituto di Entomologia della Università di Bologna, anch'esso partecipante al Gruppo per la lotta integrata, rientra felicemente nella collaborazione scientifica internazionale surricordata.

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I. GENERAL PART

1. INTRODUCTION

The application of natural enemies in insect pests control is at present one of the principal tasks of entomology. The history of the biological control of insects knows a number of cases when the insect pests were successfully controlled by aid of their natural enemies. We know a large number of these effective natural enemies. Investigations on them are growing more profound and extended to new groups, the application of which could be useful.

(*) Pubblicazione n. 105 del Centro di Entomologia alpina e forestale del Consiglio Nazionale delle Ricerche (diretto dal Prof. ATHOS GOIDANICH).

Aphids represent one of the groups of important pests in agriculture and forestry; they damage plants partly direct by sucking etc., partly by being virus vectors. Big amounts are spent on the chemical control of the aphid pests, but, nevertheless, satisfactory and especially lasting results were not reached very often for various reasons. Apart from this the chemical control has considerable disadvantages, e.g. useful organisms are destroyed together with pests, unnatural conditions are induced in a certain community, etc. That is why in the recent years the possibility of employing the natural enemies, predators and parasites, in the control of aphids has been studied very intensively.

Some groups of the *Hymenoptera*, especially the family *Aphidiidae*, are very effective parasites of aphids. Their importance and effectiveness in the open has been well known since long ago. Recently successfull experiments were made in using the aphidiids in the biological control of aphids.

The European aphidiid fauna was roughly studied during the past few years. The investigations, however, were carried out mainly on material from Central, Northern and Western Europe. Eastern and Southern Europe have been investigated very little in this respect.

The aphidiid fauna of Italy has practically not been studied. Therefore the research of this group was made in international cooperation between Centro di Entomologia alpina e forestale del Consiglio Nazionale delle Ricerche, and Entomological Institute of the Czechoslovak Academy of Science. The results of this cooperation attained until now are presented in this paper.

For metodic reasons the paper is divided in three parts:

1. Regarding that literature on aphidiids is rather fragmentary, we decided to give a short summary of general knowledge of this group in the first part of the paper, enabling the Italian workers a quick initial orientation and making their further work easier.

2. The second part contains the results of the author's trip in Italy in 1963, covered by the « Centro ». In this part also the results of Italian materials from various institutes are included, especially from the « Istituto di Entomologia agraria della Università di Torino ».

3. In the third part evaluation and the results of our Italian trip are given, as far as it can be done on the basis of our knowledge and problems.

Acknowledgements. I am deeply indebted to Prof. Dr. Athos Goidanich, director of « Centro », Doc. Dr. C. Vidano, Dr. Sampò, Mr. Couvert, and all the Italian scientific workers who were helping us during our journey. The aphids were kindly identified by Dr. J. Holman (EI CSAV, Praha) and Dr. H. Szelegiewicz (Warszawa), the ants by Dr. B. Pisarski (Warszawa).

2. Literary review

In the Italian literature on aphidiids any summary elaboration is missing. Mostly there are isolated descriptions of species, data on the parasites of aphids, etc.

The oldest literary data are by RONDANI (1844, 1877), who described a few new species and genera. Some of the taxons described by him are synonymized nowadays, the other can be evaluated only after the revision of types. In 1902 DE STEFANI described a species of the genus *Aphidius* Nees, a parasite of *Rhopalosiphum* sp. The paper by PIERANTONI (1907) deals with an aphid parasite *Toxoptera aurantii*. It is a species of the genus *Lysiphlebus*. In this paper the first figures and bionomic data can de found. BERLESE (1909) in his monumental work dealt with anatomy and morphology of aphidiid genitalia and with their development. MARTELLI's (1911) paper contains data on parasites of the aphid *Brevicoryne brassicae* (L).

In the thirties 2 papers were published. The first of them — by QUILIS M. P. (1932) — brings a description of a new species *Aphidius goidanichi* and data on 2 other aphidiid species. The type of the new species got lost, and until now it has been impossible to collect identical material and identify the species properly. Determinations of other 2 aphidiid species are doubtful. The second paper — GOIDANICH (1934) — is a classical example of precise morphological and ecological work. It concerns the morphological-anatomical structure of abdomen in one species of the genus *Lysiphlebus*, and contains description of a new genus and species together with bionomical-ecological information.

In total we can say that the investigations on aphidiids in Italy till the end of World War II corresponded to the situation in Europe, where no fundamental works were published, and determinations were made on the MARSHALL's (1896-1899) work standard with corresponding conception of species and precision of determination.

Further development of the research of Italian aphidiids takes place in recent years. At experiments on the biological control of the aphid *Therioaphis maculata* in USA the material of the aphid 's parasites in Italy and other countries of the Old World was collected too; the parasites were described by MUESEBECK (1958) as new species of the genera *Trioxys* and *Praon*. Successful employment of these parasites as biological control agents against *Therioaphis maculata* in California (v. d. BOSCH, SCHLINGER, HALL, and other papers) induced an increased interest in this parasitic group in general. At that time the intensive investigations on the aphid parasites in Europe began (STARY', 1958, MACKAUER, 1959, and on); in papers of both authors data on the Italian aphid parasites can be found. Also VIDANO (1959) published a monograph on the aphid *Rhopalosiphum oxycanthae*, with bionomic-ecological data on its parasites. Newly a paper by TREMBLAY (1963) came out, concerning the problems of morphology and specific classification of the species *Lysiphlebus fabarum* (Marsh.).

3. METHODS OF SAMPLING, PRESERVING AND DETERMINATION OF MATERIAL.

The aphidiids are represented — similarly as their hosts, aphids — in nearly all terrestric habitats. A large number of specimens can be obtained by

using the sweeping method. However, material obtained in this manner is not worth much, especially for the opening phase of work, as usually we get only single specimens that are hardly determinable for a less experienced workers. The most advantageous form of sampling, somewhat more difficult and demanding though, is collecting colonies of various aphid species and their laboratory rearing. In the open most of the aphid colonies are more or less infested by aphidiids, and that is how we obtain a substantial number of specimens of both sexes. For this manner of sampling it is necessary to get acquainted with the methods of collecting aphids, and with their bionomy and ecology.

It is useful to have a file of breedings. There is recorded: 1. Finding place, 2. plant, 3. habitat, 4. host species, 5. notes on the and occurrence, etc. (fig. 39). On the back side of the file card we take down names of parasites reared. Authomatic data (IBM cards) are quite suitable, too.

In the field we found collecting parts of plants with aphid colonies in large vials covered by silon texture, most useful (fig. 41). The vials are kept in large tin or plastic boxes. At long-lasting work the boxes with the collected material should be opened at least at night, and placed in an airy room, to prevent the material from moulding. Generally it is recommended to put smaller parts of plants in the vials. In each vial we put a number of the sample; the same number is put in the aphid sample from the colony, fixed in alcohol for later determination. Mass samples of the aphid colonies are reared — as far as it is possible technically — in big bottles etc., topped with silon texture. In the plants or their parts layers of crumpled filter paper are laid to prevent moulding and make airing sure. The hatched material of aphidiids is left in the vials and only dead, full-frown and coloured material is sorted together with hyperparasites. If big bottles are used, where there the dead aphidiids can get lost in the plant remainders, it is better to capture the hatched specimens.

Some aphidiid species enter diapause in the course of a year. That is why the samples should be examined to find if all mummies are really hatched. If not, some mummified aphids may be crushed to ascertain if they contain a living larva or are dry. After a long experience the diapause-cocoons are easily distinguished (see diapause).

The aphidiid species parasitising the aphids living on moss or peat-bogs may be obtained from samples by using Tulgren apparatus.

Dead parasites are put in small vials among pieces of cotton-wool to prevent moving during transport. In each vial the number of sample is enclosed. In each sample we keep a part of the dry plant with aphid mummies, too, as their colour may be a good supplementary character, especially when the aphid is infested by several aphidiid species.

Mounting. The sticking of specimens on white standardized labels by the right side of thorax was found to be the best kind of preparation. Wings of the sticked specimen are formed and abdomen is bent down pro-

perly so that characters on propodeum and on the first abdominal tergite can be observed. This manner of preparation has many advantages: 1. Margins of the label prevent the specimen to a great extent from mechanical injury. 2. All parts necessary for determination are well visible. 3. The white ground of the label makes a good reflecting surface and improves the contrasting picture of the object examined. It is recommendable to use an adhesive soluble in water, or a platic matter dissolvable by common dissolvents.

The specimens are sticked in the upper quarter of the label; on the lower margin we write a sex mark and perhaps the number of antennal segments, that would make the later identification easier. It is advisable to fix always a larger number of specimens (at least 10) so that the variability of some characters may be ascertained. The set of specimens is then labelled as usual by data identical with those on the file card.

For the examination of characters on external genitalia microscopic slides should be prepared by normal procedure: about a half of the dry abdomen is separated, boiled for some time in 10% solution of KOH. The object is washed in water and mounted as slide. The suitable medium is De Swann fluid. Liq. de Faure, etc. If the object is stout, one half is separated.

Determination: The aphidiids are a group parasitising aphids exclusively, i.e. hosts rather similar in morphology; that is why they are not very different either. Doubtless they are one of the groups of parasitic *Hymenoptera* which are difficult for determination, and their exact determination demands certain experience and large material.

Diagnostic characters are various, and differently variable in individual genera and species. That is why only their scheme is given here.

Synopsis of the diagnostic characters.

Head: Shape; distance — interocular, facial, transfacial, clypeoantennal, width; distance of the tentorial pit from the eye-margin with regard to the distance between tentorial pits; convergence, shape and size of eyes; shape and pubescence of clypeus; width of temples and cheeks. Antennae- number of segments, ratio of width of the first and second flagellar segments; length of antennae regarding the other body parts; the number of rhinaria on F_1 and F_2; distance of antennal sockets from the eye-margin.

Thorax: Declivity of mesoscutum to prothorax. Notaulices. Width of praescutellar groove. Shape of scutellum. Sculpture of lateral impressions on metanotum. Wings: venation. Propodeum: shape of areolae, their concavity, sculpture, hairs.

Abdomen: general shape. Ratio of the length of head and thorax (watch drying!). Shape, sculpture and hairs of the first tergite. External female genitalia: hairs, shape of ovipositor sheaths, accessory prongs.

Colour: All body parts (often considerably variable).

Good complementary characters can be found in the ecology of the species (host, habitat), etc.

4. Morphology and anatomy

Egg. Aphidiid eggs are microscopical, according to the size of specimens of the species concerned. E.g. *Lysiphlebus fabarum* - 86 × 36μ, *Aphidius* spp. 70-90μ × 24-29μ; *Ephedrus plagiator* (Nees) 80-100μ × 16-24μ. Having been laid into the host the eggs increase several times in size.

The eggs are of various shape: in species of the genus *Aphidius* they are spindle or lemon-like, in *Ephedrus* oblong, etc.

Larva. There are three larval instars in the aphidiids, easily distinguishable by the shape of head, cauda, etc. Instar I larva has apart from the head a 13-segmented body. Head with strongly developed mandibles is distinctly differentiated. Pubescence on the abdominal segments occurs often, variously developed in the shape of rows of hairs, etc. The terminal abdominal segments is of different shape in different genera; it is either simple with variously dense bristles or spines, or 2 accessory prongs are developed, pointed obliquely or upright to it. Instar II larva: Oral lobes are diversely developed. Mandibles are small. Pubescence on the abdominal segments is missing. Cauda is much shorter, accessory prongs missing. Instar III larva is mandibulate. Cauda is missing completely. Head is relatively very small, very mobile, especially at spinning.

Praepupa. In this stage the larva becomes shorter, the segmentation and lateral folds are more conspicuous. Whitish tat bodies showing through the skin are well visible.

Pupa is of exarate type, segmentation is very fine. Legs are bent and pressed under the body. Antennae are pressed along the ventral side of the body. Fore wings are folded and cover the second pair.

Imago. The head is orthognathous, bearing eyes, 3 ocelli, antennae and mouth. Eyes are of various size, globular, half-globular or oval. Mandibles are double-teethed. Antennae are of various length, mostly filiform, rarely moniliform. They are situated in the upper or middle part of face. The big scape differs distinctly from the smaller globular pedicell. After the pedicell the other, more or less identical antennal segments follow, forming the flagellum. The number of antennal segments is variable, between 10-30. In males the antennae are usually longer, having a few more segments than in females. Clypeus is separated from the face by a more or less deep groove; usually it is smooth, sparsely haired. By the sides of the clypeus more or less deep tentorial pits can be seen. Occiput is margined.

Thorax. Pronotum is usually smooth or finely sculptured. Sometimes the pronotum is invisibile from above, being covered by strongly developed mesoscutum; mostly, however, the descent of the mesoscutum to the pronotum is rather vertical. The mesoscutum is usually smooth, rather densely haired, rarely finely granulated. Notaulices may be distinct on base only, or reach ot the praescutellar groove, or be absent. Their sculpture varies; usually they are more or less granulate, rugose or smooth. The praescutellar groove may be

of diverse depth and width, usually it is smooth. Propodeum is of various sculpture and pubescence. Often it bears carinae forming areolae of various shape. Wings: 2 pairs of wings are developed, rarely females are wingless. Wing venation is reduced in different ways (figs. 00). Legs are slender, rarely stout, comparatively long.

Abdomen is either lanceolate or rounded. Its shape may be a generic character, or that of sexual dimorphism; in such a case the female abdomen is lanceolate, the male one rounded. First tergite varies in shape, sculpture and pubescence. Spiracles are situated laterally leading into more or less prominent spiracular tubercles called primary tubercles. Apart from this in some genera (*Trioxys*) secondary tubercles are developed, noted for not bearing spiracles. The other abdominal tergites are smooth, with variously dense pubescence. All abdominal segments are loosely connected by membranes except the second and third tergites which are grown together. The external genitalia (fig. 6) bear generic and specific characters. It concerns especially the shape of ovipositor sheaths, bending of the ovipositor, shape of the anterior prong of second valvulae, etc.

A special modification of abdomen occurs in the female of the species *Protaphidius wissmannii* (Ratz.). First, second and third tergites are quite normal, only the third tergite is strongly narrowed. Beginning with the fourth tergite the abdominal segments are narrowed in a tubular shape and may be pulled in as a telescope, forming thus a morphologically distinct part of the abdomen that may be considered a pseudoovipositor. The genitalia proper are situated normally.

In some highly specialized aphidiid genera acessory apparatus developed, making the grasp of the aphid easier. In principle the accessory apparatus is of two types:

1. *Trioxys* - type. On the terminal abdominal sternite 2 movable fork-like processes developed, serving for holding the attacked aphid and facilitating the injection of ovipositor.

2. *Metaphidius* - type. The accessory grasping apparatus forms a small tubular process on the base of the sixth abdominal tergite; used against slender and upturned ovipositor sheaths.

5. Life history

Development. From the egg inside the host a larva hatches, and goes through 3 instars. A mature larva of instar III kills the aphid. Then it bites out gradually an oblong hole in the ventral side, and sticks the aphid to the plant with the secret of salivary glands. Afterwards the larva keeps turning in the skin of the dead aphid, bebbing it with a texture produced by salivary glands. The skin of the dead aphid, transparent at first, becomes dull, mummy-like, and changes its shape a bit. Some genera (*Praon*, *Dyscritulus*) pupate in special cocoon under the infested aphid's skin. The imago

then bites a round opening in the mummified aphid by circular movements of mandibles, pushes the inside out in shape of a round lit and emerges. After the emergence a period of cleaning follows. The emerged imago matures comparatively quickly in dependence on the environment.

Mating behaviour is very typical. Contact lasts for a various time. One male can mate several females, a female is mated only once in its life.

Oviposition. Female parasite orientates at first by antennae; if it touches an aphid, assumes the ovipositing attitude position. Then it stretches the abdomen forwards and stabs the host. The oviposition behaviour is rather identical, but there are always some specific variations in host search, time of oviposition, etc. By one insertion of the ovipositor usually one egg is laid.

Progeny, sex ratio. The female parasite lays eggs immediately after reaching maturity, having been mated or not. From the unfertilized eggs males hatch, from the fertilized ones females (arrhenotoky). The mated female may produce, however, unfertilized eggs as well, e.g. if the eggs are laid in a too quick succession, or if the sperm reserve is exhausted. Deuterotoky occurs rarely in the aphidiids. Sex ratio is variable and depends on many factors.

The adults live for a variously long time in dependence on the environmental conditions. Honey is the best food for the laboratory breedings. The honey-dew of aphids is considered a source of food in the open.

Reproductive capacity is very different in different species, and in one species it is determined by a number of factors. It ranges from a few to several hundreds of eggs. Usually only a part of the number of eggs in ovaries is laid.

Hibernation. The aphidiids in Central Europe hibernate as praepupae in the mummified aphids. Probably *Paralipsis enervis* (Nees) is the only exception, having been found in winter as the imago hibernating in an ant nest. This manner of hibernation apparently bears upon the bionomics of this species.

The occurrence period of different species is different and is determined by the environmental factors.

Diapause. Some species endure the unfavourable season in the state of diapause. The diapause in the aphidiids is connected with the host's life cycle, either with its migration in another type of habitat, or with the host's stage (egg) that is not suitable for infestation, etc. Usually the diapause is conditioned by the geographic area, season, habitat, host plant of the host aphid, and host. The diapause sets in the praepupal stage. The larval entering diapause produce, however, a special type of cocoon, differering distinctly from the normal non-diapausing one. E.g. in *Ephedrus persicae* Frog. occurring as common parasite of leaf-curling aphids in Europe: *a*) non-diapause cocoons have the usual appearance of mummified aphids; they are mat, smal-

ler in comparison with the diapause cocoons, segmentation of the mummified aphids is easily recognizable. *b*) diapause cocoons: the mummified aphids are unusually big, globular, shiny, strongly mummified, segmentation of their abdomen is unrecognizable.

6. Foci in nature

For the study of foci of aphid parasites in nature it is necessary to collect samples of aphids on various host plants throughout the vegetation period in various types of habitats. Only this kind of work enables to gain some knowledge of the occurrence, habitat-preference and factors influencing it in the *Aphidiidae*, as well as of some factors influencing their host-specificity, etc.

The focus of the aphid parasite may be defined as a part of the geographical area, which a certain biogeocenosis is peculiar, characterized by more or less characteristic habitats and by the presence of biocenosis, to which the host aphid belongs.

Aphid migration and foci of aphid parasites.

For solving the given problem the classification of aphids to monoecious and dioecious species has been found to be satisfactory.

The monoecious aphid does not change the type of its habitat during the season, although it migrates to other plants in a certain period to feed here. Our studies showed that, owing to the fact that they do not change the type of their habitat during the season, such aphids are infested throughout the season by same species of parasites, which form the characteristic parasite complex typical for the given type of habitat. E.g. *Brevicoryne brassicae* is a monoecious species, limited during the season to the steppe-type habitats (Brassica fields, weeds, etc.), where it is infested by a parasite species occurring in the steppe habitats, i.e. *Diaeretiella rapae* (M' Int.).

Dioecious aphids change the type of their habitat during the season, migrating from primary to secondary host plants etc. and for this reason they are infested in various types of habitats by different complexes of parasites typical for a given type of habitat Example: *Aphis fabae* Scop. occurs in spring and in autumn on Euonymus europaea (primary host plant) on the edges of woods, in groves and parks, i.e. in the forest type habitats. There, it is infested by the characteristic parasite-complex of the forest-type habitats — by *Ephedrus plagiator* (Nees), *Trioxys angelicae* (Hal.) and *Praon abjectum* (Hal.). By the end of spring and at the beginning of summer this aphid migrates to the steppe-type habitats to live on secondary host plants — on sugar beet and later on weeds, where it is infested by characteristic complex of parasites, *Lysiphlebus fabarum* (Marsh.) in this case.

Typification of foci of aphid parasites.

The below mentioned division is necessary for the rational typification of natural foci of aphid parasites and their peculiarities in some relation of abiotic, biotic, geographical and other character, as well as their origin in relation to the activity of man.

1. According to the number of parasite species:

a) The focus includes only a single parasite species of a given host - monospecific focus.

b) The focus includes 2 or more parasite species of a given host aphid - bispecific or polyspecific focus.

2. According to the total rate of the existence of the focus:

a) old foci (e.g. steppe reservation, representing a naturally balanced community).

b) recent foci (e.g. waste places, formed as the result of human activity).

3. According to the character of the origin of the focus.

a) developed by evolution — autochthonous (In cultivated areas only reservations belong to this type; they become, however, mixed with newly formed type of cultivated area).

b) resulting from human activity — anthropurgic. (Under the influence of human activity, pathways, roadsides, field boundaries, waste land, etc. are formed).

4. In the areas, where two various types of land or habitats are adjacent (e.g. forest and steppe) the parasites may in some cases pass from one type in the other. Such foci are named intermediary.

5. The following landscapes or zones exist in the palearctic region: *a*) Tundra, *b*) Taiga, *c*) wood steppe, *d*) steppe, *e*) semi-desert, *f*) desert, *g*) mountains. The various types of foci are connected with these zones. It is to point out that within the rule of station variation (by BEY-BIENKO, 1936) some species of a larger area of distribution may occur in various landscapes in various types of foci.

Conditions in the forest type habitats are usually of a very little changeable character. The changes are mostly caused by the succession of different components of the phytocoenosis. Although being nowadays cultivated too, forest habitats are, therefore, by their character long-termed, and they are also inhabited by a long-termed community or biocoenosis, which can in general develop naturally there. The foci of parasites are therefore constant in this type ot habitats.

The steppe type habitats are represented by the so-called cultivated steppes in Central Europe; the original steppe formation may be found in small remnants only. The general character of the habitats of this type is as follows: They are originally habitats of the steppe type, habitats of the open area, partly formed into a cultivated steppe by human activity. For the purpose of this chapter, the steppe type habitats may be further divided in two groups:

A) Steppe habitats under the direct and fairly important influence of human activity (fields). They represent mostly monocultures that have more or less limited composition of aphid fauna. In connection with the bio-

nomics and life-cycles of aphids two subgroups may be differentiated in this type of habitats:

Aa) Monocultures temporarily inhabited by the fauna of dioecious aphids (e.g. *Aphis fabae* Scop. in sugar-beet fields, *Sitobium avenae* Fabr. on corn). Aphids migrate to these places during a certain period of the year from their hibernating places where they developed in spring on the primary host plants. The given monocultures represent, consequently, the secondary host plants, which the aphids leave again after spending some time here (when they do not find the plant juices suitable any longer) and fly to other secondary host plants, or back to the primary ones. Owing to the influence of agrotechnical activities, these habitats are each year inhabited by a different community. Therefore the *Aphidiidae* have not favourable conditions for hibernating there (tillage), or, if hibernating, they do not find here a suitable host the following year, as a new entomofauna of some cultural plant is formed with another specifically different aphid fauna composition, which is no longer suitable for the given parasite species. Consequently, the *Aphidiidae* do not occur in these habitats again in spring for 2 reasons: On the one hand, they could not hibernate properly and, on the other hand, the host migrates to this habitat from primary host plants during a later period. This type of habitats, therefore, does not practically include by its character any foci, or it includes temporary foci only. On the contrary the *Aphidiidae* move to these habitats in the course of the season — after the immigration of the host from environmental habitats that include foci of parasites.

Ab) Monocultures inhabited by a monoecious aphid fauna. The aphids occur in the fields during the whole year. The *Aphidiidae* may concentrate and hibernate there, and in the following year find again the same host species in the same habitat. Therefore habitats of this kind include chronic foci of parasites.

B) Steppe habitats that are not exposed to the direct and effective influence of human activities (pastures, virgin lands, waste lands, roadsides, etc.). These habitats are often inhabited by a rather heterogeneous phytocoenosis, with which a fairly heterogeneous aphid fauna is connected. These habitats include the classical foci of parasites.

6. According to the rate of existence of the focus within one year:

A) Temporary — occurring temporarily in the course of one year (e.g. groups of Cirsium-plants, weeds, infested by *Aphis fabae* Scop. represent temporary foci of *Lysiphlebus fabarum* Marsh., which moves from them after the emigration of the aphids).

B) Chronical — representing sources of parasites during the whole time of their existence (e.g. waste places in the neighbourhood of potato-fields or rape-fields are covered with weeds, e.g. Atriplex, Chenopodium, which are infested by *Hayhurstia atriplicis*. These are monospecific foci — foci of the parasite *Diaeretiella rapae* M' Int.), which moves from these du-

ring the vegetation season to potato- and sugar-beet-fields, where it parasitises on the pest aphid *Myzus persicae*, or to rape-fields, where it attacks *Brevicoryne brassicae*.

7. According to the importance of the specific composition of parasites:

A) Indifferent — containing parasites of the economically indifferent aphid species, which do not include any economically important aphid species within the range of their food specificity (e.g. waste places covered with Achillea, Artemisia or Tanacetum that have a rather specific aphid fauna and their parasites, completely indifferent to human activity).

B) Useful — including parasites of the economically harmful pest aphids (e. g. field boundary covered with Salvia spp. — infested by *Aphis salviae*, Plantago spp. — infested by *Aphis plantaginis*, Tragopogon pratense — infested by *Brachycaudus tragopogonis*; all the aphid species mentioned are reservoir — hosts of their parasite *Lysiphlebus fabarum* Marsh.), which also parasitises on quite a number of pest aphids — e.g. *Aphis fabae*, *Aphis medicaginis*, *Brachycaudus cardui*, etc.

C) Noxious — very rare. Some *Cinara* spp. occurring in woods could be mentioned, as these aphids are producers of honey-dew, which is of certain importance for bees.

The end of foci of aphid parasites. The foci cease to exist if:

A) The host or parasite falls out of the community (e.g. as the result of chemical treatment).

B) The territory of the focus changes (drainage, irrigation, burning, etc.).

C) The geomorphological structure changes (ploughing, etc.) — particularly in chronical foci.

D) The factors of microclimate and particularly of humidity change acutely (partial mowing).

The importance and protection of foci of aphid parasites. As it was mentioned above, the *Aphidiidae* are found in foci from which they spread to the neighbourhood. From this follow important practical conclusions that in cultural annual crops the parasites cannot influence the aphid occurrence on larger areas at the initial stage, if there does not exist a sufficient number of suitable habitats in the neighbourhood with the foci of parasites. Even in the latter case, the parasites disperse gradually all over the area. Their effectiveness also depends to a great extent on climatic conditions and other factors.

In natural conditions the native parasites may be economically effective in particular on perennials, mostly on forage crops, on which aphids occur during the whole season, and where chronic foci of parasites may gradually originate.

Aphid parasites are of great importance, although it is hard to evaluate

it, in the control of economically significant aphid pests in the habitats where the foci occur from which the aphids can spread to the neighbourhood on various crops.

Our studies have shown that the foci of parasites are of different types. The protection of a focus must be based on a detailed analysis of the host plants, host aphids and complexes of parasites of the respective foci, by which the structure and type of a given focus becomes established. It is also necessary to see to it that the protection or preservation of the given focus is not in conflict with more important phytopathological measures. Similarly, we shall not protect or expand the growth of Artemisia or Achillea plants in suitable habitats, because they represent foci of an indifferent type.

Thus, the general scheme of work on the study of foci of the aphid parasites should be directed in the following:

1. Ascertainement of the structure of the focus, its occurrence and conditions of existence.

2. Determination of all factors regulating the possibility of parasitization of the aphids in the focus.

3. The whole complex of all arrangements enabling the protection of the existing foci of entomophagous insects and efforts for the creation of new foci.

7. Geographic distribution

Geographic distribution of the *Aphidiidae* is determined by a number of various factors, among which centres of host and parasite evolution, their dispersion possibilities, food specificity, etc. play the most important role. For this reason we may recognize some centres of aphidiid evolution but a number of cases shows that ecological factors other than host x parasite phylogenetical relationship are more important. Some species are today cosmopolitan in distribution due to the economic activity of man.

According to the factors influencing the host specificity in the *Aphidiidae* it seems suitable to classify the distribution of species in connection with their existence in different zones, so that following faunistic complexes may be recognized in Europe: 1) Tundra f. c., 2) coniferous forest f. c., 3) deciduous forest f. c., 4) steppe f. c., 5) semi-desert f. c. By this way but only a rough classification is obtained and the faunistic complexes of this type must be subdivided in dependence on food specificity factors in different species, etc.

8. Host x parasite interrelationship

The relations of the host and parasite are very complicated and considerably influenced specifically. That is why we shall deal here with a rough frame only.

Parasitization influences the host life essentially. The host responses to infestation either actively (defensive movements, fall from the plant, etc.)

or passively. The parasite larva destroys gradually the host individual organs, and finally kills it. That is why the infested aphid moves more and more slowly, and reacts little to mechanical stimuli.

The parasitization influences the reproduction of the host, length of its development, form of its progeny, etc. Inversely, the host can influence the parasite development, size fecundity, etc.

Host specificity.

Host specificity phases.

a) Host habitat finding. The aphidiids are connected with a certain type of habitat which they seek primarily. In the given type of habitat they occur in various types of foci from which they spread in the environment.

b) Host finding. The female parasite finds a host by macro-orientation, using its antennae (stimuli) by which the host is finally tapped. At the following micro-orientation various setae on ovipositor-sheaths or acessory prongs are used.

c) Host acceptance. The host acceptance depends on defensive reactions and modifications of the host, which are active or passive, on the host mobility, host instar degree, distinguishing between parasitised and non-parasitised aphids, etc.

d) Host suitability depends for the greatest part on the immunity reactions of the host.

