



The British and some other European Eriococcidae (Homoptera: Coccoidea)

D. J. Williams

Commonwealth Institute of Entomology, c/o British Museum (Natural History), Cromwell Road, London SW7 5BD

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Synopsis

Eleven of the 12 indigenous British Eriococcidae, *Cryptococcus fagisuga* Lindinger, *Eriococcus devonien-sis* (Green), *E. glyceriae* Green, *E. greeni* Newstead, *E. inermis* Green, *E. insignis* Newstead, *E. munroi* (Boratynski), *E. placidus* Green, *E. pseudinsignis* Green, *E. spurius* (Modeer) and *Pseudochermes fraxini* (Kaltenbach), are redescribed; the twelfth species, *E. cantium*, is described as new. Four introduced species, *E. lagerstroemiae* Kuwana, *Kuwanina parva* (Maskell), *Noteococcus hoheriae* (Maskell) and *Ovaticoccus agavium* (Douglas), are discussed. *Coccus buxi* Fonscolombe, the type-species of *Eriococcus* Targioni Tozzetti, is redescribed, as are *Coccus spurius* Modeer, *Acanthococcus aceris* Signoret and *Rhizococcus gnidii* Signoret, the type-species of *Gossyparia* Signoret, *Acanthococcus* Signoret and *Rhizococcus* Signoret respectively.

In agreement with some earlier works, these three genera remain synonyms of *Eriococcus* but *Greenisca* Borchsenius and *Kaweckia* Koteja & Zak-Ogaza are newly synonymised with *Eriococcus*. *R. gnidii* is newly synonymised with *E. thymi* (Schrank). An unnamed species of *Eriococcus* near *E. buxi*, occurring in the U.S.S.R. and Turkey, is also discussed and lectotypes of the British species are designated, where appropriate. There are sections also on morphology, biology and economic importance.

Introduction

The family Eriococcidae has been formerly associated with the Pseudococcidae, or mealybugs, but the two are now considered to be distinct, and Afifi (1968) has given good characters to separate the adult males of both families. Ferris (1957*a*, 1957*b*) discussed numerous genera, based on the female, that might be included in the Eriococcidae, and defined the family, mainly on negative characters or without certain characters normally found in other families of scale insects. Many genera that have been included in the family have never been studied critically and their affinities may lie elsewhere.

In order to establish the true relationships and possible phylogeny of the Eriococcidae, Dr J. M. Cox, British Museum (Natural History), and the present writer are currently studying the group on a world basis, and it is hoped to publish on these aspects later. In the meantime this

paper has been written to facilitate identification of the British species currently assigned to the family, and to discuss some European genera, the type-species of which are not British although such genera have been recorded from Britain.

Williams (1984) discussed briefly the distribution of the family and commented on its possible origins in Gondwanaland. It is poorly represented in the tropics and much speciation has taken place in the more temperate areas. The North American fauna was described by Ferris (1955) (under the name *Dactylopiidae*) and by Miller & McKenzie (1967). Much of the Palaearctic fauna has been discussed in recent years by Borchsenius (1949), Danzig (1962, 1980), Dzedicka & Koteja (1971) and Tereznikova (1981). Some interesting species from South America have been described by Miller & González (1975) and a thorough study of the 75 New Zealand species was made by Hoy (1962). The British species were listed by Boratynski & Williams (1964). Of the 481 species included by Hoy (1963) in his catalogue of world species, almost 150 are known from Australia. It is doubtful, however, if more than one or two Australian species can be identified from the present literature and, because the Australian Region probably includes some of the most interesting and bizarre species, it is clear that a definition of the family and its limits can only be made after the Australian species have been studied adequately. Species from the Oriental Region, although at present rather few, are virtually unrecognisable from the literature and need revising.

Acknowledgements and depositories

The writer is much indebted to Dr A. Kaltenbach, Naturhistorisches Museum, Vienna, who has kindly supplied for study specimens from V. Signoret's collection mentioned in the text. Mrs D. Matile-Ferrero, Muséum National d'Histoire Naturelle, Paris, has sent for study valuable material of *Rhizococcus gnidii* and *Eriococcus thymi* collected in France, for which the writer extends his sincere thanks. Dr J. M. Cox, British Museum (Natural History), has given much help in discussions during the preparation of the manuscript.

Most of the material studied is deposited in the British Museum (Natural History) (BMNH) but other depositories of original material mentioned are the Imperial Agricultural Experiment Station, Tokyo (IAES) and the New Zealand Arthropod Collection, Auckland (NZAC).

Morphology

Many of the characters of the North American species were discussed by Ferris (1955) and by Miller & McKenzie (1967), resulting in definitions of the family for this area. The morphology has also been discussed by Danzig (1980) and Hoy (1962) and a study of the labium was made by Koteja (1974a). Present studies of the British and other genera have revealed characters that have not normally been used to separate species or genera and these characters are discussed briefly here.

There is no generally accepted common name for the family but the names 'felted scale insects' or 'felted coccids' have gained some acceptance and the former name could easily be used. The name refers to the ovisac produced by most species from the dorsum and the ventral margins. This ovisac, secreted from ducts, has a felted texture and completely covers the top of the insect except for a hole at the posterior end, allowing first instars to escape. The felted sac combines with mealy secretion on the venter, but on the dorsum rods of wax that seem to be produced from the dorsal setae are also present. Many slide preparations show these rods attached to the enlarged setae.

Body shape and segmentation. The shape of the body varies from globular to broadly-oval and elongate, and although species may be found on leaves, stems and roots, the elongate species are usually found on grasses. In many species the body is strongly nodulose and when this takes up stain, it often masks minute characters. Numbering of the segments follows that given by Miller (1984) for *Eriococcidae* and by Williams (1985a) for *Pseudococcidae*. In this system the vulva is situated between the 7th and 8th abdominal segments, so that the first abdominal segment on the venter is represented by areas lateral to the 3rd coxae and the 2nd abdominal segment is

complete after the metathorax. On the dorsum the 1st abdominal segment is complete, but because the segment containing the anal lobes is probably complex, it is here regarded as the 8th or anal lobe segment.

Anal area. In many genera of Eriococcidae the posterior end of the body is produced into two prominent anal lobes, each usually sclerotised and often conical with a long apical seta. Dorsally there are frequently enlarged setae, varying in number, but in most species there are two such setae on the inner edge and one on the outer edge, although this may be reduced to a much smaller seta. Ventrally there are flagellate setae, often numbering 1–3, and near the inner corner of each lobe there is a seta that Hoy (1962) named the suranal seta. This is usually slender but in some genera it is flat or spatulate. In all the species discussed here the suranal setae are slender. Sometimes the inner edges of the lobes are so strongly nodulose and sclerotised that they appear to be toothed or serrate. When there are no definite anal lobes present the suranal setae are represented by a pair just anterior to the anal ring on the venter. Species with anal lobes often have a small dorsal lobe or plate projecting between the base of the lobes. It varies from being only a slight prominence to triangular, well developed and nodulose. In some species it is heavily sclerotised in the form of a definite plate, as in *Eriococcus phyllanthi* Ferris, and this led Ferris (1957*b*) to refer to it as a cauda. It is not certain whether this plate is homologous with the cauda of the Aphidoidea and it is here called a dorsal plate no matter what the extent of its development is. The anal ring, in species with well-developed anal lobes, is normally situated vertically to the body between the dorsal plate and the apical margin of the venter between the suranal setae. When prepared on microscope slides it often becomes distorted or is pushed inwards, lying neither on the dorsum nor venter. Although the shape varies considerably, and this is mentioned in the text when appropriate, a normal anal ring usually has 8 setae and a single row of pores, except laterally, where there are a few pores forming a double row.

Antennae. These vary from being normal with 6 or 7 segments, to small stubs with 1 or 2 segments. A normal antenna appears to taper, with the terminal segment usually one of the shortest and not wider than the previous segments.

Frontal lobes and frontal tubercles. Often just antero-medially to each basal antennal segment there is a lobe-like structure that varies in size and length. They are much more pronounced in distorted specimens when they can be observed to stick out from the surface. Normally they are membranous but sometimes, as in *Eriococcus buxi* and its relative herein described, they tend to be sclerotised. Their function is unknown. Signoret (1875) mentioned these lobes when describing *Acanthococcus aceris*. Boratynski described them as eversible membranous tubercles in *A. munroi* but there is no evidence that they are eversible. They were mentioned also by Dzedicka & Koteja (1971) when describing *Rhizococcus palustris*. These structures seem to have been ignored in most other works but Dr J. M. Cox and the present writer have observed them in numerous species from all the zoogeographical regions. In at least one species from Australia these lobes extend around and posterior to the basal antennal segment; for this reason a more appropriate term would be frontal lobes and this term is used throughout this work.

Frontal tubercles are minute raised spots situated antero-medially to each antennal base. They are difficult to see but once their normal position is located their presence or absence can be noted. Again, their function is unknown but they seem to be homologous with the 'conical disc pores' mentioned by Ben-Dov *et al.* (1975) in *Protopulvinaria mangiferae* (Green), and to the 'preantennal spots' discussed by Ben-Dov (1979) in species of *Kilifia*. The species in these genera belong to the family Coccidae and the presence of these tubercles may be much more common throughout the group. They are certainly present in many species of Eriococcidae and may have some taxonomic significance. In all species studied so far, frontal lobes and frontal tubercles never occur together and one may have been derived from the other. *Pseudochermes fraxini*, herein described, possesses frontal tubercles in all instars and this may be normal, but some species have neither frontal lobes nor frontal tubercles.

Legs. Unlike species of Pseudococcidae, most of which have the tibia longer than the tarsus, the tarsus in the Eriococcidae is often longer than the tibia. Also the trochanter pores in the

Eriococcidae form a line from the anterior lateral corner to about half-way along the posterior edge, more or less dividing the trochanter into two equal parts. In the Pseudococcidae the trochanter pores are situated towards the distal end.

Labium. The basal segment often has 2 pairs of setae but in some genera these are reduced to a single pair. In *Cryptococcus fagisuga*, herein described, they are absent except in the first instar when a single pair is present.

Setae. On the dorsum and ventral edges, there are often enlarged setae that are spine-like, conical, pointed, blunt or truncate, but sometimes they are cylindrical, lanceolate or even bulbous. Sometimes they are interspersed by quite slender setae. In some species, enlarged setae are confined to the anal lobes or they are absent entirely, but usually the dorsal setae, which may be minute, show some signs of being stiff and not flagellate. When the dorsal setae tend to be small and slender in the adult, there are usually thicker setae in at least the first instar. On the median part of the venter, what are here referred to as normal setae are flagellate setae found in many groups of the Coccoidea. Laterally there are often other setae which, although slender, are nevertheless stiff.

Macroducts. These have been discussed by Ferris (1955), Miller & McKenzie (1967), Miller (1984) and by many other workers. They normally have the inner end reflexed in the form of a cup and, although found in some other families, they represent one of the most important characters of the Eriococcidae, although sometimes they are absent entirely.

Microducts. The significance of these minute ducts has been little understood but their structure may indicate affinities and evolutionary paths. They have been discussed in some detail by Goux (1948). Normally the inner end is bulbous, and the term ampulla is here adopted for it. It usually bears a minute filament arising from the inner end. Between the ampulla and the external orifice there is a tube varying from filamentous and slender to short and bulbous at the inner end, and situated internally just next to the orifice there is a structure often wing-nut-shaped in profile but which is here called a collar. Sometimes the orifice is bifid, as shown already by Miller & González (1975) in *Eriococcus araucariae* Maskell. The bifid orifice is external and may be seen on microducts at the edge of the body where the bifid part protrudes from the surface of the integument. They are not internal as shown by Hoy (1962) for *E. araucariae*. It is still not clear whether the shape and type of the microduct has generic significance. *Cryptococcus fagisuga* herein described possess microducts in the form of a double tube.

Enlarged ducts. These are illustrated here in *E. buxi* and *E. sp. near buxi*. They are usually larger than the macroducts but differ in having a flat or slightly rounded inner end, instead of being reflexed into a cup. Because *Eriococcus* possesses these ducts, Borchsenius (1949) separated this genus from all others. The significance of these special ducts is still not clear because Miller & González (1975) discussed them in *Exallococcus laureliae* Miller & González. Furthermore, some Australian species currently assigned to *Eriococcus* also have them.

Pores. Although the disc pores are usually quinquelocular, there are often pores with up to 9 loculi. They are usually on the ventral surface but when present on the dorsum they have sometimes been given generic significance. Cruciform pores are usually oval with a central slit in the form of a cross. When present they are usually found on the venter but their presence on the dorsum has been given generic importance by Koteja & Žag-Ogaza (1981) when describing *Kaweckia*.

Biology and economic importance

Little work has been done on the biology of the British Eriococcidae, but Newstead (1903) has given useful field notes on some species. Gullan (1984) included the specialised gall-forming genus *Apiomorpha* in the family and has given important information on gall formation. Normally British species are univoltine but Patel (1971), discussing *Eriococcus coriaceus* Maskell from South Australia, has stated that it has five generations a year there.

British species are oviparous but whether this is true for all Eriococcidae is not clear from the literature. So far as is known, there are always three instars in the female and five in the male when present. Koteja (1983) has discussed an additional moult in *Acanthococcus greeni* (Newstead) after the adult female had formed, but this was probably caused by parasitism. In Pseudococcidae there are normally four female instars.

The ovisac in the indigenous British species is felted but, apart from the gall-forming species, it is not clear how the covering of many is formed. In *Ovaticoccus agavium* it is described by Boratynski (1958) as loosely felted. The ovisac of *Eriococcus spurius* in mature adults is present only around the margins, but this is because there are no macroducts in the median areas. The insect is, therefore, easily recognisable and is specific to elms.

Most of the British species feed on grasses but it is not known if they cause damage. *Eriococcus devoniensis* is always found on *Erica tetralix* in Britain, causing the stems to turn a complete circle enclosing the insect and ovisac in the bend. Large areas of the plant can be killed and this led Warburton (1937) to recommend burning to destroy the insect. *Pseudochermes fraxini* is found in enormous numbers in the crevices of bark of ash trees and often causes concern, but so far there are no records of mortality of trees. By far the most important insect is *Cryptococcus fagisuga*, found in the crevices of bark of beech trees. It is particularly prevalent in older trees (Wainhouse, 1980, states that trees around 25 years of age are particularly susceptible) and the species is probably found throughout Britain wherever beech is grown. Parker (1975) has stated that beech planted in southern England 1951–60 will be susceptible during the 1980s. The insect is probably the only parthenogenetic species of Eriococcidae in Britain and is often present in enormous numbers producing what has been termed fluffy white wool, so that trunks appear to be completely white. Despite the large numbers, the insects themselves apparently do not cause damage. But, associated with the insect is an ascomycete fungus, *Nectria* sp., known as 'beech bark disease', a name coined by Ehrlich (1934) in a comprehensive account of the disease and insect in Canada and U.S.A. The fungus causes considerable damage resulting in mortality of the tree, and is dependent on the insect for providing an entry wound at the point of feeding. Parker (1975) showed that *Nectria* infected the bark only following wounding, but as Lonsdale (1980) has shown, heavy infestations of the insect induce a lowering of resistance to fungal invasion within bark tissue.

In the Old World the insect is distributed throughout Europe, with incursions into Turkey and Iran. Covassi (1975) stated that Sicily is the southern limit, and the Commonwealth Institute of Entomology (1979) has produced a map showing the world distribution. Thomsen *et al.* (1949) gave a full and important account of the insect and fungus in Denmark. In Britain the insect has been made the subject of a Forestry Commission Leaflet (Hussey, 1956). Wainhouse (1979) showed that the larvae are dispersed passively by wind and a small percentage are carried above the canopy. Some trees are more susceptible than others (Wainhouse & Howell, 1983) and, although there is possible intraspecific variation within populations of the beech scale, there is no evidence of adaptation of the scale to particular trees.

It was reported by Elliott (1933) that, in Suffolk, this species was devoured by a small beetle, *Enicmus* [now *Lathridius*] *minutus* (L.), but this was unlikely because the beetle is normally a fungus-feeder.

ERIOCOCCIDAE Cockerell

Acanthococcites Signoret, 1875: 16. Type-genus: *Acanthococcus* Signoret. [Placed on Official List of Family-Group Names in Zoology (Name Number 535) with an endorsement that it is not to be given priority over Eriococcini Cockerell, 1899 whenever both names are held to denote a single taxon (Melville, 1982: 96).]

Acanthococcidae Signoret; Maskell, 1887: 47.

Eriococcini Cockerell, 1899a: 389. Type-genus: *Eriococcus* Targioni Tozzetti. [Placed on Official List of Family-Group Names in Zoology (Name Number 534) with an endorsement that it is to be given precedence over *Acanthococcidae* Signoret, 1875 whenever both names are held to denote a single taxon (Melville, 1982: 96).]

Eriococcidae Cockerell; Brues & Melander, 1932: 134.

Cryptococcidae Kosztarab, 1968b: 12. Type-genus: *Cryptococcus* Douglas. [Synonymised with Eriococcidae by Danzig, 1980: 58.]

Until all genera are studied, including the peculiar gall-producing forms, it is impossible to define the family on a world basis. The following definition is based only on species that have been studied in some detail.

ADULT FEMALES. Body elongate, broadly oval or globular, usually membranous but often strongly nodulose. Segmentation usually distinct in the oval and elongate forms, obscure in the globular forms. Anal lobes often well developed, conical and sclerotised; when present usually with a dorsal plate between and with suranal setae at inner ventral bases. Anal ring often with 8 setae and pores, sometimes reduced, without pores. Antennae, when normal, with 6 or 7 segments, the apical segment usually narrower than preceding segments, sometimes segments reduced to one or two. Frontal lobes or frontal tubercles sometimes present. Legs present or absent; when absent sometimes third pair represented by minute flaps; when present and normal, tibia frequently longer than tarsus, trochanter pores in a line almost dividing trochanter into two equal parts. Labium usually with 1 or 2 pairs of setae on basal segment, rarely absent entirely. Dorsal setae often enlarged, conical, bulbous or cylindrical, if small, remaining spine-like or stiff. Disc pores, when present, usually quinquelocular, but sometimes with up to 9 loculi, frequently on venter and sometimes on dorsum. Macroducts normally present, at least on dorsum, sometimes absent. Microducts usually present. Cruciform pores often present on venter, rarely on dorsum.

Key to genera of British Eriococcidae

Adult females

- | | | |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| 1 | Legs absent except for third pair replaced by small leg flaps | 2 |
| – | Legs present | 3 |
| 2 | Macroducts present on dorsum | CRYPTOCOCCUS Douglas (p. 352) |
| – | Macroducts absent on dorsum, replaced by large invaginated quinquelocular pores | KUWANINA Cockerell (p. 384) |
| 3 | Anal lobes present, sclerotised | 4 |
| – | Anal lobes absent | 5 |
| 4 | Anal lobes with a series of about 12 enlarged setae on dorsum. Segmentation absent between trochanter and femur and between tibia and tarsus | NOTEOCOCCUS Hoy (p. 384) |
| – | Anal lobes with at most 4 enlarged setae on dorsum. Segmentation distinct between trochanter and femur and between tibia and tarsus | ERIOCOCCUS Targioni Tozzetti (p. 356) |
| 5 | Anal ring crescentic, containing pores and setae. Cruciform pores absent | PSEUDOCHERMES Nitsche (p. 385) |
| – | Anal ring not as above, without pores. Cruciform pores present | OVATICOCCUS Kloet (p. 384) |

CRYPTOCOCCUS Douglas

Cryptococcus Douglas, 1890: 155. Type-species: *Coccus fagi* Baerensprung [= *Cryptococcus fagisuga* Lindinger], by original designation.

The type-species is now known to occur on *Fagus* spp. throughout Europe and the eastern part of the U.S.A. *C. aceris* Borchsenius is known from Georgia and Azerbaizhan in U.S.S.R. and from Germany on *Acer*. Another species on *Acer* was described as *C. williamsi* Kosztarab from eastern U.S.A., and *C. integricornis* Danzig is known from the Primorsky region in the far east of U.S.S.R. on *Tilia amurensis*. Kosztarab (1968a) gave a key to the species known at the time.

All four species are without legs in the adult female, but the hind pair are replaced by small flaps. In the type-species these are simple, each with at most a single seta, but in the other species the flaps are either reticulate or they possess minute pores. When viewed at the edge of the body these structures are flap-like and protrude. They are not plates on the surface of the body or pore plates, as has been suggested; because they are always in the positions of the third legs and probably emit pheromones they are here referred to as leg flaps. *C. integricornis* possesses also spine-like remains of the first and second pairs of legs. All four species have 2–5 segmented antennae that are stub-like, and macroducts each with a cup-shaped inner end on the dorsum and at least the ventral margins. Microducts are present. In the type-species they are in the form of double tubes, the ampulla of each being expanded, with a filament between. The microducts of the other species need more critical study. Quinquelocular pores are present and the anal ring is simple, square or oval with 4–6 setae and a few pores. In *C. fagisuga* the basal segment of the labium is without setae but

there is a single pair present in the first instar. Specimens of *C. fagisuga*, *C. aceris* and *C. williamsi* examined possess neither frontal lobes nor frontal tubercles.