Factors influencing the host specificity.

a) Habitat. The habitat is of the greatest importance in the host specificity of aphidiids. In the parasites of the monoecious aphids the importance of relation to the habitat is less distinct, as these parasites occur mostly, similarly as their hosts, throughout the season in the same type of habitat (forest, steppe). There is a more apparent relation to the habitat in parasites of dioecious aphids, which during their life change the habitat throughout the season (forest-steppe-forest) in connection with the aphid migration from the primary to the secondary host plants. In this case 1 dioecious aphid species is attacked by different parasite complexes in dependence on the type of habitat in which it occurs. Dioecious aphid parasites are not, as far as we know, monophagous. After the migration of the dioecious aphid host from the given type of habitat the parasites infest other aphid species, either the other dioecious species that still occur in the habitat, or some other suitable monoecious species.

Our studies have shown that the type of habitat is more important than the occurrence of the primary or secondary host plant of the aphid in that habitat. In some cases of intermediate habitats it is possible that in the forest type habitat (park) also secondary host plants occur (undergrowth) besides the primary ones (shrubs). In this case the aphid parasite complex is mixed. The influence of habitat boundaries is also important.

b) Host. The occurrence of suitable host in a suitable type of habitat is another necessary condition of the parasite existence. The host suitability

is determined by the phylogenetic relationship of the host and the parasite, and by the range of plasticity of the parasite specificity. In many cases the mode of the host life is more important than the host x parasite phylogenetic relationship. The quantity of host species present in the habitat is also important and influences the host selection.

c) Host attending insects. The ants are usually indifferent to aphidiid wasps, or, more rarely, there exists the relation of mutualism between them (*Paralipsis*).

d) Food of adult parasites. It seems that the honey-dew represents the food the adult parasites. Therefore, the food of adults exists in the same place as the host aphid.

e) Ovipositional stimuli of the female parasite. The long-termed lack of host is, no doubt, a strong stimulus for the female parasite, and both in the field and in the laboratory it may result the attack of a less suitable host and possible increase of the host list. The act of mating or presence of sperm in spermatheca does not have any marked effect on the ovipositional stimuli of the female.

f) Host plant of the host aphid. The aphid host plant does not seem to be of much importance for the host selection of the parasites.

Host selection and geographic distribution.

The parasite fauna of the same aphid species often varies in different geographical areas. Sometimes the host species is attacked by the same parasite species in the whole area of distribution, or the host is attacked by a certain parasite species only in a part of the whole area of distribution. The same parasite species often prefers in different parts of its distribution area different host species. A parasite species sometimes attacks various species of the same genus or aphid group in its distribution area. Some groups of parasites are vikariant in distribution.

Adaptation of parasite to host.

It is a long-termed and complicated process in nature. There is quite a number of types of the parasite adaptation to the host, which must be classified in different way according to their degree, e.g. morphological, physiological, ecological adaptations, etc.

a) Accessory prongs (*Trioxys*, *Metaphidius*) enable the infestation in a certain host instar only, but the infested host can hardly escape if being attacked.

b) Sham ovipositor (*Protaphidius*) enables the host infestation if the host lives in crevices of rind.

c) In case of mutualism (*Paralipsis*) the morphological similarity of the parasite and the ant that attends root aphids, is apparent.

d) Immunity reactions are distinct in unnatural host propagation.

e) Behaviour of the host and parasite. The parasite behaviour is adapted to the host's, namely to its mobility and escape reactions.

f) Mode of host life. There are typical complexes of specialized parasites — of gall-producing aphids, root aphids, etc.

g) Host life cycle. The relatively wide range of host specificity of dioecious aphid parasites seems to be also an adaptation to the host life cycle, as the parasite must attack other aphid species after migration of its dioecious host to another habitat.

h) The diapause of aphid parasites is also an adaptation to the host life cycle. This diapause-adaptation enables the parasite to stay in a quiescent state for the period when suitable host is lacking in the given type of habitat.

Host classification.

The following 3 types of hosts are believed to be most suitable for the differentiation of hosts according to their preference by the parasite. *a*) The main host is evidently preferred in the number of samples. *b*) The subsidiary host is parasitized occasionally, but does not occur as often as the main host. *c*) The facultative host is parasitised only exclusively.

Definitions of parasitism based on the number of host species attacked.

The classification used by us is based on the relation of the parasite to the certain host species or host species group.

Type 1: The parasite specificity is restricted to a single host species (« monophagous »).

Type 2: The parasite specificity is restricted to 2 or more host species of the same genus (« oligophagous »).

Type 3: The parasite specificity is restricted to 2 or more genera of the same host group, more or less closely related. Other host groups are not parasitised (« oligophagous »).

Type 4: The parasite specificity is restricted to 2 or more genera of the same group of hosts, more or less closely related. Other host groups are rarely parasitised as subsidiary or additional hosts (« oligophagous-polyphagous »).

Type 5: The parasite specificity includes a few host genera of the same host group to which also the main host belongs, but a few other host-groups are often attacked. The mode of host life is important (« polyphagous »).

Type 6: The parasite specificity includes some host genera of various host groups. The mode of host life plays the most important role (« polyphagous »). Nevertheless, also in this type with wide ecological plasticity some aphid groups lack the numerous aphid list.

Unnatural host propagation.

This is the perspective of using many aphidiids for the biological control of aphids. At the unnatural host propagation there items must be considered: 1. behaviour of the host, 2. morphology of the host, 3. its mode of life, 4. stimulating effects of various factors on the ovipositing female parasites, and other factors influencing the food specificity of the *Aphidiidae*. We consider, however, the possible regulation of laboratory conditions to be very important for the unnatural host propagation. Nevertheless, only the field application of unnatural host experiments can show the result.

9. Superparasitism

The ovipositing female parasites do not distinguish between parasitised and non-parasitised aphids, so that often one aphid is infested several times. It depends on many factors, especially on the opportunity of choosing the host, and on the female 's oviposition possibilities. Consequently, several parasite larvae develop in one aphid.

In connection with the ovipositional instinct of the females the following situations may arise:

1. The eggs are laid in the same host specimen almost simultaneously by one or more female parasites. Consequently, several larvae of the same age develop.

2. The eggs are laid by one or more females in certain intervals, so that larvae of a different age develop.

As only one parasitic larva can complete its development, competition arises among the larvae of the same or different instar (in one host).)The competition among the instar I larvae is apparently mechanical, as these larvae are markedly mandibulate. The competition among the larvae of higher and lower instars is physiological, as always the older larva survives, having negligible mandibles in comparison with the instar I larvae. The physiological mechanism can be either of food character, but more probably the lack of oxygen for the lower instar larvae is the matter, so that they cannot hold out in the competition.

Superparasitism is quite common especially in the laboratory breedings with a higher population density of the parasites, but occurs often under natural conditions too, if the parasite has achieved a high effectiveness.

10. Relation between the parasites and ants

The aphidiids mostly ignore the ants attending on the aphids. They do not react to tapping by the ant antennae and even do not interrupt oviposition. The ants apparently do not take the parasites for enemies, as they never attack them actively as far as we have observed, attacking some predators of the aphids though. Also the fact that even the aphid colonies densely attended by ants are strongly parasitised by aphidiids gives evidence about the indifference of the ants to the aphidiids. Anyway, the parasite behaviour, its response to the mechanical stimuli of the environment, etc. are very important.

A special case of a complete adaptation to the ants attending the aphids is *Paralipsis enervis* (Nees) (mutualism). Adults of this parasite greatly resemble morphologically the ants of the genus *Lasius* that attend most root aphids infested by *Paralipsis*. Undoubtedly these adults are taken for members of the ant nest community. The ants feed the adult parasites and bite off parts of their wings, so that the parasites cannot fly and have to stay in the ant nest community.

11. Natural enemies

In the plant realm the infestation of aphidiid cocoons by some species of parasitic fungi are well known.

In the animal realm the aphidiids are attacked by various parasites and predators. Among the common obligatory parasites various representatives of *Hymenoptera* can be found (*Chalcidoidea*), namely *Asaphes vulgaris* Walk., *Coruna clavata* Walk., *Pachyneuron aphidis* Bouché, and others. Females of these hyperparasites attack the parasitised aphids containing mature aphidiid larvae or pupae. The eggs are laid on the surface of the parasitic larva or pupa. The ectoparasitic larvae are barrel-shaped, pointed at the end. It pupates inside the host cocoon in the mummified aphid. The hyperparasite's emergence hole is of an irregular shape, different from that of the primary parasite — the aphidiid; the lid is not formed. Also the encyrtid *Aphidencyrtus aphidivorus* (Mayr) is quite a common parasite of the aphidiids. However, its primary parasitism is not excluded. Representatives of the family *Ceraphronidae*, especially of the genus *Lygocerus*, also belong among the hymenopterous parasites of the aphidiids. The females of *Lygocerus* search for the aphids parasitised by the aphidiids, only for those containing mature larvae or pupae of the primary parasite. The eggs are oval, slightly arched, laid on the surface of the host larva or pupa. The larvae live as ectoparasites, feeding mostly on the thorax or abdomen of the pupa. They are barrel-shaped, slightly narrowed at the end. They pupate inside the host's cocoon in the mummified aphid. The emergence hole of the adult is of an irregular shape. If the secondary parasite — the entoparasitic larva of *Charipinae*, occurs in the host larva or pupa of the primary parasite of the aphid, it is killed by *Lygocerus* together with the primary parasite. *Lygocerus* can be then the tertiary parasite of the aphids. Many genera of the subfamily *Charipinae*, the family *Cynipidae* (*Charips*, *Alloxysta*) are frequent parasites of the aphidiids. The females of *Charips* attack the living aphids containing aphidiid larvae of lower instars, usually III-IV. The eggs are laid in the host larvae; they are oval, with a short stalk on one end. Segments of the instar I larva are strongly sclerotised, with a long cauda on the last segment that is gradually reduced in the higher instars. The mature larva is slightly bent, without any processes on the body. The larvae live as entoparasites feeding gradually on the reproductive organs, fat body, and finally the digestive tract and nervous system of the aphidiid host larva. The mature larva of *Charips* emerges from the host larva skin and pupates in the cocoon inside the mummified aphid. The emergence hole is of irregular shape, similarly as in other hyperparasites of aphids.

The facultative ectoparasites of the aphidiids are not very abundant. Their facultative parasitism has mostly not been proved. Some hymenopterous species of the family *Aphelinidae*, and some dipterous genera of the family *Itonididae* (*Endaphis*, etc.) belong among them.

The predators of the aphidiids are a very numerous group. They are not obligatory predators, but normal predators feeding on the aphids and thus eating also the larvae parasitising the aphids, so that they are more facultative predators. Some species of mites, and of insects some species of *Neuroptera*, *Thysanoptera*, *Heteroptera*, *Coleoptera*, *Hymenoptera*, *Diptera*, etc. belong there.

The influence of natural enemies. Of all the groups of natural enemies mentioned above only the obligatory hymenopterous parasites are important. Their influence varies under different conditions. In some cases, especially at the end of gradation of the certain aphid species, the percentage of hyperparasites uses to be very high and decreases markedly the effectiveness of the primary parasites.

12. Economic importance

Natural limitation.

Many aphidiid species decrease essentially the abundance of aphids. Their effectiveness is difficult to be evaluated economically as they kill aphids in places that are not looked after very much from the plant protection point of view and from where the aphids disperse.

In a long-lasting community the effective aphidiid species usually reach such a level of the population density that the pests are kept on a level tolerable economically. In short-termed communities, however, the aphids usually gain advantage in reproduction that cannot be controlled by the parasites before the calamity increase in the aphid population, and the parasites reproduce only when the plants have been seriously damaged by the aphids. But the aphidiids are not the only group of the natural enemies of aphids, and their importance in the natural limitation of individual species of pest aphids should be investigated in connection with the other components of the natural enemies complex.

Effectiveness: The parasite effectiveness under normal conditions is influenced by a large number of factors:

A) Host and parasite population densities. The parasite population density with the highest percentage of infestation of the host, but with a low percentage of superparasitism, can be considered optimal.

B) Host and parasite fecundity. The parasite fecundity should be high sufficiently to control the increase in the host population. The parasitic species killing the host before it starts reproducing are of special value.

C) Presence of certain host instars. Each parasitic species prefers a certain host instar; usually lower instars are attacked, quaranteeing that the parasite completes its development before the host dies in a natural way. If these suitable instars are lacking the eggs are laid e.g. in adult hosts too, which die before the parasite reaches maturity.

D) Host and parasite behaviour. Each host's behaviour is of special type, to which the parasite must conform. It depends on the ecological plasti-

city of the parasite to what degree it is able to conform to less suitable hosts, and thus multiply the range of hosts (see food specificity).

E) Food sources of adult parasites. This problem has not been solved yet in the aphidiids. For the time being it seems probable that the adult aphidiids feed on the honey-dew of aphids, i.e. the source of food is found at the same place as the host.

F) The opportunity of both sexes to meet (see food-specif.)

G) The presence of foci. The proximity of foci from which the parasites can disperse on new lands often changed by human activity (see 6).

H) Activity of the natural enemies. Under certain conditions the natural enemies, especially the secondary parasites of aphids, are able to keep down the primary parasite population density and thus check its outbreak.

I) Abiotic factors (temperature, humidity, rainfall). Environmental requirements are conditioned specifically.

Control.

Before a certain species is used in the biological control of some aphid species, it is necessary to evaluate *a*) the parasite after laboratory and semi-field experiments, *b*) the host, *c*) the environmental conditions where the parasite is to be established, *d*) native parasite effectiveness, etc., inter-specific competition among the parasites.

Mass rearing. For the laboratory breeding of aphids and parasites silon cages are most suitable. As the laboratory work is restricted to artificial light, the aphids (and their parasite complex) than can be reared on beans, corn, onion, potatoes, pea, etc. are suitable. Regarding the life cycle of the aphids a long daylight period is necessary (usually 18 hours). Honey or agar with honey is the best food for the adult parasites. For mass rearing a well-adapted, aired, sprinkled and illuminated glass-house is most suitable.

Mass collection. The emerged adults may be captured by aspirator-suction collector. The captured adult parasites are stored in big plastic bottles covered with silon texture, or in smaller silon cages in a cool place to slow down their mobility. Food supply (honey) and spraying are necessary.

Storage during the transport. The parasites are transferred to the field in the before mentioned bottles. They are liberated at good weather. Apart from the adult parasites introduction of the mummified and living infested aphids from the laboratory breedings is recommendable, so that the parasites occur for the longest time possible before their initial establishment.

Selection of localities for the initial establishment. When localities for the initial establishment are selected, the parasite should be introduced into more or less natural habitat as well as into the new environment, e.g. cultivated (field) areas (see food specificity). Analysis of the environment structure of aphidofauna (secondary hosts), etc. is necessary. During the initial establishment the parasite effectiveness and factors influencing it are observed as well as the rate of dispersion, hibernation in the natural and cultivated habitat, infestation of the secondary hosts, etc.

II. TAXONOMIC PART

13. Specific criteria

The problems of specific classification in entomophagous parasites are more difficult than in phytophagous insects, as there is a very important factor — the host.

The aphidiids represent a suitable group for the study of specific development, as they include aphid parasites exclusively and, therefore, the specific development is not distorted by the influence of hosts that belong to various insects orders as in some other groups of entomophagous parasites.

The historical literature on the *Aphidiidae* was based on morphological criteria of the species. Nowadays the classification of biological species is necessary. Such a classification requires:

A) In the host.

1. General knowledge of the group. It is important under which conditions the host group developed in the past, which groups were probably ancestors or which are at least at present archaic or progressive. The knowledge of different groups and factors that led to inhabiting of new landscapes and habitats is necessary.

2. Requirements on the environment. Aphids have various requirements on the environment. Some groups are mostly hygro- or mesophilic, other are xerophilic, other change types of habitats due to their life-cycle throughout the season. This is also rather important for the development of their parasite-complexes.

3. Distribution. It is in close connection with the requirements of aphids on the environment. Quite a number of aphids, especially of pests, is distributed nowadays also in other districts or areas due to the economic activity of man; they spread therefore in territories where they may be infested by other parasite complexes.

4. Main morpho-ecological types. Although aphids are a homogeneous group, there exists quite a number of morpho-ecological types important for the parasite specificity (gall producing aphids, root aphids, aphids living in dense colonies, aphids producing strong wax covers, etc.).

5. Bionomics. General features of the main aphid groups are necessary.

6. Behaviour. The type of behaviour is also important. There are some mobile aphids, escaping the female parasites by falling down from the plant or applying defensive reactions or movements; or there are aphid species rather slow in movements, nearly without any defensive reactions, etc. Mostly the parasites are specialized on the host behaviour.

B) In the parasite:

In general we must begin from:

1. General line of development of a higher taxonomic group (superfamily, etc.). Both the host and parasite groups have in general different lines of development, and the specific development has been influenced by quite a number of factors besides the host x parasite relationship.

2. General rule influencing the host specificity. Judging from our studies the host specificity is determined by a number of factors (see 8).

3. The main morpho-ecological types. In quite a number of cases there exists distinct morphological adaptation in the parasites, enabling easier host infestation. They have often convergent character. Similarly, they can also conform to the infestation of a certain host instar, etc.

4. Behaviour. There is a distinct adaptation to the host behaviour in the parasite.

Classifying a parasite species we must consider the complex of the following items in the range of all the area of specific distribution, which must be based on a large series of material reared. The reared material enable e.g. to ascertain the existence of females and males, etc. Similarly, the knowledge of the world group is also necessary, at least in the main features.

A) Morphology. Knowledge of the variation range and importance of different characters in the frame of all groups. The same character is often of different values in different genera and species.

B) Development. According to the rate of development some species can be distinguished.

C) Behaviour. The parasite behaviour is very important when studied isolately. E.g. oviposition behaviour is typical.

D) Rauge of food specificity (see 8).

E) Relation to environment. In general the habitats of the *Aphidiidae* may be divided (and subdivided) into *a*) forest, *b*) steppe, *c*) desert. The requirements on the environment must be classified on the basis of data of all the area of distribution (Bey-Bienko 's rule of habitat-change).

14. Key to the European genera and subgenera (♀♀)

(* = established in Italy)

1	Apterous	see: *Diaeretellus* Stary'
–	Wings fully developed	2
2(1)	Median vein developed throughout, separating radial cell 1 from median cell (Fig. 3, 21)	3
–	Median vein effaced frontally or entirely, radial cell 1 and median cell 1 confluent; venation often reduced behind basal vein (Fig. 11, 14) .	6

3(2) Interradial veins effaced (Fig. 21) 4

– Both interradial veins developed (Fig. 3) 5

4(3) Propodeum smooth. Ovipositor sheaths sparsely haired (Fig. 5). Pupation under parasitised aphid in a separate cocoon. Distr.: Pal. Nea. . . . . * **Praon** Haliday

– Propodeum more or less distinclty areolated. Ovipositor sheaths densely haired (Fig. 16). Pupation inside parasitised aphid-Distr.: Europe . . . . * **Areopraon** Mackauer

5(4) Ovipositor sheaths and ovipositor straight or slightly curved upwards. Antennae 11-segmented. Abdomen lanceolate. Pupation inside mummified aphid. Distr.: Pal., Nea., Aeth. . . . . * **Ephedrus** Haliday

– Propodeum smooth, areolated. Ovipositor sheaths comparatively narrow and long, only gradually directly narrowing to the apex; with sparse hairs; apex of sheaths nearly angular or rounded (Fig. 32). Distr.: Pal., Nea., Arth., ... * **Ephedrus** s. str.

– Propodeum coarsely, irregularly and deeply rugose; carinae elevated and often relatively indistinct. Ovipositor sheaths very wide, in the proximal third relatively directly and strongly narrowing to the apex; slightly curved upwards, all surface densely haired, bluntly pointed at apex (Fig. 19). Distr.: Europe, Far East . . . . . **Lysephedrus** Stary'

– Ovipositor sheaths curved downwards, rather broadened, deltoid and trifid at extremity (Fig. 17). Ovipositor curved downwards. Antennae 18-segmented. Abdomen rounded. Pupation inside mummified aphid. Distr.: Europe. . . . . **Toxares** Haliday

6(2) Radial and median cells confluent, distinctly completed by 2nd interradial vein along their external margin (2nd interradial vein sometimes nearly colourless but distinct) (Fig. 11, 24) 7

– Radial and median cells confluent, open, not completed by interradial vein 2 along their external margin (Fig. 18, 20) 14

7(6) Pterostigmal cell distinctly complete. Eyes small. Antennae moniliform. Notaulices distinct at base as slight rugosities. Propodeum smooth. Abdomen rounded. Tergite 1 transverse. Distr.: Europe . . **Aclitus** Förster

– Pterostigmal cell distinctly incomplete 8

8(7) Confluent radial and median cells distinctly separated on lower margin by intermedian + median veins (Fig. 11) 9

– Confluent radial and median cells on the lower margin open - the rest of median vein visible only under the 2nd interradial vein (Fig. 24) . . 13

9(8) Abdominal segments beginning with the 4th remarkably tubiform and telescopic (Fig. 36). Pupation inside mummified aphid. Distr.: Europe, Far East . . . . . * **Protaphidius** Ashm.

– Abdominal segments of normal shape, abdomen lanceolate or rounded . 10

10(9) Ovipositor sheaths slightly curved upwards (Fig. 22) 11

– Ovipositor sheaths curved downwards, ploughshare-shaped (Fig. 8), or slender, gradually narrowing to the apex (Fig. 28). (Note: Wing venation variable). Pupation inside mummified aphid. Distr.: Pal., Nea. . . . . * **Monoctonus** Haliday

– Propodeum distinctly areolated, with central areola (Fig. 2). Ovipositor sheaths stout, ploughshare-shaped, or slender, gradually narrowing to the apex . . . . . b

– Propodeum with 2 divergent carinae in the lower part (Fig. 4). Ovipositor sheaths slender, gradually narrowing to the apex. Distr.: Europe . **Paramonoctonus** Stary'

b(a) Ovipositor sheaths stout, ploughshare-shaped. Distr.: Pal., Nea. . . * **Monoctonus** s. str.

– Ovipositor sheaths slender, gradually narrowing to the apex. Distr.: Europe . . . . . **Falciconus** Mackauer

11(10) Carinae on propodeum forming large wide pentagonal areola (sometimes poorly visible in the longitudinal part) (Fig. 27) 12

– Carinae on propodeum forming very narrow, small, central areola (Fig. 9). Pupation inside mummified aphid. Distr.: Almost cosmop. . . . . * **Aphidius** Nees

12(11) Tergite 7 with small tubiform prong at base (Fig. 31). Pupation inside parasitised aphid. Distr.: Europe . . . **Metaphidius** Stary' and Sedlag

– Tergite 7 without small tubiform prong at base. Pupation inside parasitised aphid. Distr.: Pal., Nea., Orient. . . . . * **Pauesia** Quilis M.P.

13(8) Tergite 1 with more or less developed central tubercle only, without central carina or coarse rugosities. Tentorio-ocular l. almost or equal to intertentorial line. Propodeum smooth or with 2 short divergent carinae in lower part. Anterior prong of valvulae 2 normal. Pupation inside mummified aphid. Distr.: Almost cosmop. . . . . * **Lysiphlebus** Förster

– Tergite 1 with more or less distinct central carina, more or less rugose. Tentorio-ocular l. distinctly shorter than intertentorial l., usually as 1/3. Anterior prong of valvulae 2 large and appearing flat from side (Fig. 33). Pupation inside mummified aphid. Distr.: Europe, Nea., Neotr. . . . . **Lysaphidus** C. F. Smith

14(6) Radial vein pointlike (Fig. 15). Pterostigma large, triangular, strongly sclerotized. Legs stout. Pupation inside mummified aphid. Distr.: Europe, Far East . . . . . **Paralipsis** Förster

– Radial vein distinctly developed, always longer, never pointlike. Legs normal 15

15(14) Ovipositor sheaths curved downwards, terminal abdominal sternite sometimes with 2 prongs (Fig. 35, 13) 16

– Ovipositor sheaths straight or slightly curved upwards, terminal abdominal sternite without posterior prongs 19

16(15) Terminal abdominal sternite with 2 prongs (Fig. 35) . . * **Trioxys** Haliday

a Tergite 1 with primary (= spiracular) and secondary tubercles, the latter being sometimes poorly visible because nearly fused with primary tubercles (Fig. 26) . . . . . * **Binodoxys** Mackauer

– Tergite 1 with primary tubercles only (Fig. 23) . . . . . b

b(a) Prongs curved beyond the centre, with some at base dilated spines at apex (Fig. 10). Tergite 1 almost parallelsided, primary tubercles almost invisible. Distr.: Europe . . . . . **Betuloxys** Mackauer .

– Prongs slightly curved to nearly straight (Fig. 37, 38) c

c(b) Primary tubercles situated at the first third (Fig. 23). Prongs of variable length. Ovipositor sheaths normal, apical hairs normal or dilated at the base. Distr.: Pal., Nea., Neotr., Orient. . . * **Trioxys** s. str.

– Primary tubercles situated near the half of the tergite (Fig. 34). Prongs remarkably long, without apical hairs. Ovipositor sheaths rather long, with stout brush-like bristles at the inner side (Fig. 38). Distr.: Europe . **Pectoxys** Mackauer

– Terminal abdominal sternite without prongs 17

17(16) Radial vein longer than 2/3 of its possible length so that pterostigmal cell nearly complete (Fig. 25). Ovipositor sheaths slightly curved downwards, their upper part more strongly sclerotized (Fig. 13). Pupation inside mummified aphid. Distr.: Europe, Far East . . . * **Lipolexis** Förster

– Radial cell never longer than 2/3 of its possible length; pterostigmal cell distinctly incomplete (Fig. 18, 20). Ovipositor sheaths slightly curved downwards, more or less ploughshare-shaped (Fig. 8) or clawed (Fig. 30) or slender (Fig. 28) 18

18(17) Tergite 1 always longer than wide at spiracles. Ovipositor sheaths triangular, ploughshare-shaped (Fig. 8) or slender, gradually narrowing to the apex (Fig. 28) . . . . . see: **Monoctonus** Haliday

– Tergite 1 square (Fig. 12). Ovipositor sheaths triangular, clawed (Fig. 30). Pupation inside mummified aphid. Distr.: Europe, C. Asia . . . . . * **Monoctonia** Stary'

19(15) Notaulices entirely effaced. Propodeum with more or less distinct wide central areola (Fig. 14). Pupation inside mummified aphid. Distr.: Europe, Far East . . . . . * **Diaeretus** Förster

– Notaulices at least at the base distinct 20

20(19) Propodeum distinctly areolated, with small central areola 21

– Propodeum smooth or with 2 divergent carinae in the lower part . . . . see: **Lysiphlebus** Förster

21(20) Head nearly square (Fig. 7). Notaulices deep and distinct throughout. Pupation under parasitised aphid in a separate cocoon. Distr.: Europe . **Dyscritulus** Hincks

– Head transverse. Notaulices more or less deep but distinct at the ascedent part only 22

22(21) Intermedian vein (fused with part of median vein entirely effaced) (Fig. 20). Pupation inside mummified aphid. Distr.: cosmop. . . * **Diaeretiella** Stary'

– Intermedian vein (fused with part of median vein) distinct, somewhat less coloured than the radial vein. Pupation inside mummified aphid. Sometimes females wingless. Distr.: Europe . . . **Diaeretellus** Stary'

Genera not included in the key: **Calaphidius** Mackauer, **Harkeria** Cameron, **Tanytrichophorus** Mackauer.

15. Faunistic review of the Italian Aphidiidae

This is an original elaboration of material either deposited in various collections (on the collection of Istituto di Entomologia della Università, Torino, namely) or collected by the author during the trip. Records on general distribution, habitat, host specificity of various species are original and generalized on the basis of Central European material mostly. The results

of our Italian trip are presented separately, representing an addition to the ecological characteristics of parasite species.

Abbreviations of Italian districts: Piem. = Piemonte, Lig. = Liguria, Ven. = Veneto, Emi. = Emilia, Tosc. = Toscana, Lat. = env. Roma, Bas. = Basilicata, Pugl. = Puglia, Cal. = Calabria, Sic. = Sicilia.

Genus: Ephedrus Haliday.

E. campestris Stary'.

Gen. distribution: Europe, Transcaucasia, Far East.

Habitat: Steppe, in a lesser degree wood-steppe. It occurs in cultured steppe areas of Central Europe, namely in meadows, waste places. Italy: Meadows, waste places, valleys of rivers (Sicily).

Host-specificity: Parasite of *Dactynotus*, *Macrosiphoniella*-species.

Hosts and localities in Italy: *Dactynotus inulae* (Ferr.): Sic. - Balestrate (Palermo) VI.1963, on Inula viscosa, river valley (Stary'). *Dactynotus jaceae* (L.): Piem. - Brusnengo (Vercelli) VI.1963, on Centaurea jacea, meadow (Stary'). *Pyrethromyzus sanborni* (Gill.): Ve. - Fusina (Venezia) 5.X.1933, on Aster tripolium (Goidanich).

E. nacheri Quilis M.P.

Gen. distribution: Europe (Czechoslovakia, Italy).

Habitat: Steppe type, meadows, waste places. Italy: waste places on sea-shore.

Host-specificity: A parasite of some gall-producing aphid species (*Hayhurstia*, *Cryptosiphum*).

Hosts and localities in Italy: *Hayhurstia atriplicis* (L.): Cal. Rossano (Cosenza) VI.1963, on sea-shore, waste place (Stary').

E. persicae Froggatt.

Gen. distribution: Europe, N. Africa, Central Asia, Asia Minor, Far East, Nearctic reg., S. Africa, Madagascar, Australia.

Habitat: Forest type; orchards, parks, mixed and deciduous woods, shrubs in fields. Italy: Shrubs near roads, sea-shore, valleys of rivers (Sicily), orchards.

Host-specificity: A typical parasite of leaf-curling and gall-producing aphids namely (*Anuraphidina*, *Myzina*, etc.).

Hosts and localities in Italy: *Brachycaudus* sp.: Piem. - Torino VI.1963, on Prunus sp., Shrubs near a road (Stary'). *Brachyunguis* sp.: Lig. - Ventimiglia VI.1963, on Tamarix sp., shrubs on sea-shore (Stary'). Cal. - Reggio Calabria VI.1963, on Tamarix sp., river valley (Stary'). Sic. - Balestrate (Palermo) VI.1963, on Tamarix sp., river valley (Stary'). *Dysaphis sorbi* (Kalt.): Piem. - Alpinia, env. Lago Maggiore, VI.1963, on Sorbus aucuparia,

Botanic garden (Stary'). *Dysaphis* spp.: Tosc. - Pisa VI.1963, on Malus silvestris, garden (Stary'). *Myzus cerasi* (F): Piem. - Morghengo (Novara) VI.1963, on Prunus cerasus, orchard (Stary').

E. plagiator (Nees).

Gen. distribution: Pal. region.

Habitat: Mostly in forest-type habitats, orchards, gardens, shrubs in fields, borders of mixed and deciduous woods, in a lesser degree in steppe-type habitats. Italy: Forest meadows, shrubs, orchards.

Host-specificity: A widely specialized species. As the main hosts *Aphis*, *Brachycaudus*, *Ceruraphis*, *Dysaphis*, *Myzus*, *Hyalopterus*, *Hyperomyzus*, *Macrosiphum*, *Rhopalosiphum*, *Sitobium*-species may be mentioned.

Hosts and localities in Italy: *Aphis fabae* Scop.: Cal. - Sant'Elia (Catanzaro) VI.1963, on Papaver sp., field and meadow in Aesculus-wood (Stary'). *Hyadaphis foeniculi* (Fonsc.): Lig. - Triora (Imperia) VI.1963, on Lonicera implexa, hillside, shrubs (Stary'). *Hyalopterus pruni* (Geoffr.): Piem. - Caluso 3.V.1953 (Goidanich). *Sitobion avenae* (F): Cal. - Sant'Elia (Catanzaro) VI.1963, on Avena sativa v. barbata, field in a wood (Stary').

Genus: Areopraon Mackauer

A. lepelleyi (Waterston).

Gen. distribution: Europe (Sweden, England, Italy, Czechoslovakia, Germany).

Habitat: Forest-type, mixed and deciduous woods, orchards, parks. Italy: Mixed wood.

Host-specificity: A typical parasite of *Schizoneura*-species causing galls (Ulmus).

Hosts and localities in Italy: *Schizoneura lanuginosa* Htg.: Lig. - Pieve di Teco (Imperia) VI.1963, on Ulmus sp., mixed wood (Stary').

Genus: Praon Haliday

P. abjectum (Haliday).

Gen. distribution: Europe, Asia Minor.

Habitat: Forest and intermediary type; borders of mixed and deciduous woods, shrubs in fields, parks, orchards. Italy: Shrubs in vineyards.

Host-specificity: A parasite of *Aphis*-species and some allied genera (*Rhopalosiphum*) in forest type habitats.

Hosts and localities in Italy: *Aphis fabae* Scop.: Sic. - Puntalazzo (Mt. Etna) VI.1963, on Evonymus europaea, shrubs in vineyards (Stary').

P. dorsale (Haliday).

Gen. distribution: Europe, C. Asia.

Habitat: Steppe type, meadows, waste places, fields-alfalfa, etc. Italy: Fields (alfalfa), steppe, sea-shore waste places.

Host-specificity: A typical parasite of *Dactynotus*-species, into a lower degree it parasitizes also other aphid genera (*Acyrthosiphon*, *Megoura*).

Hosts and localities in Italy: *Acyrthosiphon pisum* (Harris): Tosc. - La Rotta (Pisa) VI.1963, on Medicago sativa, field (Stary). *Dactynotus carthami* HRL.: Sic. Ventimiglia di Sicilia (Palermo) VI.1963, on Carthamus lanatus, steppe (Stary'). Villa Fassini, env. Terrasini, VI.1963, on Carthamus lanatus, steppe (Stary'). *Dactynotus jaceae* (L.): Sic. - Caronia Marina (Messina) VI.1963, on Centaurea sphaerocephala, sea-shore waste places (Stary').

P. exoletum (Nees).

Gen. distribution: Europe, Asia Minor, Central Asia (introduced also in Nearctic region).

Habitat: Steppe type; it occurs commonly in alfalfa fields, in roadsides, pathways, waste places, where Melilotus and alfalfa may be found. Italy: Alfalfa fields.

Host-specificity: A specialized parasite of *Therioaphis*-species.

Hosts and localities in Italy: *Therioaphis medicaginis*: Cal. - Davoli (Catanzaro) VI.1963, on Medicago sativa, alfalfa (Stary').

P. volucre (Haliday).

Gen. distribution: Europe, Asia Minor, Central Asia.

Habitat: It occurs mostly in forest type and intermediate habitats, nevertheless it may be found also in steppe habitats, being a comparatively eurytopic species. Italy: Parks, gardens, sands on sea-shore, orchards, meadows, growth along irrigating ditches, waste places, fields.

Host-specificity: A widely specialized species, parasitizing a number of various aphid groups.

Hosts and localities in Italy: *Aphis pomi* Deg.: Lat. - Roma VI.1963, on Crataegus sp., park (Stary'). *Aphis* sp.; Lig. - Grimaldi (Ventimiglia) VI.1963, on Lavatera cretica, garden (Stary'). *Aulacorthum geranii* (Kalt.): Sic. - Balestrate (Palermo) VI.1963, on Erodium botrys, sands (Stary'). Ventimiglia di Sicilia (Palermo) VI.1963, on Erodium malacoides, undergrowth of an orchard (Stary). *Dactynotus jaceae* (L): Piem. - Brusnengo (Vercelli) VI.1963, on Centaurea jacea, meadow (Stary'). *Dactynotus* sp.: Sic. - Taormina VI.1963, on Reichardia picroides, sea-shore (Stary'). *Hyalopterus amygdali* (Blanch): Bas. - Policoro (Matera) VI.1963, on Prunus persica, orchard (Stary'). *Hyalopterus pruni* (Geoffr.): Piem. - Val della Torre (Torino) VI.1963, on Prunus domestica, orchard (Stary'). Lig. - Pieve di Teco (Imperia) VI.1963, on Prunus spinosa, shrubs near an orchard (Stary'). Pugl. - Taranto VI.1963, on Phragmites communis, growth along irrigating ditch

(Stary). Cal. - Reggio Calabria VI.1963, on Prunus sp., orchard (Stary'). *Hyperomyzus lactucae* (L): Sic. - Caronia Marina (Messina) VI.1963, on Sonchus oleraceus, sea-shore waste places (Stary'). *Hyperomyzus* sp.: Tosc. - Firenze, Giardino di Boboli, VI.1963, on Sonchus sp., park (Stary'). Sic. - Ventimiglia di Sicilia (Palermo) VI.1963, on Sonchus sp., waste place (Stary'). *Macrosiphon rosae* (L.): Pugl. - Taranto, VI. 1963, on Rosa sp., garden (Stary'). Sic. - Cesarò (Messina) VI 1963, on Rosa sp , pasture meadows, submountain deciduous woods (Stary'). *Macrosiphon solanifolii* (Ashm.): Sic. - Castellammare del Golfo (Trapani) VI.1963, on Ecbalium elaterium, sea-shore steppe (Stary'). *Sitobion avenae* (F.): Tosc. - La Rotta (Pisa) VI.1963, on Avena sativa, field (Stary'). Pisa VI.1963, on Poaceae (Stary'). Firenze, Giardino di Boboli VI.1963, on Avena sativa, park (Stary'). Montelupo Fiorentino VI.1963, on Triticum vulgare, field (Stary'). Cal. - Sant'Elia (Catanzaro) VI.1963, on Avena sativa, field (Stary').

Genus: Protaphidius Ashmead

P. wissmannii (Ratz.).

Gen. distribution: Europe.

Habitat: Forest type-parks, mixed and deciduous woods. Italy: Parks, growth along irrigating ditches, deciduous woods.

Host-specificity: A specialized parasite of *Stomaphis*-species.

Hosts and localities in Italy: *Stomaphis* spp.: Piem. - Valli di Lanzo, Cantoira (Torino) 15.VII.1959, 4.VIII.1958, on Acer sp. (Goidanich). Valle della Dora Riparia, Bussoleno (Torino) 15.VI.1958, on Populus sp. (Goidanich). Caluso 1.XI.1957, on Quercus sp. (Goidanich). Caluso 15.IX.1958, on Acer sp. (Goidanich). Colline Torinesi, Val S. Martino 2.V.1959, on Acer sp. (Goidanich). Colline Torinesi, Pino 14.VII.1959, on Salix sp. (Goidanich). Ven. - Oriago (Venezia) VI.1963, on Salix viminalis, irrigating ditch (Stary').

Genus: Pauesia Quilis M.P.

P. abietis (Marshall).

Gen. distribution: Europe.

Habitat: Forest type (coniferous and mixed woods). Italy: Coniferous woods.

Host-specificity: A parasite of *Cinara*-species.

Hosts and localities in Italy: *Cinara* sp.: Piem. - Gran Paradiso, Valsavaranche 17.VI.1959, on Larix sp. (Goidanich). Gran Paradiso, Livionaz 17.VI.1958, on Larix sp. (Goidanich). Valli di Lanzo, Forno (Torino) 13.IX.1957, on Pinus sp. (Goidanich).

P. alpina n. sp.

Gen. distribution: Europe (N. Italy).

Habitat: Italy: Coniferous woods.

Host-specificity: A parasite of *Cinara*-species.

Hosts and localities in Italy: *Cinara* sp.: Piem. - Gran Paradiso, Tignet 23-VII-1958, on Larix sp. (Goidanich).

P. goidanichi n. sp.

Gen. distribution: Europe (N. Italy).

Habitat: Coniferous woods, pasture meadows (mountains).

Host-specificity: A parasite of *Cupressobium*-species.

Hosts and localities in Italy: *Cupressobium* spp.: Piem. - Gran Paradiso, Livionaz 13.VIII.1958, on Juniperus sp. (Goidanich). Gran Paradiso, Tignet 30.X.1958, on Juniperus sp. (Goidanich). Valle della Dora Riparia, dint. Ulzio 8.X.1957, on Juniperus sp. (Goidanich). Dint. Giaveno (Torino) 26.IV.1957, on Juniperus sp. (Goidanich). Ternavasso, dint. Torino, 8.IV.1957, on Juniperus sp. (Goidanich). Ven. - Monte Pastello (Verona) 1.V.1957, on Juniperus sp. (Goidanich). Tosc. - Pratolino (Firenze) 18.IX.1957, on Juniperus sp. (Goidanich).

P. juniperorum (Stary').

Gen. distribution: Europe (Czechoslovakia, N. Italy).

Habitat: Submontain and mountain meadows and pasture meadows with Juniperus - sp. Italy: Mountain coniferous woods and pasture meadows.

Host-specificity: A specialized parasite of *Cupressobium*-species.

Hosts and localities in Italy: *Cupressobium* sp.: Ven. - Monte Pastello (Verona) 1.V.1957, on Juniperus sp. (Goidanich).

P. laricis (Haliday).

Gen. distribution: Europe.

Habitat: Coniferous and mixed woods. Italy: Coniferous woods.

Hosts and localities in Italy: *Cinara* sp.: Piem. - Meana (Torino 8.IV.1959, on Pinus sp. (Goidanich). Dint. Giaveno (Torino) 26.IV.1957, on Pinus sp. (Goidanich).

P. media n. sp.

Gen. distribution: Europe (N. Italy).

Habitat: Italy: Mountain coniferous woods (Juniperus).

Host-specificity: Probably a specialized parasite of *Cupressobium*-species.

Hosts and localities in Italy: *Cupressobium* sp.: Piem. - Gran Paradiso, Tignet 24.VII.1957 (Goidanich).

P. montana n. sp.

Gen. distribution: Europe (N. Italy).

Habitat: Italy: Coniferous woods.

Host-specificity: Probably a specialized parasite of *Todolachnus*-species.

Hosts and localities in Italy: *Todolachnus* sp.: Piem. - Valli di Lanzo, Forno (Torino) VIII.1958 (Goidanich).

P. pini (Haliday).

Gen. distribution: Europe, Far East.

Habitat: Forest type (coniferous and mixed woods). Italy: Coniferous woods.

Host-specificity: A parasite of *Cinara*-species.

Hosts and localities in Italy: *Cinara* spp.: Tosc. - Pratolino (Firenze) 18.IX.1957, on Pinus sp. (Goidanich).

P. rufiabdominalis n. sp.

Gen. distribution: Europe (Italy).

Habitat: Italy: Forest type (coniferous and mixed woods).

Host-specificity: A parasite of *Cinara*-species.

Host and localities in Italy: *Cinara* spp.: Tosc. - Pratolino (Firenze) 18.IX.1957, on Pinus sp. (Goidanich).

P. silvestris (Stary').

Gen. distribution: Europe (Czechoslovakia, Italy).

Habitat: Forest type (coniferous and mixed woods). Italy: Pine woods on sea-shore (Sicily), macchia shrubs.

Host-specificity: A parasite of *Cinara*-species.

Hosts and localities in Italy: *Cinara excelsae* HRL.: Lig. - San Giacomo (Sanremo) VI.1963, on Pinus maritima, sea-shore sands (Stary'). Sic. - Balestrate (Palermo) VI.1963, on Pinus pineopinaster, seashore sands, (Stary'). *Cinara pini* (L): Lig. - Noli (Savona) VI.1963, on Pinus halepensis - macchia shrubs (Stary'). *Cinara* spp.: Piem. - Valle della Dora Riparia, Salabertano (Torino) 8.X.1957, on Pinus sp. (Goidanich).

P. similis n. sp.

Gen. distribution: Europe (Italy).

Habitat: Italy: Forest type (coniferous woods).

Host-specificity: A parasite of *Cinara*-species.

Hosts and localities in Italy: *Cinara* sp.: Piem. - Gran Paradiso, Livionaz 13.VIII.1958, on Pinus sp. (Goidanich). Valle della Dora Riparia, dint. Ulzio, 21.V.1958, on Larix sp. (Goidanich).

P. unilachni (Gahan).

Gen. distribution: Europe, S. China, Taiwan, S. Korea, Africa-Congo.

Habitat: Forest type (coniferous and mixed woods). Italy: Coniferous woods.

Host-specificity: A specialized parasite of the *Schizolachnini*.

Hosts and localities in Italy: *Schizolachnus* sp.: Piem. - Val Chisone, Pra Martino (Torino) 28.III.1957, on Pinus sp. (Goidanich).

Genus: Diaeretus Förster

D. leucopterus (Haliday).

Gen. distribution: Europe, Far East.

Habitat: Forest type (coniferous and mixed woods). Italy: Coniferous (pine) woods.

Host-specificity: A specialized parasite of *Protolachnus*-species.

Hosts and localities in Italy: *Protolachnus* sp.: Tosc. - Pisa VI.1963, on Pinus pinaster, pine wood (Stary').

Genus: Aphidius Nees

A. absinthii Marsh.

Gen. distribution: Europe, C. Asia, Transcaucasia, S. Korea, Japan, Taiwan.

Habitat: Steppe; in cultivated areas in meadows, waste places, Italy: Meadows, waste places.

Host-specificity: A specialized parasite of *Macrosiphoniella*-species.

Hosts and localities in Italy: *Macrosiphoniella absinthii* (L): Lig. - Triora (Imperia) VI.1963, on Artemisia absinthium, meadow (Stary'). *Macrosiphoniella artemisiae* (B.d.F.): Piem. - Novara VI.1963, on Artemisia vulgaris, waste place (Stary'). Ven. - Oriago (Venezia) VI.1963, on Artemisia vulgaris, waste place (Stary'). *Pyrethromyzus sanborni* (Gill.): Ven. - Fusina (Venezia) 5.X.1953, on Aster tripolium (Goidanich).

A. avenae Haliday.

Gen. distribution: Europe, N. Africa, Asia Minor.

Habitat: Steppe, in cultivated areas in corn fields, meadows, waste places. Italy: Corn fields, meadows, waste places.

Host-specificity: A typical parasite of *Sitobium*-species on Gramineae.

Hosts and localities in Italy: *Sitobion avenae* (F.): Piem. - Valle della Dora Riparia, Salice d'Ulzio (Torino) 1800 m, 5.VII.1939, on Trisetum flavescens (Goidanich). Stupinigi, dint. Torino, 9.VI.1939, on Lolium italicum (Goidanich). Tosc. - Pisa VI.1963, on Poaceae, garden (Stary'). Pisa VI.1963, on Avena sativa v. barbata, waste place near a garden (Stary'). La Rotta (Pisa) VI.1963, on Avena sativa v. barbata, meadow (Stary'). Montelupo-Lastra (Firenze) VI.1963, on Triticum vulgare, field (Stary'). Cal. - Sant'Elia (Catanzaro) VI.1963, on Avena sativa v. barbata, field (Stary'). Bas. - Policoro (Matera) VI.1963, on Avena sativa v. barbata, undergrowth in an orchard (Stary'). Sic. - Catania VI.1963, on Avena sativa v. barbata, garden (Stary'). Ventimiglia di Sicilia (Palermo) VI.1963, on Avena sativa v. barbata, sea-shore (Stary'). Acireale VI.1963, on Avena sativa v. barbata, garden (Stary').

A. ervi Haliday.

Gen. distribution: Europe, N. Africa, C. Asia, India, introd. into California-USA.

Habitat: Steppe type; in cultivated areas in fields, meadows, waste places. Italy: Alfalfa fields, meadows, gardens.

Host-specificity: A typical parasite of *Acyrthosiphon*-species and allied genera (*Microlophium*).

Hosts and localities in Italy: *Acyrthosiphon pisum* (Harris): Piem. - Stupinigi, dint. Torino, 9.VI.1939, on Medicago sp. (Goidanich). Tosc. - La Rotta (Pisa) VI.1963, on Medicago sativa, field (Stary'). Cal. - Reggio Calabria VI.1963, on Lathyrus silvester, meadow (Stary'). Sic. - Trapani VI.1963, on Medicago sativa, field (Stary'). Puntalazzo (Mt. Etna) VI.1963, on Medicago tribuloides, meadow (Stary'). Acireale VI.1963, on Melilotus albus, garden (Stary'). *Microlophium evansi* (Theo.): Piem. - Lombriasco (Torino) 10.VIII.1962, on Urtica sp. (Goidanich).

A. funebris Mackauer.

Gen. distribution: Europe, N. Africa.

Habitat: Steppe type; in cultivated areas in meadows, gardens, waste places. Italy: Steppe, meadows, waste places, sea-shore.

Host-specificity: A specialized parasite of *Dactynotus*-species.

Hosts and localities in Italy: *Dactynotus carthami* HRL.: Sic. - Villa Fassini, env. Terrasini, VI.1963, on Carthamus lanatus, steppe (Stary'). *Dactynotus cichorii* (Koch): Piem. - Brusnengo (Vercelli) VI.1963, on Cichorium intybus, meadow (Stary'). Ven. - Scaltenigo (Venezia) VI.1963, on Cichoriun intybus, meadow (Stary'). *Dactynotus jaceae* (L.): Piem. - Gignese, env. Lago Maggiore, VI.1963, on Centaurea jacea, meadow (Stary'). Sic. - Caronia Marina (Messina) VI.1963, on Centaurea sphaerocephala, sea-shore, orchards, waste places (Stary'). *Dactynotus sonchi* (L.): Lig. - Ventimiglia VI.1963, on Reichardia picroides, sea-shore (Stary'). Ventim'glia VI.1963, on Sonchus oleraceus, border of a road (Stary'). Sic. - Puntalazzo (Mt. Etna) VI.1963, on Sonchus sp., vineyards-meadows (Stary'). Acireale VI.1963, on Sonchus sp., waste place (Stary'). *Dactynotus* sp.: Piem. - Moncalieri, dint. Torino, 21.VI.1939, on Cichorium intybus (Goidanich). Lig. Ventimiglia VI.1963, on Reichardia picroides, waste place (Stary'). Cal. - Sant'Elia (Catanzaro) VI.1963, on Cirsium sp., waste place (Stary'). Env. Catanzaro VI.1963, on Cynara cardunculus, garden (Stary').

A. hortensis Marshall.

Gen. distribution: Europe, N. America.

Habitat: Forest type (parks, deciduous and mixed woods). Italy: Parks.

Host-specificity: A specialized parasite of *Liosomaphis berberidis* (Kalt.).

Hosts and localities in Italy: *Liosomaphis berberidis* (Kalt.): Piem. - Torino VI.1963, on Berberis vulgaris, park (Stary').

A. matricariae Haliday.

Gen. distribution: Palearctic region, Mearctic and ? Neotropical regions.

Habitat: Steppe type; in a lower degree it occurs also in intermediary and sometimes in forest type habitats too. Italy: Gardens, meadows, fields, parks.

Host-specificity: A parasite of Myzine aphids (*Myzus*, *Myzodes*, *Galiobium*) and some other aphid groups (*Aphis*).

Hosts and localities in Italy: *Aphis* sp.: Lig. - Grimaldi (Ventimiglia) VI.1963, on Lavatera cretica, gardens (Stary'). *Capitophorus* sp.: Pugl. - Taranto VI.1963, on Cynara scolymus, garden (Stary'). *Galiobium langei* Börn.: Piem. - Alba VI.1963, on Galium sp. meadow (Stary'). *Hayhurstia atriplicis* (L.): Lat. - Roma VI.1963, on Chenopodium sp., park (Stary'). *Myzodes persicae* Sulz.: Tosc. - Navacchio (Pisa) VI.1963, on Solanum tuberosum, field (Stary').

A. pascuorum Marshall.

Gen. distribution: Europe.

Habitat: Steppe type; common in fields, Italy: Waste places, gardens.

Host-specificity: A parasite of aphids infesting Gramineae (*Sitobium*, *Rhopalosiphum*, *Metopolophium*).

Hosts and localities in Italy: *Sitobion avenae* (F.): Tosc. - Pisa VI.1963, on Avena sativa v. barbata, waste place (Stary'). Sic. - Catania VI.1963, on Hordeum murinum, garden (Stary').

A. picipes (Nees).

Gen. distribution: Europe.

Habitat: Steppe type; intermediate habitats. Italy: Fields.

Host-specificity: A parasite of *Myzus*-species namely.

Hosts and localities in Italy: Lig. - Noli (Savona) VI.1963, on Solanum tuberosum, fields (Stary').

A. pterocommae Ashmead.

Gen. distribution: Europe, C. Asia, Nearctic region.

Habitat: Forest type; deciduous and mixed woods, orchards, parks. Italy: Gardens, deciduous woods.

Host-specificity: A specialized parasite of *Pterocomma*-species.

Hosts and localities in Italy: *Pterocomma populeum* (Kalt.): Pugl. - Taranto VI.1963, on Populus pyramidalis, garden (Stary). *Pterocomma* spp.: Piem. - Torino 22.VII.1941, on Populus nigra (Goidanich). Torino, Valentino 31.V.1946, on Salix caprea (Goidanich). Torino, Valentino

2.X.1941, on Populus italica (Goidanich). Fenestrelle (Torino) 20.IV.1947, on Salix sp. (Goidanich).

A. rosae Haliday.

Gen. distribution: Europe, N. Africa, Asia, N. America.

Habitat: Forest type; orchards, parks, deciduous woods. Italy: Gardens, parks, woods, orchards.

Host-specificity: A typical parasite of *Macrosiphon rosae* (L.).

Hosts and localities in Italy: *Macrosiphon rosae* (L.): Piem. - Morghengo (Novara) VI.1963, on Rosa sp., garden (Stary'). Lig. - Sanremo VI.1963, on Rosa sp., park (Stary). San Giacomo (Sanremo) VI.1963, on Rosa sp., garden (Stary'). Tosc. - Firenze, Giardino di Boboli VI.1963, on Rosa sp., park (Stary'). Navacchio (Pisa) VI.1963, on Rosa sp., garden (Stary'). Pisa VI.1963, on Rosa sp., garden (Stary'). Sic. - Cesarò (Messina) VI.1963, on Rosa sp., submountain pastures and woods (Stary'). Caronia Marina (Messina) VI.1963, on Rosa sp., sea-shore orchards (Stary'). Catania VI.1963, on Rosa sp., garden (Stary').

A. sonchi Marshall.

Gen. distribution: Europe.

Habitat: Steppe type, especially waste places, long fallow lands. Italy: Gardens.

Host-specificity: A specialized parasite of *Hyperomyzus*- species.

Hosts and localities in Italy: *Hyperomyzus* sp.: Sic. - Catania VI.1963, on Sonchus, garden (Stary').

A. transcaspicus Telenga.

Gen. distribution: S. Europe, C. Asia, Asia Minor.

Habitat: Forest type; orchards, mixed and deciduous woods. Italy: Orchards, sea-shore shrubs.

Host-specificity: A parasite of some *Aphidinae* (*Hyalopterus*, *Rhopalosiphum*).

Hosts and localities in Italy: *Hyalopterus amygdali* (Blanch.): Sic. - Catania VI.1963, on Prunus persica, orchard (Stary'). *Hyalopterus pruni* (Geoffr.): Cal. - Reggio Calabria VI. 1963, on Prunus divaricata, orchard (Stary'). Sic. - Marsala VI. 1963, on Phragmites communis, vineyards (Stary'). Taormina VI. 1963, on Prunus sp., sea-shore orchard (Stary'). *Rhopalosiphum donacis* (Pass.): Lig. - Noli (Savona) VI.1963, on Arundo donax, macchia shrubs (Stary'). Sic. - Taormina VI.1963, on Arundo donax, sea-shore orchards (Stary').

Genus: Diaeretiella Stary'

D. rapae (M'Int.).

Gen. distribution: Almost cosmopolitan.

Habitat: Steppe type; in fields, waste places, meadows. Italy: Waste places, meadows.

Host-specificity: A parasite of *Myzinae* (*Brevicoryne*, *Hayhurstia*, *Myzodes*) and some other aphid groups (*Schizaphis*).

Hosts and localities in Italy: *Brevicoryne brassicae* (L.): Piem. - Caluso 18.V.1953, on Brassica (Goidanich). Lig. - Ventimiglia VI.1963, on Moricandia arvensis, waste place (Stary'). Sic. - Puntalazzo (Mt. Etna) VI.1963, on Brassicaceae, meadow (Stary'). *Schizaphis longicaudata* HRL.: Sic. - Balestrate (Palermo) VI.1963, on Arundo donax, vineyard (Stary').

Genus: Lysiphlebus Förster

L. ambiguus (Haliday).

Gen. distribution: Europe, Transcaucasia, Asia Minor, Central Asia.

Habitat: In Central Europe it occurs in forests and intermediary habitats, in southern areas it occurs in orchards, oases etc. from where it spreads in the neighbourhood. Italy: Olive orchards, gardens, macchia shrubs, undergrowth of orchards, waste places, growth in irrigating ditches, vineyards, parks, oleander alleys, woods, etc.

Host-specificity: A parasite of *Aphis*-species namely.