Hoy (1962) accepted *C. nudatus* Brittin in the genus. The species was described from New Zealand on *Hoheria* spp., but because it lacks macroducts it may belong to another genus, although it is very close. *Kuwanina parva* (Maskell), described from Japan and recorded from Britain on *Prunus*, has at one time been assigned to *Cryptococcus*, but the genus *Kuwanina* is here accepted as distinct because it lacks macroducts. These are replaced by large invaginated quinquelocular pores.

Cryptococcus is represented by *C. fagisuga* only in Britain, where it is sometimes injurious to beech.

Cryptococcus fagisuga Lindinger

(Figs 1, 2)

Coccus fagi Baerensprung, 1849: 174. Syntypes ♀, GERMANY: Berlin (probably lost). [Junior homonym of *Coccus fagi* Sulzer, 1776.]

Coccus fagi Walker, 1852: 1086. LECTOTYPE ♀, ENGLAND (BMNH), here designated [examined]. [Junior homonym of *Coccus fagi* Sulzer, 1776.]

Pseudococcus fagi (Baerensprung) Douglas, 1886: 152.

Cryptococcus fagi (Baerensprung) Douglas, 1890: 155; Newstead, 1903: 215; Schmutterer, 1952: 417; Ferris, 1955: 83; Tereznikova, 1981: 46.

Cryptococcus fagisuga Lindinger, 1936: 444; Borchsenius, 1949: 37; Hoy, 1963: 54; Danzig, 1964: 634. [Replacement name for *Coccus fagi* Baerensprung.]

DESCRIPTION. Adult female (Fig. 1) in life, globular, bright to lemon yellow, completely covered in a white ovisac. On the slide, rotund, membranous, nodulose, largest about 0.6 μm in diameter, often wider than long, anal lobes not developed, their positions removed to ventral surface of body. Antennae reduced, with 1–2 segments. Legs absent but position of each third leg represented by a small flap often containing a single seta. Labium 48 μm long, often wider than long, shorter than clypeolabral shield, basal segment without setae. Spiracles often triangular, sclerotised. Anal ring at apex of venter, sclerotised, almost quadrate, with 4 short setae 12 μm long occupying corners, a few minute pores on posterior margin or morphologically anterior margin.

Dorsal surface with small setae that are pointed and stiff, 5 μm long, in more or less single rows across the segments. Macroducts in single rows across the segments, each about 8 μm long, with the cup wider than a dorsal setal base. Microducts in moderate numbers, each about 6 μm long, in the form of a double tube tapering towards double orifice, each tube with inner end swollen into an ampulla with a filament between.

Ventral surface with setae about same size as dorsal setae except on anal lobe segment where the suranal setae, and one or two near margins, are larger and conical, about 10 μm long and usually a pair of slightly longer setae near anterolateral corners of anal ring, probably the anal lobe setae. Macroducts of two types. A large type, similar to those on dorsum, few, around margins and sometimes in submarginal areas of thorax and anterior abdominal segments. A small type, not much larger than a microduct, arranged singly in submedian areas of third to fifth abdominal segments and on metathorax anterior to leg-flaps, each duct with a shallow cup. Microducts, same as on dorsum, sparse, present in median areas as well as margins. Quinquelocular pores, about same diameter as the cup of a large macroduct, in more or less single rows on posterior abdominal segments, there being also one or two near each spiracular opening and one or two between clypeolabral shield and labium.

Second instar female (Fig. 2B) broadly oval, smaller than adult female. Antennae near margins, 2-segmented, reduced. Legs absent but position of each third leg represented by a minute sclerotised point. Labium 36 μm long, smaller than clypeolabral shield, basal segment without setae. Anal ring on venter at apex of abdomen, similar to that of adult but smaller. Dorsal surface with small pointed but stiff setae, each 4 μm long, many not much longer than a setal base. Macroducts smaller than in adult female, present in single transverse rows on most segments. Microducts, as in adult, bitubular, represented by one or two only. Ventral surface with setae as on dorsum except for larger conical setae lateral to anal ring, a pair of which longer than others and probably apical setae. Suranal setae small. Macroducts same as on dorsum, occasionally on margins only. Microducts represented by one or two on margins only. Quinquelocular pores arranged singly next to spiracular openings only.

First instar (Fig. 2A), oval, the smallest 300 μm long, 180 μm wide. Anal ring displaced to apex of venter, as in later instars but smaller. Antennae 65 μm long, with 5 segments. Legs normal, hind trochanter + femur 40 μm long, hind tibia 16 μm long, hind tarsus 16 μm long, claw slender, without a denticle, 16 μm long. Labium 32 μm long, basal segment with a pair of minute setae. Dorsal surface with short pointed and stiff setae, 4–5 μm long, but some on head longer and flagellate. Macroducts absent. Microducts

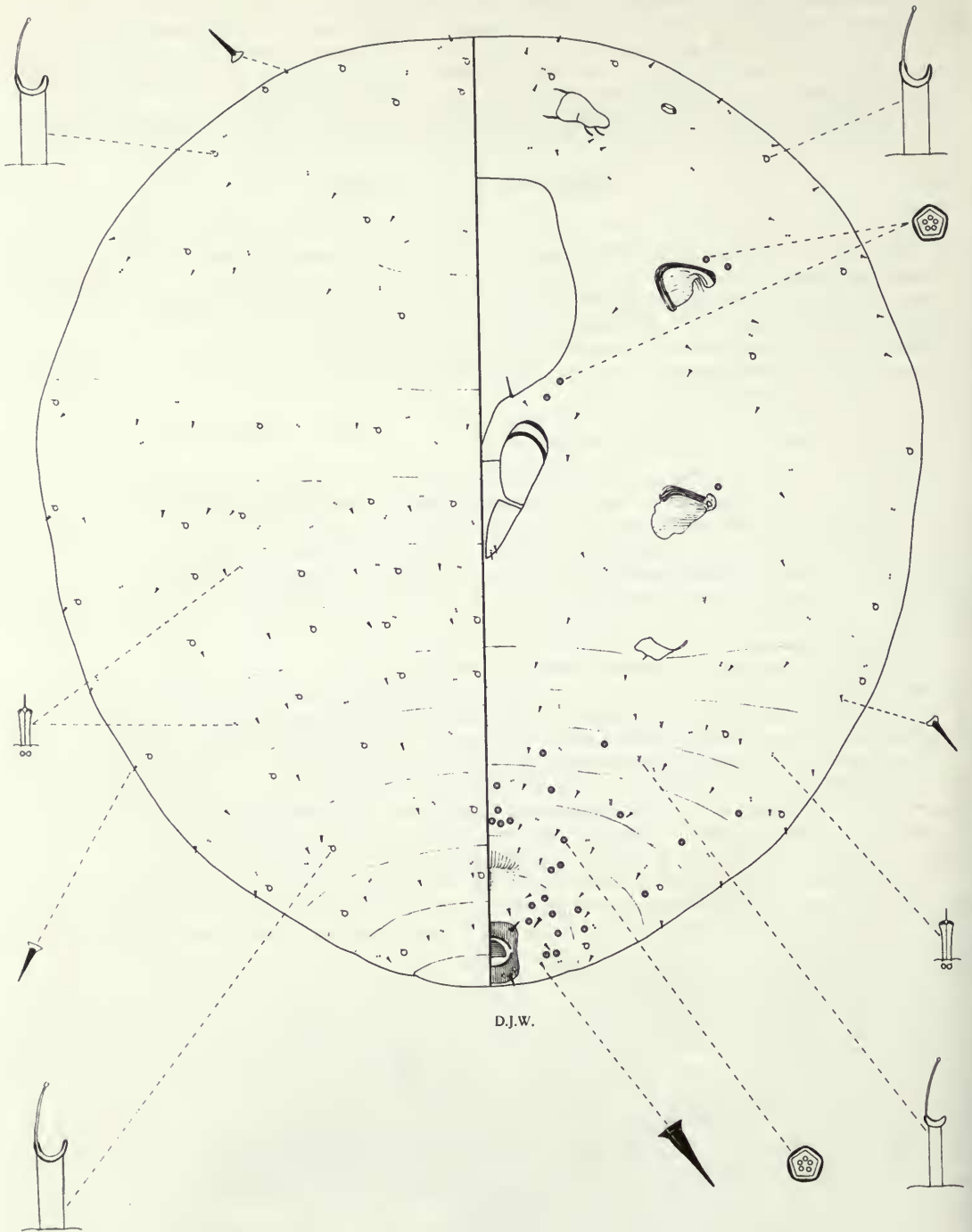


Fig. 1 *Cryptococcus fagisuga* Lindinger. England, Buckinghamshire, Burnham Beeches, on *Fagus sylvatica*.

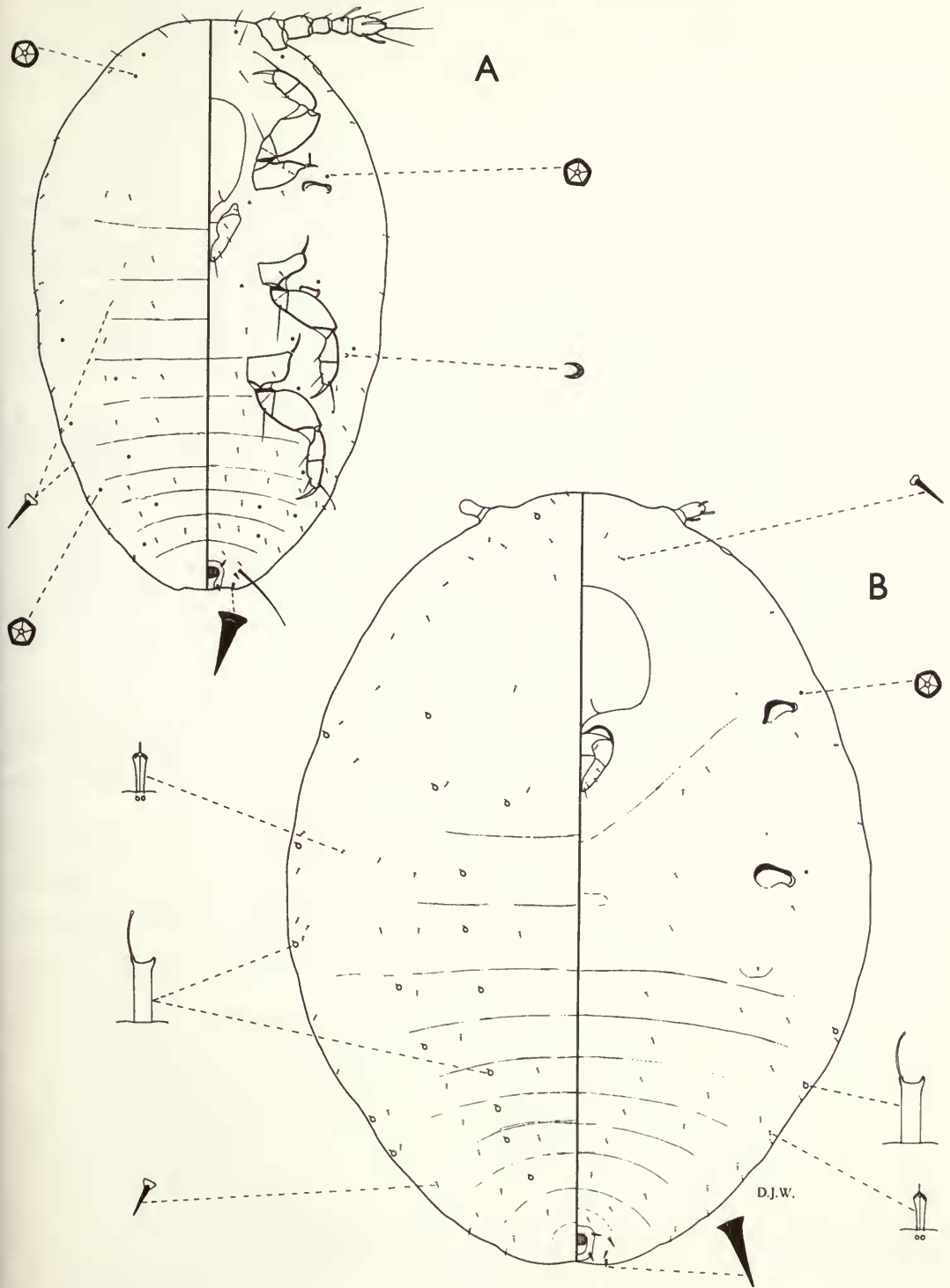


Fig. 2 *Cryptococcus fagisuga* Lindinger. (A) First instar. (B) Second instar.

represented at most by one or two varying in position. Quinquelocular disc pores sparse, rarely more than 2 on any segment. Ventral surface with short setae similar to dorsal setae except for apical setae each 40 μm long, larger conical setae lateral to anal lobes, and longer flagellate setae on head. Suranal setae small. Macroducts and microducts absent. Quinquelocular pores few in submarginal areas of abdomen and head and singly near spiracular openings. One or two pores medially to first and second coxa often trilocular, but this condition not constant. A minute indefinite scar present lateral to third coxae.

MATERIAL EXAMINED (all on *Fagus sylvatica* unless stated otherwise)

England: Berkshire, Silwood Park, 5.v.1948, 17.iii.1950, 29.v.1959 (K. L. Boratynski), Cookham, 4.iv.1973, 11.viii.1983 (D. J. Williams); Buckinghamshire, Burnham Beeches, 18.iii.1973, 1, 4, 15, 23.iv.1973 (D. J. Williams); Cheshire, nr Chester, 1890 (R. Newstead), Ince, xi.1895 (R. Newstead); Hampshire, Bolderwood, 29.iii.1975 (J. H. Martin); Kent, Malling, ix.1895 (E. E. Green), Bearsted, 27.vii.1913 (E. E. Green), nr Canterbury, 19.v.1973 (L. M. Hanford); London, Buckingham Palace Gardens, 8.x.1963 (K. L. Boratynski); Northumberland, Riding Mill, 8.x.1950 (D. J. Williams); Shropshire, 1.xi.1933 (E. E. Edwards); Suffolk, xi.1970; Surrey, Camberley, 25.v.1920, 10.iv.1930 (E. E. Green), Wisley, 4.vii.1954 (D. J. Williams); Yorkshire, Bingley, 10.x.1933 (G. Fox-Wilson), Hardcastle Crags, 22.viii.1961 (D. J. Williams). **Scotland:** Aberdeen, iv.1924 (G. D. Morison). **Luxembourg:** Beaufort, 29.vi.1961 (K. L. Boratynski). **Hungary:** Nagymilis Laszlotanya, 12.viii.1980 (F. Kozár & M. Kosztarab). **U.S.A.:** Vermont, on *F. grandifolia*, 8.v.1975.

DISCUSSION. When discussing the homonymy of *Coccus fagi*, Lindinger (1936) referred to Roemer (1789) who gave an illustration. The first 32 plates of this work are a re-issue of those in Sulzer (1776) where on Plate XI, fig. 11 there is an illustration in colour of *C. fagi*. This seems to be *Eulecanium tiliae* (L.) as present understood.

C. fagisuga is always parthenogenetic insofar as males have never been found.

Although Walker made numerous slide preparations of aphids, there is no evidence that he made any slide preparations of the scale insects that he described. A batch of dry material mounted on a card labelled *Coccus fagi* in Walker's handwriting is present in BMNH. This is here regarded as Walker's original material and among 9 specimens prepared on separate microscope slides one has been selected as lectotype. The other 8 are labelled paralectotypes.

ERIOCOCCUS Targioni Tozzetti

Eriococcus Targioni Tozzetti, 1868: 726. Type-species: *Coccus buxi* Fonscolombe, by subsequent designation (Signoret, 1872: 429) and by Opinion 1203 (Melville, 1982: 95).

Gossyparia Signoret, 1875: 20. Type-species: *Coccus ulmi* Linnaeus sensu Linnaeus, 1766 [= *Coccus spurium* Modeer, 1778.], by original designation. [Synonymised by Ferris, 1955: 94.]

Acanthococcus Signoret, 1875: 35. Type-species: *Acanthococcus aceris* Signoret, by monotypy and by Opinion 1203 (Melville, 1982: 95). [Synonymised by Ferris, 1955: 94.]

Rhizococcus Signoret, 1875: 36. Type-species: *Rhizococcus gnidii* Signoret, by monotypy. [Synonymised by Ferris, 1955: 94.]

Greenisca Borchsenius, 1948: 502. Type-species: *Eriococcus inermis* Green, by original designation.

Syn. n.

Anophococcus Balachowsky, 1954: 61. Type-species: *Eriococcus inermis* Green, by original designation. [Synonymised with *Acanthococcus* Signoret by Danzig, 1980: 205.]

Kaweckia Koteja & Zak-Ogaza, 1981: 501. Type-species: *Eriococcus glyceriae* Green, by original designation. **Syn. n.**

Eriococcus Targioni Tozzetti; Melville, 1982: 95. [Addition to Official List, Name Number 2153.]

Acanthococcus Signoret; Melville, 1982: 95. [Addition to Official List, Name Number 2154.]

Although in time it may be necessary to recognise some of the genera synonymised above, they are here regarded as components of *Eriococcus* pending further research on the family and until the characters of microducts, frontal lobes and tubercles can be assessed on a world basis. As Ferris (1955) has mentioned, division of the group seems undesirable (except for extreme forms) until comprehensive studies have been made, especially of the Australian fauna. Some reasons for the synonymy need explanation, however.

Eriococcus. This genus was separated by Borchsenius (1948, 1949) because the type-species possesses enlarged ducts. As already stated, some Australian species possess these ducts and their true significance is not yet known. The type-species also has well-developed frontal lobes, slender microducts with bifid orifice and only a single ventral seta on the anal lobes. Borchsenius based his interpretation of the type-species on Russian specimens which do not appear to be identical with specimens from the type-locality in France.

Acanthococcus. The most important characters separating the type-species from *Eriococcus* are the absence of enlarged ducts and the presence of 2 ventral setae instead of one on the anal lobes and 2 pairs of setae on the basal segment of the labium instead of a single pair. Frontal lobes are well developed and the microducts are slender with bifid orifice. At present there seems to be no reason for recognising the genus.

Gossyparia. Based on the type-species, this is almost a replica of *Acanthococcus* but lacks dorsal macroducts in the median areas of the dorsum, regarded here as nothing more than a specific character. There are well-developed frontal lobes and the microducts are slender with bifid orifice.

Rhizococcus. The genus was separated from *Acanthococcus* originally because, in the type-species, the antennae had 7 segments instead of 6 and because the body was presumed to be naked. It is now known that a normal ovisac is produced and the antennae may have either 6 or 7 segments. Other characters present are frontal tubercles instead of frontal lobes and slender microducts with bifid orifice. With our present knowledge the genus is not distinctive enough from *Eriococcus*.

Greenisca. There are nomenclatural problems concerning the type-species. According to Danzig (1962) the species on which Borchsenius (1948) based *Greenisca* was not *E. inermis* Green but another species, which Danzig (1980) stated, was later described as *Anophococcus gouxi* Balachowsky; the type-species, therefore, of *Greenisca* should be *A. gouxi* Balachowsky, 1954 = *E. inermis* Green sensu Borchsenius 1948. Article 70 of the *International Code of Zoological Nomenclature* states that 'if a zoologist considers that a type-species designated for a new genus has been misidentified, then that person should refer the case to the Commission to designate as the type-species whichever species will in its judgement best serve stability and uniformity of nomenclature . . .' Furthermore, the anal lobes of *G. gouxi* illustrated by Danzig (1980) have three enlarged setae but the same species illustrated by Balachowsky (1954) has the outer seta much reduced in size. *E. inermis* Green has a minute outer seta on the anal lobes, frontal tubercles and microducts without bifid orifice. Based on this type-species the genus *Greenisca* is here regarded as a component of *Eriococcus*. If *Anophococcus gouxi* is accepted as the type-species, a species with dorsal disc pores, there may be some justification for recognising the genus but until the significance of dorsal disc pores is better understood, the species is here regarded as belonging to *Eriococcus*.

Kaweckia. The type-species has numerous cruciform pores and disc pores on the dorsum and the numbers of dorsal enlarged setae are restricted to the margins of the posterior abdominal segments. Other characters are frontal tubercles and microducts without a bifid orifice. At present there seems to be little justification for accepting this genus and it is here regarded as a component of *Eriococcus*.

Although the type-species of *Eriococcus*, *Acanthococcus* and *Rhizococcus* are not British species they are described here to help facilitate identification and to assess the characters. The following key is presented to separate the British indigenous and introduced species.