Hosts and localities in Italy: *Aphis fabae* Scop.: Lig. - Noli (Savona) VI.1963, on Ammi majus, olive orchard (Stary'). Noli (Savona) VI.1963, on Carduus pycnocephalus v. tenuiflorus, macchia shrubs (Stary'). San Giacomo (Sanremo) VI.1963, on Fumaria capreolata, garden (Stary'). San Giacomo (Sanremo) VI.1963, on Rumex sp., garden (Stary'). Bas. - Policoro (Matera) VI.1963, on Chenopodium sp., undergrowth of an orchard (Stary'). Cal. - Rossano (Cosenza) VI.1963, on Amaranthus ascendens, waste place in sea-shore (Stary'). Sic. - Acireale VI.1963, on Chenopodium album, garden (Stary'). *Aphis farinosa* Gmel.: Piem. - Stupinigi, dint. Torino, 4.VII.1941 on Salix purpurea (Goidanich). Alba VI.1963, on Salix sp., vineyard (Stary'). Ven. - Oriago (Venezia) VI.1963, on Salix viminalis, growth in irrigating ditch (Stary'). Emi. - Bologna 17.V.1953, on Salix sp. (Goidanich). *Aphis neoreticulata* Theob.: Sic. - Capo Ali (Messina) VI.1963, on Solanum nigrum, sea-shore (Stary'). *Aphis nerii* (B.d.F.): Lat. - Roma VI.1963, on Nerium oleander park (Stary'). Bas. - Nova Siri Rotondella (Matera) VI.1963, on Nerium oelander, growth on sea-shore: Tamarix, Agave, Arundo donax, etc. (Stary'). Sic. - Termini Imerese (Palermo) VI.1963, on Nerium oelander,

alley (Stary'). Puntalazzo (Mt. Etna) VI.1963, on Nerium oleander, orchard (Stary). *Aphis punicae* (Pass.): Pugl. - Taranto VI.1963, on Punica granatum, orchard (Stary). *Aphis ruborum* Börn.: Sic. - Cesarò (Messina) VI.1963, on Rubus fruticosus, submountain pasture meadows and woods (Stary'). *Aphis sarothamni* (Franssen): Sic. - Ventimiglia di Sicilia (Palermo) VI.1963, on Sarothamnus sp., near an orchard (Stary'). *Aphis* spp.: Lig. - Grimaldi (Ventimiglia) VI.1963, on Torilis arvensis, gardens (Stary'). San Giacomo (Sanremo) VI.1963, on Vicia sativa v. macrocarpa, field in a woods (Stary'). Noli (Savona) VI.1963, on Pittosporum tobira, park (Stary'). Tosc. - Firenze, Giardino di Boboli VI.1963, on Rumex sp., park (Stary'). Bas. - Policoro (Matera) VI.1963, on Liquiricia, orchard (Stary'). Pugl. - Gioia del Colle (Bari) (VI.1963, on Rosmarinus officinalis, hedges in orchard (Stary'). Taranto VI.1963, on Citrullus sp., field (Stary'). Cal. - Sant'Elia (Catanzaro) VI.1963, on Vicia faba, field (Stary'). Sic. - Caronia Marina (Messina) VI.1963, on Astragalus siculus, meadow (Stary'). Caronia Marina (Messina) VI.1963, on Rosmarinus officinalis, sea-shore orchards (Stary'). Acireale VI.1963, on Polygonum lapathifolium, garden (Stary'). Castellamare del Golfo (Trapani) VI.1963, on Daucus carota, garden (Stary'). *Brachycaudus cardui* (L.): Lig. - San Giacomo (Sanremo) VI.1963, on Carduus pycnocephalus, garden (Stary'). Sic. - Taormina VI.1963, on Carduus sp., small woods on sea-shore (Stary'). *Chromaphis juglandicola* (Kalt.): Sic. - Acireale VI.1963, on Juglans regia, orchard (Stary'). *Toxoptera aurantii* (Fonsc.): Sic. - Acireale VI.1963, on Citrus aurantium, garden (Stary').

L. arvicola Stary'.

Gen. distribution: Europe, C. Asia.

Habitat: Steppe type; in cultivated areas in meadows, waste places, roadsides. Italy: Steppe, long fallow lands, sea-shore waste places.

Host-specificity: A parasite of *Sipha*-species.

Hosts and localities in Italy: *Sipha maydis* (Pass.): Lig. - Noli (Savona) VI.1963, on Lolium perenne, Hordeum murinum, Avena sativa v. barbata, steppe-fallow land (Stary'). Sic. - Caronia Marina (Messina) VI.1963, on Avena sativa v. barbata, sea-shore, waste places (Stary'). Catania VI.1963, on Avena sativa v. barbata, garden (Stary'). Balestrate (Palermo) VI.1963, on Agropyrum sp., hill-side, fallow land (Stary'). Balestrate (Palermo) VI.1963, on Avena sativa v. barbata, hill-side, fallow land (Stary').

L. fabarum (Marsh.).

Gen. distribution: Europe, N. Africa, Asia Minor, C. Asia.

Habitat: Steppe habitats; in cultivated areas waste places, fallow lands, fields, meadows, gardens. Italy: Meadows, fields, waste places, gardens, submountain pasture meadows, vineyards, undergrowth of orchards.

Host-specificity: A widely specialized species, its main hosts belonging to the genera *Aphis* and *Brachycaudus*.

Hosts and localities in Italy: *Aphis chloris* (Koch): Lig. - Grimaldi (Ventimiglia) VI.1963, on Hypericum perforatum, teraces (Stary'). *Aphis clematidis* Koch: Lig. - Triora (Imperia) VI.1963, on Clematis vitalba, valley of a stream (Stary'). *Aphis craccivora* Koch: Lig. - San Giacomo (Sanremo) VI.1963, on Centranthus ruber, meadow (Stary'). Cal. - Sant'Elia (Catanzaro) VI.1963, on Trifolium angustifolium field (Stary'). Davoli (Catanzaro) VI.1963, on Medicago sativa, field (Stary'). *Aphis fabae* Scop.: Piem. - Valley of the river Sesia near Carpignano (Novara) VI.1963, on Chenopodium album, waste place (Stary'). Stupinigi (Torino) VI.1963, on Chenopodium album, waste place (Stary'). Lig. - Pieve di Teco (Imperia) VI.1963, on Vicia faba, field (Stary'). Cal. - Sant'Elia (Catanzaro) VI.1963, on Papaver sp., field (Stary'). Sic. - Catania VI.1963, on Chenopodium sp., garden (Stary). *Aphis ruborum* Börn.: Sic. - Acireale (Catania) VI.1963, on Rubus sp., garden (Stary'). Cesarò (Messina) VI.1963, on Rubus sp., submountain pasture meadows (Stary'). *Aphis sarothamni* (Franssen): Lig. - Ventimiglia VI.1963, on Sarothamnus sp., vineyard (Stary'). Sic. - Puntalazzo (Mt. Etna) VI.1963, on Sarothamnus sp., meadow-vineyard (Stary'). Acireale (Catania) VI.1963, on Sarothamnus sp., garden (Stary'). *Aphis umbrellae* Börner: Pugl. - Taranto VI.1963, on Malva silvestris, near a road (Stary'). *Aphis urticata* (F.): Piem. - Stupinigi, Orbassano (Torino) VI.1963, on Urtica dioica, waste place (Stary'). *Aphis* sp.: Piem. - San Mauro, dint. Torino, 27.VII.1946, on Phaseolus sp. (Goidanich). Pugl. - Gioia del Colle (Bari) VI.1963, on Rosmarinus officinalis, along a road (Stary'). Cal. - Davoli, env. Catanzaro VI.1963, on Medicago sativa, field (Stary'). Sant'Elia (Catanzaro) VI.1963, on Vicia faba, field (Stary'). Sic. - Mt. Etna VI.1963, Astragalus siculus, meadows (Stary'). Puntalazzo (Mt. Etna) VI.1963, on Parietaria officinalis, meadows (Stary'). Caronia Marina (Messina) VI.1963, on Lupsia galactites, undergrowth of citrus orchards (Stary'). Acireale VI.1963, on Melilotus albus, garden (Stary'). Ventimiglia di Sicilia (Palermo) VI.1963, on Daucus carota, meadow (Stary'). *Protaphis* sp.: Cal. - Davoli, env. Catanzaro VI.1963, on Artemisia campestris v. variabilis, steppe (Stary').

L. salicaphis (Fitch).

Gen. distribution: Europe, W. Siberia, S. Korea, Nearctic region.
Habitat: Deciduous woods, river banks. Italy: Deciduous woods.
Host-specificity: A specialized parasite of *Chaitophorus*-species.
Hosts and localities in Italy: *Chaitophorus* spp.: Piem. - Colline del Po (Torino) VI.1963, 13.X.1949 (Goidanich). Caluso 28.V.1958 (Goidanich). Torino, Valentino 2.X.1941, on Populus italica (Goidanich).

L. thelaxis Stary'.

Gen. distribution: Europe.
Habitat: Deciduous woods. Italy: Mixed woods.
Host-specificity: A specialized parasite of *Thelaxes*-species.
Hosts and localities in Italy: *Thelaxes dryophila* (Schrk.):

Sic. - Bronte (Mt. Etna) VI.1963, on Quercus pubescens, mixed wood near a vineyard (Stary'). Bosco della Ficuzza (Palermo) VI.1963, on Quercus pubescens, deciduous wood (Stary').

Genus: Monoctonia Stary'

M. pistaciaecola Stary'.

Gen. distribution: S. Europe (Italy), C. Asia, Crimea.

Habitat: Forest type; deciduous woods, shrubs. Italy: Growth along irrigating ditches.

Host-specificity: A parasite of gall-producing aphids (*Forda*, *Pemphigus*).

Hosts and localities in Italy: *Pemphigus* sp.: Sic. - Balestrate (Palermo) VI.1963, on Populus pyramidalis, growth along irrigating ditch (Stary').

Genus: Monoctonus Haliday

M. cerasi (Marshall).

Gen. distribution: Europe.

Habitat: Forest type (orchards, shrubs). Italy: Orchards.

Host-specificity: A parasite of some Rhopalosiphine and Myzine aphids (leaf-curling species).

Hosts and localities in Italy: *Rhopalosiphum oxyacanthae* (Schrk.): Piem. - Caluso 21.VIII.1952 (Goidanich).

Genus: Trioxys Haliday

T. acalephae (Marshall).

Gen. distribution: Palearctic region.

Habitat: A comparatively eurytopic species, probably preferring steppe habitats. Italy: Shrubs, waste places.

Host-specificity: A typical parasite of *Aphis*-species.

Hosts and localities in Italy: *Aphis ruborum* Börn.: Piem. - Torino VI.1963, on Rubus sp., shrubs (Stary'). Stupinigi, Orbassano (Torino) VI.1963, on Urtica dioica, waste place (Stary'). Ven. - Oriago (Venezia) VI.1963, on Urtica dioica, waste place (Stary').

T. angelicae (Haliday).

Gen. distribution: Europe, Asia Minor.

Habitat: Forest type; borders of woods, parks, orchards, sometimes it spreads in the neighbourhood. Itlay: Parks, shrubs, orchards.

Host-specificity: The main hosts belong to the genus *Aphis*, but it parasitizes also a number of other aphid groups (*Ceruraphis*, *Dysaphis*, *Myzodes*, *Brachycaudus*).

Hosts and localities in Italy: *Aphis fabae* Scop.: Piem. - Torino VI.1963, on Philadelphus coronarius, park (Stary'). Val della Torre (Torino VI.1963, on Evonymus europaea, shrubs (Stary'). Sic. - Puntalazzo (Mt. Etna) VI.1963, on Evonymus europaea, shrubs near vineyards (Stary'). *Aphis hederae* Kalt.: Tosc. - Firenze, Giardino di Boboli VI.1963, on Hedera helix, park (Stary'). *Aphis neoreticulata* Theob.: Tosc. - Firenze, Giardino di Boboli VI.1963, on Solanum nigrum, park (Stary'). *Aphis pomi* Deg.: Piem. - Torino VI.1963, on Malus silvestris, orchard (Stary'). Lat. - Roma VI.1963, on Crataegus sp., park (Stary'). *Aphis ruborum* Börn.: Piem. - Val della Torre (Torino) VI.1963 on Rubus sp. shrubs (Stary'). *Aphis sambuci* L.: Piem. - Torino Valentino 7.V.1946 on Sambucus nigra (Goidanich). *Aphis* sp.: Piem. - Luserna San Giovanni (Torino) 16.VI.1938, on Viburnum opulus (Goidanich). *Toxoptera aurantii* (Fonsc.): Bas. - Policoro (Matera) VI.1963, on Citrus aurantium, orchard (Stary'). Sic. - Acireale VI.1963, on Citrus aurantium, orchard (Stary').

T. centaureae (Haliday).

Gen. distribution: Europe.

Habitat: Steppe type; meadows, waste places. Italy: Meadows.

Host-specificity: A parasite of *Dactynotus* and *Macrosiphoniella*-species.

Hosts and localities in Italy: *Dactynotus jaceae* (L.): Piem. - Brusnengo (Vercelli) VI.1963, on Centaurea sp., meadow (Stary').

T. cirsii (Curtis).

Gen. distribution: Europe.

Habitat: Forest type; deciduous and mixed woods, parks. Italy: Parks.

Host-specificity: A specialized parasite of *Periphyllus*-species.

Hosts and localities in Italy: *Periphyllus* sp.: Piem. - Torino VI.1963, on Acer platanoides, park (Stary').

T. pallidus (Haliday).

Gen. distribution: Europe, C. Asia.

Habitat: Forest type; deciduous and mixed woods. Italy: Mixed woods.

Host-specificity: A typical parasite of a number in forests living *Callaphididae*.

Hosts and localities in Italy: *Myzocallis coryli* (Goetze): Piem. - Stupinigi, Orbassano VI.1963, on Corylus avellana, mixed wood (Stary'). *Tuberculoides annulatus* (Htg.): Sic. - Acireale VI.1963, on Quercus lanuginosa, shrubs near orchards (Stary'). *Tuberculoides* sp.: Piem. - Torino, Caselette 28.V.1946, on Quercus sp. (Goidanich). Sic. - Acireale VI.1963, on Quercus lanuginosa, shrubs (Stary').

Genus: Lipolexis Förster

L. gracilis Förster.

Gen. distribution: Europe, Far East.

Habitat: Steppe type; in a lower degree intermediary or forest type (orchards, borders of woods). Italy: Borders of woods, waste places, parks, gardens, orchards, macchia shrubs, wood steppe.

Host-specificity: The main hosts belong to the genera *Aphis* and *Brachycaudus*, into a lower degree to the *Myzinae*.

Hosts and localities in Italy: *Anoecia corni* Koch: Piem. - Stupinigi, Orbassano (Torino) VI.1963, on Cornus, mixed wood (Stary'). *Aphis craccivora* Koch: Piem. - Valley of the river Sesia near Carpignano (Novara) VI.1963, on Robinia speudoacacia, waste place (Stary'). Lat. - Roma VI.1963, on Robinia speudoacacia, park (Stary'). *Aphis fabae* Scop.: Lig. - Triora (Imperia) VI.1963, on Vicia faba, garden a wood (Stary'). *Aphis hederae* Kalt.: Tosc. - Firenze, Giardino di Boboli VI.1963, on Hedera helix, park (Stary'). *Aphis pomi* Deg.: Cal. - Davoli, env. Catanzaro VI.1963, on Malus silvestris, orchard (Stary). *Aphis ruborum* Börn.: Lig. - Triora (Imperia) VI.1963, on Rubus sp., shrubs (Stary'). Noli (Savona) VI.1963, on Rubus sp., macchia shrubs (Stary'). Cal. - Sant'Elia (Catanzaro) VI.1963, on Rubus sp., shrubs (Stary'). Sic. - Cesarò (Messina) VI.1963, on Rubus fruticosus, submountain pasture meadows (Stary'). *Aphis sedi* (Kalt.): Lig. - Grimaldi (Ventimiglia) VI.1963, on Sedum rupestre, gardens (Stary'). *Aphis vallei*: Lig. - Noli (Savona) VI.1963, on Euphorbia cyparissias, macchia shrubs (Stary'). *Aphis* spp.: Tosc. - Firenze, Giardino di Boboli VI.1963, on Viburnum tinus, park (Stary'). Firenze, Giardino di Boboli VI.1963, on Rubia tinctorum, park (Stary'). Pugl. - Gioia del Colle (Bari) VI.1963, on Satureja juliana, wood steppe (Stary'). Cal. - Sant'Elia (Catanzaro VI.1963, on Cytisus hirsutus, undergrowth of forest (Stary'). Sic. - Bosco della Ficuzza (Palermo) VI.1963, on Lupsia galactites, waste place (Stary'). *Macchiatella* sp.: Piem. - Vauda (Torino) VI.1963, on Rhamnus cathartica, shrubs (Stary'). *Myzodes persicae* Sulz.: Lig. - Noli (Savona) VI.1963, on Prunus persica, orchard (Stary'). *Toxoptera aurantii* (Fonsc.): Cal. - Davoli, env. Catanzaro VI.1963, on Citrus aurantium orchard (Stary').

16. Description of new species.

Pauesia alpina n. sp.

It resembles *Pauesia montana* n. sp. in having 26-segmented antennae in the female, but differs from it distinctly by the shape and structure of tergite 1 (spiracular tubercles and central carina prominent).

Female. - Head transverse, slightly granulate, shiny, wider than thorax, sparsely haired, strongly narrowed behind eyes. Temple equal to half of transverse eye-diameter. Gena somewhat shorter than half of longitudinal eye-diameter. Eyes large, almost hemispherical, strongly prominent laterally, sparsely haired. Interocular line about 1/6 longer than transfacial l., which is equal to facial 1.. Clypeus flat, transverse, with dense long hairs. Tentorio-ocular 1. a little shorter than intertentorial 1. Antennae 26-segmented, filiform, F_1 equal to F_2, twice as long as wide. Socketocular 1. equal to socket-diameter.

Mesoscutum strongly raised above prothorax, covering it when viewed from side, almost smooth, shiny, along margins and notaulices on the disc with sparse long hairs. Notaulices wide and densely crenulate at the ascedent part, narrow and almost smooth on the disc, distinct as far as their joining. Propodeum (fig. 82) with wide concave rugose central areola, carinae prominent; the rest rugose, with long hairs. Wing: Pterostigma triangular, three times as long as wide, a little shorter than metacarp. Radial absc. 1. somewhat longer than width of pterostigma.

Abdomen lanceolate. Tergite 1 (fig. 87) more than 3 times as longs as wide at spiracles, coarsely rugose, with long sparse hairs in the apical portion; spiracular tubercles strongly prominent, large; central carina rather strongly prominent, reaching 2/3 of the tergite; lateral impressions deep; apical part with distinct lateral protuberances; width at apex equal to twice of width at spiracles. Genitalia: Ovipositor sheaths of middle size, obtuse at apex, slightly curved upwards, with sparse hairs.

Coloration: Head yellow brownish, ocellar triangle brownish. Antennae black brown, inner side of scape and pedicel brown yellowish. Thorax yellow brownish, metanotum and propodeum with brownish spots. Legs brownish, trochanters and base of tibiae yellowish. Wings hyaline, venation dark brownish, pterostigma whitish at the base. Tergite 1 brown, basal portion light brownish; tergite 2 yellow brownish, with dark central spot; remaining tergites yellow brownish; ovipositor sheaths dark brown.

Length of body about 6,7 mm.

Male. - Unknown.

Type. - Holotype ♀: Italy, Gran Paradiso, Tignet 23.VII.1958, bred from *Cinara* sp. on Larix, leg. A. Goidanich. Deposition: Istituto di Entomologia dell'Università di Torino.

General distribution: Europe (N. Italy).

Material examined. - *Cinara* sp. - Italy: Gran Paradiso, Tignet 23.VII.1958, on Larix, leg. A. Goidanich.

Habitat. - Mountain coniferous forests.

Host-specificity. - Parasite of *Cinara* sp.

Pauesia goidanichi n. sp.

By the shape of ovipositor-sheaths it is similar to *P. laricis* (Hal.), differing from the latter by the shape and structure of tergite 1 and by the number of antennal segments.

Female. - Head transverse, smooth, sparsely haired, wider than thorax, strongly narrowed behind eyes. Temple equal to half of transverse eye-diameter. Gena somewhat shorter than half of longitudinal eye-diameter. Eyes large, oval, prominent laterally, sparsely haired. Interocular line somewhat longer than transfacial l., which is shorter than facial 1. Clypeus suboval, slightly granulate sparsely haired. Tentorio-ocular l. subequal to intertentorial l., Antennae 18-19-segmented, filiform, reaching to half of abdomen; F_1 equal to F_2, twice as long as wide. Socket-ocular 1. shorter than socket-diameter.

Mesoscutum falling almost vertically to prothorax, without covering it when viewed laterally, smooth, shiny, along margins and notaulices with sparse long hairs. Notaulices deep, rugose, wide at the ascedent part, narrow and poorly visible on the disc. Propodeum (fig. 86) with- middle-size central wide areola, slightly rugose, carinae strongly prominent; the rest slightly rugose, with long dense hairs. Wing: Pterostigma triangular, 3,5 times as long as wide, equal to metacarp. Radial absc. 1 half longer than width of pterostigma.

Abdomen lanceolate. Tergite 1 (fig. 89) almost 3,5times as long as wide, slightly longitudinally rugose, with hardly noticeable central short carina; spiracular tubercles poorly visible, lateral impressions shallow; lateral protuberances at the hind portion almost not differentiated; with sparse long hairs; width at apex half as long as that at spiracles. Genitalia figured (fig. 86); ovipositor sheaths strongly curved, narrowing to the apex.

Coloration: Head brown black; face brown. Antennae black brown, scape and pedicel brownish. Thorax yellow brownish, lateral lobes of mesoscutum with dark spots, metanotum and propodeum black. Wing venation light brownish. Legs brown, trochanters and base of tibiae lighter. Tergite 1 brown yellow. Remaining tergites yellow brown, centre of tergites darker; apex of abdomen dark brown, ovipositor sheaths dark brown.

Length of body about 2,7 mm.

Male. - Antennae 21-22-segmented. Almost entirely black, with lighter mouthparts, prothorax. Legs brown, trochanters and base of tibiae lighter. Abdomen brown, suture between tergites 1-2,2-3 lighter.

Type. - Holotype ♀: Italy, Monte Pastello (Verona) 1.V.1957, bred from lachnids on Juniperus, leg. A. Goidanich. Allotype ♂: Topotypical, with the same data as the holotype ♀. Deposition: Istituto di Entomologia della Università di Torino.

General distribution: Europe (N. Italy).

Material examined. - *Cupressobium* sp. - Italy: Gran Paradiso, Tignet 30.X.1958, on Juniperus, 1 ♀ paratype, leg. A. Goidanich, Pratolino (Firenze) 18.IX.1957, on Juniperus, 2 ♀♀ paratypes, leg. A. Goidanich. Dint. Torino, Ternavasso 8.IV.1957, on Juniperus, 1 ♀ paratype, leg. A. Goidanich. Monte Pastello (Verona) 1.V.1957, on Juniperus, ♀ holotype, ♂ allotype, 2 ♂♂ 1♀ paratypes, leg. A. Goidanich. Piemonte, dint. Giaveno, 26.IV.1957, on Juniperus, 1 ♂ paratype, leg. A. Goidanich. Valle della Dora Riparia, dint. Ulzio, 8.X.1957, on Juniperus, 1 ♀ paratype, leg. A. Goidanich. Gran Paradiso, Livionaz 13.VIII.1958, on Juniperus, 1 ♀ paratype, leg. A. Goidanich.

Habitat. - Coniferous forests (mountains).

Host-specificity. - Parasite of *Cupressobium* sp.

Note. - The species is named in honour of Professor Dr. Athos Goidanich, head of « Istituto di Entomologia della Università di Torino ».

Pauesia media n. sp.

The species runs to *P. pinicollis* (Stary') and to *P. juniperorum* (Stary'), differing from both in the number of antennal segments, characters on mesoscutum, shape and structure of tergite 1.

Female. - Head transverse, slightly granulate, shiny, strongly narrowed behind eyes, wider than thorax, with sparse long hairs. Temple 1/3 narrower than transverse eye-diameter. Gena equal to 1/3 of longitudinal eye-diameter. Eyes large, almost hemispherical, strongly prominent laterally, sparsely haired. Interocular 1. almost equal to transfacial 1., the latter equal to facial 1.. Clypeus margined, slightly prominent, sparsely haired. Tentorio-ocular 1. a little shorter than intertentorial 1. Antennae 21-22-segmented, filiform, reaching the centre of abdomen. F_1 equal to F_2, almost 3times as long as wide. Socket-ocular 1. subequal to socket-diameter.

Mesoscutum raised above prothorax but without covering it when viewed laterally; smooth, shiny, along margins and notaulices on the disc with sparse long hairs. Notaulices wide, rugose, deep at the ascendent part, narrow and poorly visible on the disc but distinct as far as the connection. Propodeum (fig. 79) with wide concave comparatively rugose central areola, carinae prominent, the rest rugose, with long sparse hairs. Wing: Pterostigma triangular, 3times as long as wide, a little shorter than metacarp. Radial absc. 1 almost twice as long as width of pterostigma.

Abdomen lanceolate. Tergite 1 (fig. 81) 2,5times as long as wide at spiracles, coarsely rugose, with poorly distinct central carina, with long sparse hairs at the apical portion. Spiracular tubercles strongly prominent, with feeble lateral rugosities, in the apical part with 2 slight rugose lateral protuberances; apical width a little greater than at spiracles. Genitalia (fig. 88); ovipositor sheaths obtuse, slightly curved, sparsely haired.

Coloration: Head brown yellow, occiput dark. Antennae black brown, scape and pedicel slightly yellowish. Thorax yellow orange, with dark spots on lateral lobes and lower portion of mesopleurae; metanotum and propodeum almost entirely dark brown. Legs brownish, coxae, lower part of femora, base of tibiae brown rufous. Wings hyaline, venation brownish, tegulae rufous brown. Tergite 1 brown rufous, with brownish coloration on spiracular tubercles. Remaining tergites brown yellowish, darkened at apical portion, ovipositor sheaths dark brown.

Length of body about 4,1 mm.

Male. - Unknown.

Type. - Holotype ♀: Italy, Lac. Junip. 103, Gran Paradiso, Tignet 24.VII.leg. A. Goidanich. Deposition: Istituto di Entomologia della Università di Torino.

General distribution. - Europe (N. Italy).

Material examined. - *Cupressobium* sp. - Italy: Gran Paradiso, Tignet 24.VII (♀ holotype, ♀ paratype), leg. A. Goidanich.

Habitat. - Mountain coniferous forests.

Host-specificity. - Parasite of *Cupressobium* sp.

Pauesia montana n. sp.

It is similar to *P. alpina* n. sp. and differs from the latter by the shape and structure of tergite 1.

Female. - Head transverse, almost smooth, shiny, with long and dense hairs, wider than thorax, strongly narrowed behind eyes. Temple a little wider than 1/2 of transverse eye-diameter. Gena somewhat narrower than half of longitudinal eye-diameter. Eyes large, almost hemispherical, strongly prominent laterally, with sparse long hairs. Interocular 1. a little longer than transfacial 1. that is equal to facial 1. Clypeus oval, slightly prominent, with sparse long hairs. Tentorio-ocular 1. subequal to intertentorial 1. Antennae 26-segmented, filiform, reaching to centre of abdomen; F_1 equal to F_2, twice as long as wide. Socket-ocular 1. equal to socket-diameter.

Mesoscutum almost smooth, strongly raised above prothorax and almost covering it when viewed laterally, with long sparse hairs along margins and notaulices. Notaulices deep, wide rugose at the ascedent part, narrow and shallow on the disc distinct as far as the connection. Propodeum (fig. 77) with wide slightly rugose central areola, carinae prominent, the rest rugose, sparsely haired. Wing: Pterostigma triangular, 3,5times as long as wide, shorter than metacarp. Radial abscissa 1 almost twice as long as pterostigma-width.

Abdomen lanceolate. Tergite 1 (fig. 85) 3,5times as long as wide at spiracles, slender, coarsely rugose, with feebly prominent lateral carinae. Spiracular tubercles poorly distinct, lateral impressions feeble; apical lateral pro-

tuberances slightly prominent; width at apex almost twice as long as width at spiracles. Genitalia: Ovipositor sheaths obtuse, slightly curved, sparsely haired.

Coloration: Head black; face, gena, orbits brown rufous. Antennae black brown, scape and pedicel brownish. Thorax black, with rufous prothorax, base of mesoscutum and notaulices. Legs brown, with lighter trochanters and base of tibiae. Venation dark brown, base of pterostigma whitish. Abdomen black brown, with yellow bands between tergites. Ovipositor sheaths brown.

Length of body about 4,9 mm.

Male. - Antennae 30-segmented. Tergite 1 as in the female, abdomen almost entirely brown or with narrow yellowish bands.

Type. - Holotype ♀: Italy, Valli di Lanzo, Forno (Torino) 4.VIII.1958, Lac. Abies 102, leg. A. Goidanich. Allotype ♂: Topotypical, with the same data as the female holotype. Deposition: Istituto di Entomologia della Università di Torino.

General distribution. - Europe (N. Italy).

Material examined. - *Todolachnus* sp. - Italy: Valli di Lanzo, Forno (Torino) 4.VIII.1958, on Abies, (holotype ♀, allotype ♂, 2 ♂♂ paratypes), leg. A. Goidanich.

Habitat. - Mountain coniferous forests.

Host-specificity. - Parasite of *Todolachnus* sp.

Pauesia rufiabdominalis n. sp.

By the number of antennal segments it is related to *P. piceaecollis* (Stary'), differing from the latter by the shape and structure of tergite 1.

Female. - Head transverse, smooth, shiny, sparsely haired, wider than thorax, strongly narrowed behind eyes. Temple equal to half of transverse eye-diameter. Gena equal to 1/3 of longitudinal eye-diameter. Eyes large, hemispherical, strongly prominent laterally, sparsely haired. Interocular 1. a little longer than transfacial 1., which is shorter than facial 1. Clypeus narrow, oval, sparsely haired. Antennae (19)-20-segmented, filiform, reaching to centre of abdomen. F_1 equal to F_2, twice as long as wide. Socket-ocular 1. shorter than socket-diameter.

Mesoscutum falling almost vertically to prothorax, without covering it when viewed laterally, smooth, shiny, along margins and notaulices with sparse long hairs. Notaulices wide, deep, rugose at base, effaced to poorly distinct on the disc. Propodeum (fig. 84) with middle-size central wide areola, almost smooth; carinae strongly prominent, distinct both in transverse and longitudinal parts, the rest only slightly rugose, with long dense hairs. Wing: Pterostigma triangular, 3 times as long as wide, equal to metacarp. Radial abscissa 1 a little longer than pterostigma width.

Abdomen lanceolate. Tergite 1 (fig. 83) 3 times as long as wide, coarsely shallowly rugose - rugosities mostly longitudinal, with feeble central longitudinal carina. Spiracular tubercles very poorly prominent, apical protuberance poorly visible, sparsely haired. Genitalia (fig. 90); ovipositor sheaths slightly curved, obtuse at apex.

Coloration: Head rufous, occiput, vertex and upper part of temples brownish. Antennae black-brownish, scape and pedicel brownish. Thorax rufous mesopleurae, metanotum and propodeum with brownish spots. Venation brown. Legs brown yellowish, trochanters and base of tibiae yellow. Abdomen yellow brown, ovipositor sheaths brown.

Lenght of body about 3,5 mm.

Male. - Antennae 21-22-segmented. Coloration as in the female, but darker. Mesoscutum with dark spots on the lobes, abdomen brown yellowish, darkened to the apex.

Type. - Holotype ♀: Italy, Pratolino, Firenze, 18.IX.1957, Lac. Pinus 16, leg. A. Goidanich. Allotype ♂: Topotypical, with the same data as the ♀ holotype. Deposition: Istituto di Entomologia della Università di Torino.

General distribution. - Europe (Italy).

Material examined: *Cinara* sp. - Italy: Pratolino (Firenze), 18.IX.1957, on Pinus (♀ holotype, ♂ allotype, 2 ♀♀, 4 ♂♂ paratypes), leg. A. Goidanich.

Habitat. - Coniferous woods.

Host-specificity. - Parasite of *Cinara* sp.

Pauesia similis n. sp.

It is related to *P. pini* (Hal.), differing from the latter in the number of antennal segments.

Female. - Head transverse, slightly granulate, comparatively densely haired, strongly narrowed behind eyes, wider than thorax. Temple equal to half of transverse eye-diameter. Gena equal to 1/4 of longitudinal eye-diameter. Eyes large, almost hemispherical, strongly prominent laterally, sparsely haired. Interocular 1. a little longer than transfacial 1 that is equal to facial 1. Clypeus oval, slightly convex, sparsely haired. Tentorio-ocular 1. subequal to intertentorial 1. Antennae 23-24-segmented, reaching to half of abdomen. F_1 equal to F_2, twice as long as wide. Socket-ocular 1. subequal to socket-diameter.

Mesoscutum raised above prothorax, without covering it when viewed laterally, almost smooth, shiny, along notaulices and margins with sparse long hairs. Notaulices wide, deep, rugose at the ascedent part, narrow and poorly visible on the disc. Propodeum (fig. 80): Central areola wide, with longitudinal rugosities; carinae prominent in the longitudinal part, the rest slightly rugose. Wing: Pterostigma more than 3 times as long as wide, shorter than metacarp. Radial abscissa 1 longer than width of pterostigma.

Abdomen lanceolate. Tergite 1 (fig. 78) 4 times as long as wide at spiracles, with strongly prominent long central carina, slightly longitudinally rugose with deep lateral impressions. Spiracular tubercles strongly prominent, apical protuberances prominent. Apical width as twice of width at spiracles. Genitalia: ovipositor sheaths obtuse, slightly curved, sparsely haired.

Coloration: Head yellow brown, vertex and upper part of temples more or less brownish. Antennae brown black, scape and pedicel yellow brown. Thorax yellow brownish, mesopleurae, metanotum and propodeum with brownish and yellowish spots. Venation dark brown, pterostigma whitish at base. Legs yellow brown, tarsi, hind coxae, femora and tibiae at base dark brown. Abdomen yellow brownish, sometimes brown to the apex. Tergite 1 with brownish coloration. Ovipositor sheaths brown.

Length of body about 4,9 mm.

Male. - Antennae 25-26-segmented, as long as the body. Base of antennal sockets, face and clypeus yellowish. Thorax black, prothorax and base of mesoscutum yellow brownish or brown yellowish, sometimes the coloration more distributed on the rest of mesoscutum and the mesopleurae. Legs dark brown, coxae, and base of tibiae lighter. Abdomen black brown, or with more or less distributed yellow brownish coloration.

Type. - Holotype ♀: Italy, Gran Paradiso, Livionaz 17.VI.1958, Lac. Pinus 107, A. Goidanich. Allotype ♂: Topotypical, with the same data as the holotype ♀. Deposition: Istituto di Entomologia della Università di Torino.

General distribution. - Europe (N. Italy).

Material examined. - *Cinara* sp. - Italy: Gran Paradiso, Livionaz 17.VI.1958, on Pinus (♀ holotype, ♀ allotype, 2 ♀♀, 9 ♂♂ paratypes), leg. A. Goidanich. Valle della Dora Riparia, 21.V.1958, on Pinus (1 ♀ paratype), leg. A. Goidanich.

Habitat. - Mountain coniferous forests.

Host-specificity. - Parasites of *Cinara* sp.

17. Host and parasite catalogue

In the aphid nomenclature the Börner's classification has been mostly followed. All the records are original. The aphid names have been arranged alphabetically, in every species the list of parasites, host plant and occurrence in the given Italian district (abbreviations see ch. 15) are given.

Acyrthoshiphon pisum (Harris).

Aphidius ervi Hal.: Piem. - Medicago sp., Tosc. - Medicago sativa, Cal. - Lathyrus silvester, Sic. - Melilotus albus, Medicago tribuloides, Medicago sativa.

Praon dorsale (Haliday): Tosc. - Medicago sativa.

Anoecia corni Koch.

Lipolexis gracilis Förster: Piem. - Cornus sp.

Aphis chloris (Koch).

Lysiphlebus fabarum (Marshall): Lig. - Hypericum perforatum.

Aphis clematidis Koch.
Lysiphlebus fabarum (Marshall): Lig. - Clematis ¿vitalba.

Aphis craccivora Koch.
Lipolexis gracilis Förster: Piem. - Robinia pseudoacacia, Lato. - Robinia speudoacacia.
Lysiphlebus fabarum (Marshall): Lig. - Centranthus ruber; Cal. - Vicia pannonica, Medicago sativa, Trifolium angusti-folium.

Aphis fabae Scop.
Ephedrus plagiator (Nees): Cal. - Papaver sp.
Lipolexis gracilis Förster Lig. - Vicia faba.
Lysiphlebus ambiguus (Hal.): Lig. - Rumex sp., Ammi majus, Fumaria capreolata, Carduus pycnocephalus v. tenuiflorus, Pugl. - Chenopodium sp., Cal. - Amaranthus ascendens, Sic. - Chenopodium album.
Lysiphlebus fabarum (Marshall): Piem. - Chenopodium album, Lig. - Vicia faba, Cal. - Papaver sp., Sic. - Chenopodium sp.
Praon abjectum (Hal.): Sic. - Evonymus europaea.
Trioxys angelicae (Hal.): Piem. - Evonymus europaea, Philadelphus coronarius, Sic. - Evonymus europaea.

Aphis farinosa Gmel.
Lysiphlebus ambiguus (Hal.): Piem. - Salix viminalis, Salix sp., Salix purpurea, Tosc. - Salix sp.

Aphis hederae Kalt.
Lipolexis gracilis Förster: Tosc. - Hedera helix.
Trioxys angelicae (Hal.): Tosc. - Hedera helix.

Aphis nerii (B.d.F.).
Lysiphlebus ambiguus (Hal.): Pugl. - Nerium oleander, Lat. - Nerium oleander, Sic. - Nerium oleander.

Aphis neoreticulata Theob.
Lysiphlebus ambiguus (Hal.): Sic. - Solanum nigrum.
Trioxys angelicae (Hal.): Tosc. - Solanum nigrum.

Aphis pomi Deg.
Lipolexis gracilis Förster: Cal. - Malus silvestris.
Praon volucre (Hal.): Lat. - Crataegus sp.
Trioxys angelicae (Hal.): Lat. - Crataegus sp., Piem. - Malus silvestris.

Aphis punicae (Pass.).
Lysiphlebus ambiguus (Hal.): Pugl. - Punica granatum.

Aphis ruborum Börn.
Lipolexis gracilis Förster: Piem. - Rubus sp., Lig. - Rubus sp., Cal. - Rubus sp., Sic. - Rubus fruticosus.
Lysiphlebus ambiguus (Hal.): Sic. - Rubus fruticosus.
Lysiphlebus fabarum (Marsh.): Sic. - Rubus sp.
Trioxys acalephae (Marsh.): Piem. - Rubus sp.

Aphis sambuci L.
Trioxys angelicae (Hal.): Piem. - Sambucus nigra.

Aphis sarothamni (Franssen).
Lysiphlebus ambiguus (Hal.): Sic. - Sarothamnus sp.
Lysiphlebus fabarum (Marsh.): Sic. - Sarothamnus sp.

Aphis sedi (Kalt.).
Lipolexis gracilis Förster: Lig. - Sedum rupestre.
Lysiphlebus fabarum (Marsh.): Pugl. - Malva silvestris.

Aphis urticata (F.).
Lysiphlebus fabarum (Marsh.): Piem. - Urtica dioica.
Trioxys acalephae (Marsh.): Piem. - Urtica dioica.

Aphis vallei H.R.L. et Stroyan.
Lipolexis gracilis Först.: Lig. - Euphorbia cyparissias.

Aphis spp.
Aphidius matricariae Hal.: Lig. - Lavatera cretica.
Lipolexis gracilis Först.: Cal. - Cytisus hirsutus, Tosc. - Rubia tinctorum, Viburnum tinus, Sic. - Lupsia galactites, Satureia juliana.
Lysiphlebus ambiguus (Hal.): Lig. - Torilis arvensis, Vicia sativa var. macrocarpa, Tosc. - Rumex sp., Pugl. - Pittosporum tobira, Citrullus sp., Rosmarinus officinalis, Liquiricia sp., Cal. - Vicia faba, Sic. - Daucus carota, Polygonum lapathifolium, Rosmarinus officinalis, Astragalus siculus.
Lysiphlebus fabarum (Marsh.): Piem. - Phaseolus sp., Pugl. - Rosmarinus officinalis, Cal. - Medicago sativa, Vicia faba, Sic. - Daucus carota, Melilotus albus, Lupsia galactites, Astragalus siculus, Parietaria officinalis, Carduus pycnocephalus.
Praon volucre (Hal.): Pugl. - Lavatera cretica.
Trioxys angelicae (Hal.): Piem. - Viburnum opulus.

Aulacorthum geranii (Kalt.).
Praon volucre (Hal.): Sic. - Erodium botrys, Erodium malacoides.

Brachycaudus cardui (L.).
Lysiphlebus ambiguus (Hal.): Sic. - Carduus sp., Lig. - Carduus pycnocephalus.

Brachycaudus spp.
Ephedrus persicae Froggatt: Piem. - Prunus sp.

Brachyunguis sp.
Ephedrus persicae Froggatt: Lig. - Tamarix sp., Cal. - Tamarix sp. Sic. - Tamarix sp.

Brevicoryne brassicae (L.).
Diaeretiella rapae (M'Int.): Piem. Lig. - Moricandia arvensis, Sic. - Brassicaceae.

Capitophorus sp.
Aphidius matricariae Hal.: Pugl. - Cynara scolymus.

Chaitophorus sp.
Lysiphlebus salicaphis (Fitch): Piem. - Populus italica.

Chromaphis juglandicola (Kalt.).
Lysiphlebus ambiguus (Hal.): Sic. - Juglans regia.

Cinara excelsae HRL.
Pauesia silvestris (Stary'): Lig. - Pinus maritima, Sic. - Pinus pineopinaster.

Cinara pini (L.).
Pauesia silvestris (Stary'): Lig. - Pinus halepensis.

Cinara spp.
Pauesia abietis (Hal.): Piem. - Larix sp., Pinus sp.
Pauesia alpina n. sp.: Piem. - Larix sp.
Pauesia laricis (Hal.): Piem. - Pinus sp.
Pauesia? pini (Hal.): Tosc. - Pinus sp.
Pauesia rufiabdominalis n. sp.: Tosc. - Pinus sp.
Pauesia silvestris (Stary'): Piem. - Pinus sp.
Pauesia similis n. sp.: Piem. - Pinus sp., Larix sp.

Cupressobium sp.
Pauesia goidanichi n. sp.: Piem. - Juniperus sp., Tosc. - Juniperus sp.
Pauesia media n. sp.: Piem. - Juniperus sp.

Dactynotus carthami HRL.
Aphidius funebris Mackauer: Sic. - Carthamus lanatus.
Praon dorsale (Hal.): Sic. - Carthamus lanatus.

Dactynotus cichorii (Koch).
Aphidius funebris Mackauer: Piem. - Cichorium intybus.

Dactynotus inulae (Ferr.).
Ephedrus campestris Stary': Sic. - Inula viscosa.

Dactynotus jaceae (L.).
Aphidius funebris Mackauer: Piem. - Centaurea jacea, Sic. - Centaurea sphaerocephala.
Ephedrus campestris Stary': Piem. - Centaurea jacea.
Praon dorsale (Hal.): Sic. - Centaurea sphaerocephala.
Praon volucre (Hal.): Piem. - Centaurea jacea.
Trioxys centaureae (Hal.): Piem. - Centaurea sp.

Dactynotus sonchi (L.).
Aphidius funebris Mackauer: Lig. - Reichardia picroides, Sic. - Sonchus sp., Sonchus oleraceus.

Dactynotus spp.
Aphidius funebris Mackauer: Piem. - Cichorium intybus, Lig. - Reichardia picroides, Cal. - Cirsium sp., Cynara cardunculus.
Praon volucre (Hal.): Sic. - Reichardia picroides.

Dysaphis sorbi (Kalt.).
Ephedrus persicae Froggatt: Piem. - Sorbus aucuparia.

Dysaphis spp.
Ephedrus persicae Froggatt: Tosc. - Malus silvestris.

Galiobium langei Börn.
Aphidius matricariae Hal: Piem. - Galium sp.

Hayhurstia atriplicis (L.).
Aphidius matricariae Hal.: Lat. - Chenopodium sp.
Ephedrus nacheri Quilis: Cal. - Chenopodium sp.

Hyadaphis foeniculi (Pass.).
Ephedrus plagiator (Nees): Piem. - Lonicera implexa.

Hyalopterus amygdali (Blanch.).
Aphidius transcaspicus Tel.: Sic. - Prunus persica.
Praon volucre (Hal.): Cal. - Prunus persica.

Hyalopterus pruni (Geoffr.).
Aphidius transcaspicus Tel.: Lig. - Prunus sp., Cal. - Prunus divaricata, Sic. - Phragmites communis.
Ephedrus plagiator (Ness): Piem.
Praon volucre (Hal.): Piem. - Prunus domestica, Lig. - Prunus spinosa, Pugl. - Phragmites communis, Cal. - Prunus sp.

Hyperomyzus lactucae (L.).
Praon volucre (Hal.): Sic. - Sonchus oleraceus.

Hyperomyzus spp.
Aphidius sonchi Marsh.: Sic. - Sonchus sp.
Praon volucre (Hal.): Tosc. - Sonchus sp., Sic. - Sonchus sp.

Liosomaphis berberidis (Kalt.).
Aphidius hortensis Marsh.: Piem. - Berberis vulgaris.

Macchiatella sp.
Lipolexis gracilis Förster: Piem. - Rhamnus cathartica.

Macrosiphoniella absinthii (L.).
Aphidius absinthii Marh.: Lig. - Artemisia absinthium.

Macrosiphoniella artemisiae (B.d.F.).
Aphidius absinthii Marsh.: Piem. - Artemisia vulgaris.

Macrosiphum rosae (L.).
Aphidius rosae Hal.: Piem. - Rosa sp., Lig. - Rosa sp., Tosc. - Rosa sp., Sic. - Rosa sp.
Praon volucre (Hal.): Pugl. - Rosa sp., Sic. - Rosa sp.

Macrosiphum solanifolii (Ashm.).
Praon volucre (Hal.): Sic. - Ecbalium elaterium.

Microlophium evansi Theo.
Aphidius ervi Hal.: Piem.
Myzocallis coryli (Goetze).
Trioxys pallidus (Hal.): Piem. - Corylus avellana.

Myzodes persicae Sulz.
Aphidius matricariae Hal.: Tosc. - Solanum tuberosum.
Aphidius picipes (Nees): Lig. - Solanum tuberosum.
Lipolexis gracilis Först.: Lig. - Prunus persica.

Myzus cerasi (F.).
Ephedrus persicae Froggatt: Piem. - Prunus cerasus.

Pemphigus sp.
Monoctonia pistaciaecola Stary': Sic. - Populus pyramidalis.

Periphyllus sp.
Trioxys cirsii (Curt.): Piem. - Acer platanoides.

Protaphis sp.
Lysiphlebus fabarum (Marsh.): Cal. - Artemisia campestris v. variabilis.

Protolachnus sp.
Diaeretus leucopterus (Hal.): Tosc. - Pinus pinaster.

Pterocomma populeum (Kalt.).
Aphidius pterocommae Ashm.: Pugl. - Populus pyramidalis

Pterocomma spp.
Aphidius pterocommae Ashm.: Piem. - Populus italica, Populus nigra, Salix sp., Salix caprea.

Pyrethromyzus sanborni (Gill.).
Aphidius absinthii Marsh.: Ven. - Aster tripolium.
Ephedrus campestris Stary': Ven. - Aster tripolium.

Rhopalosiphum donacis (Pass.).
Aphidius transcaspicus Tel.: Lig. - Arundo donax.

Rhopalosiphum oxyacanthae (Schrk.).
Monoctonus cerasi (Marsh.): Piem.

Schizaphis longicaudata HRL.
Diaeretiella rapae (M'Int.): Sic. - Arundo donax.

Schizolachnus sp.
Pauesia unilachni (Gahan): Piem. - Pinus.

Schizoneura lanuginosa Htg.
Areopraon lepelleyi (Waterston): Piem. - Ulmus sp.

Sipha maydis (Pass.).
Lysiphlebus arvicola Stary': Lig. - Lolium perenne v. rigidum, Hordeum murinum, Avena sativa v. barbata, Sic. - Agropyrum sp., Avena sativa v. barbata.

Sitobium avenae (Fabr.).
Aphidius avenae Hal: Piem. - Trisetum flavescens, Lolium italicum, Tosc. - Avena sativa v. barbata, Poaceae sp., Triticum vulgare, Cal. - Avena sativa v. barbata, Sic. - Avena sativa v. barbata.
Aphidius pascuorum Marsh.: Sic. - Hordeum murinum, Tosc. - Avena sativa v. barbata.
Ephedrus plagiator (Nees): Cal. - Avena sativa v. barbata.
Praon volucre (Hal.): Tosc. - Avena sativa v. barbata, Triticum vulgare, Sic. - Avena sativa.

Stomaphis spp.
Protaphidius wissmannii (Ratz.): Piem. - Salix sp., Acer sp., Populus sp., Quercus sp., Ven. - Salix viminalis.

Thelaxes dryophila (Schrk.).
Lysiphlebus thelaxis Stary': Sic. - Quercus pubescens.

Therioaphis medicaginis
Praon exoletum (Nees): Sic. - Medicago sativa.

Todolachnus sp.
Pauesia montana n. sp.: Piem. - Abies sp.

Toxoptera aurantii (Fonsc.).
Lipolexis gracilis Först.: Sic. - Citrus aurantium.
Lysiphlebus ambiguus (Hal.): Sic. - Citrus aurantium.
Trioxys angelicae (Hal.): Cal. - Citrus aurantium, Sic. - Citrus aurantium.

Tuberculoides spp.
Trioxys pallidus (Hal.): Piem. - Quercus sp., Sic. - Quercus lanuginosa.

III. APPLIED PART

18. Diapause.

The three following cases of the diapause in the *Aphidiidae* were ascertained during our Italian trip:

Aphidius avenae Haliday.

Material of collected mummified *Sitobium*-aphids on Avena sativa v. fatua in Ventimiglia (Liguria) in June 1963 was transferred in room-temperature, where adults emerged at the end of October, i.e. more than 4 months later. The mummified aphids containing diapause cocoons of *Aphidius avenae* were remarkably dark brown, being easily distinguishable from the light yellowish brown mummified aphids that contained non-diapause cocoons.

This is clearly a case of summer-diapause, in which the hot summer period, when the number of host aphids is low, too, is spent.

Ephedrus persicae Froggatt.

Material of mummified *Dysaphis sorbi* aphids was collected in the environs of Lago Maggiore in June 1963. The diapause in *Ephedrus persicae* was dealt with by the author (1962, Entomophaga 7 : 91-100) so that diapause cocoons were easily recognized.

The mummified aphids are unusually large in this case, globular in shape, shiny, strongly mummified, the segmentation of the abdomen being unrecognizable on them. They have the appearance of darkred-brown shiny balls as usually the head and legs of the mummified aphids are broken off by a mechanical injury. Their fixation to the leaf surface is rather feeble.

The diapause in *Ephedrus persicae* is an adaptation to the host life-cycle as the parasite falls in the diapause for the whole period till the time the host (dioecious, mostly leaf-curling aphid species) appears in the same type of habitat again in the next year.

The occurence of diapause cocoons in *Ephedrus persicae* has been ascertained only in Czechoslovakia till now. Their occurrence in Italy represents a new locality of the existence of the diapause in this species in another part of its distribution area that covers the Holarctic region, etc.

Monoctonia pistaciaecola Stary'.

Material of mummified *Pemphigus*-aphids was collected in Balestrate (Sicily) on Populus pyramidalis in June 1963.

The diapause cocoons (Fig. 48) are almost globular in shape, mat and big if compared with non-diapause cocoons.

As *Pemphigus* on Populus is a gall-producing aphid, the mummified aphids are found in a gall, where also the parasite (in a diapause cocoon inside the mummified aphid skin) spends unsuitable hot summer period in diapause state in the praepupal stage.

Diapause cocoons have been known from Central Asia mountains till now and their occurrence in Sicily is a good contribution to the biology of the parasite, which is known from the Crimea, Central Asia and Sicily.

19. Zoogeography.

The exact classification of different faunistic complexes in the *Aphidiidae* is hardly possible today.

In the development of different faunistic complexes factors influencing the host specificity in the *Aphidiidae* played a big role, the factors of the host and the environment namely. For this reason only the fame-classification of the Italian *Aphidiidae* according to the zoogeographical zones was used. It is necessary to stress the fact that in Central Europe namely, where the different types of landscape are not so clearly differentiated from each other as e.g. in Central Asia, etc., many intermediary habitats had developed and their fauna mixed in consequence. Because of this fact we used the more ge-

geralized classification of different species that is based on our study of the species in all their known distribution area.

A) Coniferous forest zone. This zone is mostly typical for mountain districts of Italy (Alps, Appenine, etc.), in a lower degree it penetrates to the south - e.g. elements of this zone may be recognized in Sicily, where some Pinus species are used to keep the shifting sands; here the *Cinara* aphids and their parasites — *Pauesia*, *Diaeretus* — occur, too.

The faunistic complex of this zone form the species of genera *Pauesia* and *Diaeretus leucopterus*. Some species of *Pauesia* were described from Italian Alps, but their distribution is believed to be wider.

B) Deciduous forests and woods zone. This a rather typical complex that penetrates in the intermediary zone, too. The penetrating of various species of this complex along rivers, irrigating ditches, etc. in orchards, oases, etc. is rather typical.

From the holarctic species following species belong to this complex: *Lysiphlebus salicaphis* Fitch, *Ephedrus persicae* Frog. and *Aphidius pterocommae* Ashmead.

Following species are distributed in Europe namely, they but penetrate in Asia Minor and Central Asia, and sometimes in the Far East, too: *Ephedrus plagiator* (Nees), *Areopraon lepelleyi* (Waterston), *Praon abjectum* (Haliday), *Praon volucre* (Haliday), *Protaphidius wissmannii* (Ratzeburg), *Aphidius rosae* Haliday, *Lysiphlebus ambiguus* (Haliday), *Lysiphlebus thelaxis* Stary, *Trioxys angelicae* (Haliday), *Trioxys cirsii* (Curtis), *Trioxys pallidus* (Haliday).

From southern Europe to Central Asia *Monoctonia pistaciaecola* Stary and *Aphidius transcaspicus* Telenga are distributed.

C) Steppe zone. Typical species of this faunistic complex, mostly distributed, besides Europe, to the East and often to eastern part of Palearctic region, have the greatest influence in Italy. They are: *Ephedrus campestris* Stary, *Ephedrus nacheri* Quilis M. P., *Praon absinthii* Bignell, *Praon dorsale* (Haliday), *Praon exoletum* (Nees), *Aphidius absinthii* Marshall, *Aphidius avenae* Haliday, *Aphidius ervi* Haliday, *Aphidius funebris* Mackauer, *Aphidius matricariae* Haliday, *Aphidius pascuorum* Marshall, *Aphidius picipes* Nees, *Diaeretiella rapae* (M' Intosh), *Lysiphlebus arvicola* Stary', *Lipolexis gracilis* Förster, *Monoctonus caricis* (Haliday), *Trioxys acalephae* (Marshall), *Trioxys centaureae* (Haliday), *Trioxys complanatus* Quilis M. P. From them, *Aphidius matricariae* Haliday and *Diaeretiella rapae* (M' Int.) are almost cosmopolitan in distribution.

From the zoogeographical point of view the research of various parasite species in a host -area is interesting, although being at the initial stage only. There is one case, which may be mentioned as a result of our Italian trip: *Hyalopterus pruni* (Geoffr.) is attacked widely by *Praon volucre*, in southern Europe in addition by *Aphidius transcaspicus* Telenga.

20. Foci in nature.

During our trip a number of various landscapes and habitats was visited. In the greatest number of cases if was possible to collect numerous samples both of aphids and parasites in the given types of habitats to ascertain their main typical features. The results of our Italian trip represent also examples of the relation of the parasites to habitats, their specificity in the frame of the given habitat and often also new records on the ecological requirements of different species. The records enable to get a certain imagination on the importance of the study of the foci of aphid parasites.

The different types of habitats are generalized on the ground of samples made in habitats of similar type. Typical examples of different habitats are shown in photographs added.

Because of the connection between different types of habitats certain similar features between two types of habitats usually occur. The typical trees shrubs herbs are given also from the viewpoint of our classification of aphids and parasites. As the results were obtained during one collection trip, further research is necessary. Nevertheless, in northern Italy namely, there will be many similar features in foci of parasites with those of Central Europe, where a rather detailed study has been undertaken (see Stary', l. c.).

1. Mountain coniferous forest, N. Italy (Photogr. 56).

Coniferous forests represent a characteristic long-lasting community that contains chronic foci of aphid parasites. All the coniferous trees are infested by various lachnid species (*Cinara* spp., *Schizolachnus* spp., *Protolachnus* spp.) that are attacked by a specialized parasite complex (*Pauesia*, *Diaeretus*, *Metaphidius* spp.) the members of which do not parasitize other aphid groups.

Parks and orchards, N. Italy.

Habitats of this type represent results of man activity. According to the composition of aphidofauna and its parasites there are many similar features to deciduous forest habitats.

Following trees and shrubs are especially typical for park community: Populus pyramidalis (*Pemphigus* spp.), Acer platanoides, Acer pseudoplatanus (*Periphyllus*, *Drepanosiphon* spp.), Populus alba (*Chaitophorus* spp.), Rosa sp. (*Macrosiphum rosae* L., *Passerinia* sp.), Rubus sp. (*Aphis* sp.), Prunus mahaleb (*Roepkea marchali* B.), Prunus avium (*Myzus cerasi* F.), Ulmus campestris (*Schizoneura*, *Byrsocrypta* sp.), Cornus sanguinea (*Anoecia* sp.), Crataegus sp. (*Aphis pomi* Deg.), Viburnum opulus (*Ceruraphis eriophori*, Walk., *Aphis viburni* Scop.), Sorbus aucuparia (*Dysaphis sorbi* Kalt.), Robinia pseudoacacia (*Aphis craccivora* Koch), Berberis vulgaris (*Liosomaphis berberidis* Kalt.), Philadelphus coronarius (*Aphis fabae* Scop.), Hedera helix (*Aphis hederae* Kalt.), Sambucus nigra (*Aphis sambuci* L.), Prunus spinosa (*Hyalopterus pruni* Geoffr., *Brachycaudus* sp.). The mentioned trees and

shrubs often form a uncultivated growth in the neighbourhood of gardens, villages, etc., and they have a rather important relation to the orchard trees. Acer spp., Populus spp., Rosa spp., Rubus spp., Berberis vulgaris, represent indifferent trees and shrubs. Parasites of the mentioned aphids are strictly specialized and their host-list does not include pest aphid species. Aphidofauna of Viburnum opulus, Sorbus aucuparia, Hedera helix, Sambucus nigra, is economically indifferent and represents also hosts of pest aphid parasites. Aphidofauna of Ulmus, Cornus, Viburnum opulus, Crataegus, Euonymus europaea, Philadelphus coronarius, includes mostly dioecious pest aphid species that spread from these habitats on cultural plants (secondary host plants).

The orchard trees are the following: Prunus persica, Prunus domestica, Prunus armeniaca, (*Brachycaudus* spp., *Hyalopterus pruni* Geoffr., *Myzodes persicae* Sulz.), Prunus avium (*Myzus cerasi* F.), Malus silvestris (*Aphis pomi* Deg., *Dysaphis* spp., *Eriosoma lanigerum* Hausm.). The typical parasite complex form the following species: *Ephedrus persicae* Froggatt, *Trioxys angelicae* (Haliday), *Praon volucre* (Haliday), *Praon abjectum* (Haliday), *Lysiphlebus ambiguus* (Haliday), *Lipolexis gracilis* Först., all being parasites of pest aphid species, and indifferent parasite species - *Lysiphlebus salicaphis* Fitch, *Aphidius pterocommae* Ashm., *Aphidius hortensis* Marsh., *Trioxys cirsii* (Curt.).