Key to British species of *Eriococcus*

- | | | |
|---|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 1 | Enlarged setae on abdomen confined to inner edges of dorsum of anal lobes only. Outer dorsal setae on anal lobes much smaller | 2 |
| - | Enlarged setae on abdomen on at least a few segments anterior to anal lobes. Outer dorsal setae on anal lobes same type as inner setae | 3 |
| 2 | Disc pores of quinquelocular type present on dorsum of body. Enlarged setae present on head margins | <i>placidus</i> Green (p. 376) |
| - | Disc pores on dorsum absent. Enlarged setae absent on head margins | <i>inermis</i> Green (p. 370) |
| 3 | Enlarged setae in bands across head, thoracic and most abdominal segments | 4 |
| - | Enlarged setae on margins only except for a few occasionally on head | 9 |
| 4 | Anal lobes with 4 enlarged setae | <i>cantium</i> sp. n. (p. 363) |
| - | Anal lobes with 3 enlarged setae | 5 |
| 5 | Enlarged setae in median areas of posterior abdominal segments much smaller than others on dorsum | <i>munroi</i> (Boratynski) (p. 374) |
| - | Enlarged setae in median areas of posterior abdominal segments same size as others on dorsum | 6 |
| 6 | Dorsal macroducts in bands across segments | 7 |
| - | Dorsal macroducts absent in mid-regions of thorax and abdomen | <i>spurius</i> (Modeer) (p. 380) |
| 7 | With at least 2 setae in mid-dorsal area of anal lobe segment | <i>lagerstroemiae</i> Kuwana (p. 374) |
| - | Without setae in mid-dorsal area of anal lobe segment | 8 |
| 8 | Body elongate-oval. Dorsal setae sharply pointed. Frontal tubercles present | <i>greeni</i> Newstead (p. 367) |
| - | Body broadly oval. Dorsal setae truncate. Frontal lobes present | <i>devoniensis</i> (Green) (p. 365) |

- 9 Dorsal enlarged setae truncate, with almost parallel sides, on margins only of 7th and two or three preceding segments, in addition to anal lobe setae. Dorsal disc pores present. Dorsal cruciform pores present *glyceriae* Green (p. 367)
- Dorsal enlarged setae conical, either truncate or bluntly pointed, in a continuous row around margins. Dorsal disc pores absent. Dorsal cruciform pores absent 10
- 10 Margins of 7th abdominal segment each with 4 enlarged marginal setae. All dorsal setae except marginal, minute and about same length *insignis* Newstead (p. 372)
- Margins of 7th abdominal segment each with 3 enlarged marginal setae. Dorsal setae, excluding marginal, noticeably longer on head and thorax than on posterior abdominal segments *pseudinsignis* Green (p. 378)

Eriococcus aceris (Signoret)

(Fig. 3)

Acanthococcus aceris Signoret, 1875: 35; Borchsenius, 1949: 347; Danzig, 1964: 632; Tereznikova, 1981:

15. Syntypes ♀, SAVOIE and AUSTRIA: on *Acer campestre* (probably lost).

Eriococcus aceris (Signoret) Cockerell, 1896: 323; Schmutterer, 1952: 406.

Nidularia aceris (Signoret) Lindinger, 1933: 108.

DESCRIPTION. Adult female on slide broadly oval, largest specimens 3.75 mm long, 2.2 mm wide. Surface of body strongly nodulose. Anal lobes protruding, about twice as long as wide, apically rounded, moderately sclerotised with inner margins conspicuously nodulose, each lobe with apical seta 200 μm long, two inner dorsal enlarged setae and one outer enlarged seta situated towards mid-dorsum; ventral setae flagellate, one subapical, one at outer base and suranal seta longest but shorter than anal ring setae. Dorsal plate triangular, lightly sclerotised, strongly nodulose. Antennae 6- or 7-segmented, 250–330 μm long. Frontal lobes developed but smaller than basal antennal segment. Legs normal, well developed. Trochanter + femur 180–220 μm long, tibia 110–140 μm long, tarsus about 150 μm long, the tibia + tarsus always longer than trochanter + femur, claw 35 μm long, stout and curved with denticle near apex. Coxa without translucent pores but with spicules. Labium 160–170 μm long, shorter than clypeolabral shield, basal segment with 2 pairs of setae. Anal ring with 8 setae, each about 150 μm long.

Dorsal surface with numerous enlarged setae of two main sizes, but all with more or less straight sides tapering gradually to a truncate tip, in profile curved and bluntly thorn-like. The largest setae 50 μm long on margins of posterior segments, the shortest, which are the most numerous, about 28 μm long. Macrotubular ducts of one size, 30 μm long, tapering to orifice, the cup wider than base of a dorsal seta, evenly distributed. Microducts about 10 μm long, elongate, each with orifice bifid, evenly distributed.

Ventral surface with normal flagellate setae in median areas, short, slender but stiff in lateral areas. Macrotubular ducts of three sizes. A large type similar to dorsal ducts on margins of abdomen. A smaller type about half width of large type, not numerous, in more or less single rows on abdominal segments and around submargins to head. A small type about half as wide again as the medium-sized ducts in small numbers across abdominal segments. Microducts absent. Disc pores predominantly quinquelocular but occasional pores present that have 6 or 7 loculi; in bands across the abdominal segments, around margins to head and on mid-venter. Cruciform pores present in a wide submarginal band from head to about fourth abdominal segment.

MATERIAL EXAMINED

Austria: Weidling, on *Acer campestre*. **Germany:** Baden, on *A. campestre*, 24.v.1916 (*H. Wünn*); Munich, on *A. platanoides*, 26.v.1951 (*H. Schmutterer*), Erlangen, 6.vi.1949 (*H. Schmutterer*). **Switzerland:** Valais, on *A. campestre*, 20.viii.1906.

DISCUSSION. No original material has been traced. The specimens from Austria, one of the type-localities, are from the Naturhistorisches Museum, Vienna, identified by F. Löw, and the specimens from Switzerland are from the collection of P. Marchal. There seems to be no doubt about the identity of the species now recognised as such by many modern workers.

Eriococcus buxi (Fonscolombe)

(Fig. 4)

Coccus buxi Fonscolombe, 1834: 218. Syntypes ♀, FRANCE: Aix[-en-Provence] (probably lost).

Eriococcus buxi (Fonscolombe) Targioni Tozzetti, 1868: 726; Fernald, 1903: 72.

Nidularia buxi (Fonscolombe) Lindinger, 1933: 108.

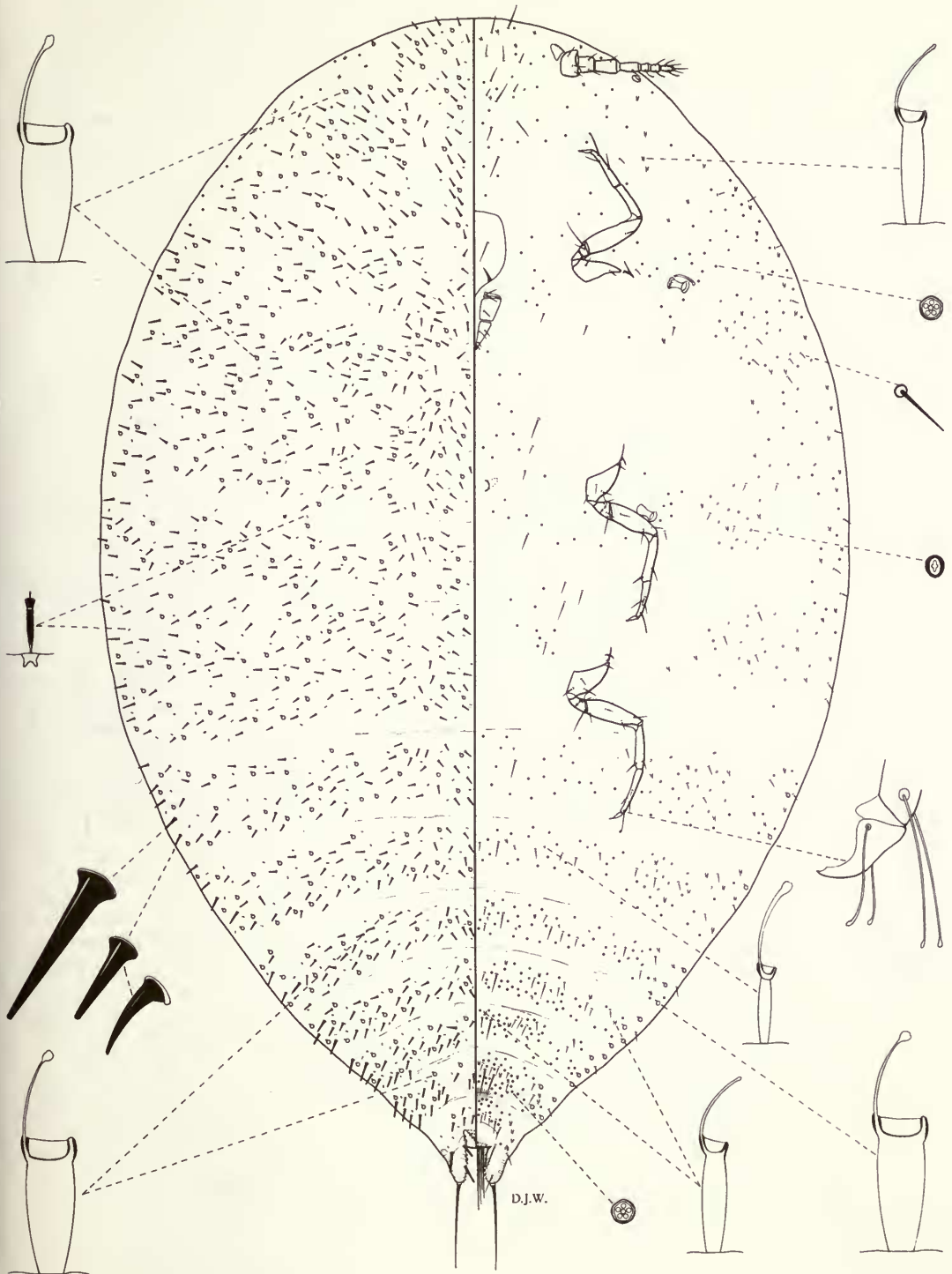


Fig. 3 *Eriococcus aceris* Signoret. Germany, Erlangen.

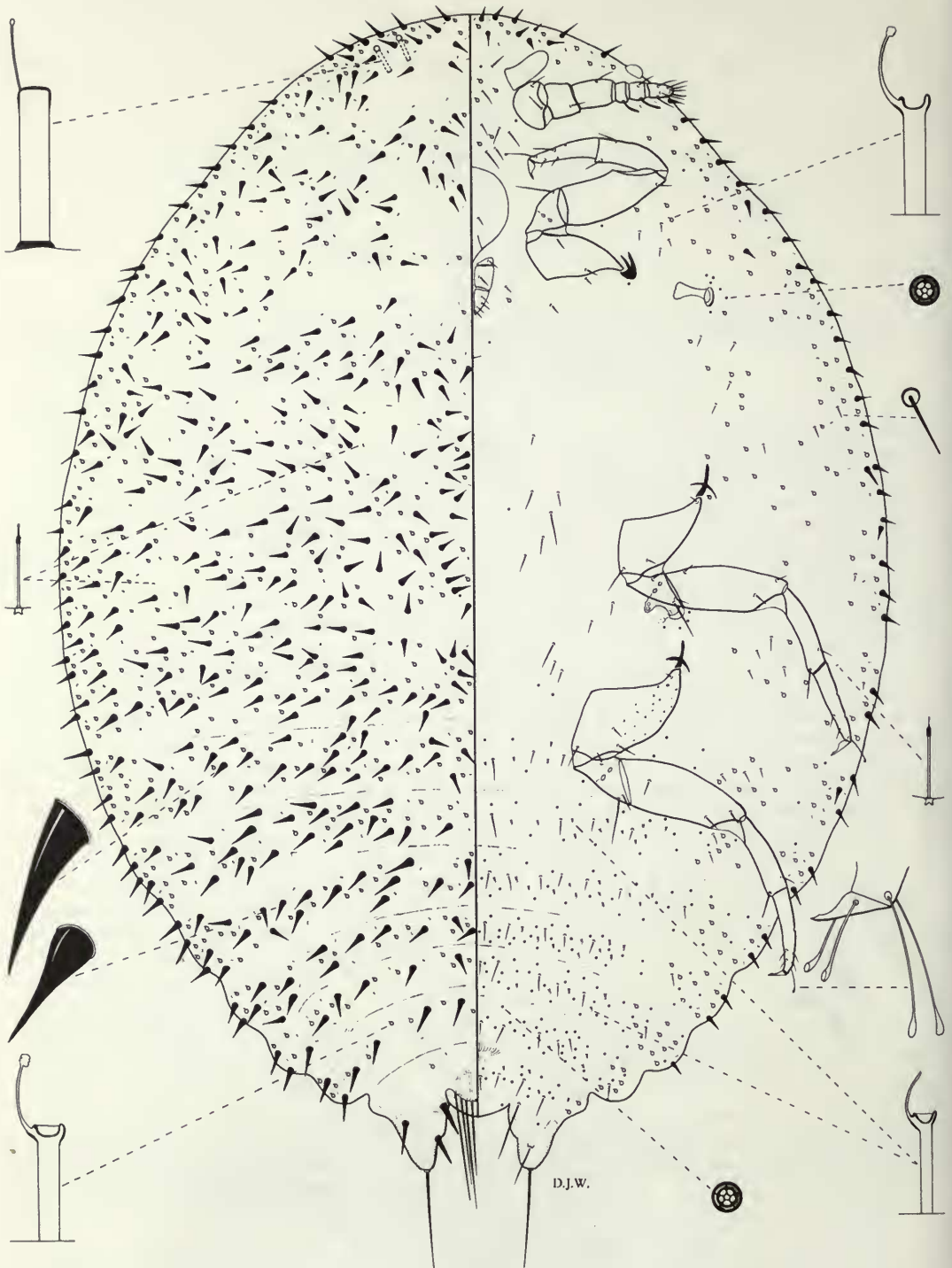


Fig. 4 *Eriococcus buxi* (Fonscolombe). France, Orange, on *Buxus sempervirens*.

DESCRIPTION. Adult female broadly oval, largest specimens 1.9 mm long, 1.35 mm wide, not nodulose. Anal lobes about twice as long as wide, conical, each lobe with an apical seta 140 μm long. Dorsally with an outer enlarged conical seta situated submarginally rather than on edge, and 2 inner enlarged setae. Ventrally with a single slender seta and a suranal seta shorter than anal ring setae. Dorsal plate only lightly sclerotised, rounded. Anal ring with 8 setae, each about 110 μm long. Antennae 160–175 μm long, with 6 segments. Frontal lobes well developed, about as long as width of basal antennal segment. Legs robust, hind trochanter + femur 170–190 μm long, hind tibia 80–90 μm long, hind tarsus 80–90 μm long, the tibia + tarsus either same length as trochanter + femur or slightly shorter, claw 25 μm long, straight, with a minute denticle near apex. Hind coxa with a few small translucent pores. Labium 80 μm long, shorter than clypeolabral shield, basal segment with a single pair of setae.

Dorsal surface densely covered with enlarged setae, lanceolate, 32–52 μm long, pointed, the sides concave but curved in profile and thorn-like. Macroducts of one size, evenly distributed, each about 20 μm long, the cup about two-thirds width of diameter of setal base of a dorsal seta, the inner end of filament small and barely perceptible. Enlarged ducts present, each 35 μm long, the sides almost parallel, with inner end flat and rim of orifice sclerotised, but in profile thicker towards one side; present either singly or sometimes in pairs on head margin where there are 2–4 present at most. Microducts in a regular arrangement, each about 12 μm long, very slender, the sides parallel, with orifice widely bifid.

Ventral surface with normal slender setae in median areas. In submarginal areas the setae are shorter, stiff and blunt. Enlarged setae, same as on dorsum, around margins only. Macroducts of two sizes. A larger type, same as dorsal macroducts, numerous in a wide zone around margins and submargins, on thorax reaching to spiracles, and on head occupying area between clypeolabral shield and antennal bases. A narrower type on abdomen only, in transverse rows or bands across median areas of segments. Microducts, same as on dorsum, around margins only. Cruciform pores absent. Disc pores of quinquelocular type, numerous across abdominal segments almost to margins, occasional pores present in median areas of thorax and head and around spiracular openings.

MATERIAL EXAMINED (all on *Buxus sempervirens*)

France: 'south' (det. Signoret); Lyons, 20.vi.1932 (*L. Goux*); Orange, 15.iv.1978 (*D. Matile-Ferrero & D. J. Williams*). **Switzerland:** Rolle, ix.1906 (*P. Marchal*), others labelled ex coll. P. Marchal.

DISCUSSION. The most important characters are the dorsal setae 32–52 μm long, the dorsal macroducts about half width of setal base of dorsal seta, the enlarged ducts on head only and the lateral enlarged seta on anal lobes submarginal.

There seems to be no doubt about the identity of this species, even though the original material cannot be traced. The species was described from Aix-en-Provence and the specimens at hand collected in Orange, and from Lyons not far from the type-locality, are considered by French workers to be this species. A further specimen is available from material collected in the south of France and this was identified by V. Signoret as *E. buxi*.

Eriococcus sp. near *buxi* (Fonscolombe)

(Fig. 5)

DESCRIPTION. Body of adult female on slide, broadly oval, membranous, not nodulose, largest specimens 2.3 mm long, 1.3 mm wide. Anal lobes sclerotised, conical, pointed, about twice as long as wide at base, each lobe with an apical seta 180 μm long; dorsally with 1 outer enlarged seta on groove on edge and 2 lateral enlarged setae; ventrally with 1 slender seta and a suranal seta shorter than anal ring setae. Dorsal plate projecting slightly, rounded. Anal ring with 8 setae, each about 185 μm long. Antennae 150–210 μm long, 6-segmented. Frontal lobes lightly sclerotised at tip, elongate, sometimes twice as long as width of basal antennal segment. Legs well developed, hind trochanter + femur 160–190 μm long, hind tibia 80–95 μm long, hind tarsus 80–95 μm long, the tibia + tarsus either same length as trochanter + femur, or slightly longer, claw straight, 25 μm long, with a minute denticle, near apex. Hind coxa with a few translucent pores. Labium 80–95 μm long, shorter than clypeolabral shield, basal segment with 1 pair of setae.

Dorsal surface with numerous enlarged setae, evenly distributed, each seta broadly lanceolate, pointed, 25–45 μm long, curved in profile. Groups of these setae usually present submarginally on mid-head region, behind eyes, on prothorax, 1st and 7th abdominal segments, each group associated with a single enlarged duct or sometimes 2, each duct 40 μm long with inner end flat and with sclerotised rim raised from surrounding integument. Other enlarged ducts sometimes present on submargins without the groups of setae, up to 17 marginal ducts present in some specimens and others present on midline, varying in number but there is usually one on mesothorax and another on 1st abdominal segment. Macroducts of one size, numerous, evenly distributed each duct about 25 μm long, with a clear circular rim surrounding orifice, the

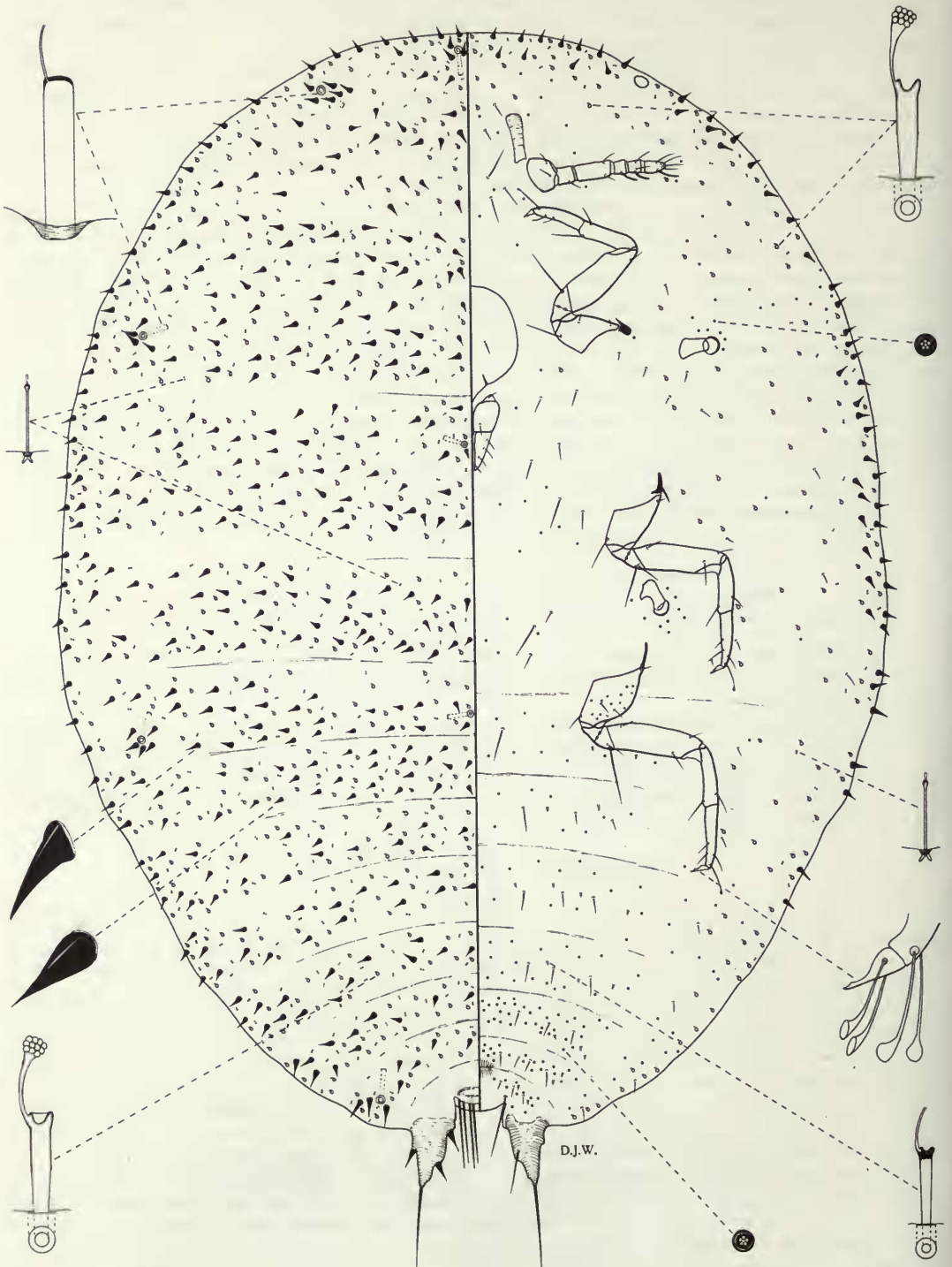


Fig. 5 *Eriococcus* sp. near *buxi* (Fonscolombe). U.S.S.R., Crimea, on *Buxus* sp.

cup about half width of setal base of a dorsal seta, the inner end of filament resembling a bunch of grapes. Microducts numerous, each about 12 μm long, slender, with parallel sides and with orifice widely bifid.