3. Gardens and their neighbourhood, N. Italy (Photogr. 57).

Gardens are formed especially by monocultures of cultured, mainly annual plants. For this reason they can include temporary foci of parasites only, which spread here from chronical foci in the neighbourhood.

The neighbourhood of gardens is composed usually from habitats of waste places type, inhabited by corresponding plant community that is composed on the one hand from waste place species, on the other hand from common meadow species. As for waste place species there occur especially Urtica dioica (*Aphis urticata* F.)), Capsella bursa-pastoris (*Aphis fabae* Scop.), Rumex pulcher (*Aphis rumicis* L.), Chenopodium sp. (*Aphis fabae* Scop., *Hayhurstia atriplicis* L.), Amaranthus retroflexus (*Aphis fabae* Scop.), Arctium lappa (*Aphis fabae* Scop.). Meadow plants: Galium verum (*Aphis fabae* Scop., *Aphis galli-scabri* Schrk.), Cichorium intybus (*Dactynotus cichorii* Koch), Silene cucubalus (*Brachycaudus* sp.,) Achillea millefolium (*Macrosiphoniella millefolii* Deg.), Melandrium album (*Brachycaudus lychnidis* L.), Artemisia vulgaris (*Macrosiphoniella artemisiae* B. d. F.), Salvia sclarea (*Aphis salviae* Walk.).

As it is apparent from the list there occur the pest aphid *Aphis fabae* Scop. in the majority of waste place plants in the neighbourhood of gardens. Although it is attacked by parasites here, such plants occurence must be kept as undesiderable. Among the indifferent plants, which aphidofauna serves as alternative hosts of pest aphid parasites, the following species may be mentioned: Salvia sclarea, Galium sp., Urtica dioica, partly Chenopodium.

Among the plants, which are inhabited by indifferent aphidofauna and specialized parasite complex that does not attack other (pest) aphid species, there are: Cichorium intybus, Achillea millefolium, Artemisia vulgaris.

The typical parasite complex consists of the following species: *Lysiphlebus ambiguus* (Hal.), *Lysiphlebus fabarum* (Marsh.), *Lipolexis gracilis* Förster, *Aphidius avenae* Hal., *Trioxys acalephae* (Marsh.), *Diaeretiella rapae* (M' Int.), *Aphidius ervi* Hal., *Aphidius pascuorum* Marsh. *Aphidius matricariae* Hal., *Praon volucre* (Hal.), all these being parasites of pest aphids while *Lysiphlebus arvicola* Stary', *Aphidius funebris* Mack., *Aphidius rosae* Hal., *Ephedrus campestris* Stary', *Ephedrus nacheri* Quilis, *Praon dorsale* (Hal.), are indifferent parasites.

4. Field habitats, N. Italy (Photogr. 58).

Only waste place and foci including field habitats (balks) that have the greatest importance for parasite spread, were observed in N. Italy. Balks are overgrown by a number of meadow plants: Plantago media (*Aphis plantaginis* Goetze), Galium sp. (*Galiobium langei* Börn.), Galium verum (*Aphis galii-scabri* Schrk.), Artemisia vulgaris (*Macrosiphoniella artemisiae* B. d. F.), Centaurea jacea (*Dactynotus jaceae* L.), Ranunculus acer (*Aphis*), Cichorium intybus (*Dactynotus cichorii* Koch). Besides in the neighbourhood of field roads there is a common growth of waste place plants Rumex crispus (*Aphis*), Urtica dioica (*Aphis urticata* F.), Lappa major (*Aphis fabae* Scop.).

Regarding that the succession of aphid occurrence in these habitats guarantees almost continuous aphid occurrence throughout all the season, chronic foci of parasites exist in such habitats. Furthermore the parasites must be divided on useful and indifferent species.

In the aphidofauna of foci of indifferent type aphids infesting Artemisia vulgaris, Centaurea jacea, Cichorium intybus belong. Parasites of these aphid species (*Ephedrus campestris* Stary', *Praon dorsale* Hal., *Aphidius absinthii* Marsh., *Trioxys centaureae* Hal.) are mostly strictly specialized on a given aphid group, and they do not attack other (pest) aphid groups.

The useful aphidofauna is represented by aphids on Plantago media (*Aphis plantaginis* Goetze), Galium (*Galiobium langei* Börn.), Galium verum (*Aphis galii-scabri* Schrk.), Cichorium intybus (*Aphis intybi* Koch), Urtica dioica (*Aphis urticata* F.), which represent hosts of economically important parasite species (*Lysiphlebus fabarum* Marsh., *Lipolexis gracilis* Först.), which spread from here in the neighbourhood on cultured areas, parasitizing pest aphids here. On weeds and some other plants also pest aphids (*Aphis fabae* Scop. on Lappa major), for a certain period of their life cycle (dioecious species) often occur. Regarding the heterogeneity of aphidofauna and its parasites in these habitats the aphids are often heavily controlled by parasites, so that a lower number of them may then migrate on primary host plants. The effectiveness of parasites in this type of foci is conditioned on the one hand by the parasite attachment to the type of habitat (see Food specificity), on the other hand by the life cycle of dioecious aphids.

In spring the parasites (*Lysiphlebus fabarum* Marsh. *Lipolexis gracilis* Först.) attack at first root-collar infesting aphids (*Aphis plantaginis* Goetze, *Aphis intybi* Koch) and reach a comparatively high effectiveness in the period, when dioecious aphids begin to migrate here from forest type habitats.

The parasite effectiveness in foci of this type may be easily ascertained by collecting a number of aphid colonies in these habitats in summer, but just for the great spread it is hardly evaluable economically.

Because of irrigation of field cultures the elements of forest type (Populus, Salix, Ulmus), grown along irrigating ditches, often penetrate in field type habitats. In their fauna both of aphids and parasites, there are some species *Lysiphlebus ambiguus* Hal., a parasite of *Aphis farinosa* Gmel. on Salix), which can attack also aphids living in steppe habitats; in such places the fauna of forest and steppe habitats then mixes here.

5. Deciduous woods, N. Italy (Pthotogr. 59).

Fauna of aphids and parasites is rather typical and it has many common features with the similar derived type of habitats-with parks and orchards.

On trees and shrubs occurring here both monoecious and dioecious aphid species may be found - for the latter trees and shrubs represent primary host plants.

If the possible significance for infestation of forest trees is not considered, monoecious aphid species are rather important as in a number of cases they represent also hosts of parasites that attack dioecious aphids too. Monoecious aphid species (*Aphis viburni* Scop. on Viburnum, etc.) represent hosts of effective parasite species at the period when dioecious aphid species migrate on secondary host plants in field type habitats. Deciduous woods, therefore, include chronic foci of parasites. Following trees and shrubs are typical for deciduous woods habitats: Cornus sanguinea (*Anoecia* spp.), Viburnum opulus (*Ceruraphis eriophori* Walk.), Viburnum lantana (*Ceruraphis eriophori* Walk, *Aphis viburni* Scop.), Rubus sp. (*Macrosiphum funestum* Macch., *Aphis ruborum* Börn.), Ulmus sp. (*Schizoneura* sp.), Rhamnus frangula (*Aphis, Macchiatella*), Corylus avellana (*Corylobium avellanae* Schrk., *Myzocallis coryli* Goetze), Betula sp. (*Glyphina betulae* Bckt.), Alnus sp. (*Glyphina schrankiana* Börn.), Acer spp. (*Periphyllus* sp., *Drepanosiphum platanoides* Schrk.), Euonymus europaea (*Aphis fabae* Scop.), Padus racemosa (*Rhopalosiphum padi* L.), in wet places Phragmites communis (*Hyalopterus pruni* Geoffr.) is common. The indifferent aphid species are represented by *Glyphina betulae* Bckt. on Betula, *Glyphina schrankiana* Börn. on Alnus. The useful aphidofauna is represented by *Aphis viburni* Scop. on Viburnum spp. From dioecious pest aphids the following species may be mentioned: *Anoecia* spp. (Cornus sanguinea), *Schizoneura* spp. (Ulmus), *Aphis fabae* Scop. (Euonymus europaea), *Rhopalosiphum padi* L. (Padus racemosa), *Hyalopterus pruni* Geoffr. (Phragmites communis). The typical parasite species that occur in this habitat are the following: *Trioxys angelicae* (Hal.), *Ephedrus plagiator* (Nees), *Praon volucre* (Hal.), *Praon abjectum* (Hal.),

Lipolexis gracilis Först., *Trioxys pallidus* (Hal.), *Lysiphlebus ambiguus* (Hal.), *Aphidius pterocommae* Adhm., *Lysiphlebus thelaxis* Stary', *Protaphidius wissmanii*(Ratz.), *Ephedrus persicae* Froggatt, *Areopraon lepelleyi* (Waterston), *Trioxys cirsii* (Curtis).

6. Valleys of rivers, N. Italy (Photogr. 60).

Typical growth of North Italian valleys of rivers is made by Populus sp. (*Thecabius* sp., *Chaitophorus* sp., *Pterocomma* sp.), and Salix sp. (*Chaitophorus* sp., *Aphis farinosa* Gmel.).

In connection with common floods many plants that are typical for fallow lands, etc., may be found commonly in valleys of rivers, too: Rumex sp. (*Aphis* sp.), Robinia pseudoacacia (*Aphis* sp.), Chenopodium sp. (*Aphis fabae* Scop.), Urtica dioica (*Aphis urticata* F.), Carduus sp. (*Aphis fabae* Scop., etc.).

The growth of Populus sp. and Salix sp. include chronic foci of parasites - *Lysiphlebus salicaphis* Fitch, *Aphidius pterocommae* Ashm. and *Lysiphlebus ambiguus* (Hal.). There are from the greatest part foci of indifferent type, as the parasites are specialized on a certain aphid groups (*Pterocomma* sp., *Chaitophorus* spp.). There is one exception - *Lysiphlebus ambiguus* (Hal.), which attacks a number of indifferent and pest aphid species. It spreads along rivers and irrigating ditches in orcards and parks. By growing of Salix along irrigating ditches in field habitats it spreads also in habitats of this type and attacks aphids in their neighbourhood, occurring on weeds, etc. (see Photogr. 57, 58, etc.).

7. Sea shore, Riviera (Photogr. 61, 62, 63, 64).

A comparatively narrow zone is made by steppe type growth (Photogr. 61, 63), to this zone also long fallow lands and various waste places, which are not overgrown by trees, belong too. A typical character of this complex is its seasonal occurence, as due to the insolation they dry very soon. In consequence, these plants are mostly infested by seasonal aphidofauna and there are, although this is a more or less natural community, only temporary foci of parasites.

The composition of plants and aphidofauna of this zone is as follows: Lolium perenne v. rigidum (*Rungsia* sp.), Hordeum murinum (*Rungsia* sp.), Avena sativa v. barbata (*Rungsia* sp., *Sitobium* sp.), Psoralea bituminosa (*Aphis* sp.), Centaurea aspera (*Protaphis* sp.), Sedum rupestre (*Aphis* sp.), Melilotus albus (*Aphis* sp.), Sonchus oleraceus (*Dactynotus* sp., *Hyperomyzus* sp.), Carduus pycnocephalus (*Brachycaudus* sp.), Mentha arvensis (*Aphis* sp.), Ranunculus bulbosus (*Aphis* sp.).

The typical parasite species are the following: *Lysiphlebus arvicola* Stary', *Lysiphlebus ambiguus* (Hal.), *Lysiphlebus fabarum* (Marsh.), *Aphidius funebris* Mack., *Aphidius absinthii* Marsh., *Aphidius rosae* Hal., *Trioxys acalephae* (Marsh.), *Praon dorsale* (Hal.), *Aphidius avenae* Hal., *Trioxys centaureae* (Hal.).

In the close vicinity of the mentioned grassy zone there are shrubs and

groves, among which often orchards (olives, fruit trees) or small oat fields, carnation fields, and small places of more or less natural community (Photogr. 64) are situated. In olive and fruit orchards there is comparatively specifically numerous undergrowth of herbs that represents a natural intermediary zone between the steppe coastal zone and shrubs and trees. In some areas also the « macchia » shrubs occur, with rather common Sarothamnus scoparius and Pinus halepensis (Photogr. 62).

Trees and shrubs are represented by the following species: Pinus halepensis (*Cinara* sp.), Pinus marittima (*Cinara* sp.), Rubus sp., (*Aphis* sp.), Pistacia terebinthus (*Forda* sp.), Pistacia lentiscus (*Forda* sp.), Crataegus sp. (*Aphis pomi* Deg.), Tamarix sp. (*Aphis* sp.), Ulmus campestris (*Schizoneura* sp.), Lonicera implexa (*Hyadaphis* sp.), Sarothamnus scoparius (*Aphis* sp.) In orchards Prunus persica (*Myzus varians* Davids., *Hyalopterus pruni* Geoffr.), Malus silvestris (*Aphis pomi* Deg.), Oeleagnus, etc. are most common. The parasite complex consists of *Aphidius transcaspicus* Tel., *Pauesia silvestris* (Stary'), *Monoctonia pistaciaecola* Stary', *Ephedrus plagiator* (Nees), *Praon volucre* (Hal.), *Trioxys angelicae* (Hal.).

The grassy undergrowth is composed from the following species: Rubia tinctorum (*Aphis* sp.), Carduus pycnocephalus (*Aphis* sp.), Euphorbia characias (*Aphis* sp.), Arundo donax (*Rhopalosiphum donacis* Pass., *Schizaphis longicaudata* HRL.), Ammi majus (*Aphis* sp.), Chrysanthemum segetum (*Aphis* sp.), Sonchus arvensis (*Dactynotus* sp.), Torilis arvensis (*Aphis* sp.), Lavatera cretica (*Aphis* sp.), Sedum rupestre (*Aphis* sp.), Hypericum perforatum (*Aphis chloris* Koch), Sonchus oleraceus (*Dactynotus* sp., *Hyperomyzus* sp.), Reichardia picroides (*Dactynotus* sp.), Moricandia arvensis (*Brevicoryne brassicae* L.), Fumaria capreolata (*Aphis fabae* Scop.), Centranthus ruber (*Aphis* sp.), Vicia sativa v. macrocarpa (*Aphis fabae* Scop.), Vicia faba (*Aphis fabae* Scop.).

Besides, in gardens Pelargonium (*Aulacorthum* sp.), and Rosa sp. (*Macrosiphum rosae* L.), and along roads Pittosporum tobira as hedges (*Aphis* sp.) are commonly grown. The corresponding parasite complex is similar like in the sea-shore habitat.

From trees and shrubs, Pinus, Pistacia and Tamarix are infested by indifferent aphid species that represent alternative hosts of valuable parasite species. Crataegus, Ulmus, Sarothamnus, Pittosporum, are sources of pest aphids.

From the undergrowth Sonchus arvensis, Sonchus oleraceus, Reichardia picroides, Hypericum perforatum and Sedum are infested by indifferent aphis species.

Arundo donax and Moricandia arvensis are infested by aphid species that represent alternative hosts of pest aphid parasites. The other plants are attacked by various pest aphid species. The parasite complex is rather heterogeneous in connection with the coincidence of habitats.

8. Coniferous, mixed and deciduous woods, C. and S. Italy (Photogr. 65, 67, 70).

In the wood-steppe zone there are more or less continuos forests formed by in a various degree mixed growth of Pinus pinaster (*Protolachnus*, *Cinara*), Ulmus campestris (*Schizoneura* sp.), Quercus ilex (*Thelaxes* sp.), Quercus robur var. pedunculata (*Thelaxes* sp.), Quercus suber (*Lachnus* sp.), Quercus lanuginosa (*Lachnus* sp.), Pistacia terebinthus (*Forda* sp.).

Typical parasite complex is represented by *Lysiphlebus thelaxis* Stary', *Trioxys pallidus* (Hal.), *Protaphidius wissmannii* (Ratz.), *Areopraon lepelleyi* (Wat.), which are all parasites of aphids infesting deciduous trees, and by *Diaeretus leucopterus* (Hal.), *Pauesia* sp., that parasitize coniferous trees infesting aphids.

According to the type of habitat it includes chronic foci of parasites.

In higher mountains there are common Castanea- forests (*Lachnus*, *Myzocallis*), mixed with other trees (Juglans regia, etc.).

Due to the activity of man there are small areas - oat fields (Avena sativa - *Sitobium* sp.), bean fields (Vicia faba - *Aphis*, Vicia pannonica - *Aphis* sp.), clover fields (Trifolium angustifolium - *Aphis* sp.), where also various weeds are common (Cirsium - *Dactynotus* sp., Dorycnium hirsutum - *Aphis* sp., Papaver - *Aphis* sp.). In these areas spread elements of steppe habitats: *Lysiphlebus fabarum* (Marsh.) *Lysiphlebus ambiguus* (Hal.), *Aphidius funebris* Mack.

9. Orchards, C. and S. Italy (Photogr. 66, 67, 69, 71, 73).

In the research of plant community of orchards in central and southern Italy the trees undergrowth and neighbourhood of orchards were especially dealt with. The greatest interest was paid to peach and citrus orchards. Citrus trees (Citrus aurantium - *Toxoptera aurantii* B. d. F.), mostly in monocultures, peach tree (*Hyalopterus pruni* Geoffr., *Brachycaudus* sp., *Myzus* sp.) commonly with Punica granatum (*Aphis* sp.), Liquiricia sp. (*Aphis* sp.), Nespilus germanica (*Aphis* sp.), Malus silvestris (*Aphis pomi* Deg.), Juglans regia (*Callaphis* sp., *Chromaphis* sp.), Amygdalus communis (*Brachycaudus* sp.), Cydonia sp. (*Aphis pomi* Deg.) are grown. The mentioned trees may be often found in smaller farm gardens.

The undergrowth of orchards is rather heterogenous and depends on the cultivation degree. There occur the following plant species: Chenopodium sp. (*Aphis fabae* Scop., *Hayhurstia atriplicis* Geoffr.), Sonchus oleraceus (*Dactynotus* sp., *Hyperomyzus* sp.), Malva silvestris (*Aphis umbrella* Börn.), Papaver rhoeas (*Aphis* sp.), Amaranthus ascendens (*Aphis* sp.), Inula viscosa (*Dactynotus* sp.), Polygonum lapathifolium (*Aphis* sp.), Rubus sp. (*Aphis* sp.), Solanum nigrum (*Aphis* sp.), Melilotus albus (*Aphis* sp., *Acyrthosiphum pisi* Harris), Daucus carota (*Semiaphis dauci* F.), Artemisia sp. (*Macrosiphoniella* spp.), Avena sativa (*Sitobium* sp., *Rungsia* sp.), Urtica urens (*Aphis* sp.), Erysimum hieracifolium (*Brevicoryne brassicae* L.), Carduus pycnocephalus (*Brachycaudus* sp.), Carthamus lanatus (*Dactynotus* ap.).

The neighbourhood of orchards is various. There are either orchards in the open landscape, but they are mostly surrounded by various hedges. Besides, there are various ornamental shrubs as Rosa (*Macrosiphum rosae* L.), Glyphinia sp. (*Aphis* sp.), Spiraea sp. (*Aphis* sp.), in smaller farm gardens. Hedges are mostly formed by Pittosporum tobira (*Toxoptera aurantii* Fonsc.), Rosmarinus officinalis (*Aphis* sp.), Crataegus sp. (*Aphis pomi* Deg.), Robinia pseudoacacia (*Aphis* sp.), Quercus sp. (*Tuberculoides* sp., *Lachnus* sp.), Hedera helix (*Aphis hederae* Sckr.), Nerium oleander (*Aphis nerii* B. d. F.) - common along roads, Rosa sp. (*Macrosiphum rosae* L.). Irrigating ditches and their neighbourhood are bordered by Populus sp. (*Chaitophorus* sp., *Pterocomma* sp.) and often grown by Arundo donax (*Rhopalosiphum donacis* Pass.) and Phragmites communis (*Hyalopterus pruni* Geoffr.). From these plants, Pittosporum tobira, Crataegus and Glyphinia, Phragmites may be kept as unsuitable as they represent sources of pest aphids that infest fruit trees in orchards. On the contrary, the existence of Nerium oleander, Hedera helix, Rosmarinus officinalis, Arundo donax, in hedges is rather valuable as their aphidofauna is economically indifferent and represents alternative hosts of orchard pest aphids.

The aphidofauna of Quercus, Rosa and Populus and its parasites are quite indifferent in relation to orchards.

As for the undergrowth, the aphidofauna of Inula viscosa, Daucus carota, Artemisia, Erysimum, Carthamus, and its parasites are quite indifferent.

The rest of the above mentioned plants that occur in undergrowth or in the neighbourhood of orchards may be classified as useful. Although some of the aphid species that occur there (e.g. *Aphis fabae* Scop.) are in general pest aphids, they do not represent pest species in orchards but they are often alternative hosts of parasites that infest orchards pest aphids.

The typical species of parasites that occur here are the following: *Lysiphlebus ambiguus* (Hal.), *Trioxys angelicae* (Hal.), *Lipolexis gracilis* Först., *Aphidius rosae* Hal., *Aphidius transcaspicus* Tel., *Ephedrus persicae* Frog., *Praon volucre* (Hal.). In the undergrowth *Lysiphlebus ambiguus* (Hal.), *Lysiphlebus fabarum* (Marsh.), *Aphidius funebris* Mack., *Aphidius absinthii* Marsh., *Aphidius ervi* Hal., *Diaeretiella rapae* (M'Int.) may be found.

10. Field habitats, Central and Southern Italy (Photogr. 72).

Only some of the crops were studied: Medicago sativa (*Acyrthosiphon pisum* Harris, *Therioaphis* sp., *Aphis craccivora* Koch.), Solanum tuberosum (*Macrosiphum* sp.), Avena sativa (*Sitobium* sp)., Pisum sativum (*Acyrthosiphum pisum* Harris), Citrullus colocynthis (*Aphis* sp.), Foeniculum sp. (*Cavariella* sp., *Aphis* sp.), Cynara scolymus (*Capitophorus* sp.), Cynara cardunculus (*Dactynotus* sp.), Triticum vulgare (*Sitobium* sp.).

With the exception of Medicago sativa all the mentioned plants are annual crops. For this reason they represent only temporary foci of parasites, which spread on these areas from neigbouring habitats that include chronic foci.

Medicago sativa is a perennial crop, which entomofauna does not change for several years. For this reason alfalfa fields include chronic foci of parasites.

As for the aphid parasites, following species may be mentioned as being typical for field habitats: *Aphidius ervi* Hal., *Praon exoletum* (Nees), *Aphidius matricariae* Hal., *Lysiphlebus ambiguus* (Hal.), *Lysiphlebus fabarum* (Marsh.), *Aphidius avenae* Hal., *Praon volucre* (Hal.).

11. Afforestation of sea shore sands, Sicily (Photogr. 74).

In afforestation of sea shore sands in southern Sicily Eucalyptus-tree and Pinus pineopinaster are used. Pinus pineopinaster, although its growth are rather thin and represent dry habitats, is attacked by the same aphid species (*Cinara*) and parasites (*Pauesia* spp.) as in other Italian districts.

Eucalyptus-tree is not attacked by any aphid species. Otherwise there occur common plants in Eucalyptus and Pinus growths, such as Erodium botrys, Eryngium maritimum, etc. which are attacked by common aphidofauna and represent only possible sources of mostly indifferent parasite species.

12. Valleys of rivers, S. Italy and Sicily (Photogr. 75).

Habitats of valleys of rivers are rather important in dry areas of Italy, as because of continuous source of humidity green plants occur here almost continually, being infested by various aphidofauna that is attacked by a number of parasite species.

Along irrigating ditches all this plant complex reaches cultured areas, namely orchards, which represent similar groups of habitats. This has a big importance for the spread of parasites and the existence of chronic foci in the neighbourhood of orchards.

From plants that are attacked by indifferent aphidofauna, there are Populus pyramidalis (*Chaitophorus* sp., *Pemphigus* sp.), Inula viscosa (*Dactynotus inulae*), Agropyrum sp. (*Rungsia* sp.). Parasites of the mentioned aphids do not attack pest aphids.

The following plants are infested by aphidofauna, which is a source of alternative hosts of pest aphid parasites: Arundo donax (*Rhopalosiphum donacis* Pass.), Nerium oleander (*Aphis nerii* B. d. F.), Tamarix (*Aphis* sp.).

Phragmites communis (*Hyalopterus pruni* Geoffr.), is a source of pest aphids, which may spread from these plants in the neighbourhood (orchards), although they are attacked by parasites also in these habitats.

Typical parasite species occurring in valleys of rivers are: *Aphidius transcaspicus* Tel., *Praon volucre* (Hal.), *Ephedrus plagiator* (Nees), *Lysiphlebus ambiguus* (Hal.), all being parasites of pest aphids. *Ephedrus campestris* Stary, *Aphidius absinthii* Marsh., *Praon dorsale* (Hal.), *Aphidius funebris* Mack., *Lysiphlebus arvicola* Stary', *Lysiphlebus salicaphis* Fitch, *Monoctonia pistaciaecola* Stary' are indifferent parasite species.

21. Integrated control of pest aphids.

On the basis of material and habitat studies made during our Italian trip we decided to deal only with integrated control of pest aphids in long-termed communities - in citrus and peach orchards, where the problems are comparatively clear and our proposed integrated control possibilities may be easily accepted after a more detailed study (held throughout all the season) is made.

Our studies on integrated control of pest aphids in citrus and peach orchards may be summarized as follows:

Citrus and peach orchards in Italy.

Citrus and peach tree are grown especially in southern districts, in the Riviera along the coast to the south. There are either citrus or peach tree monoculture orchards, or mixed orchards, or both are commonly grown in smaller farm gardens, etc.

In orchards the grassy or weed undergrowth is usually more or less developed. The paths are bordered with shrubs, usually with Pittosporum tobira that serves as hedges. Pittosporum is also planted by the roads (Riviera), in parks, etc. as a decorative shrub. Irrigation ditches and secondary marshes are commonly overgrown with Phragmites communis and Arundo donax.

Aphidofauna of citrus and peach trees in Italy.

Citrus is mostly attacked by *Toxoptera aurantii* (B.d.F.). Is it an anholocyclic species, widely distributed, occurring commonly in orchards and gardens. It attacks, besides Citrus, Thea, Morus, Illicum, Pittosporum, etc.

Peach is attacked by *Myzus varians* Davids., which causes strong crocking of leaves and tops, and by *Hyalopterus pruni* (Geoffr.), which causes curling and drying of leaves. *Hyalopterus pruni* (Geoffr. ind. *H. amygdali* (Blanch.)), which was studied more intensively, has Prunus spp. (P. domestica, P. spinosa, P. armeniaca, P. persica) as the primary host plants, while Phragmites communis is the main secondary host plant. Arundo donax, which is also quoted as a secondary host plant, is according to our studies attacked only rarely, while Phragmites communis is clearly preferred. *Hyalopterus pruni* occurs both on the primary and secondary host plants in orchards and gardens, i.e. in habitats of the same type.

Parasites of citrus and peach aphid pests in Italy.

Toxoptera aurantii (B.d.F.) on citrus is attacked mainly by *Lysiphlebus ambiguus* (Haliday), in a lower degree by *Lipolexis gracilis* Förster and *Trioxys angelicae* (Haliday).

Lysiphlebus ambiguus (Hal) is widely distributed in Europe, Asia Minor, Transcaucasia and Central Asia. In northern districts it occurs in forest-type habitats (parks, orchards, wood-borders, etc.). In southern districts it occurs in similar habitats (orchards, oases, Salix-belts along irrigation ditches, etc.), from where it also spreads in xerophilous habitats in the neighbourhood (desert plants in the neighbourhood of oases, etc.).

It parasitises mainly species of the subfamily *Aphidiinae* (genus *Aphis*), in a lower degree also other aphid groups (*Brachycaudus* spp., etc.). According to our observation it is the main parasite of *Toxoptera aurantii* in Italy.

Lipolexis gracilis Först. is a widely distributed species, known from Europe and Far East. It occurs mainly in steppe -type habitats, in a lower degree in intermediary or forest-type habitats (wood-borders, orchards).

It attacks mostly *Aphis* spp., but also *Brachycaudus* spp., *Myzus cerasi*, etc. Its occurrence as parasite of *Toxoptera aurantii* seems to be rare.

Trioxys angelicae (Hal.) is distributed all over the Europe and Asia Minor. It occurs mostly in habitats of the forest and intermediary type (borders of woods, parks and orchards), from where it spreads in a lower degree to the steppe-type habitats in the neighbourhood.

It attacks mainly *Aphis* spp., besides some other aphid groups. Its occurrence as parasite of *Toxoptera aurantii* seems to be rare in Italy.

Hyalopterus pruni (Geoffr.) is attacked by two parasite species: *Aphidius transcaspicus* Tel. and *Praon volucre* (Hal.).

Aphidius transcaspicus Tel. As we know so far, it is distributed in southern Europe and Central Asia; its area of distribution seems to cover all the Mediterranean, Asia Minor, Transcaucasia and Central Asia. It occurs in forest type habitats, in orchards and gardens, or in wet habitats (« forest-like ») as Arundo donax thickets in orchard neighbourhood, etc.

It is a parasite of some members of the subfamily *Aphidinae* (*Hyalopterus*, *Rhopalosiphum*). According to our observation it is the most common and most effective parasite of *Hyalopterus pruni* in the south of Italy. It seems that its introduction in some other countries of *Hyalopterus pruni* pest occurrence might be valuable economically.

Praon volucre (Hal.) is distributed from Europe to Central Asia. It is a comparatively widely eurytopic species, occurring in orchards, gardens, but in fields and steppes, too.