Ventral surface with normal slender setae in median areas and laterally towards margins. Enlarged setae same as on dorsum, around margins. Macroducts of two sizes. A large type, same size as dorsal ducts, present around margins and submargins, reaching to spiracles. A narrower type, not numerous in median areas of abdomen only, each duct with a distinct rim around orifice. Microducts on margins, same shape as on dorsum. Quinquelocular pores numerous on abdomen where they almost reach margins; others present in median areas of head and thorax and around spiracular openings, those next to first spiracle extending to margin. Cruciform pores absent.

MATERIAL EXAMINED

U.S.S.R.: Crimea, Massandra, on *Buxus* sp., 24.vii.1951 (*T. Bustchik*). Turkey: Gerede, on *B. sempervirens*, 13.vii.1970.

DISCUSSION. The large number of submarginal enlarged ducts, many surrounded by groups of setae, and other ducts on the midline, easily distinguish this species from *E. buxi*. Specimens from Crimea have the dorsal setae 25–40 μm long and noticeably shorter than those in *E. buxi*; in Turkish specimens, although 28–45 μm long, these setae are still shorter than in *E. buxi*. The position of the lateral enlarged seta on each anal lobe is always marginal, whereas in *E. buxi* this seta is displaced slightly to dorsum. Another main difference is the size of a dorsal macroduct, which in this species has the cup about half the width of a setal base, but in *E. buxi* it is about two-thirds the width. Furthermore, the dorsal ducts have a conspicuous rim around the orifice.

There is every indication that this species is new but for the moment it is left un-named pending further research by workers in U.S.S.R. It seems certain that it is the same as that described by Borchsenius (1949) and Tereznikova (1981) as *E. buxi*.

Eriococcus cantium sp. n.

(Fig. 6)

DESCRIPTION. Adult female, when prepared on microscope slides, elongate-oval with almost parallel sides, 2.6 mm long and 1.00 mm wide, nodulose. Anal lobes about twice as long as wide, moderately sclerotised. Each lobe with an apical seta 300 μm long, dorsally with 1 inner and 3 outer enlarged setae and ventrally with 2 slender setae and a slender suranal seta shorter than anal ring setae. Dorsal plate not prominent, rounded, nodulose. Antennae 7-segmented, 300 μm long. Frontal tubercle present, just anterior to basal antennal segment. Legs well developed, hind trochanter + femur 250 μm long, hind tibia 150 μm long, hind tarsus 160 μm long, claw curved 40 μm long, with a denticle near apex. Hind coxa with minute translucent pores on outer half and hind femur with a small group on mid-anterior margin. Labium 100 μm long, slightly shorter than clypeolabral shield and basal segment with 2 pairs of setae. Anal ring with 8 setae.

Dorsal surface with enlarged conical setae, pointed, 35–75 μm long, in bands across the segments. On 7th segment medially a group of 4–5 present and on 6th segment a similar group present but this merging with lateral setae. Macroducts of one size, about 25 μm long, the cup narrower than setal bases of largest setae, fairly evenly distributed across segments. Microducts not numerous, each about 4 μm long, with short collar, ampulla and swollen inner end to tube.

Ventral surface with normal slender setae in median areas. Enlarged setae, same as on dorsum, on margins of head, thorax and anterior abdominal segments, but submarginally a few setae that are more slender but stiff. Macroducts of two sizes; a larger type, same size as on dorsum, around margins and a narrower type in transverse rows on abdominal segments, and in median to submarginal areas of thorax and head. Microducts in small numbers on margins. Disc pores of quinquelocular type numerous across abdominal segments, in median areas of thorax and head and near spiracles. Cruciform pores present in small numbers in a narrow submarginal zone from about 5th abdominal segment forward to head.

Holotype ♀, England: Kent, Bearsted, on *Brachypodium sylvaticum* (Poaceae), 30.vii.1925 (*E. E. Green*) (BMNH).

Paratype. England: 1 ♀, same data as holotype (BMNH).

DISCUSSION. This species is close to *E. greeni* in having a similar distribution of enlarged dorsal setae. It differs, however, in possessing groups of 4–6 setae in the median areas of the seventh and sixth segments whereas in *E. greeni* these groups usually possess only 2 or at most 3 setae. The median group of setae on the sixth segment of *E. cantium* is not so differentiated and is almost continuous with the lateral setae. Furthermore there are three lateral setae on each anal lobe whereas in *E. greeni* there are only two.

The name is the Latin word for the county of Kent, and is used as a noun in apposition.

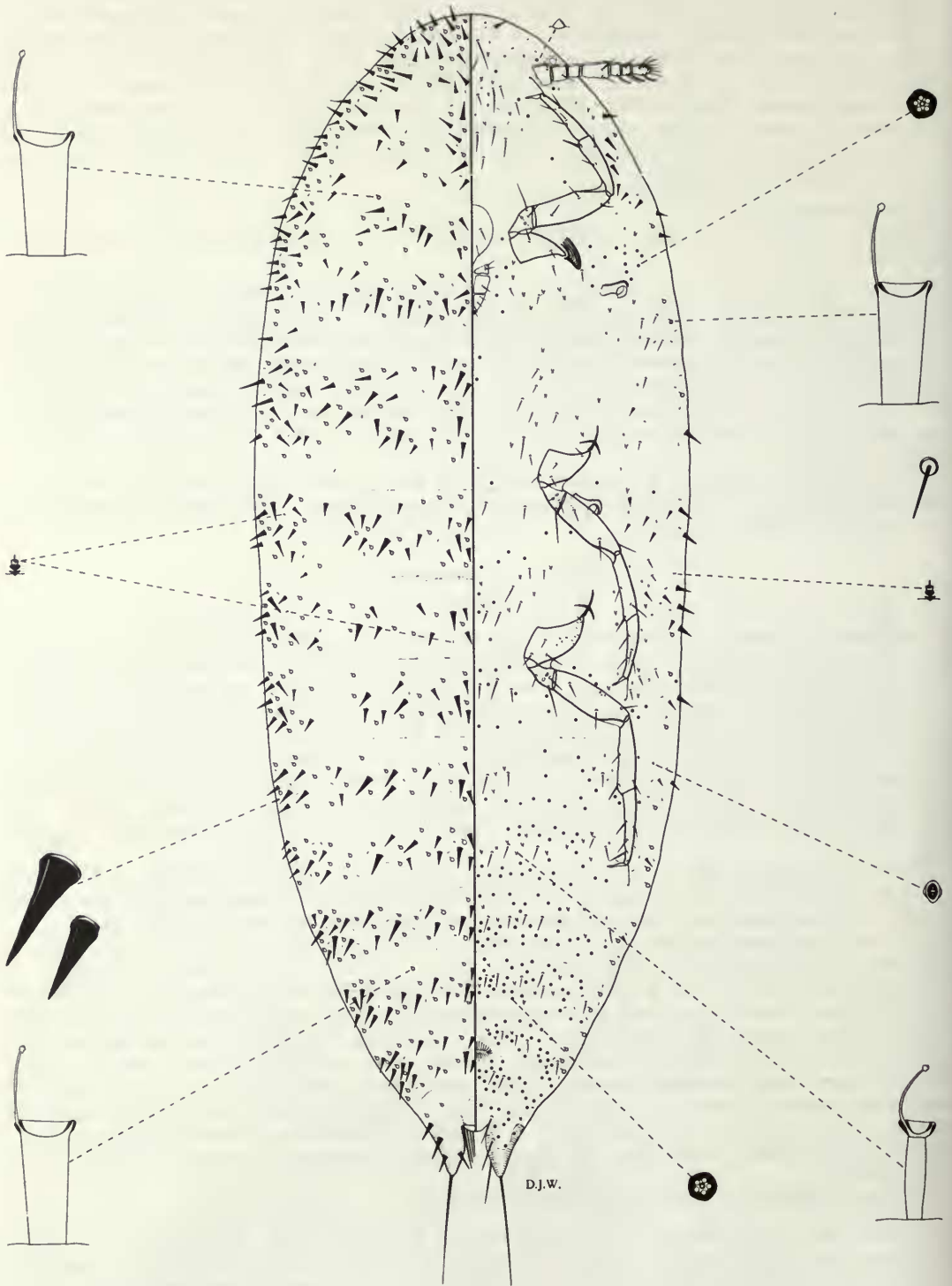


Fig. 6 *Eriococcus cantium* sp. n. England, Kent, Bearsted, on *Brachypodium sylvaticum*.

Eriococcus devoniensis (Green) comb. rev.

(Fig. 7)

Rhizococcus devoniensis Green, 1896: 260. LECTOTYPE ♀, ENGLAND (BMNH), here designated [examined].

Eriococcus devoniensis (Green) Cockerell, 1897: 589; Newstead, 1903: 201; Schmutterer, 1952: 413.

Acanthococcus devoniensis (Green) Borchsenius, 1949: 337.

DESCRIPTION. A broadly oval species, attaining a length of 2.0 mm and a width of 1.3 mm, body nodulose. Anal lobes sclerotised, rather wide and pointed, triangular, about as wide as long at base in older specimens, but conical and rounded in young specimens. Each lobe with an apical seta 180 μ m long and dorsally 2 inner submarginal enlarged setae and 1 outer marginal seta. Ventrally each lobe with 2 slender setae and a suranal seta shorter than anal ring setae. Dorsal plate poorly developed, rounded. Anal ring with 8 setae, each 100 μ m long. Antennae 190–210 μ m long, 7-segmented. Frontal lobes conspicuous and larger than a basal antennal segment. Legs well developed. Hind trochanter + femur 180–200 μ m long, hind tibia 100–115 μ m long, hind tarsus 110–120 μ m long, the tibia + tarsus longer than trochanter + femur, claw stout and curved, 30 μ m long, with a denticle near apex. Hind coxa with a few noticeable translucent pores and hind femur with a few on anterior edge. Labium 130–150 μ m long, usually slightly shorter than clypeolabral shield, basal segment with 2 pairs of setae.

Dorsal surface with an even distribution of enlarged setae of various sizes, 28–40 μ m long, each truncate, the sides straight or only slightly concave, and tapering gradually. Macroducts of one size, about 20 μ m long, the cup about same size or smaller than diameter of setal base of largest setae, fairly numerous. Microducts each about 4 μ m long, with ampulla, inner end of tube swollen, but without internal collar, opening to exterior with minute orifice, in moderate numbers over entire surface.

Ventral surface with normal slender setae in median areas and enlarged setae similar to those on dorsum, in a marginal zone, on thorax, reaching almost to spiracles. Macroducts of two sizes. A large type, same as those on dorsum, in a marginal zone, interspersed with the enlarged setae. A narrower type present across median areas of abdominal segments and in groups in median areas of thorax and head. Microducts few, on margins only. Disc pores predominantly quinquelocular, numerous on abdomen and present in median areas of thorax and around spiracles. Cruciform pores few, in submargins of head and thorax.

MATERIAL EXAMINED (all on *Erica tetralix* unless stated otherwise)

England: Devon, Budleigh Salterton, ix.1896 (lectotype), 20.ix.1896 (*E. E. Green*), Sherbrook, 18.viii.1896; Surrey, Camberley, 11.iv.1922, vii.1914, ix.1914, xi.1929 (*E. E. Green*), 10.vi.1959 (*D. J. Williams*); Durham, Waldrige Fell, vi.1950, 16.viii.1960 (*D. J. Williams*); Yorkshire, Hawkesworth, 12.viii.1960, Levisham, 27.viii.1959, Goathland, 25.viii.1959 (all *D. J. Williams*), Ickornshaw Moor, 29.viii.1948 (*A. Smith*), Shipley Glen, 25.viii.1984 (*N. B. Pungertl*). **Ireland:** Kerry, Mt Mangerton, in sphagnum, viii.1943 (*R. S. Bagnall*). **Austria:** Lunz, on *E. carnea*. **Germany:** Ratzeburg. **Corsica:** Vizzavone Forest, on *E. arborea*, 1.xi.1930 (*A. Balachowsky*).

DISCUSSION. Green's original slide contains three specimens, and the lectotype selected is clearly marked. The two other specimens are here designated paralectotypes.

Although Green described this insect originally on *Erica cinerea* he (Green, 1917) corrected the misidentification of the host-plant to *E. tetralix* and the insect seems to be restricted to this plant in Britain, even when other species of *Erica* are growing next to it. It distorts the stems at the point of feeding, so much so that stems may curl in a circle enclosing the insect in the middle as illustrated in colour by Newstead (1903). Specimens are at hand from Corsica collected on *E. arborea* and the record led Green (1931) to correct an early impression that *E. tetralix* was the only host-plant. There are unconfirmed records on *E. cinerea* and *Calluna* by Goux (1934) and on *C. vulgaris* by Balachowsky (1937).

Apart from the British records already listed, Harrison (1916a, 1916b, 1918, 1948, 1949) has recorded it from Northumberland, Durham and Yorkshire, and from western Scotland including the Isle of Rhum and Benbecula, Ronay and Grimsay in the Outer Hebrides. Other records include those of Green (1917) from Cheshire and Green (1923) from Aberdeenshire, while Killington (1936) recorded it from Hampshire.

The species is found throughout Europe as far north as Sweden and may be present throughout the Palaearctic region wherever *E. tetralix* is found.

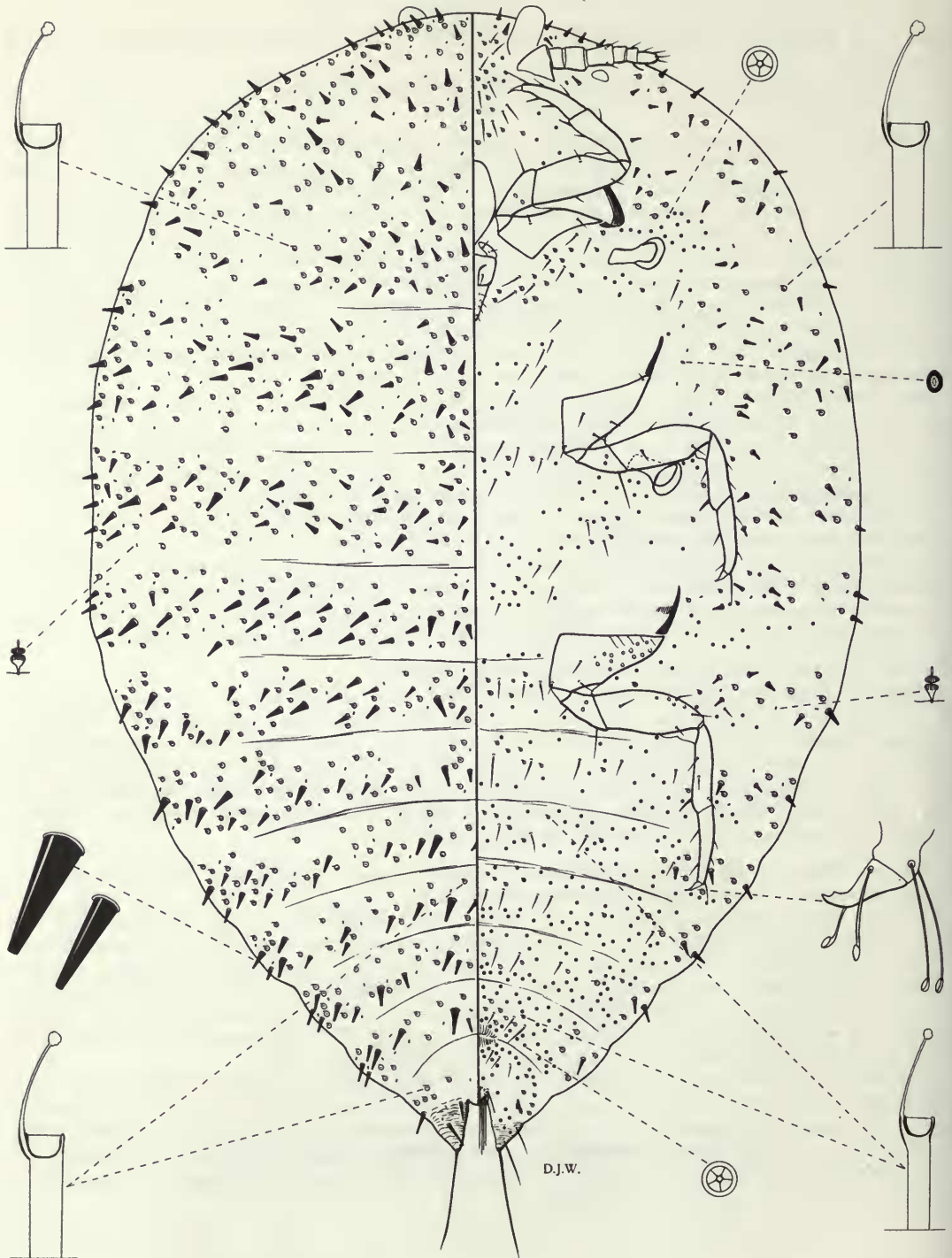


Fig. 7 *Eriococcus devoniensis* (Green). England, Durham, Waldrige Fell, on *Erica tetralix*.

Eriococcus glyceriae Green comb. rev.

(Fig. 8)

Eriococcus glyceriae Green, 1921: 146; Schmutterer, 1952: 410. LECTOTYPE ♀, ENGLAND (BMNH), here designated [examined].

Nidularia glyceriae (Green) Lindinger, 1933: 116.

Greenisca glyceriae (Green) Borchsenius, 1949: 368; Danzig, 1964: 634; Danzig, 1980: 228; Tereznikova, 1981: 52.

Kaweckia glyceriae (Green) Koteja & Žak-Ogaza, 1981: 506.

DESCRIPTION. Body elongate-oval, largest specimens 3.4 mm long, 1.7 mm wide, membranous throughout, not nodulose. Anal lobes either membranous or faintly sclerotised, each lobe about as long as wide, with an apical seta 140 μm long and dorsally 2 inner and 1 outer truncate setae and one ventral seta that is flagellate and situated towards outer margin. Suranal setae slender and flagellate, shorter than anal ring setae. Antennae 7-segmented, 220–230 μm long. Frontal tubercle present just anterior to each basal antennal segment. Legs well developed, hind trochanter + femur 180 μm long, hind tibia 110 μm long, hind tarsus 110–120 μm long, the tibia + tarsus always longer than trochanter + femur, claw 35 μm long, curved with minute denticle near apex. Hind coxa with proximal edge indistinct, translucent pores numerous, a few extending on to surrounding integument at base. Labium 85–100 μm long, shorter than clypeolabral shield, basal segment with 2 pairs of setae. Spiracles heavily sclerotised, this sclerotisation completely surrounding atrium. Dorsal plate membranous in form of a narrow rounded lobe.

Dorsal surface with enlarged setae on 5th and posterior segments only except for an occasional seta on 4th segment, few, on margins, each seta with almost parallel sides, truncate, 15–25 μm long. Other dorsal setae slender, often curved but stiff, with blunt tip 12–20 μm long. Macroducts of two sizes, the largest about 16–20 μm long with the cup about same diameter as an enlarged setal base, in bands across the segments except on anal lobe segment where they are replaced by a narrower type. Microducts minute, about 6 μm long, with ampulla, swollen inner end to tube and an inner collar, few, across the posterior abdominal segments and around the margins to head. Disc pores, usually with 7 loculi, in more or less single rows at anterior edges of segments. Cruciform pores present in wide bands across median areas of second abdominal segment and forward to mesothorax; a few others present in lateral areas of these segments, on third abdominal segment and on prothorax.

Ventral surface with normal setae in median areas, replaced by shorter stiff setae, similar to those on dorsum, around margins of thorax and anterior abdominal segments. Macroducts, of the large type, similar to those on dorsum, on margins only. A narrower type in moderate numbers across abdominal segments, in median areas of thorax and head and reaching to submargins of thorax. Microducts as on dorsum, few, on margins. Cruciform pores restricted to a few only on margins of prothorax and head. Disc pores, usually with 7 loculi, but occasionally with more or fewer loculi at anterior and posterior edges of 5th and posterior segments, at anterior edges of anterior abdominal segments, in median area of thorax and in a zone around thoracic margins to head.

MATERIAL EXAMINED

England: Norfolk, Blakeney Point, on *Glyceria maritima* (now *Puccinellia maritima*), vii.1920 (*E. E. Green*) (lectotype), ix.1920 (*N. E. Brenchley*). **Hungary:** Zicsiujfalu, on *Agropyron* sp., 8.ix.1981 (*F. Kozár*). **U.S.S.R.:** Odessa, on *A. repens* (*A. Kirishenko*).

DISCUSSION. The lectotype is here designated from three specimens on the same slide and clearly indicated. The two other specimens are labelled paralectotypes.

Although this species has concentrations of cruciform pores on the mid-dorsum and rather heavily sclerotised spiracles, these characters are probably of specific significance only and the species seems to be congeneric with the type-species. Specimens available from eastern Europe tend to have the enlarged setae with slightly concave sides.

Eriococcus greeni Newstead comb. rev.

(Fig. 9)

Eriococcus greeni Newstead, 1898: 96; Newstead, 1903: 200. LECTOTYPE ♀, ENGLAND (BMNH), here designated [examined].

Acanthococcus greeni (Newstead) Borchsenius, 1949: 340; Danzig, 1975: 71; 1980: 212; Tereznikova, 1981: 27.

DESCRIPTION. An elongate-oval species, attaining a length of 3.0 mm and a width of 1.6 mm, body

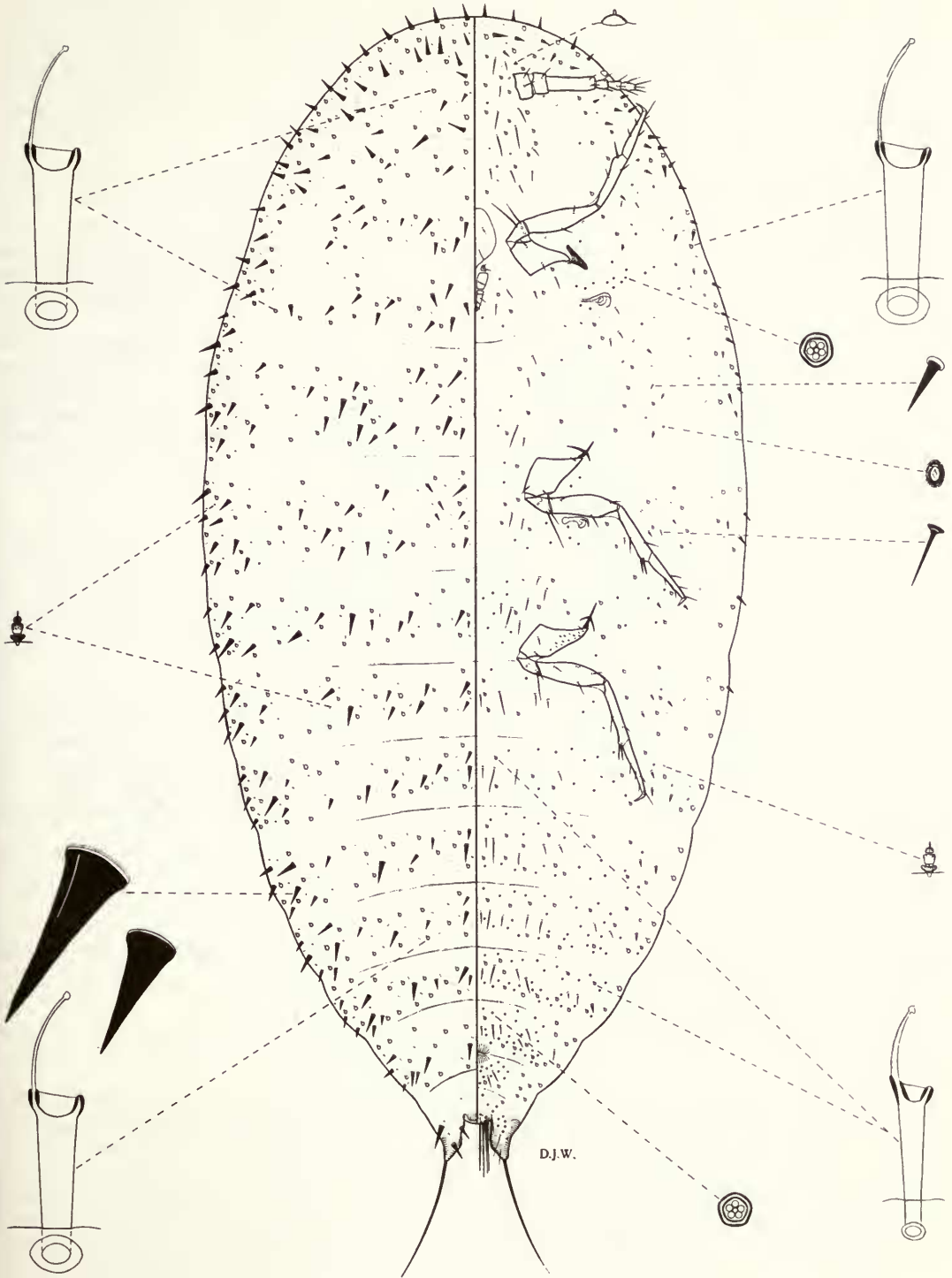


Fig. 9 *Eriococcus greeni* Newstead. England, Surrey, Camberley, on grass.

nodulose. Anal lobes about twice as long as wide, conical, tending to be pointed, moderately sclerotised. Each lobe with an apical seta $380\ \mu\text{m}$ long and dorsally with 1 outer and 2 inner enlarged setae and ventrally with 2 slender setae and a slender suranal seta much shorter than anal ring setae. Dorsal plate sclerotised, moderately developed, rounded but nodulose. Anal ring with 8 setae each about $140\ \mu\text{m}$ long. Antennae $280\text{--}300\ \mu\text{m}$ long, with 6 or 7 segments. Frontal tubercle present just anterior to basal segment. Legs well developed. Hind trochanter + femur $240\text{--}270\ \mu\text{m}$ long, hind tibia $150\text{--}170\ \mu\text{m}$ long, hind tarsus $150\text{--}170\ \mu\text{m}$ long, tibia + tarsus always longer than trochanter + femur. Claw curved, $35\ \mu\text{m}$ long, with a minute denticle near apex. Hind coxa with translucent pores on outer half and hind femur with a small group on mid-anterior edge. Labium $110\text{--}120\ \mu\text{m}$ long, shorter than clypeolabral shield.

Dorsal surface with pointed conical setae $30\text{--}70\ \mu\text{m}$ long, the sizes in a haphazard arrangement but there are always some of the longest in the marginal groups. On the mid-dorsum of 7th abdominal segment, there is usually a group of 2 such setae, rarely 3, and a similar group is present on the mid-dorsum of 6th abdominal segment. Macroducts in a regular distribution, of one type, about $25\ \mu\text{m}$ long, the cup smaller than diameter of setal base of largest setae, tapering gradually, the orifice usually surrounded by a pale oval area. Microducts about $4\ \mu\text{m}$ long, each with ampulla, swollen inner end to tube and an internal collar, evenly distributed.

Ventral surface with normal slender setae in median areas, marginally with a few enlarged setae similar to dorsal setae, submarginally with more slender but stiff setae. Macroducts of two sizes. A large type, same as on dorsum, in small numbers around margins. A narrower type in bands across abdominal segments, in median areas of thorax and head, extending in submargins almost to marginal macroducts. Microducts not numerous, in a marginal zone from anterior abdominal segments to head. Quinquelocular pores numerous on abdomen, in median areas of thorax and around spiracles. Cruciform pores few, in submarginal areas only of head, thorax and first few abdominal segments.

MATERIAL EXAMINED

England: Devon, Budleigh Salterton, on grass, 20.ix.1896 (*E. E. Green*) (lectotype); Somerset, Minehead, on grass, ix.1920 (*E. E. Green*), Cheddar, vii.1926 (*E. E. Green*); Surrey, Camberley, 31.viii.1914, ix.1914, 25.ix.1934, Hog's Back, 21.vii.1922, on grass (all *E. E. Green*); Kent, Thurnham, on grass, 15.ix.1926 (*E. E. Green*); Berkshire, Silwood Park, on *Festuca* sp., *Deschampsia caespitosa*, 27.x.1948, on grass 19.viii.1948 (all *K. L. Boratynski*); Yorkshire, Hawkesworth, on grass, 20.viii.1961 (*D. J. Williams*). **Scotland:** E. Lothian, Gullane, on grass, viii.1925 (*E. E. Green*).

DISCUSSION. The lectotype designated is the only original specimen seen. In all specimens there is always a group of 2 large setae on the mid-dorsum of the 7th abdominal segment or rarely with a small seta forming a group of 3. Furthermore, there is always a median group of setae on the 6th segment. These characters separate it from *R. cantium* herein described as new, a species that has a group of 4 on the mid-dorsum of the 7th segment and with the setae on the mid-dorsum of 6th segment not forming a distinct group.

Green (1923, 1926, 1928) recorded this species also from Sea View, Isle of Wight; Bearsted, Kent; Yatley, Hampshire; and from Monument Hill in East Lothian (Haddington).

Eriococcus inermis Green comb. rev.

(Fig. 10)

- Eriococcus inermis* Green, 1915: 176. LECTOTYPE ♀, ENGLAND (BMNH), here designated [examined].
Nidularia inermis (Green) Lindinger, 1933: 116.
Greenisca inermis (Green) Borchsenius, 1948: 502; 1949: 367.
Anophococcus inermis (Green) Balachowsky, 1954: 61.
Rhizococcus inermis (Green) Danzig, 1962: 854; 1964: 634; Dziedicka & Koteja, 1971: 576.
Acanthococcus inermis (Green) Danzig, 1975: 64; 1980: 226.

DESCRIPTION. Body of adult female not nodulose, elongate-oval, anterior end rounded, sides at times subparallel, largest specimens $2.5\ \text{mm}$ long, $1.5\ \text{mm}$ wide. Anal lobes about twice as long as wide, pointed. Each lobe with an apical seta $180\ \mu\text{m}$ long, dorsally with 2 inner enlarged conical setae, the anterior usually the larger, about $28\ \mu\text{m}$ long, the posterior about $24\ \mu\text{m}$ long, and a minute outer seta near base; ventrally with 2 slender setae and a suranal seta shorter than anal ring setae. Dorsal plate rounded, lightly sclerotised. Anal ring with 8 setae each $130\ \mu\text{m}$ long. Antennae $150\text{--}210\ \mu\text{m}$ long, 6-segmented. Frontal tubercle present just anterior to basal antennal segment. Legs well developed, hind trochanter + femur $140\text{--}170\ \mu\text{m}$ long, hind tibia $90\text{--}110\ \mu\text{m}$ long, hind tarsus $110\text{--}130\ \mu\text{m}$ long, the tibia + tarsus conspicuously longer than trochanter + femur, claw curved, $30\ \mu\text{m}$ long, with a denticle near apex. Hind coxa with a few large translucent pores on outer half and hind femur sometimes with one or two on anterior edge. Labium $95\text{--}110\ \mu\text{m}$ long, shorter than clypeolabral shield, basal segment with 2 pairs of setae.

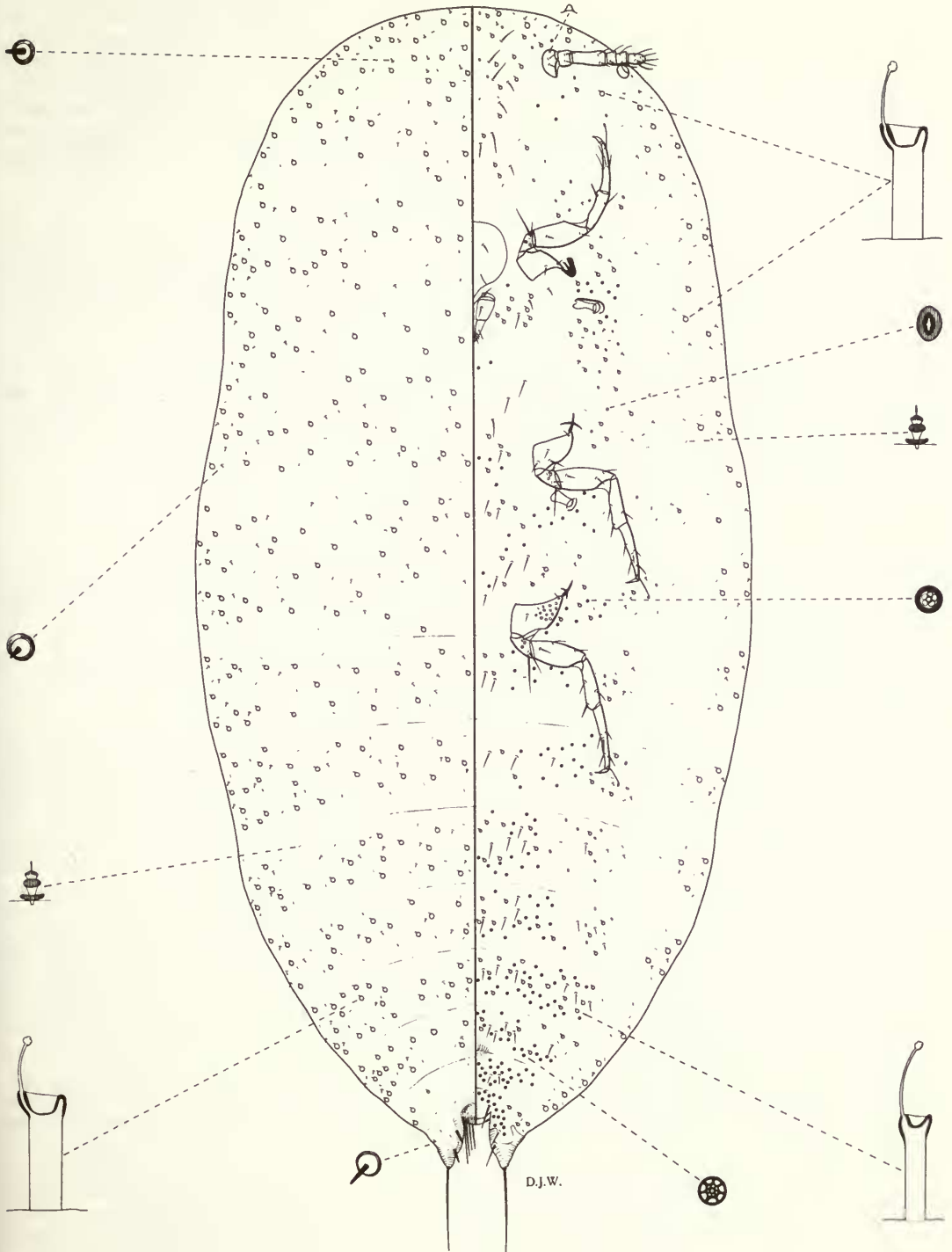


Fig. 10 *Eriococcus inermis* Green. England, Surrey, Camberley, on grass.

Dorsal surface with minute bluntly pointed setae, most scarcely longer than diameter of setal base and some appreciably shorter, in moderate numbers across segments. Macroducts evenly distributed, each about 20 μm long with cup nearly twice diameter of a dorsal setal base. Microducts each about 4 μm long, with ampulla, tube with inner end swollen, and an internal collar, in moderate numbers over surface.

Ventral surface with slender setae in median areas and minute setae, similar to those on dorsum, around margins and submargins. Macroducts of two sizes. A larger type, the same as dorsal ducts, on margins only. A narrower type in median areas as far forward as head margins. Disc pores varying in size, numerous on abdomen where, on the posterior segments, many have 7 or occasionally more loculi but anteriorly on the abdomen, the median area of thorax and around the spiracles, they are quinquelocular. Cruciform pores present in a submedian zone from head to about 5th abdominal segment.

MATERIAL EXAMINED

England: Surrey; Camberley, on grass, ix.1914 (*E. E. Green*) (lectotype, paralectotypes), 15.iv.1922, 1.x.1925, on *Festuca ovina*, ix.1929 (*E. E. Green*); Somerset, Cheddar, viii.1926 on *F. ovina* (*E. E. Green*); Berkshire, Silwood Park, on *F. ovina*, *Deschampsia flexuosa* 1948–1956 (various dates) (*K. L. Boratynski*); Yorkshire, Steeton Moor, 29.viii.1948 (*A. Smith*), Hawkesworth, on grass, 20.viii.1961 (*D. J. Williams*); Durham, Waldrige Fell, on grass, 17.vii.1960 (*D. J. Williams*).

DISCUSSION. The original material comprises 12 specimens, six on each of two slides, one labelled 'type' and the other labelled 'co-type'. The lectotype has been selected from the slide labelled 'type' and is clearly marked, the remaining 11 specimens are labelled paralectotypes.

The distribution at present also includes France, western U.S.S.R. and the far eastern area of U.S.S.R. It will probably be found throughout the Palaearctic Region.

Eriococcus insignis Newstead comb. rev.

(Fig. 11)

Eriococcus insignis Newstead, 1891: 164; 1903: 198. LECTOTYPE ♀, ENGLAND (BMNH), here designated [examined].

Nidularia insignis (Newstead) Lindinger, 1933: 116.

Rhizococcus insignis (Newstead) Borchsenius, 1949: 357; Danzig, 1962: 841; 1964: 633; Dziedicka & Koteja, 1971: 561.

Acanthococcus insignis (Newstead) Danzig, 1975: 64; Tereznikova, 1981: 29.

DESCRIPTION. Body of adult female elongate-oval, the sides often subparallel, nodulose, largest specimens 2.9 mm long and 1.2 mm wide. Anal lobes conical, pointed, about twice as long as wide, moderately sclerotised. Each lobe with an apical seta 280–320 μm long, on the dorsum 1 outer and 2 inner enlarged setae, on the venter 2 slender setae and a suranal setae shorter than anal ring setae. Dorsal plate rounded, narrow, sometimes nodulose and lightly sclerotised. Anal ring with 8 setae, each 135 μm long. Antennae 200–270 μm long with 7 segments. Legs well developed, hind trochanter + femur 200–250 μm long, hind tibia 120–160 μm long, hind tarsus 130–150 μm long, the tibia + tarsus always longer than trochanter + femur, claw curved, 35 μm long, with a denticle near apex. Hind coxa with conspicuous translucent pores on outer half. Labium 100 μm long, shorter than clypeolabral shield, basal segment with 2 pairs of setae.

Dorsal surface with a marginal row of enlarged setae 40–65 μm long, each with slightly concave sides. On segments 5–7 these setae are truncate, but anteriorly they are bluntly pointed and on head they extend to submarginal area near midline. The setae on the 7th abdominal segment always number 4. Elsewhere on the dorsum there are small setae in moderate numbers, 6–8 μm long. These vary in thickness on different specimens, even from the same batch, sometimes being quite slender but usually they are slightly conical and often they are thicker on the head and thorax. Despite these differences they vary little in length. Macroducts of one size, evenly distributed, about 25 μm long, cup narrower than a setal base of a marginal seta. Microducts in an even distribution, each about 4 μm long with ampulla, tube with swollen inner end, and an internal collar.

Ventral surface with normal slender setae in median areas, a few enlarged setae on head margin and stiff setae in a marginal zone from head to anterior abdominal segments, these setae usually larger than the small dorsal setae but smaller than dorsal marginal setae. Macroducts of two sizes. A larger type, same as on dorsum around margins, and a narrower type in median areas, extending laterally almost to marginal macroducts. Microducts few, around margins only. Disc pores usually with 7 loculi, fairly numerous across abdominal segments, but not reaching margins, also present in median areas of thorax and head and around spiracular openings. Cruciform pores in a narrow submarginal zone around entire body, not numerous.

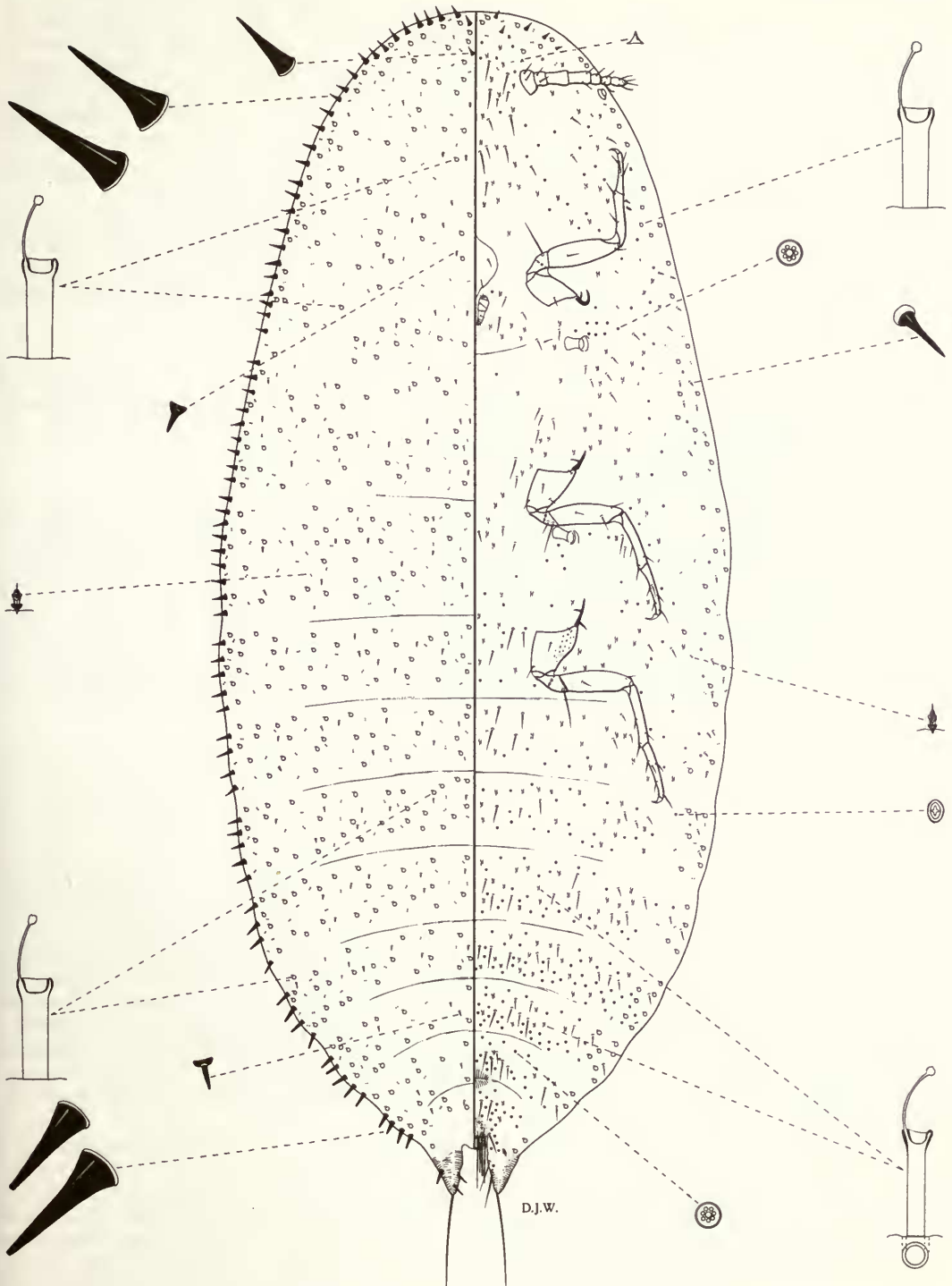


Fig. 11 *Eriococcus insignis* Newstead. England, Surrey, Camberley, on grass.