Its food specificity is wide including many aphid groups. According to our observation it is a rather common but not too effective parasite of *Hyalopterus pruni* in Italy.

Augmentation of aphid parasites.

By chemical treatment in orchards the parasites (including their developmental stages) are killed with aphid pest. Their reoccurrence in the orchard depends on the existence of foci in the neighbourhood of the area treated. As to the existence of foci there are two possibilities in this case:

1. In the neighbourhood there occurs either in a poorly or untreated part of orchard or on other untreated plants (hedges) the same aphid pest, which is attacked by the same parasite, from where they both may spread in the area treated. The foci of this type are not desirable, as from them the same aphid pest that was controlled chemically spreads in the orchards and the pest is reestablished in the orchard. Therefore, according to the pest occurrence (although parasites occur here, too) preservation of the foci of this type is not recommendable.

2. The parasite of pest aphid species attacks also economically indifferent aphid species living on other plants species in the neighbourhood and from here it spreads in the area treated. The foci of this type are rather valuable, as they represent the possibility of parasite spread in areas treated, while its host in the focus is economically indifferent and does not spread on other cultural plants. The support of such a focus existence by growing such economically indifferent (decorative) plants is recommendable, the aphidofauna of which is suitable in relation to the augmentation of parasites.

Integrated control possibilities.

Citrus tree (Citrus aurantium).

In the neighbourhood and in citrus orchards Pittosporum tobira commonly occurs or is planted, being a preferred host plant of *Toxoptera aurantii*. The Pittosporum shrubs are often cut and especially on the young leaves the aphid pest reproduces very intensively, and speads from there on Citrus. For this reason it is recommended to cut over Pittosporum shrubs in citrus orchards and their neighbourhood and plant other shrubs or trees instead, the aphidofauna of which is indifferent to citrus. *Toxoptera aurantii* on Pittosporum tobira is attacked by the same parasite complex as citrus, but for the reasons above mentioned the existence of such a type of parasite-focus is not recommendable. To augmentate *Lysiphlebus ambiguus* (Hal.) it is suitable to replace Pittosporum shrubs by other plants: 1. Oleander (Nerium oleander); its main aphid pest - *Aphis nerii* (B.d.F.) is one of the preferred hosts of *Lysiphlebus ambiguus* (Hal.). Oleander is a common decorative plant like Pittosporum, but *Aphis nerii* does not attack citrus. 2. Willow (Salix spp.) is also a very suitable tree. It is attacked by specialized *Aphis farinosa* Gmel., which is one of the main hosts of *Lysiphlebus ambiguus* (Hal.). The growth, belts, etc. of both plants mentioned represent chronical foci of a rather effective aphid parasite - *Lysiphlebus ambiguus* (Hal.) that spreads from theme in citrus orchards and attacks *Toxoptera aurantii*. Besides, it attacks also *Aphis punicae*, a pest aphid on Punica granatum. 3. In citrus orchards the occurrence of grassy and weed undergrowth may be supported as *Aphis* spp. occur on weeds, representing for the greatest part hosts of *Lysiphlebus ambiguus* (Hal.). However it may not be suitable, representing on one hand foci of temporary type, on the other hand the orchards undergrowth usually treated together with citrus.

Peach tree (Prunus persica).

Hyalopterus pruni migrates on Prunus persica from the secondary host plant of which Phragmites communis is the most important, or from other host plants - weed trees like Prunus spinosa, or other Prunus species (P. domestica, P. armeniaca).

Phragmites thickets are common in the neighbourhood of orchards in irrigation ditches and marshes formed by irrigation. Prunus spinosa is planted sometimes as hedge. For the reason above mentioned Phragmites thicket are recommended to be cut over and Prunus spinosa should be considered un-

necessary, where possible. *Hyalopterus pruni* is attacked on the host plants mentioned by the same parasite complex as on the peach tree, but in connection with the pest existence and its spread on cultured trees foci of this type must be considered unsuitable.

In the same type of habitat (thickets on marches, ditches, etc.), as Phragmites, Arundo donax is common. According to our observation the latter is attacked very poorly by *Hyalopterus pruni*, while *Rhopalosiphum donacis* (Pass.) is rather common and *Schizaphis longicaudata* HRL. less common on this plant. *Rhopalosiphum donacis* is a preferred host of *Aphidius transcaspicus* Tel. that occurs very commonly here, too, and from here it spreads in the neighbourhood, where it attacks *Hyalopterus pruni* on Phragmites, or in the neighbouring orchards where it attacks *Hyalopterus pruni* on peach. Thickets of Arundo donax represent a chronical type of foci, the occurrence of which should be supported, as its aphidofauna includes economically indifferent species and represents alternative host of *Aphidius transcaspicus* Tel. - an effective parasite of *Hyalopterus pruni* on peach.

Considerations.

On the basis of our field observation and samples made during our Italian trip the following research programme for the future has been proposed:

1. General study of the Italian *Aphidiidae*.
2. The study must source from reared material of parasites, while, beside host aphid, the aphid host plant and the type of habitat is recommended to be also dealt with.
3. The parasites of all aphid species, both pests and economically indifferent species, must be studied as the indifferent species often represent alternative hosts of economically important aphidiids.
4. The host-specificity of different parasite species in connection with results obtained by 3.
5. Effectiveness of different parasite species and factors influencing it.
6. The foci of parasites in various types of habitats, namely in cultured areas.
7. The relation of Italian aphidiid fauna to other countries. Appreciation of native parasites. Possibility of export and introduction of effective species.
8. Possibilities of integrated control of pest aphids.

Conclusions.

1. The research of aphid parasites in Italy has shown that there are many widely distributed species represented in the fauna. Nevertheless, in subtropic areas namely, occur species that are typical only for such territories.

2. A number of species of parasites was observed to reach high effectiveness in the natural limitation of aphids. Such species are recommended to be studied in a more detailed way.

3. Research of parasite foci has shown the practical possibilities of integrated aphid control in peach and citrus orchards namely. *Aphidius transcaspicus* Tel. is recommended to be introduced in other countries of *Hyalopterus*-species pest occurrence.

4. The further direction of research ought to include: *a*) Further research of host-composition of Italian aphid parasites. *b*) Research of laboratory and field ecology in economically valuable species. *c*) Research of foci of parasites with regards to integrated control. *d*) Possibilities of export and import of aphid parasites.

RIASSUNTO

Nella elaborazione di materiali originali di *Aphidiidae* (*Hym. Ichneum.*) di Italia, una famiglia di parassiti endofagi degli Afidi, l'Autore fa precedere una parte generale, come introduzione allo studio degli *Aphidiidae* stessi. Ciò con una rassegna della letteratura esistente, istruzioni sui metodi di raccolta, conservazione e preparazione del materiale, dati sulla morfologia e l'anatomia, biologia, focolai in natura, distribuzione geografica, interrelazione tra ospite ed endofago, superparassitismo, rapporti tra parassiti e Formiche, nemici naturali, importanza economica.

La parte tassonomica include l'esposizione di criteri sistematici specifici, le chiavi di determinazione (per gli individui ♀♀) dei generi e dei sottogeneri europei, una rivista faunistica degli *Aphidiidae* italiani (con tutti gli ospiti e i biotopi conosciuti dall'Autore), un catalogo degli Afidi ospiti e dei loro parassiti. Vengono date le descrizioni di: *Pauesia alpina, P. goidanichi, P. media, P. montana, P. rufiabdominalis, P. similis* spp. nn. italiane.

La terza parte, applicata, comprende la trattazione della diapausa, della corologia, della ecologia in natura e della lotta integrata contro gli Afidi, sulla scorta delle attuali informazioni sulla fauna italiana. L'Autore pone particolare interesse nella lotta integrata negli agrumeti e nei pescheti. Per gli agrumeti (*Citrus* spp.) egli raccomanda la limitazione delle colture di *Pittosporum tobira*, focolai di moltiplicazione dell'Afide degli agrumi *Toxoptera aurantii*, sostituendole con altri arbusti od alberi quali *Nerium oleander* o *Salix* spp. l'afidofauna dei quali è indifferense per i *Citrus* e rappresenta viceversa delle conv,ttime (od ospiti alternativi) per i parassiti della *Toxoptera aurantii*, alla quale essi ritornano in volo da qui agli agrumeti. Per i pescheti (*Prunus persica*) l'Autore raccomanda di eliminare dalle loro vicinanze le formazioni di *Phragmites communis*, quali focolai di *Hyalopterus pruni*, conservando ed aiutando viceversa nei medesimi ambienti le colture di *Arundo donax*, poichè la afidofauna di questa graminacea è indifferente per i Peschi e invece rappresenta gli ospiti alternativi o convittime dei parassiti di *Hyalopterus pruni*.

L'Autore raccomanda di curare l'esportazione, e l'acclimatazione in altri Paesi ospitanti il nocivo *Hyalopterus pruni*, dell'*Aphidius transcaspicus* Tel., il suo più efficace parassita nell'Italia centro-meridionale.

Vengono dati un breve programma per le ricerche future sull'argomento, una bibliografia speciale e generale, una illustrazione in disegni e in fotografie di particolari morfologici dei generi e delle specie descritti e di alcuni interessanti biotopi degli *Aphidiidae* trattati nella memoria.

SUMMARY

This is an elaboration of original material of the Italian *Aphidiidae*, a hymenopterous group of aphid parasites.

In the general part, which is an introduction to the study of the *Aphidiidae*, the following was briefly summarized: Literary review, methods of sampling, etc. of material, morphology and anatomy, life history, foci in nature, geographic distribution, host and parasite relationship, superparasitism, parasites and ant relationship, natural enemies, economic importance.

The second, taxonomic part, includes specific criteria, key to the European genera and subgenera, faunistic review of the Italian *Aphidiidae*, host and parasite catalogue. Descriptions of new *Pauesia*-species are added.

In the third, applied part of the paper the diapause, zoogeography, foci in nature and integrated control of aphids are dealt with as the result of application of our contemporary knowledge of Italian material. Interest was paid to integrated control in citrus and peach orchards, the following being recommended:

Citrus orchard. 1. It is necessary to restrict hedges of Pittosporum tobira in gardens and citrus orchards namely as they represent foci of *Toxoptera aurantii* - the citrus pest aphid. 2. The hedges of Pittosporum tobira are recommended to be replaced by other shrubs or trees, such as Nerium oleander or Salix spp., the aphidofauna of which is indifferent to citrus and represent alternative hosts of *Toxoptera aurantii* parasite, which spreads from here in citrus orchards.

Peach orchard. 1. Thickets of Phragmites communis are necessary to be cut over in the neighbourhood of peach orchards as they represent foci of *Hyalopterus pruni* - the peach pest aphid. 2. It is necessary to preserve and support the existence of Arundo donax in the same places, as its aphidofauna is indifferent to peach tree and represent alternative hosts of *Hyalopterus pruni* parasites, which spread from here to peach orchards.

Aphidius transcaspicus Tel., the most effective parasite of *Hyalopterus pruni* in southern Italy, is recommended for export in other countries of *Hyalopterus pruni* pest occurrence.

A short research programme for the future is added.

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CONTENTS

I. – General part

II. – Taxonomic part

III. – Applied part

EXPLANATION OF THE PLATES

I

1. – *Pauesia* sp., head. Nomenclature of distances.
2. – *Monoctonus* (*Monoctonus* s. str.) sp., propodeum.
3. – *Ephedrus* (*Ephedrus* s. str.) sp., nomenclature of wing-venation. Veins: An - anal, B - basal, C - costal, Cu - cubital, Im - intermedian, Ir - interradial (first, second), M - median (first, second, etc.), Mt - metacarp, n. - nervellus (= first intercubital), Pt - pterostigma, R - radial (first, second, third absc.), Sc - subcostal; cells: Bc - basal, Cuc - cubital (first, second), Mc - median (first, second), Ptc - pterostigmal, Rc - radial (first, second, third).
4. – *Monoctonus* (*Paramonoctonus*) sp., propodeum.
5. – *Praon* sp., ovipositor sheaths.
6. – *Ephedrus* (*Ephedrus* s. str.) sp., nomenclature of female genitalia (after Smith, 1944). IX - ninth abdominal tergite, AP - anterior prong of second valvulae (2 VL), VL - valvula (first 1 VL, second 2 VL, third 3 VL), VLF - valvifer (first - 1 VLF, second - 2 VLF), VP - ventral prong of ninth abdominal tergite, PTGR - proctiger.
7. – *Dyscritulus* sp., head from above.
8. – *Monoctonus* (*Monoctonus* s. str.) sp., ovipositor sheaths.
9. – *Aphidius* sp., propodeum.

II

10. – *Trioxys* (*Betuloxys*) sp., apex of prong of last abdominal sternite.
11. – *Aphidius* sp., wing.
12. – *Monoctonia* sp., tergite 1.
13. – *Lipolexis* sp., ovipositor sheaths.
14. – *Dieretus* sp., propodeum.
15. – *Paralipsis* sp. wing.
16. – *Areopraon* sp., ovipositor sheath.
17. – *Toxares* sp., ovipositor sheath.
18. – *Trioxys* sp., wing.
19. – *Ephedrus* (*Lysephedrus*) sp., ovipositor sheath.
20. – *Dieretiella* sp., wing.
21. – *Praon* sp., wing.
22. – *Aphidius* sp., ovipositor sheath.

III

23. – *Trioxys* (*Trioxys* s. str.) sp., tergite 1.
24. – *Lysiphlebus* sp., wing.
25. – *Lipolexis* sp., wing.
26. – *Trioxys* (*Binodoxys*) sp., tergite 1.
27. – *Pauesia* sp., propodeum.
28. – *Monoctonus* (*Paramonoctonus*) sp., ovipositor sheath.
29. – *Dyscritulus* sp., wing.
30. – *Monoctonia* sp., ovipositor sheath.
31. – *Metaphidius* sp., part of abdomen.
32. – *Ephedrus* (*Ephedrus* s. str.) sp., ovipositor sheath.
33. – *Lysaphidus* sp., female genitalia (AP - anterior prong of valvulae 2).

IV

34. – *Trioxys* (*Pectoxys*) sp., tergite 1.
35. – *Trioxys* (*Binodoxys*) sp., female genitalia.
36. – *Protaphidius* sp., abdomen of female.
37. – *Trioxys* (*Binodoxys*) sp., prong of last abdominal sternite.
38. – *Trioxys* (*Pectoxys*) sp., prong of last abdominal sternite.
39. – Parasite x host catalogue card.

V

40. – A box of the *Aphidiidae* collection. Rests of dried plants with aphid mummies are preserved in vials placed beside the series of reared mounted material of aphidids. Each series has the number of corresponding sample and all the data (locality, habitat, aphid host plant, host aphid).
41. – Field plastic or metallic boxes containing samples of aphid colonies in vials.
42. – Vials containing aphid colonies on pieces of aphid host plant. In every vial a label with corresponding number of sample is placed.
43. – Ant nest on root collar of Eryngium sp., *Dysaphis* sp. aphid. San Giorgio (Torino).

VI

44. – *Pterocomma* sp. colony on Populus pyramidalis, infested by *Aphidius pterocommae* (Ashm.). Dead mummified and living aphids in colony. Taranto.
45. – Galls on Ulmus, caused by *Schizoneura lanuginosa* Htg., San Giacomo (Sanremo).
46. – Dissected gall on Ulmus, caused by *Schizoneura lanuginosa* Htg., infested by the parasite *Areopraon lepelleyi* (Waterston). San Giacomo (Sanremo).
47. – Ditto, detailed. Mummified *Schizoneura lanuginosa* Htg. aphids infested by *Areopraon lepelleyi* (Waterston).
48. – Mummified *Pemphigus* sp. aphid, infested by *Monoctonia pistaciaecola* Stary'. Diapause cocoon.

VII

49. – Gall on Populus pyramidalis caused by *Pemphigus lichtensteini* Tullg. Taranto.
50. – *Hyalopterus pruni* Geoffr. on leave of Prunus persica. Heavily infested colony by *Aphidius transcaspicus* Telenga. Catania.
51. – Heavy infestation of *Aphis evonymi* F. on Solanum. South Italy, Capo Ali (Messina).
52. – Heavy infestation of *Aphis fabae* Scop. on Vicia faba by *Lysiphlebus fabarum* (Marsh.). Sant'Elia, env. of Catanzaro.

VIII

53. – Heavy infestation of *Aphis urticata* F. on Urtica dioica by *Lysiphlebus ambiguus* (Hal.). Stupinigi (Torino).
54. – Infestation of *Aphis farinosa* Gmel. on Salix by *Lysiphlebus ambiguus* (Hal.) Alba (Cuneo).
55. – Heavy infestation of *Aphis punicae* Pass. on Punica granatum by *Lysiphlebus ambiguus* (Hal.). Taranto.
56. – Cesana, Sestriere (Torino). Mountain meadows, coniferous forests. Habitat of many *Cinara* spp. and their parasites of the genus *Pauesia*.

IX

57. – Stupinigi (Torino) - env. gardens - horticulture districts. On the road side there is a fallow land with weeds (Chenopodium, Urtica, etc.) from where parasites spread into the cultivated areas.
58. – Env. of Alba (Cuneo). Vineyards, willow trees on balks between fields.
59. – Millesimo (Savona), env. meadows and deciduous forest (Viburnum, Cornus, Quercus, etc.).
60. – Valley of the river Sesia near Carpignano (Novara). Populus and Salix trees. Habitat of *Pterocomma, Thecabius, Aphis farinosa* Gmel., *Chaitophorus* spp. and their parasites.

X

61. – Ventimiglia. Sea shore. A group of Arundo donax plants.
62. – Capo Mele (Savona). « Macchia » shrub plant community.
63. – Noli (Savona). Road side between a road and sea-shore. Steppe habitat bordered by Pittosporum tobira strips.
64. – Noli (Savona). Old olive orchards and their neigh-bourhood. Pistacia spp., Pinus spp., etc.

XI

65. – Pisa. Coniferous forest (Pinus pinaster).
66. – Massafra (Taranto). Oleander trees along a road.
67. – Gioia del Colle (Bari). Wood steppe habitat.
68. – Taranto. Horticulture district with waste places along a road, from where parasites spread into the cultivated places.

XII

69. – Policoro (Matera). Irrigated peach and citrus orchard with grassy and weed undergrowth.
70. – Sant'Ella, env. of Catanzaro. Castanea vesca forest with a clearing where oats and beans are grown.
71. – Acireale, Sicily. Citrus orchard with roads bordered by Pittosporum tobira, with grassy and weed undergrowth.
72. – Ventimiglia di Sicilia (Palermo), Sicily. Field with waste places covered by Chenopodium, Cichorium, Carduus, Cirsium, etc.

XIII

73. – Marsala, Sicily. Fields bordered by irrigating ditches, overgrown with Arundo donax, Pharagmites communis. Sea-shore.
74. – Balestrate (Palermo), Sicily.
75. – Balestrase (Palermo), Sicily. Valley of a river in xerotherm habitats, (steppe, corn fields) overgrown with Tamarix, Arundo donax, Phragmites communis, Inula viscosa, etc.
76. – Villa Fassini, env. Terrasini (Palermo), Sicily. Gardens and (citrus) orchards, the roads are bordered by Pittosporum tobira.

XIV

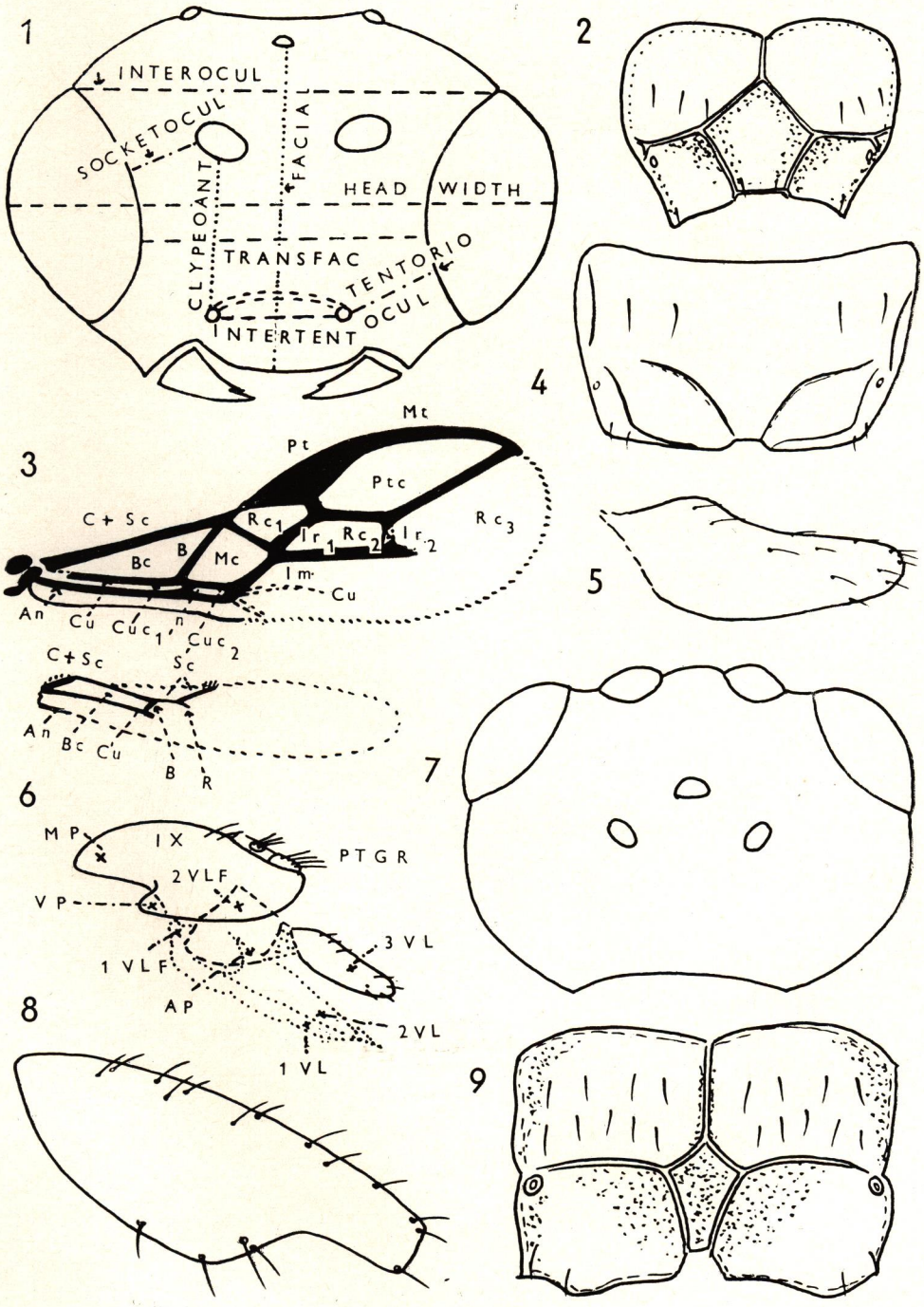
77. – *Pauesia montana* n. sp., female, propodeum.
78. – *Pauesia similis* n. sp., tergite 1, Female.
79. – *Pauesia media* n. sp., female, propodeum.
80. – *Pauesia similis*, n. sp., female, propodeum.
81. – *Pauesia media* n. sp., tergite 1, female.

XV

82. – *Pauesia alpina* n. sp., propodeum.
83. – *Pauesia rufiabdominalis* n. sp., tergite 1, female.
84. – *Pauesia rufiabdominalis* n. sp., female, propodeum.
85. – *Pauesia montana* n. sp., tergite 1, female.
86. – *Pauesia goidanichi* n. sp., propodeum, female.

XVI

87. – *Pauesia alpina* n. sp., tergite 1, female.
88. – *Pauesia media* n. sp., ovipositor sheath.
89. – *Pauesia goidanichi* n. sp., tergite 1, female.
90. – *Pauesia rufiabdominalis* n. sp., female genitalia.
91. – *Pauesia goidanichi* n. sp., female genitalia.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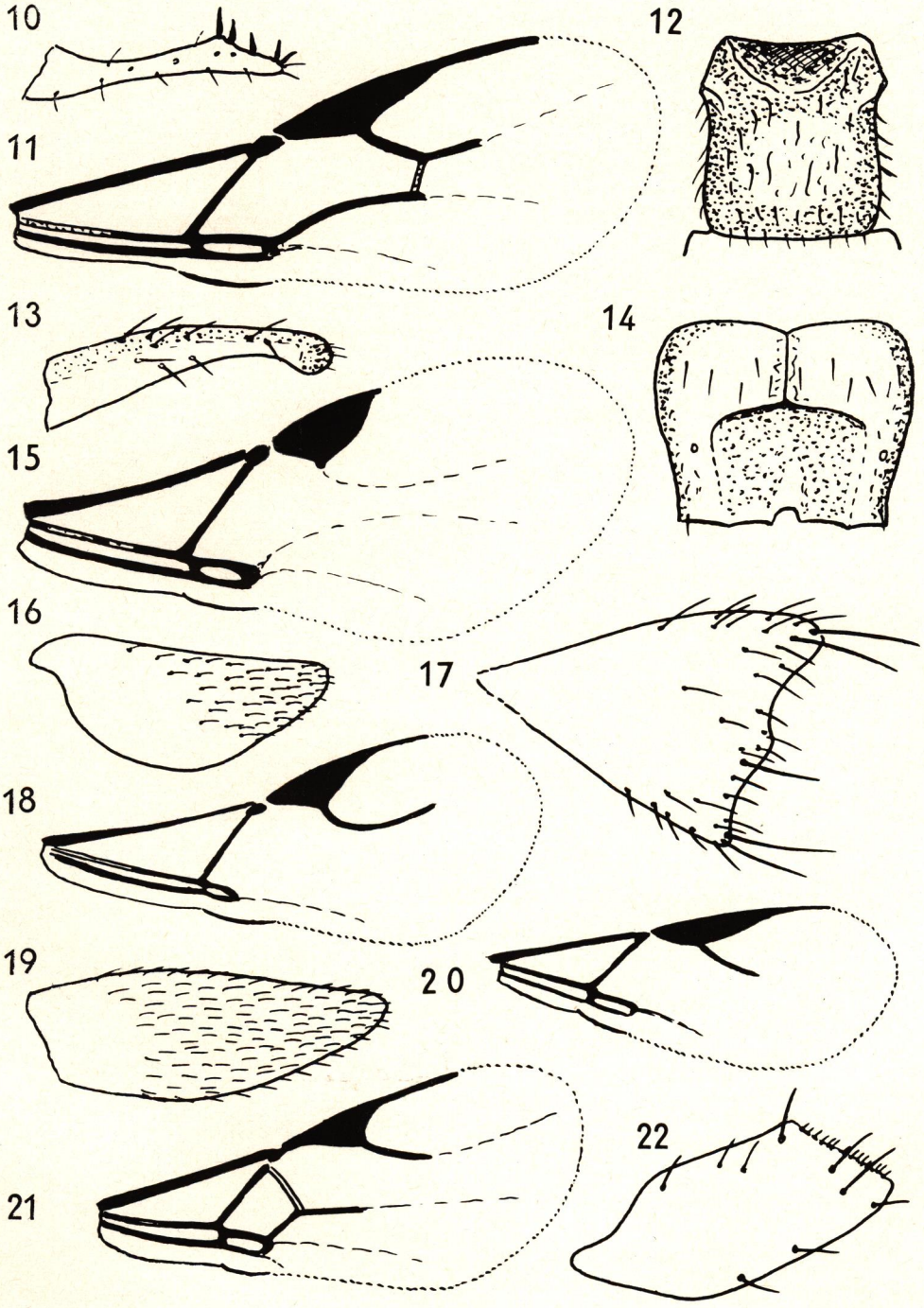
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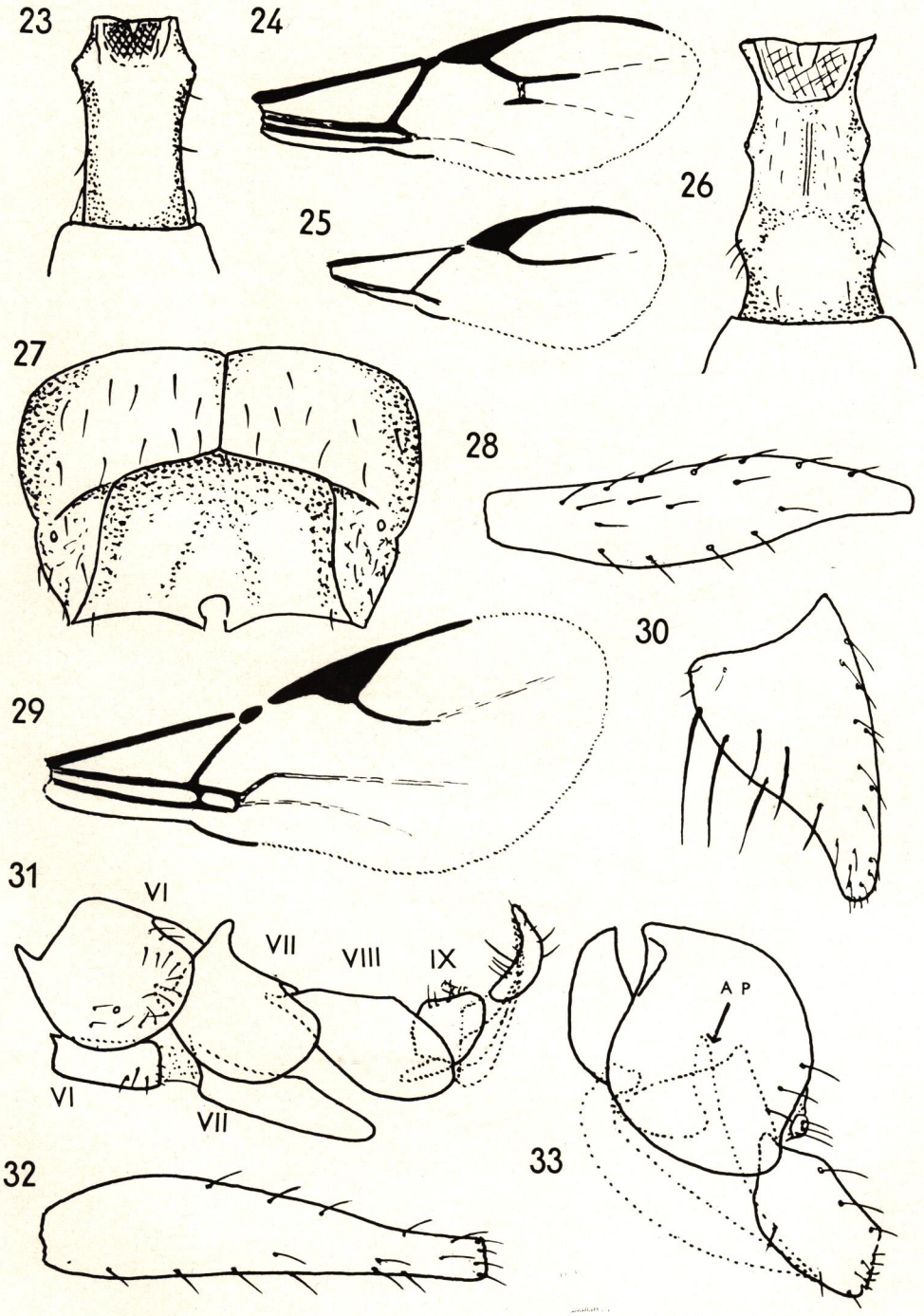
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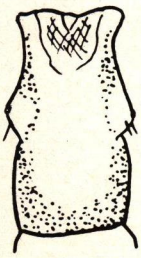