MATERIAL EXAMINED

England: Cheshire, Ince, on *Agrostis* sp., 1890 (lectotype, paralectotypes); Surrey, Camberley, 1914–1934 (various dates), on *Hypericum* sp., ix.1923, Wisley, ix.1915, Box Hill, 26.ix.1921; Sussex, Arundel, ix.1914; Kent, Thurnham, 15.ix.1926; Somerset, Cheddar, viii.1926, on *Brachypodium sylvaticum*, viii.1926, Minehead, ix.1920; Warwickshire, Morton Paddocks, 14.viii.1920 (*R. Newstead*); Devon, Budleigh Salterton, 10, 20.ix.1896; Yorkshire, Goathland, 25.viii.1959 (*D. J. Williams*). **Scotland:** E. Lothian, Gullane, vii.1925; Argyllshire, Skye, Uig, on grass, 8.ix.1973 (*D. J. Williams*). **Channel Is:** Guernsey, Houmet Homtolle, 9.ix.24; Herm, 13.ix.1924, all on grasses (all *E. E. Green*).

DISCUSSION. The lectotype has been selected and clearly marked, from four specimens on a single slide labelled 'Cotype ♀ ♀' by Newstead. The three other specimens are labelled paralectotypes.

A discussion of the similarities between this species and *E. pseudinsignis* is given under the latter. At present *E. insignis* may be identified by the presence of 4 marginal setae on each side of the seventh abdominal segment instead of 3 in *E. pseudinsignis*.

Literature records for Britain include those of Green (1915, 1925*b*, 1926, 1928) for Camberley, the Channel Is, Wales (Breconshire) and Cheddar.

Eriococcus lagerstroemiae Kuwana comb. rev.

Eriococcus lagerstroemiae Kuwana, 1907: 182; Boratynski & Williams, 1964: 91. Syntypes ♀, JAPAN: Ichijiku and Saruberi (IAES).

Nidularia lagerstroemiae (Kuwana) Lindinger, 1933: 116.

Acanthococcus lagerstroemiae (Kuwana) Borchsenius, 1960: 214.

This species was recorded from England by Green (1915) from specimens collected in a nursery garden at St. Albans on *Lagerstroemia* sp., growing in the open. It is not clear if the insects were destroyed at the time. The species has not been recorded from Britain since, but it has been found also in India and China.

No authentic material has been studied for this work, although some specimens are at hand from Japan, Tokyo, on *L. indica* sent by Kuwana to Green. The species is in great need of further study.

Material shows that the species possesses frontal lobes, numerous slender microducts with bifid orifice, and a small group of setae on mid-dorsum of the anal lobe segment. It comes close to *E. aceris* but differs in having the marginal setae, especially those on the posterior segments, not appreciably longer than those on the mid-dorsum. In *E. aceris* the marginal setae are about twice the length of the mid-dorsal setae.

Eriococcus munroi (Boratynski) comb. n.

(Fig. 12)

Acanthococcus munroi Boratynski, 1962: 56; Danzig, 1975: 71; 1980: 218; Tereznikova, 1981: 32. Holotype ♀, ENGLAND (BMNH) [examined].

DESCRIPTION. Body of adult female nodulose, elongate-oval, widest at mesothorax, largest specimens 2.1 mm long and 1.5 mm wide. Anal lobes about twice as long as wide, almost conical, sclerotised, each with apical setae up to 300 μ m long. Dorsal surface of each lobe with 2 inner enlarged conical setae, the subapical longer than inner and with an outer enlarged seta, the longest, situated slightly on dorsum towards base. Dorsal plate sclerotised, narrow and rounded, the posterior edge with 'teeth' because of the nodulosity. Anal ring with 8 setae each about 125 μ m long. Antennae usually 7-segmented, 250–300 μ m long. Frontal lobes present just anterior to basal segment. Legs normal, well developed, hind trochanter + femur 220–230 μ m long, hind tibia 130–150 μ m long, hind tarsus 140–150 μ m long, the tibia + tarsus always longer than trochanter + femur, claw curved, 30 μ m long with denticle near apex. Hind coxa with a few conspicuous translucent pores. Labium 120 μ m long, shorter than clypeolabral shield, basal segment with 2 pairs of setae.

Dorsal surface with enlarged setae, each conical with almost straight sides and with blunt tip, arranged in transverse bands across the segments but absent in the submarginal areas. These setae of various sizes, 30–60 μ m long but always with one or two of the large type present in any marginal group. On the median areas of 4th and 5th abdominal segments the conical setae tend to be shorter but the normal conical setae are replaced on the median areas of 6th and 7th abdominal segments by minute conical setae about 6 μ m long and rarely longer than the diameter of a setal base, there being usually 4 across the middle of each segment. Macroducts of one size, each about 20 μ m long with almost straight sides and with cup narrower than a setal base of an enlarged seta, fairly numerous in wide bands across the segments. Microducts each about 4 μ m long with inner end of tube swollen, ampulla and a saucer-shaped inner collar, evenly distributed.

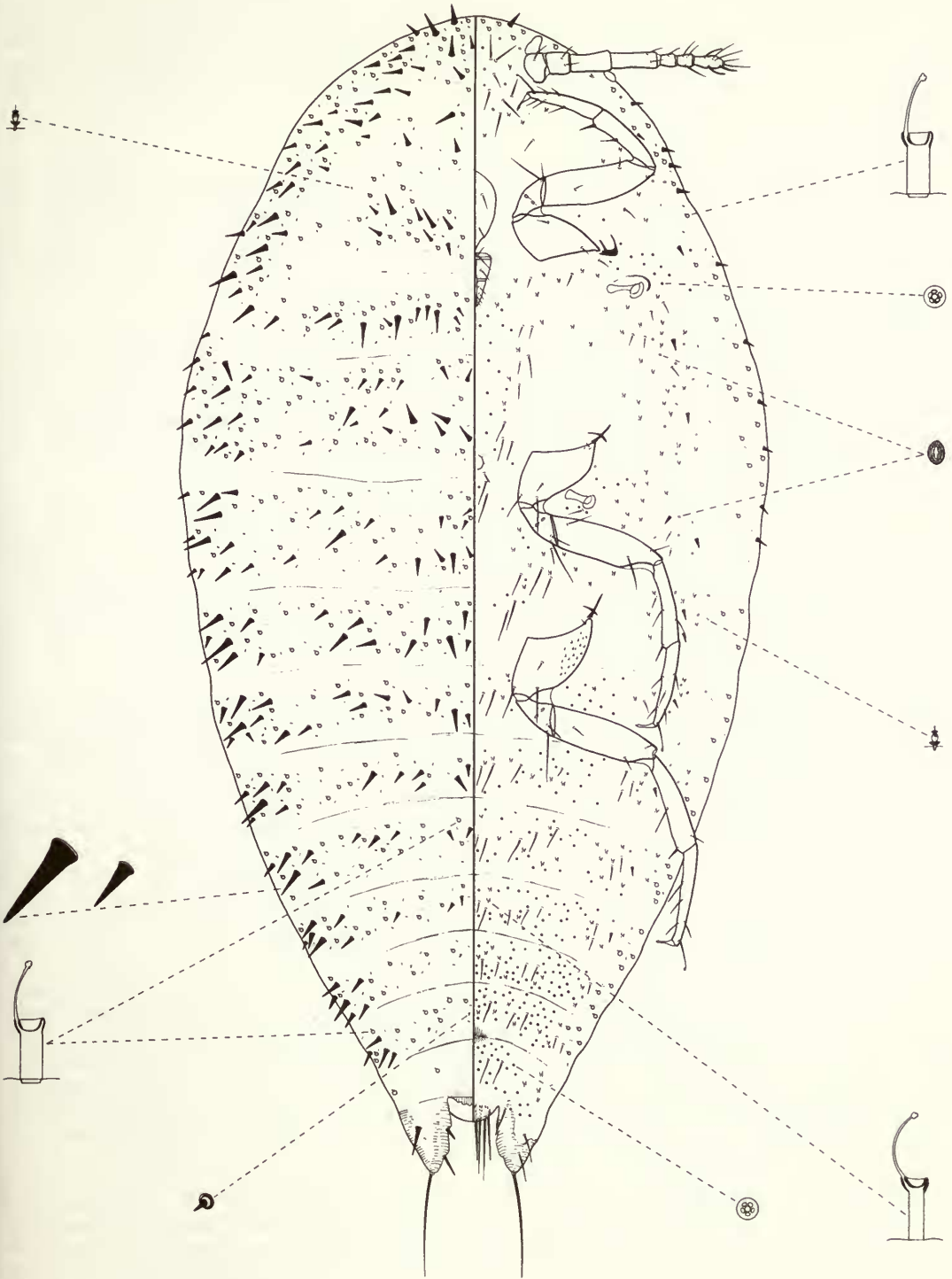


Fig. 12 *Eriococcus munroi* (Boratynski). England, Berkshire, Silwood Park, on *Veronica chamaedrys*.

Ventral surface with normal slender setae in median areas and a few enlarged conical setae on margins and submargins. Macroducts of two sizes. A larger type, similar to dorsal ducts, around margins and a narrower duct in transverse rows on abdominal segments, in median and submarginal areas of thorax and head. Microducts few, around margins only. Cruciform pores not numerous, in submarginal areas of 6th abdominal segment and forward to head. Disc pores, usually quinquelocular, numerous in bands across abdominal segments but not reaching margins, present also in median areas of thorax and around the spiracles.

MATERIAL EXAMINED

England: Berkshire, Silwood Park, on *Achillea millefolium* (Asteraceae), 7.ix.1948 (holotype) and subsequent specimens collected on the same host plant, on *Veronica chamaedrys* (Scrophulariaceae), 1948, 1949 (various dates), on *Deschampsia caespitosa* (Poaceae), 1949, *Chrysanthemum leucanthemum*, 21.vi.1949 and on 'thistle' (Asteraceae), 7.ix.1949 (all *K. L. Boratynski*); Surrey, Camberley, on grass, ix.1914 (*E. E. Green*); Somerset, Cheddar, on *Teucrium scorodoniae* (Lamiaceae); Isle of Man, Port Erin, 27.ix.1918.

DISCUSSION. Boratynski (1962) has given an extended description and an account of the biology of this species. He has also discussed some specimens available labelled ex coll. Manchester Museum, without locality data. These have the enlarged setae wider, shorter and more rounded or almost truncate at the posterior end of body. The single specimen available on *Teucrium scorodonia* has the minute setae on the sixth segment replaced by enlarged setae, and the posterior marginal setae are conspicuously rounded. The extent of variation is still not clear. Since its description the species has been found throughout Europe and the far east of U.S.S.R.

Eriococcus placidus Green comb. rev.

(Fig. 13)

Eriococcus placidus Green, 1915: 148. LECTOTYPE ♀, ENGLAND (BMNH), here designated [examined].

Nidularia placida (Green) Lindinger, 1933: 116.

Greenisca placida (Green) Rasina, 1955: 69; Danzig, 1964: 634.

DESCRIPTION. Body of adult female elongate-oval, not nodulose, largest specimens 3.5 mm long, 1.7 mm wide. Anal lobes conical, pointed, about twice as long as wide, moderately sclerotised, each lobe with an apical seta 220–300 μm long, the dorsum with 2 inner enlarged conical setae, the anterior 36–50 μm long, the posterior usually shorter, 32–40 μm long, and an outer minute seta situated, in most specimens, towards centre. Ventral surface of lobe with 2 slender setae and a slender suranal seta. Dorsal plate moderately developed, lightly sclerotised, outer edge rounded, often nodulose. Anal ring with 8 setae each 145 μm long. Antennae 280–300 μm long, with 7 segments. Frontal tubercles present, minute, just anterior to each basal antennal segment. Labium 100–120 μm long, shorter than clypeolabral shield, basal segment with 2 pairs of setae. Legs well developed, slender, hind trochanter + femur 230–240 μm long, hind tibia 140–150 μm long, hind tarsus 160–170 μm long, claw slightly curved, slender, 40 μm long, with a minute denticle near apex. Hind coxa with conspicuous translucent pores on outer half, hind femur with a small group at mid-anterior margin.

Dorsal surface with two types of setae. Apart from the enlarged setae on anal lobes there are others present about 30 μm long, on head margin in varying numbers but there are usually one or two present. Occasionally these are replaced by slender setae. Elsewhere the dorsum is beset with minute pointed setae scarcely more than 20 μm long, but often shorter, rarely more than twice as long as diameter of a setal base. Macroducts fairly evenly distributed, each about 25 μm long, the cup about 2–3 times as wide as diameter of setal base of a small seta. Microducts in a regular arrangement, each about 6 μm long, with ampulla, tube with inner end swollen, and inner collar. Quinquelocular pores present in single to double rows mainly at anterior and posterior edges of segments, each pore with wide sclerotised rim and about half width of a diameter of cup of macroduct.

Ventral surface with normal slender setae of various sizes. Short stiff setae present, often longer than small dorsal setae, on margins of head, thorax and anterior abdominal segments. Macroducts of two sizes. A larger type, same as on dorsum, around margins. A narrower type present in median to submarginal areas. Microducts apparently absent. Disc pores always smaller than dorsal pores, fairly numerous on abdomen, where on the posterior segments they have usually 7 loculi, but on the anterior abdominal segments, thorax and head they are quinquelocular. Cruciform pores not numerous, in a narrow submarginal zone from about 5th abdominal segment forward to head.

MATERIAL EXAMINED

England: Kent, Thurnham, on ?*Festuca* sp., 8.ix.1920 (*E. E. Green*) (lectotype, paralectotypes), on *Avena flavescens*, *Brachypodium sylvaticum*, 13.vii.1921 (*E. E. Green*), Bearsted, on *B. sylvaticum*, 30.vii.1925 (*E. E. Green*); Isle of Wight, on *B. sylvaticum*, 3.ix.1921 (*E. E. Green*); Berkshire, Wytham, on *B. pinnatum*, 24.viii.1966, 30.viii.1968 (*G. Varley*), x.1969 (*D. Manawadu*). **Germany:** Ebernburg, on *B. pinnatum*, 16.ix.1928 (*H. Wünn*).

DISCUSSION. The original slide contains four specimens and the specimen selected as lectotype is clearly marked, the other three specimens are labelled paralectotypes.

This species is easily recognisable by the dorsal quinquelocular pores that have wide rims and are always larger than the ventral disc pores.

Green (1923) recorded the species from the Isle of Wight and from Box Hill in Surrey.

Eriococcus pseudinsignis Green comb. rev.

(Fig. 14)

Eriococcus pseudinsignis Green, 1921: 149; Schmutterer, 1952: 407. LECTOTYPE ♀, ENGLAND (BMNH), here designated [examined].

Nidularia pseudinsignis (Green) Lindinger, 1933: 116.

Rhizococcus pseudinsignis (Green) Borchsenius, 1949: 354; Danzig, 1962: 845; 1964: 633; Dziedicka & Koteja, 1971.

Acanthococcus pseudinsignis (Green) Tereznikova, 1981: 35.

DESCRIPTION. Slide-mounted specimens, elongate-oval, the largest 2.8 mm long and 1.4 mm wide, nodulose. Anal lobes conical, about twice as long as wide, sclerotised. Each lobe with an apical seta 280 μ m long; dorsally 1 outer and 2 inner enlarged setae and ventrally 2 slender setae and a suranal seta shorter than anal ring setae. Dorsal plate lightly sclerotised, narrow, rounded and slightly nodulose. Anal ring with 8 setae each about 140 μ m long. Antennae 250–300 μ m long with 7 segments. Frontal tubercle present just anterior to basal segment. Legs well developed, slender, hind trochanter + femur 230–260 μ m long, hind tibia 130–150 μ m long, hind tarsus 150–160 μ m long, claw 35 μ m long, curved, with a small denticle near apex. Coxa with a few translucent pores on outer half. Labium 100–120 μ m long, shorter than clypeolabral shield, basal segment with 2 pairs of setae.

Dorsal surface with a single row of enlarged marginal setae, 28–60 μ m long, those on head extending to submarginal areas. Each seta almost conical but inner edges sometimes slightly concave or convex. On the posterior abdominal segments these setae are bluntly pointed, tending to be truncate, but anteriorly they are more sharply pointed. Margins of 7th abdominal segment always with 3 setae varying little in length. Elsewhere on the dorsum the setae on the head and thorax are conical, often curved, sometimes only slightly smaller than the enlarged setae on head, but usually 12–15 μ m long. On the posterior abdominal segments the setae become shorter and more slender, 6–8 μ m long. Macroducts of one size in moderate numbers, fairly evenly distributed, about 25 μ m long, the cup only a little narrower than diameter of a setal base of marginal seta. Microducts not numerous, about 4 μ m long, with inner end of tube swollen, ampulla and internal collar.

Ventral setae normal in median areas but laterally towards margins they are conical and thick but not so large as dorsal marginal setae. Macroducts of two sizes. A larger type, similar to dorsal ducts, around margins only. A narrower type in bands across abdominal segments in median areas of head and thorax, extending to submargins. Microducts around margins only. Cruciform pores in a narrow submarginal zone and in area between clypeolabral shield and antennae. Disc pores, usually with 7 loculi, numerous on abdominal segments but not reaching margins, present also in median areas of thorax and around spiracles.

MATERIAL EXAMINED

England: Kent, Thurnham, on *Festuca* sp., 9.ix.1920 (*E. E. Green*) (lectotype, paralectotypes); Surrey, Hog's Back, on *Brachypodium sylvaticum*, 21.vii.1922 (*E. E. Green*); Isle of Wight, Seaview, on *B. sylvaticum*, 3.ix.1921, Alum Bay, on grass, vii.1927 (*E. E. Green*); Berkshire, on *Achillea millefolium*, *Veronica chamaedrys*, *Alopecurus pratensis*, *Agrostis* sp., *Holcus mollis*, *Deschampsia caespitosa*, 1948 (various dates) (*K. Boratynski*); Yorkshire, Ickornshaw Moor, x.1958 (*A. Smith*), Steeton Moor, 29.viii.1948 (*A. Smith*).

DISCUSSION. Green's original slide contains three specimens, one of which is selected as lectotype and clearly marked, the other two are labelled paralectotypes.

It is sometimes difficult to distinguish this species from *R. insignis*. At present the main differences are the 3 marginal setae on the 7th abdominal segment in *R. pseudinsignis* compared with 4 in *R. insignis*. The

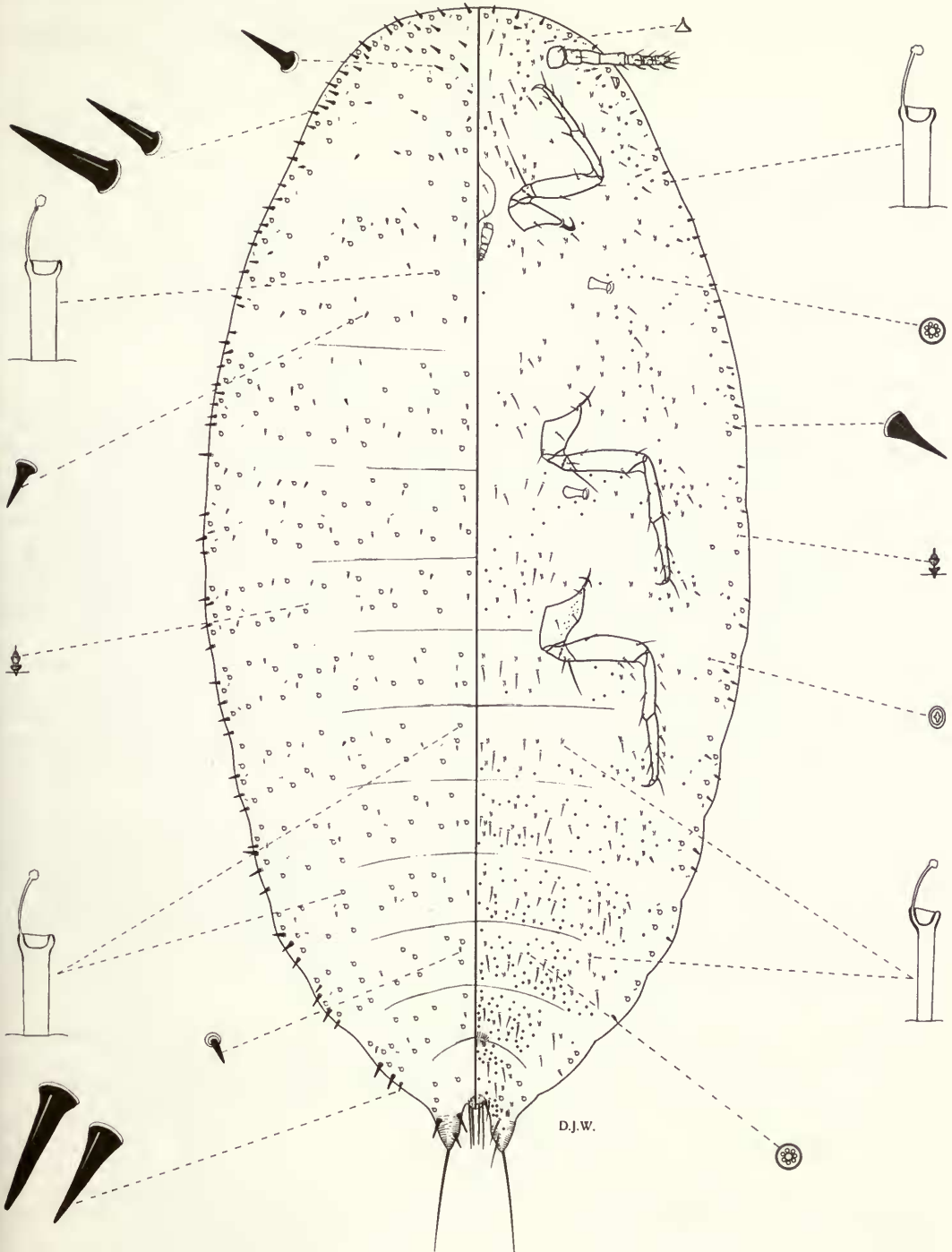


Fig. 14 *Eriococcus pseudinsignis* Green. England, Yorkshire, Ickornshaw Moor, on grass.

dorsal setae on the head and thorax of *R. pseudinsignis* are quite robust and are much longer than the setae on the posterior abdominal setae, whereas all the dorsal setae in *R. insignis* are short and usually slender, although those on the head and thorax are often wider than the abdominal setae.

At present both species are here regarded as distinct but intermediates may be found to warrant further research.

Eriococcus spurius (Modeer)

(Fig. 15)

Coccus ulmi Linnaeus, 1758: 455 (in part).

[*Coccus ulmi* Linnaeus sensu Linnaeus, 1766: 740. Misidentification.]

Coccus spurius Modeer, 1778: 43. Syntypes ♀, EUROPE (probably lost).

[*Gossyparia ulmi* (Linnaeus) sensu Linnaeus, 1766; Signoret, 1875: 21; Schmutterer, 1952: 416. Misidentifications.]

Gossyparia spuria (Modeer) Cockerell, 1899b: 268; Fernald, 1903: 68; Borchsenius, 1949: 330; Danzig, 1964: 632; Tereznikova, 1981: 50.

Nidularia spuria (Modeer) Lindinger, 1933: 108.

Eriococcus spurius (Modeer) Ferris, 1955: 164.

DESCRIPTION. Adult female, when prepared on slides, broadly oval, strongly nodulose, 3.0 mm long and 1.8 mm wide. Anal lobes well developed, protruding, about twice as long as wide, rounded at apex, moderately sclerotised, strongly nodulose with sclerotised teeth, especially on inner margins. Each lobe with an apical seta 250 μ m long, dorsally with 2 inner and 1 outer enlarged setae, ventrally with 2 slender setae and a pointed suranal seta. Antennae 230–300 μ m long, with 7 segments. Frontal lobes present, just anterior to basal segment. Legs normal, well developed. Hind trochanter + femur 160–190 μ m long, hind tibia 100–110 μ m long, hind tarsus 130–150 μ m long, the tibia + tarsus always longer than trochanter + femur, claw 40 μ m long, curved, with a denticle near apex. Hind coxa without translucent pores but with numerous spicules. Labium 150 μ m long, shorter than clypeolabral shield, basal segment with 2 pairs of setae. Dorsal plate well developed, triangular, lightly sclerotised and strongly nodulose. Anal ring with 8 setae, each about 150 μ m long.

Dorsal surface with numerous setae, in a regular distribution except on the intersegmental areas of thorax where they are absent, but present on mid-line. Setae long and slender with almost straight sides, tapering gradually to a blunt point, the largest 60 μ m long around posterior margins, the smallest about 25 μ m long. Macrotubular ducts, each about 20 μ m long, tapering slightly to orifice, cup wider than a setal base, present around margins and submargins, rarely extending to submedian areas, absent entirely on median area. Microtubular ducts slender, about 10 μ m long, with the orifice widely bifid, in an even distribution over entire dorsum.

Ventral surface with normal slender setae in median areas, a few enlarged setae the same as on dorsum, around margins, and a few short setae that are slender and stiff on submargins. Macroducts of two main sizes. A large duct, same size as on dorsum, on margins, and a narrower duct in transverse rows on abdomen and in submedian areas of thorax and head. Microtubular ducts absent. Quinquelocular disc pores present across median areas of abdominal segments, on metathorax and near spiracles and in an area between antennae and clypeolabral shield. Cruciform pores in submedian zone between first spiracles and anterior abdominal segments.

MATERIAL EXAMINED

England: Surrey, Camberley, on *Ulmus angustifolia*, iv–vii.1916, 18.iv.1922 (*E. E. Green*); Farnham, on *U. angustifolia*, x.1915 (*C. J. F. Fryer*); Woking, on *Ulmus* sp., vi.1918 (*G. C. Gough*). **France:** (ex coll. P. Marchal). **Germany:** Hanover, on *U. procera* (*U. campestris*), vii.1893. **Austria:** 'Donau-Auen', on *U. procera*. **Czechoslovakia:** 'Bohemia', on *Ulmus* sp. (ex coll. K. Šulc). **Turkey:** Istanbul, on *U. 'campestris* var. *pyramidalis*.'

In addition numerous specimens have been examined from U.S.A.

DISCUSSION. Linnaeus (1758) cited Réaumur (1738) but unfortunately referred to two distinct species that Réaumur had figured and described. The first refers to pl. 5, figs 5, 6 and this is undoubtedly an armoured scale insect discussed on p. 78 as found on a branch of elm. This species is accepted at present as *Lepidosaphes ulmi* (L.). The second species referred to by Linnaeus is illustrated on pl. 7, figs 1–10 and discussed by Réaumur on p. 119 as found on a branch of elm. There is no doubt from Réaumur's illustrations that this is the species under discussion here. Linnaeus (1766) realising his mistake in 1758, listed *C. ulmi* but referred to Linnaeus (1761) where only the name is mentioned and to Geoffroy (1762) (a work not consistently binominal but nevertheless vital) who, apart from giving a short description, refers to

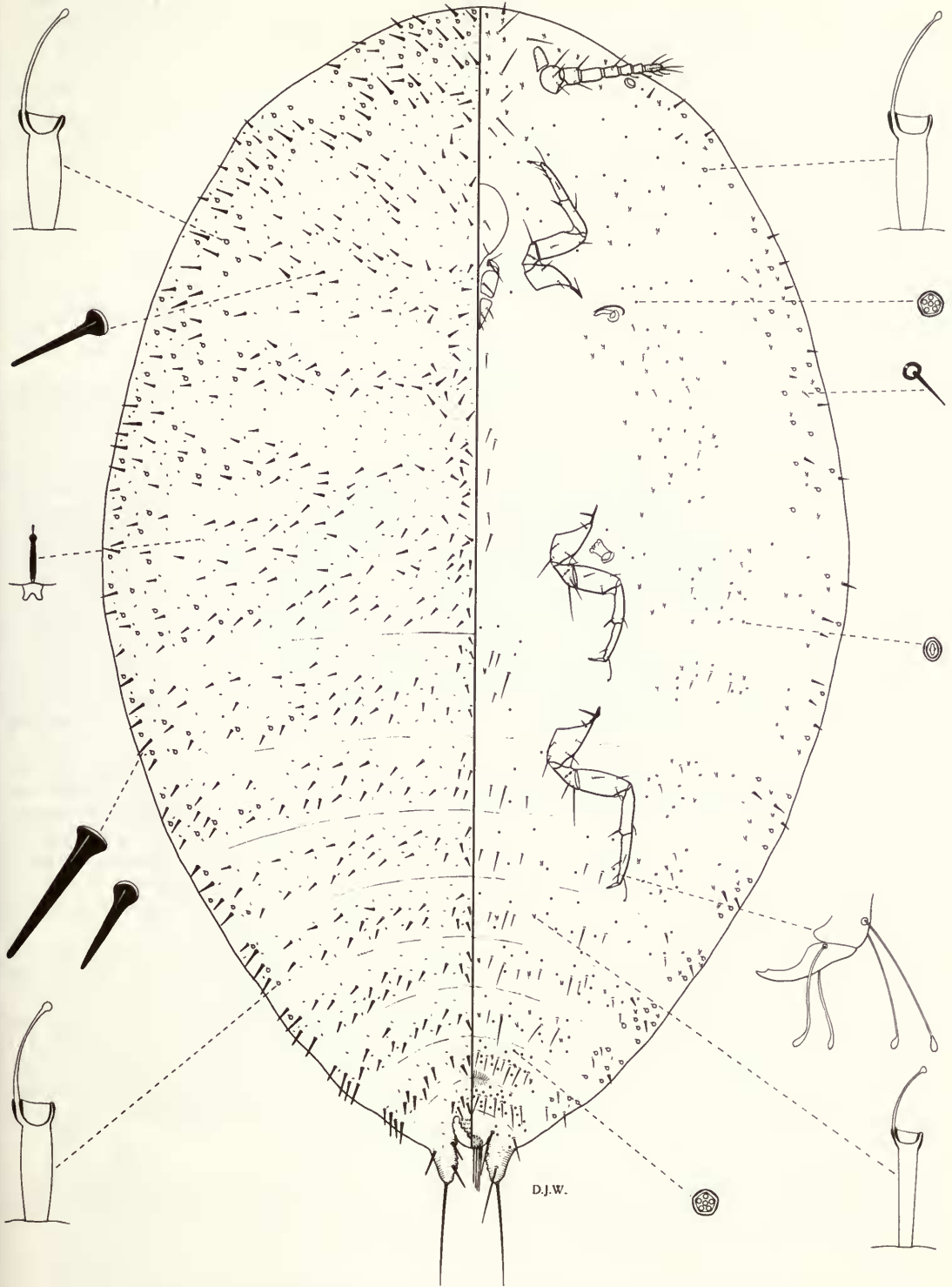


Fig. 15 *Eriococcus spurius* (Modeer). England, Surrey, Camberley, on *Ulmus angustifolia*.

the second of Réaumur's species mentioned by Linnaeus (1758). Clearly the listing by Linnaeus (1766) is based on a misidentification of the species listed by Linnaeus (1758). All subsequent references to '*ulmi*' the eriococcid, from Fabricius to the present day must refer to 'sensu Linnaeus, 1766'. Modeer (1778) described *Coccus spurius* and referred to the excellent illustrations of Réaumur (1738: pl. 7, figs 1–10). Modeer's name is accepted by all modern workers.

Records from England, listed above, were discussed by Green (1916, 1917) when there were outbreaks in Surrey. The insect has not been found since and it is not clear if it has become established but its external appearance is so distinctive that it should be easily recognised. Since it was introduced to the U.S.A., probably in the last century, it has caused concern by its frequent large aggregations on elms. The species seems to be confined to the genus *Ulmus*.

Macropterous and brachypterous males have been recorded and both forms have been described by Affi (1968).

***Eriococcus thymi* (Schrank) comb. rev.**

(Fig. 16)

Coccus thymi Schrank, 1801: 146. Syntypes ♀, GERMANY: Kehlheim (probably lost).

Eriococcus thymi (Schrank) Signoret, 1875: 32; Fernald, 1903: 79.

Rhizococcus gnidii Signoret, 1875: 37; Fernald, 1903: 66. Syntypes ♀, FRANCE: Estrelle Mts, nr Cannes (probably lost). **Syn. n.**

Nidularia gnidii (Signoret) Lindinger, 1933: 116.

Nidularia thymi (Schrank) Lindinger, 1957: 548.

DESCRIPTION. Body of adult female broadly oval, nodulose, largest specimens 1.9 mm long, 1.35 mm wide. Anal lobes well developed, conical, about twice as long as wide at base, heavily sclerotised on venter, lightly sclerotised on dorsum. Each lobe with apical seta 280 μ m long, dorsal surface with 3 enlarged setae, ventral surface with 2 slender seta and a suranal seta much shorter than anal ring setae. Dorsal plate membranous, rounded, narrow, margin irregular, nodulose. Anal ring with 8 setae each 120 μ m long. Antennae 170–250 μ m long, with 6 or 7 segments, the 3rd segment often divided. Frontal tubercle present, seta-like, just anterior to each basal antennal segment. Legs well developed. Hind trochanter + femur 140–190 μ m long, hind tibia 70–100 μ m long, hind tarsus 110–130 μ m long, claw 30 μ m long, stout, curved with a denticle near apex. Ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.18–1.30. Hind coxa with a few translucent pores. Labium 130–160 μ m long, slightly shorter than clypeolabral shield, basal segment with 2 pairs of setae. Spiracles heavily sclerotised, the sclerotisation continuing around the atrium in varying degrees.

Dorsal surface with enlarged setae of different sizes. The largest around margins 28–55 μ m long, each seta blunt, with sides slightly concave but curved in profile, these setae tending to be longest on posterior abdominal segments. Remaining dorsal setae shorter, 12–28 μ m long on the head, thorax and anterior abdominal segments, sometimes approaching in length the shorter marginal setae, becoming short, 8 μ m long on the 6th and 7th segments, each seta blunt and curved in profile. Macroducts of one size, each about 25 μ m long, the cup narrower than a setal base of an enlarged seta. Usually a single pair of smaller ducts on anal lobe segment. Microducts in moderate numbers, each about 8 μ m long, with inner sclerotised ampulla, sclerotised tube and collar and with bifid orifice.

Ventral surface with normal flagellate setae in median areas. Enlarged setae, similar to dorsal setae on margins and submargins, varying in size but not as long as dorsal marginal setae. Slender but stiff setae also present in a submarginal zone. Macroducts of three sizes. A large type, similar to dorsal ducts, present around margins only. An intermediate type, only slightly narrower than the large type, in transverse rows on abdominal segments and in median areas of thorax and head. A small type sparse, present singly in submedian areas of most abdominal segments. Microducts few, in marginal and submarginal areas. Quinquelocular disc pores in transverse bands on abdominal segments but not reaching margins, in median areas of thorax and head and around spiracles. Cruciform pores few, in submarginal areas of anterior abdominal segments and thorax, and in median areas of thorax and head.

MATERIAL EXAMINED

France: Montpellier, on *Thymus vulgaris* (Lamiaceae) (det. as *E. thymi* by V. Signoret), Cannes, on *Daphne gnidium* (Thymelaeaceae) (det. as *R. gnidii* by V. Signoret), Var, Agay, on *D. gnidium*, 4.v.1908 (P. Marchal), Bouc-Bel-Air, on *T. vulgaris*, v.1932 (L. Goux).

DISCUSSION. Although there is no original material available, there seems to be no doubt that the specimens examined and identified by Signoret and others identified by Marchal and Goux represent the species described by Schrank on *Thymus* as *C. thymi* and on *Daphne gnidium* as *R. gnidii*. The characters

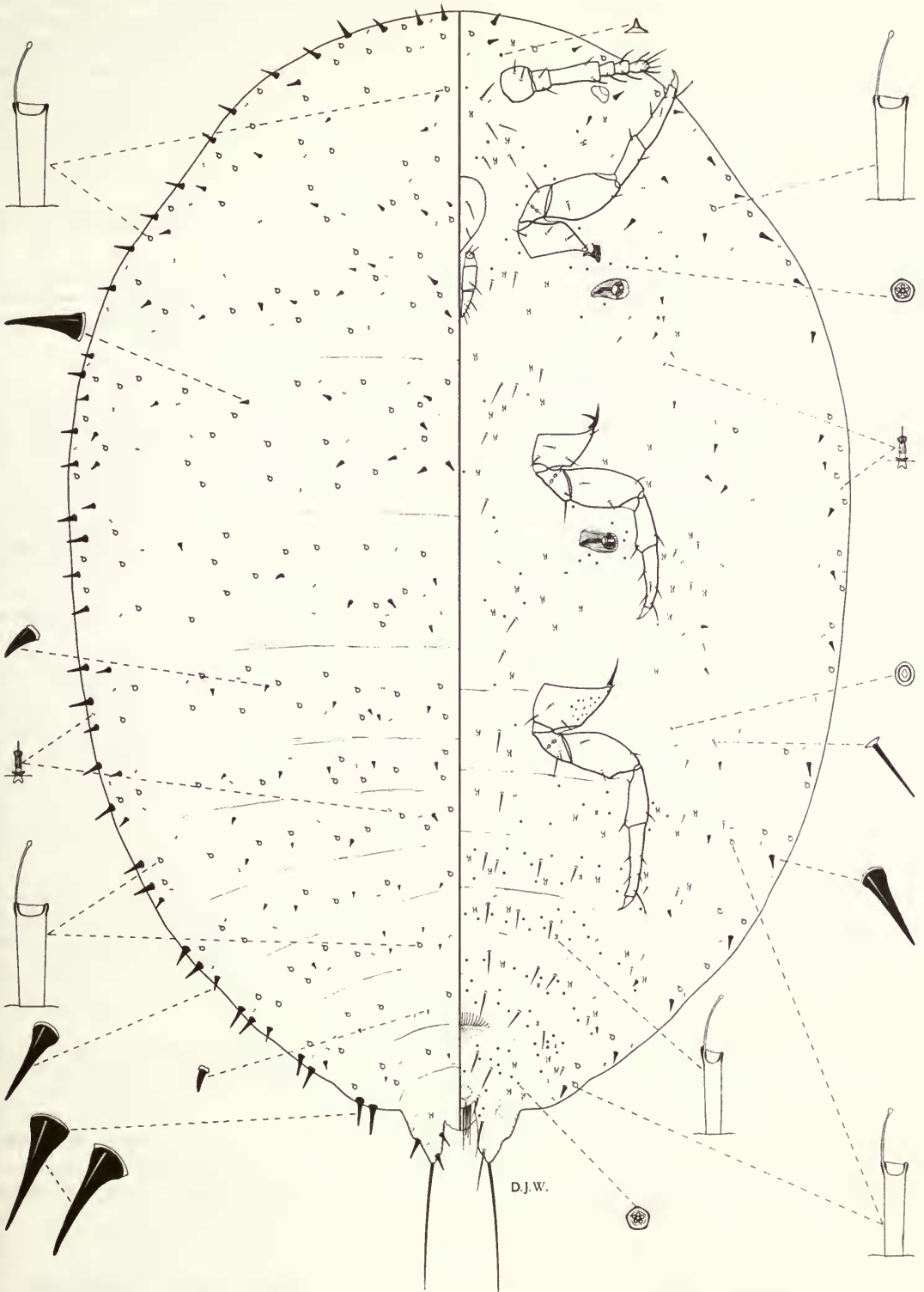


Fig. 16 *Eriococcus thymi* (Schrank). France, Montpellier, on *Thymus vulgaris*.

on some specimens of *D. gnidium* tend to be larger but the specimens themselves are larger and all represent the same species. In well-stained specimens the microducts clearly show the bifid orifice but this character is difficult to see in some specimens. The illustration is based on specimens from France on *Thymus vulgaris*, identified as *E. thymi* by Signoret. Further collecting may show a much wider host-plant range.

A record by Hardy (1876) from Watch Law in the north of Northumberland, England, on the roots of *Thymus serpyllum* (probably *T. drucei*), has never been substantiated.

KUWANINA Cockerell

Kuwanina Cockerell, in Fernald, 1903: 121. Type-species: *Sphaerococcus parvus* Maskell, by original designation.

Cockerell intimated that this genus differed from *Antonina* by the larva having 3 or 4 jointed antennae. *Antonina* belongs to the family Pseudococcidae but *Kuwanina* clearly belongs to the family Eriococcidae where it was accepted by Hoy (1963). Another species, *K. hilli* Laing, was shown by Williams (1985a) to be identical with *Chaetococcus australis* Froggatt, a mealybug in the family Pseudococcidae.

The type-species is in need of critical study, outside the scope of this work because the species is not native to Britain, having been found only once on imported cherry trees from Japan.

The genus, as represented by specimens at hand from Japan and Britain, seems to be related to *Cryptococcus* in lacking legs and having the third pair replaced by pore-bearing leg-flaps. It differs, however, in lacking macroducts. These are replaced by quite large invaginated quinquelocular pores on the dorsum and ventral margins. In addition there are smaller quinquelocular pores of two distinct sizes on the venter. Microducts are present.