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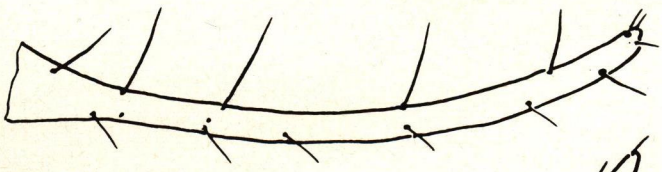

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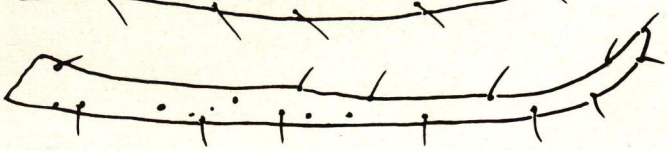

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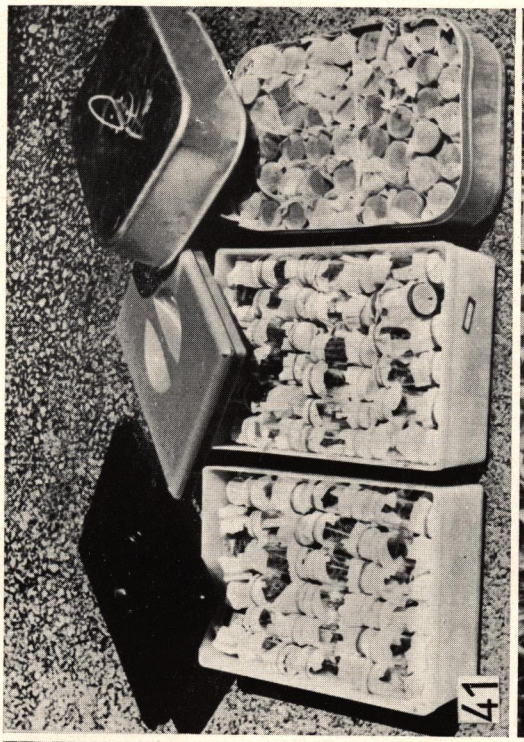
PARASITE	COUNTRY
HOSTAPHID	SAMPLE No.
APHID HOSTPLANT	
HABITAT	
NOTES	
LOCALITY	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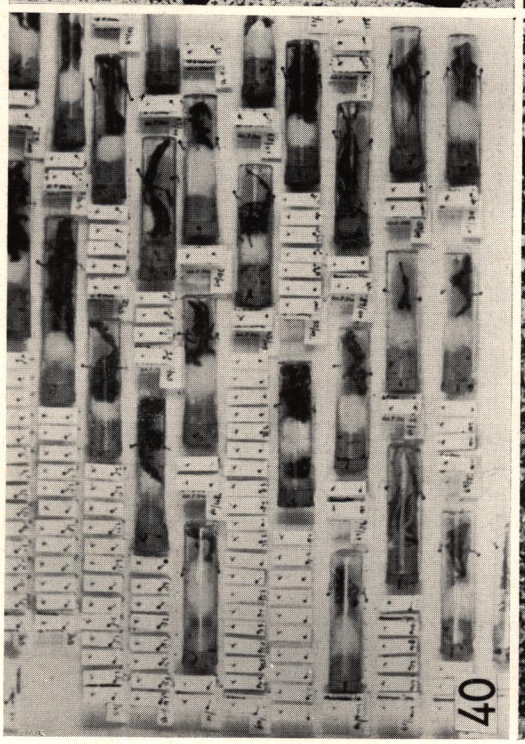
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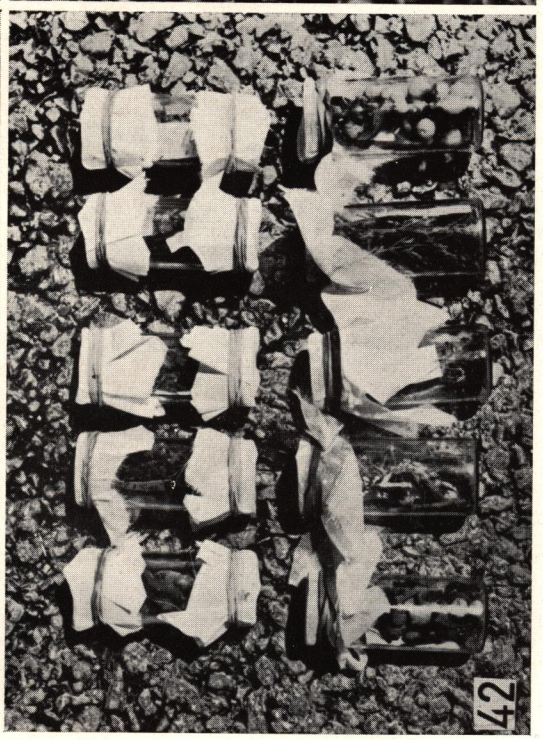
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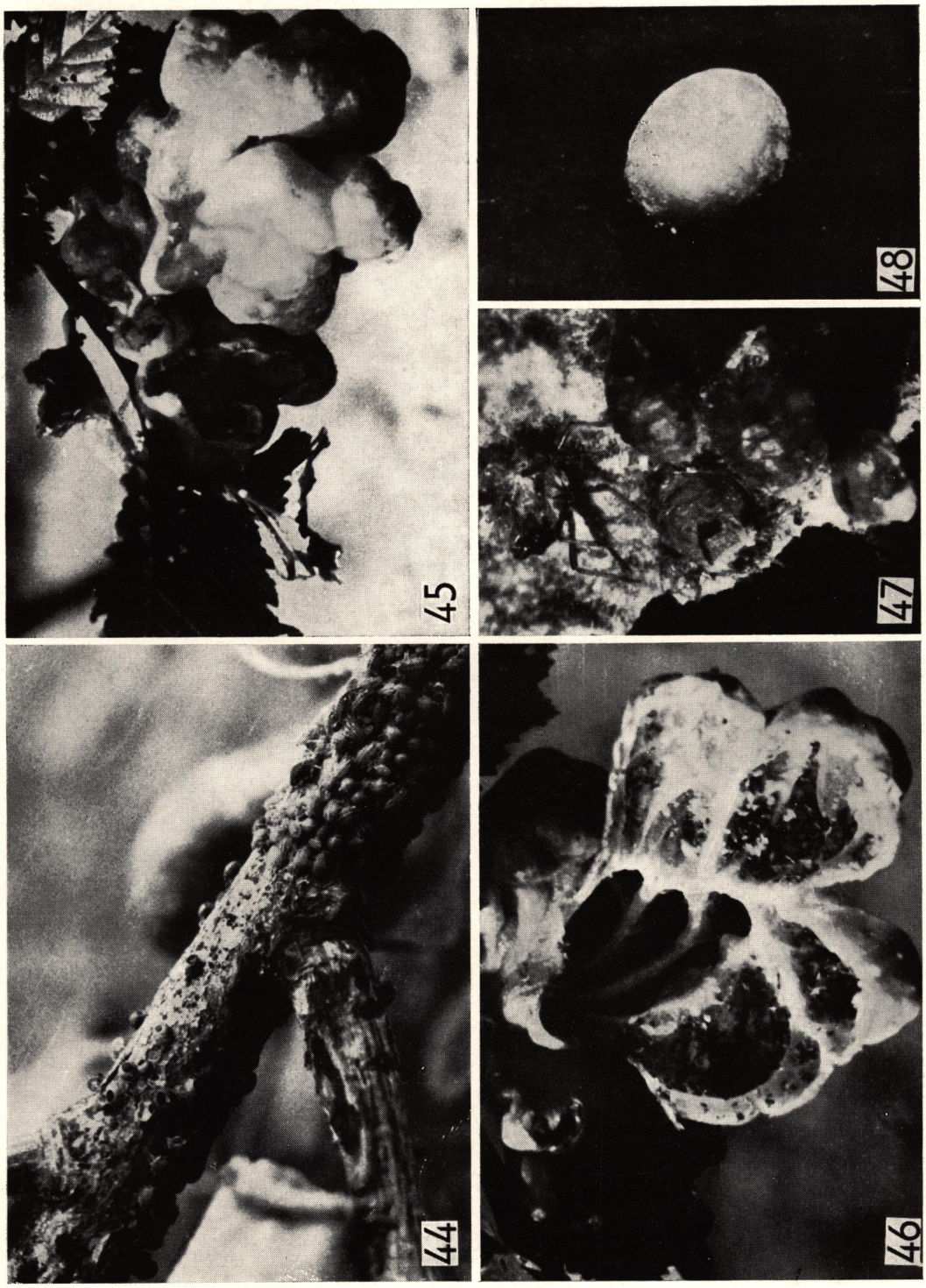
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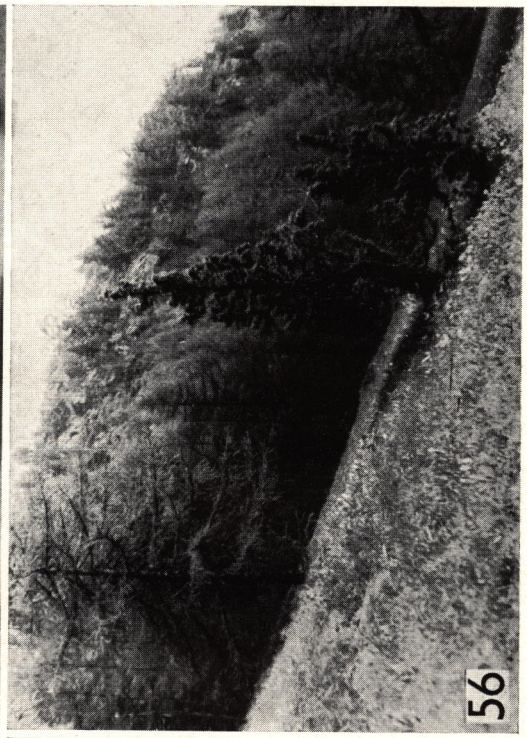
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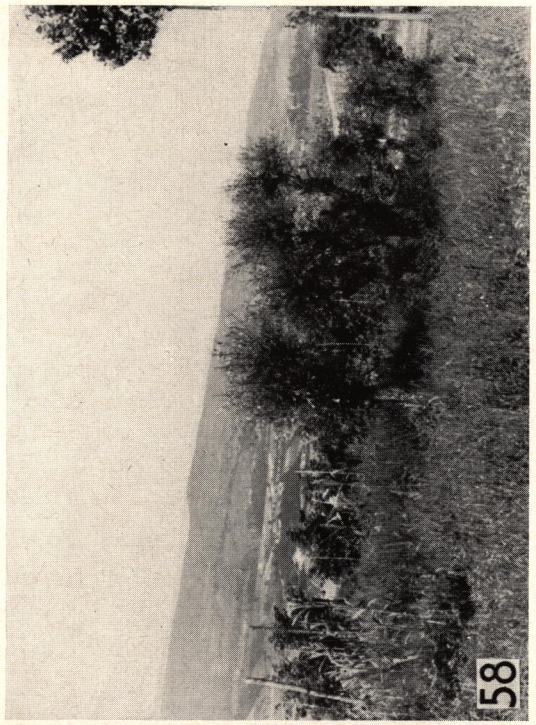
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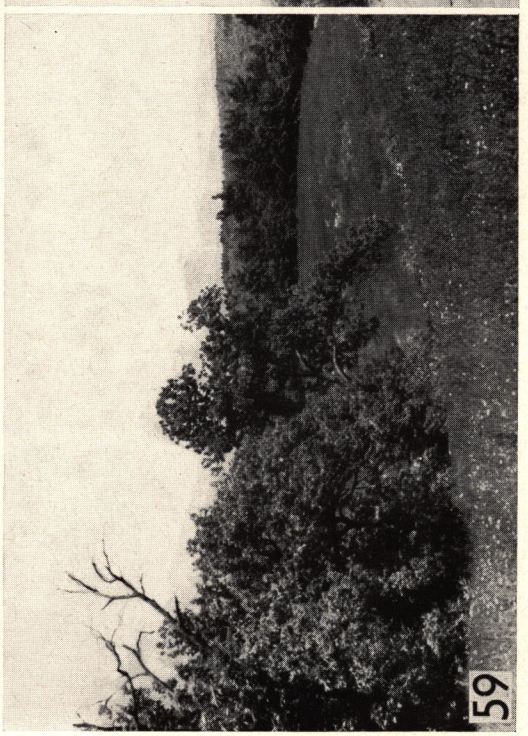
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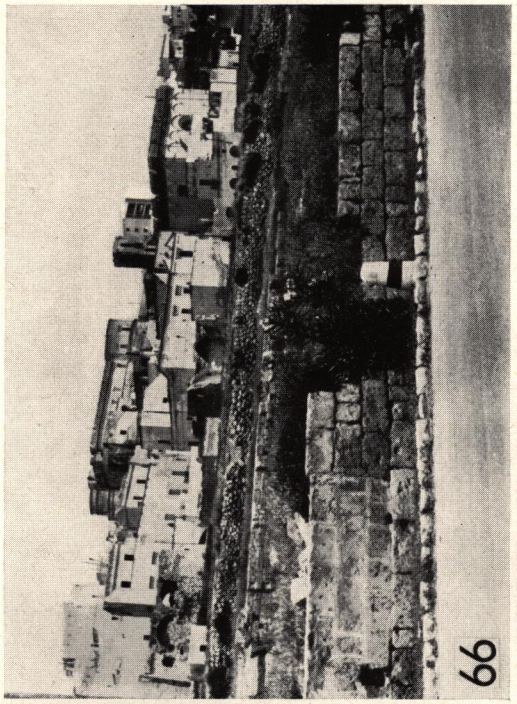
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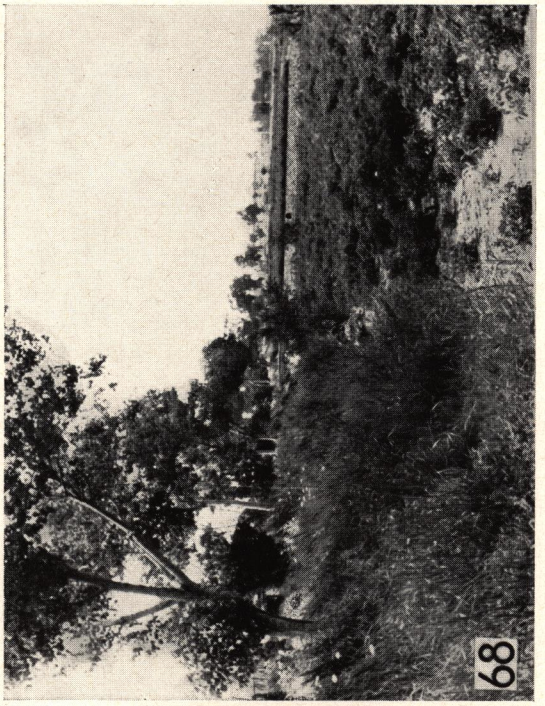
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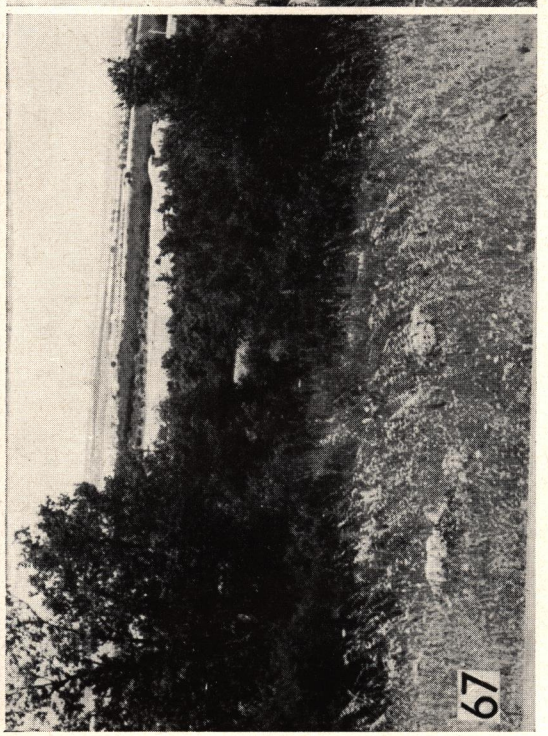
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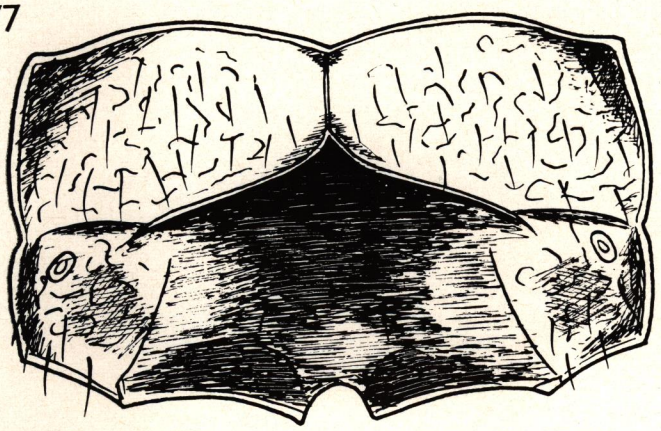

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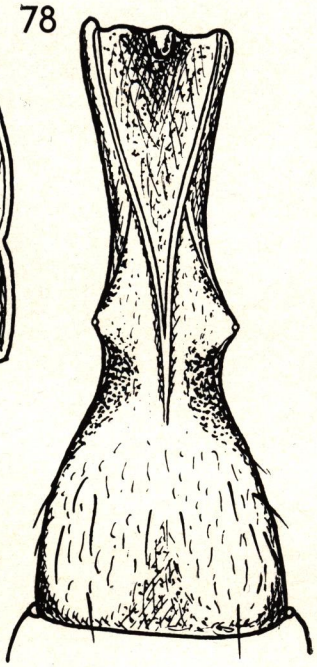

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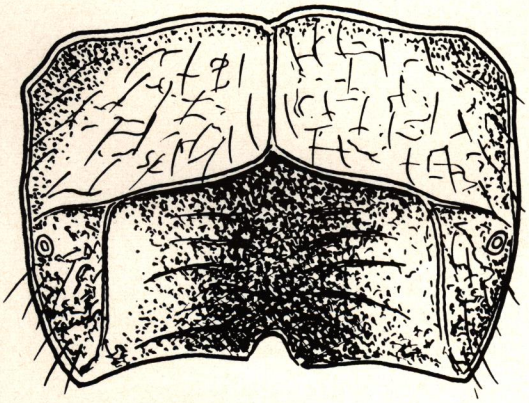

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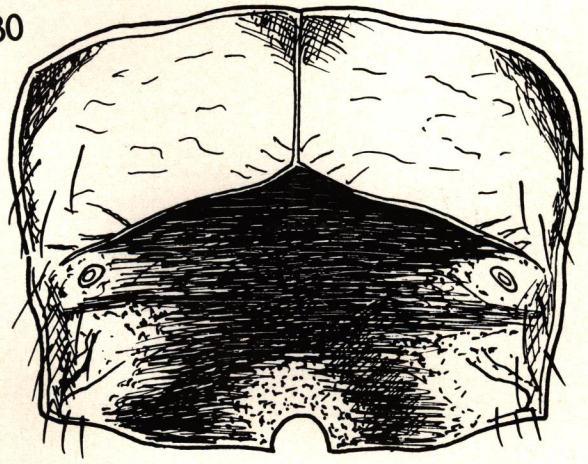

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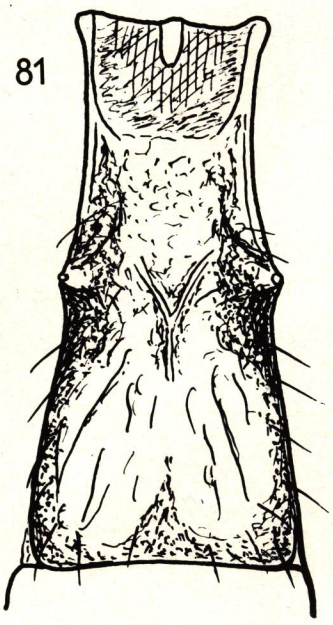

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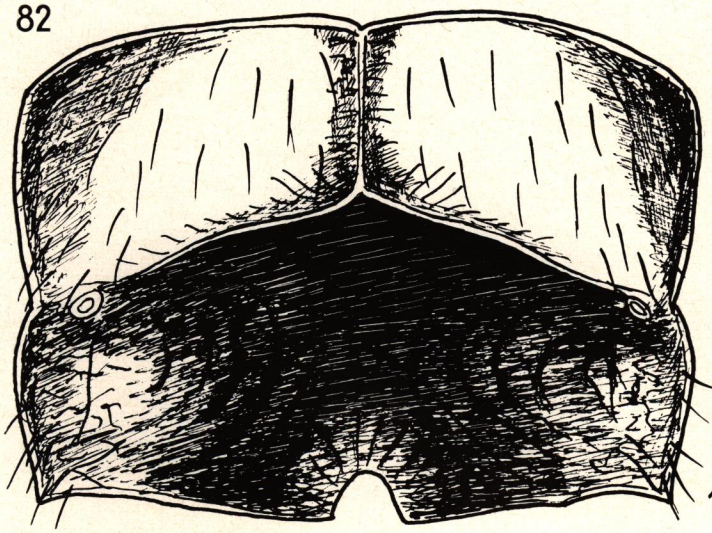

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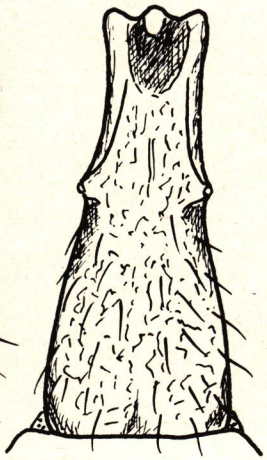

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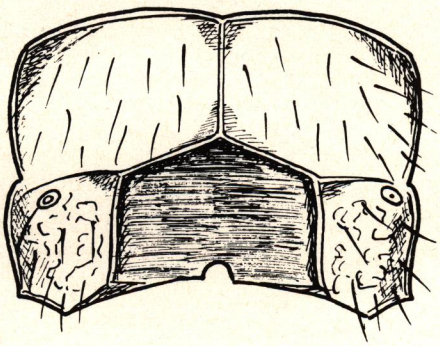

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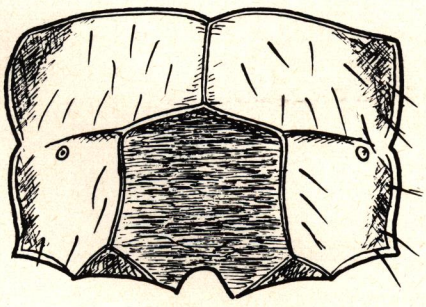

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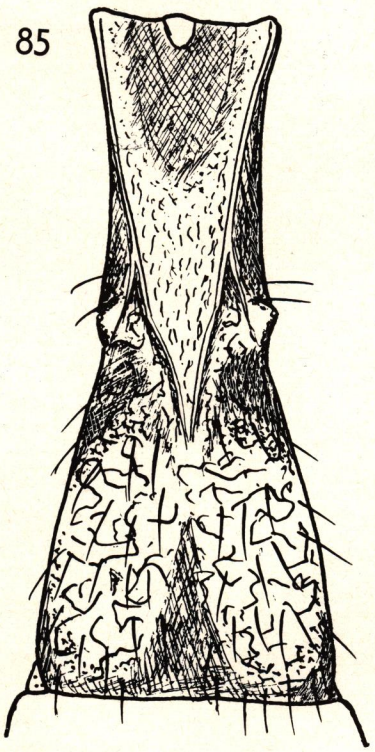

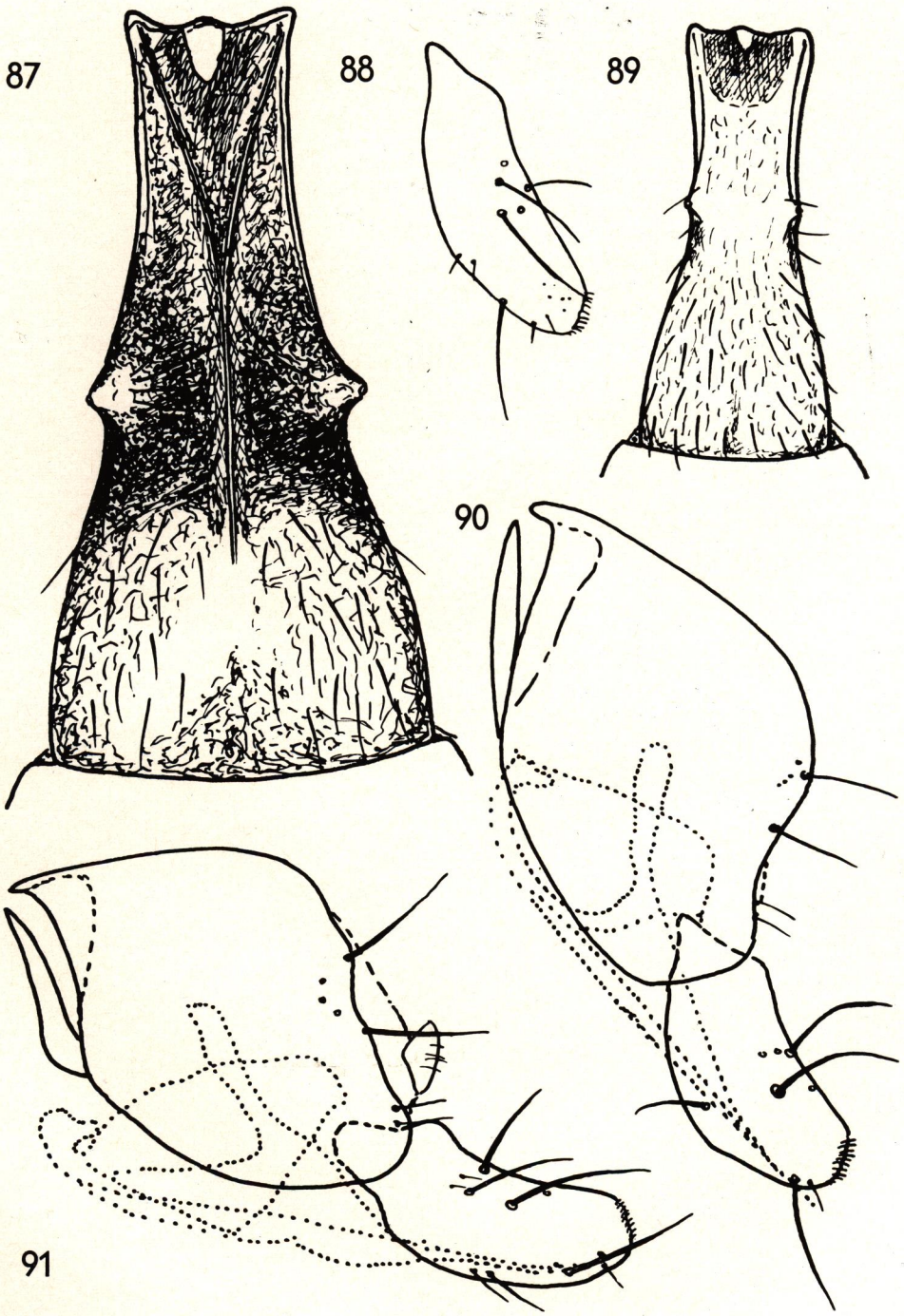
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