Kosztarab (1968b) placed *Kuwanina* in the Cryptococcidae and Koteja (1974b), although agreeing that the genus was closely related to *Cryptococcus*, believed that the '*Kuwanina* group' may form a distinct family. The genus is here regarded as a normal component of the Eriococcidae.

Kuwanina parva (Maskell)

Sphaerococcus parvus Maskell, 1897: 244. Syntypes ♀, JAPAN: on cherry (NZAC).

Kuwanina parva (Maskell) Cockerell, in Fernald, 1903: 121; Hoy, 1963: 165.

MATERIAL EXAMINED

England: Hertfordshire, St Albans, on dwarf *Prunus* sp., imported from Japan, 1914 (C. J. F. Fryer).

DISCUSSION. Green stated that examples were found on gnarled branches in a nursery garden where they were able to thrive and exist. It is doubtful if the species now exists in Britain.

NOTEOCOCCUS Hoy

Noteococcus Hoy, 1962: 164. Type-species: *Eriococcus hoheriae* Maskell, by original designation.

Hoy erected this genus to accommodate *E. hoheriae* from New Zealand, a species with large sclerotised anal lobes, each with 12 small enlarged setae on the dorsum in addition to the normal pair on the inner margins, and with an irregular series of teeth on the venter. Furthermore, apart from the strongly nodulose posterior abdominal segments, there is a large rugose plate anterior to the anal lobes on the dorsum. The legs are much reduced with the trochanter + femur and the tibia + tarsus fused.

Noteococcus hoheriae (Maskell)

Eriococcus hoheriae Maskell, 1880: 298. Lectotype ♀, NEW ZEALAND: Lyttelton (NZAC), designated by Deitz & Tocker (1980: 47).

Noteococcus hoheriae (Maskell) Hoy, 1962: 164.

Specimens are at hand recorded by Green (1925a) from Cornwall, Isles of Scilly, Tresco, on *Hoheria populnea*, iii.1924 (J. C. F. Fryer), living in the open. Williams (1985b), reporting on scale insects collected at Tresco, stated that the species has not been found since, but in common with other exotic species that have been introduced to Tresco, on plant material, the insect may still occur there.

OVATICOCCUS Kloet

Gymnococcus Douglas, 1888: 150. Type-species: *Coccus agavium* Douglas, by original designation (see below). [Homonym of *Gymnococcus* Zopf, 1887: 126.]

Ovaticoccus Kloet, 1944: 86. [Replacement name for *Gymnococcus* Douglas.]

This genus has been revised by Miller & McKenzie (1967) who included nine North American species, but at least two others described from elsewhere have been listed by Boratynski (1958) and accepted by Hoy (1963). In a description of the genus, Miller & McKenzie (1967) stated that the anal lobes are absent and that the anal ring is without pores, usually in the form of a modified circle with usually 3 pairs of setae. Enlarged dorsal setae are present in some species, as are macroducts, microducts and cruciform pores.

The type-species has been redescribed and illustrated by Boratynski (1958) and by Miller & McKenzie (1967). An examination of numerous specimens shows that well-developed frontal tubercles are present. The genus is closely related to *Pseudochermes* but differs in possessing an anal ring without pores and in possessing cruciform pores.

Although *O. agavium* is not a native British species, it is included here because it was described from the Royal Botanic Gardens, Kew (under glass) in 1888 on *Agave*, and Boratynski (1958) has indicated that he had no trouble finding it again in 1956 and 1957. This species is easily separated from *Pseudochermes fraxini* by the presence of numerous enlarged setae in addition to slender lanceolate setae on the dorsum.

Douglas (1888) proposed *Gymnococcus* conditionally when describing *C. agavium* and according to the *International Code of Zoological Nomenclature* the name is available from that date.

Ovaticoccus agavium (Douglas)

Coccus agavium Douglas, 1888: 150. Syntypes ♀, ENGLAND: Kew (probably lost, but see below).

Gymnococcus agavium (Douglas) Cockerell, 1893: 1049; Newstead, 1903: 204; Fernald, 1903: 79; Borchsenius, 1949: 370; Tereznikova, 1981: 57.

Ripersia agavium (Douglas) Newstead, 1897: 12.

Ovaticoccus agavium (Douglas) Kloet, 1944: 86; Boratynski, 1958: 175; Danzig, 1964: 634; Miller & McKenzie, 1967: 509.

MATERIAL EXAMINED

England: Surrey, Royal Botanic Gardens (under glass), ii.1888, on leaves of *Agave* sp. (original material), 1956, 1957 (various dates) on *A. decipiens*, *A. francescini*, *A. parryi* (K. L. Boratynski), on *A. francescini*, 26.v.1964 (S. A. Afifi).

DISCUSSION. Boratynski (1958) has indicated that he designated a lectotype from a slide containing type-material and that this is in the British Museum (Natural History). This slide is not present in the collections and it is doubtful if Boratynski could have done so. There are numerous unmounted specimens from Douglas' collection on cards numbered 1052 and 1056. These numbers agree with the information in his collection data books and three of these specimens were prepared on a slide by F. Laing. Douglas also sent specimens to Newstead who labelled four slides 'Type lot ex coll. J. W. Douglas'. None of these slides represents the original specimens used by Douglas in his description, although they are authentic enough. There is no doubt about the identity of the species.

Afifi (1968) has described and illustrated the alate male.

PSEUDOCHERMES Nitsche

Pseudochermes Nitsche, in Judeich & Nitsche, 1895: 1249. Type-species: *Chermes* ? *fraxini* Kaltenbach, by original designation.

Apterococcus Newstead, 1898: 97 [as subgenus of *Ripersia* Signoret]. Type-species: *Eriococcus fraxini* Newstead, by original designation [cited as *Ripersia fraxini*]. [Synonymised by Cockerell, 1899b: 264 (see below).]

This genus is now widely recognised, even though for many years most workers accepted the synonymy, by Cockerell (1899b), with *Fonscolombia* Lichtenstein. Cockerell synonymised both *Pseudochermes* and *Apterococcus* with *Fonscolombia* but *Fonscolombia* is now regarded as an unrecognisable genus in the Pseudococcidae, even so the synonymy of *Apterococcus* with *Pseudochermes* still stands. *Pseudochermes* has remained monotypic.

DESCRIPTION. Adult female oval to almost circular, posterior end rounded without recognisable anal lobes but with normal apical setae. Anal ring crescentic with 6 setae and pores. Suranal setae normal. Antennae 6-segmented. Frontal tubercles present. Legs normal, claw with denticle. Labium short, basal segment with a single pair of setae. Dorsal setae short, narrow but spine-like. Macroducts present, each with inner end cupped, on dorsum and venter. Microducts slender, elongate, with simple orifice. Disc pores quinquelocular, on dorsum and venter. Cruciform pores absent.

First and second instars with normal legs. Antennae 6-segmented, basal segment with a pair of setae. Frontal tubercles present. Anal ring as in adult female but smaller.

DISCUSSION. The genus has affinities with *Ovaticoccus* but differs in possessing an anal ring containing a crescentic plate with 6 setae and pores. In *Ovaticoccus* the anal ring is always without pores. Furthermore cruciform pores are present in *Ovaticoccus*, usually in large numbers, but are absent completely in *Pseudohermes*.

Koteja (1974a) allied this genus to *Cryptococcus* and included both in the family Cryptococcidae. There seems to be no reason for accepting this action.

Pseudohermes fraxini (Kaltenbach)

(Figs 17, 18)

Chermes (?) *fraxini* Kaltenbach, 1860: 259; 1974: 433. Syntypes ♀, GERMANY (probably lost).

Eriococcus fraxini Newstead, 1891: 165. LECTOTYPE ♀, ENGLAND (BMNH), here designated [examined]. [Synonymised by Judeich & Nitsche, 1895: 1249.]

Ripersia fraxini (Newstead) Newstead, 1892: 147.

Coccus fraxini (Kaltenbach) Judeich & Nitsche, 1895: 1247.

Pseudohermes fraxini (Kaltenbach) Judeich & Nitsche, 1895: 1249; Borchsenius, 1949: 365; Danzig, 1964: 634; Tereznikova, 1981: 59.

Fonscolombia fraxini (Kaltenbach) Cockerell, 1899b: 264; Fernald, 1903: 114; Schmutterer, 1952: 418.

Ripersia (Apterococcus) fraxini (Newstead) Newstead, 1898: 97.

Apterococcus fraxini (Newstead) Newstead, 1903: 210.

DESCRIPTION. Young adult female (Fig. 17) on microscope slide oval, 1.15 mm long, 0.9 mm wide, but mature adult female sometimes almost circular, membranous, posterior end rounded, anal lobes not developed but position of each lobe with an apical seta 60 μm long. Anal ring in form of crescentic sclerotised plate 30 μm wide, with a few pores and 6 setae, each about 30 μm long, blunt and stiff, situated on ventral surface even in young adult females. Suranal setae present just anterior to anal ring, shorter than anal ring setae. Antennae 100–110 μm long, with 6 segments. Frontal tubercles present just anterior to basal antennal segment. Legs small but well developed. Hind trochanter + femur 70–75 μm long, hind tibia 35–40 μm long, hind tarsus 30–35 μm long, claw 16 μm long, curved, with a denticle near apex. Ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.90–1.05. Hind coxa noticeably larger than anterior coxae, with a few large translucent pores. Labium 50–60 μm long, much smaller than clypeolabral shield; basal segment with a single pair of minute setae.

Dorsal surface with narrow conical setae on 7th and anal lobe segments, each about 20 μm long and usually shorter than anal ring setae. Anteriorly the setae are shorter and more slender, but stiff, 8 μm long. Macroducts fairly numerous, in an even distribution, each about 20 μm long, tapering to narrow orifice, the cup wider than a setal base of largest setae. Microducts present, not numerous, tending to be in rows across the segments, each duct filiform, about 4 μm long with a small sclerotised ampulla. Quinquelocular disc pores present in more or less single rows at posterior edges of segments.

Ventral surface with slender setae only slightly longer than dorsal setae, except on head where they are much longer. Macroducts of two sizes. A larger type, same as on dorsum, around margins only except on thorax near spiracles where they also occupy the submarginal areas. A narrower duct each with sclerotised cup and filiform tube, tapering to a minute orifice, sparse, on abdominal segments only. Microducts, same as on dorsum, few, on margins. Quinquelocular disc pores not numerous on head and thorax but more numerous on abdomen.

Second instar female (Fig. 18B), oval, similar in shape to young adult female but smaller. Anal lobes only slightly produced, each with an apical seta 40 μm long, and suranal setae minute. Anal ring 20 μm wide, crescentic, as in adult female situated at apex on venter, with 6 setae. Antennae 6-segmented, 75 μm long. Frontal tubercles present. Legs similar in shape to those of adult female but all coxae approximately same size. Hind trochanter + femur 48 μm long, hind tibia 25 μm long, hind tarsus 25 μm long, claw 12 μm long. Labium 45 μm long, basal segment with a single pair of setae. Dorsal surface with thick truncate setae, 12 μm long, on posterior segments, these longer than anal ring setae. Anteriorly the setae become shorter and more slender, but remain stiff. Macroducts in more or less single rows across the segments, each duct similar in shape to those of adult female but the cup narrower. Microducts as in adult, not numerous. Quinquelocular pores smaller than in adult, in single rows at posterior edges of segments.

Ventral surface with slender setae, usually shorter than on dorsum except for a few long setae on head. Macroducts of one size as on dorsum, on head and thoracic margins and extending almost to spiracles. Microducts few on margins only. Quinquelocular disc pores not numerous, in single rows on abdominal segments and present on head and thorax but absent in median area of thorax.

First instar (Fig. 18A) oval, 300 μm long, 180 μm wide, abdomen tapering. Anal lobes poorly developed, each with an apical seta 35 μm long. Anal ring as in second instar and adult female but 16 μm wide, with 6

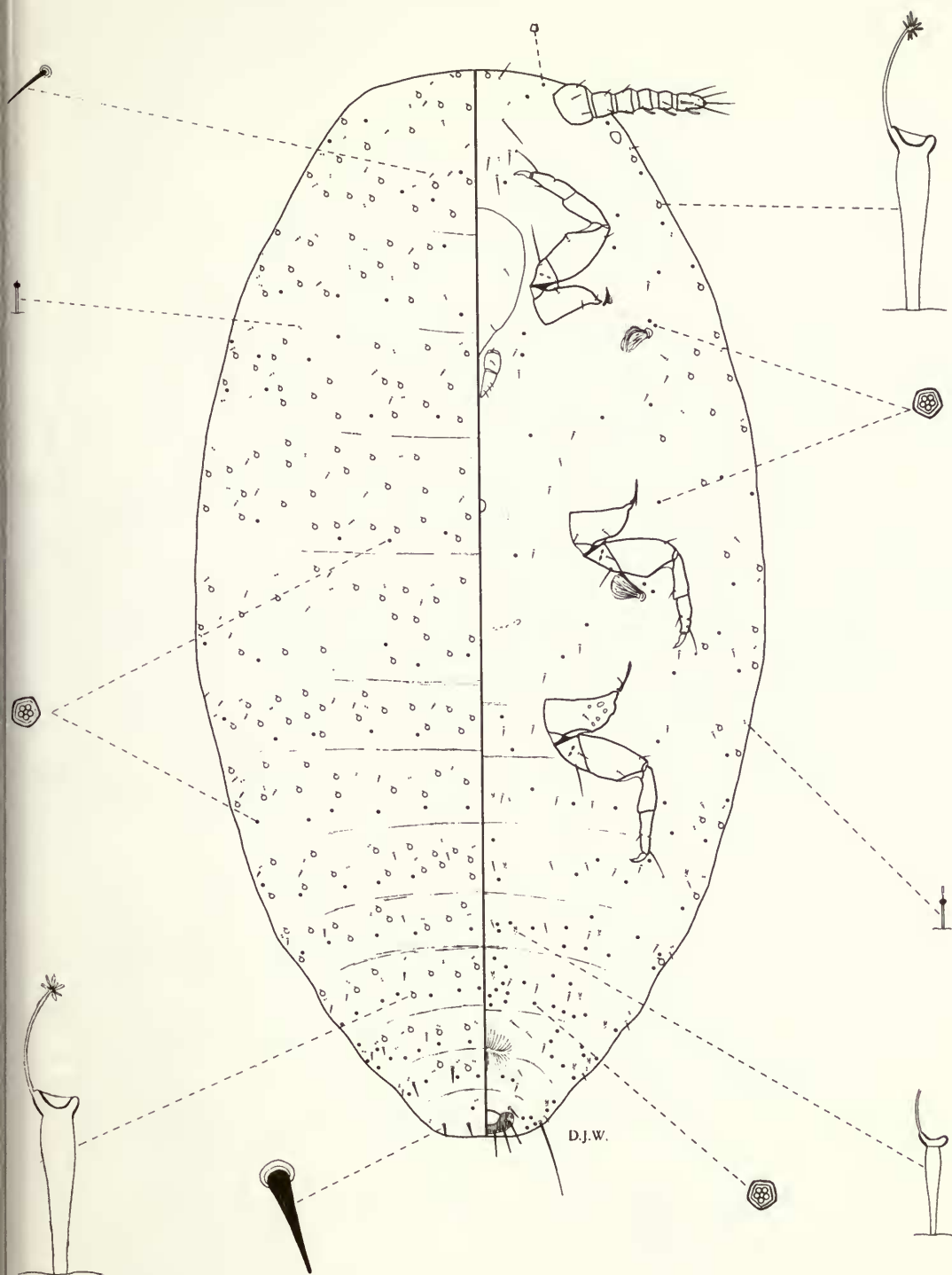


Fig. 17 *Pseudochermes fraxini* (Kaltenbach). Berkshire, Cookham, on *Fraxinus excelsior*.

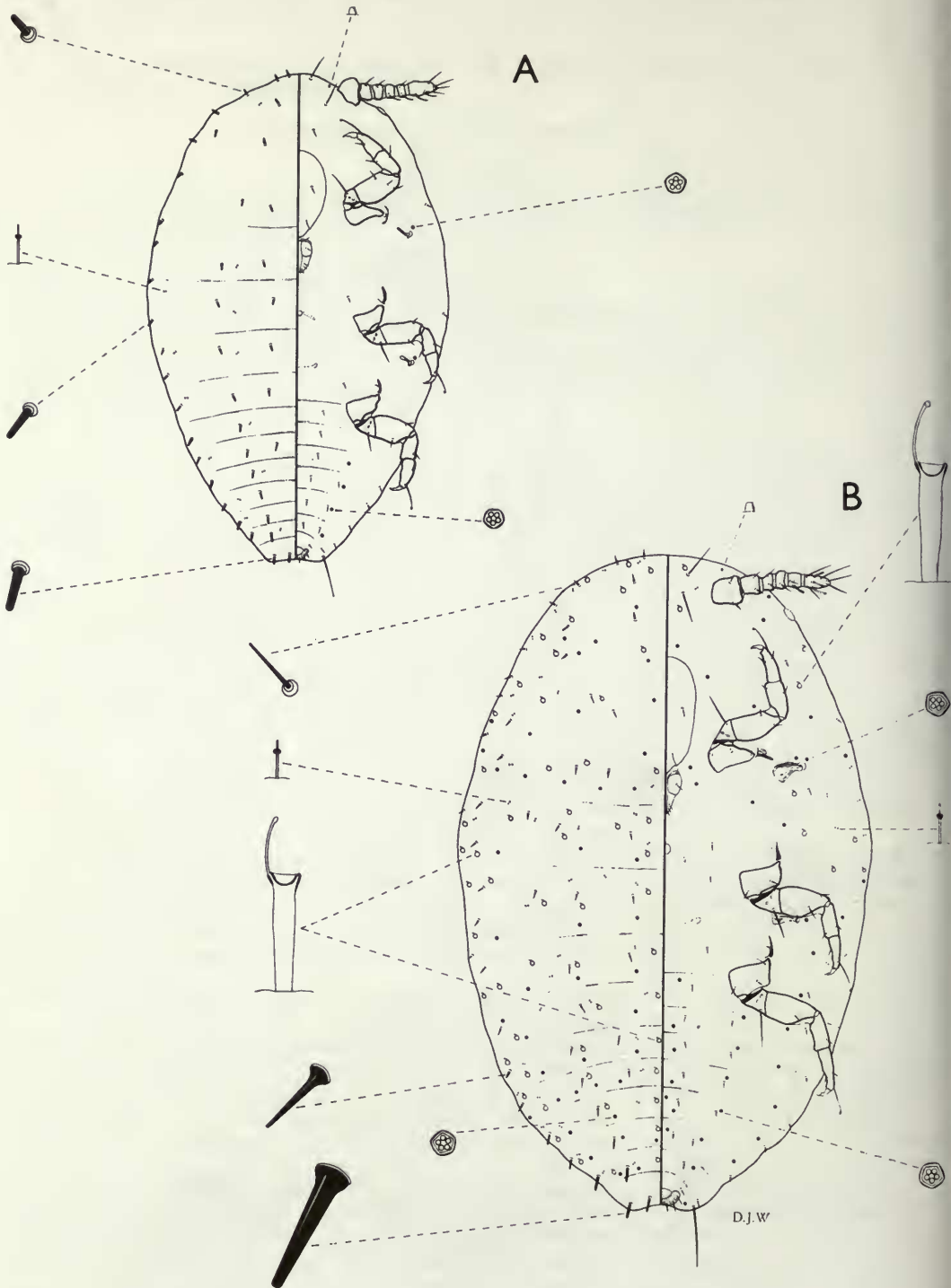


Fig. 18 *Pseudochermes fraxini* (Kaltenbach). (A) First instar. (B) Second instar female.

setae. Antennae 65 μm long, with 6 segments. Frontal tubercles present. Legs normal, hind trochanter + femur 35 μm long, hind tibia 35 μm long, hind tarsus 20 μm long. Claw curved, 10 μm long, with a minute denticle near apex. Labium 30 μm long, basal segment with a pair of setae. Dorsal surface with short truncate setae, tending to be cylindrical, tapering only slightly, those on abdomen the largest and thickest, about 8 μm long, becoming shorter anteriorly to head where they are 5 μm long, all setae thicker than anal ring setae. Microducts sparse, as in later instars. Ventral surface with slender setae, shorter than dorsal setae except for a few long setae on head. Ventral ducts absent. Quinquelocular pores smaller than in later instars, represented usually by a pair on each of 4th to 7th segments and singly next to openings of spiracles.

MATERIAL EXAMINED (all on *Fraxinus excelsior* unless stated otherwise)

England: Berkshire, Silwood Park, *F. excelsior* and *Populus tremula* (Salicaceae), 29.vi.1966 (*K. L. Boratynski*), Cookham, 5.viii.1972, 8.ix.1972, 11.iii.1973, 11.viii.1983 (*D. J. Williams*); Cheshire, Ince, viii.1890 (*R. Newstead*) (lectotype, paralectotypes), Chester, 1895, 11.xi.1895 (*R. Newstead*); Devon, Sidmouth, 26.vi.1963; Gloucestershire, Cheltenham, viii.1973 (*D. J. Williams*); Hampshire, Bentley, 18.iv.1969 (*C. I. Carter*), Exbury, viii.1974; Kent, Bearsted, vii.1913 (*E. E. Green*); Leicestershire, Loughborough, 8.xi.1938 (*A. Roebuck*); London, Buckingham Palace Gardens, 11.x.1963 (*K. L. Boratynski*); Northumberland, Riding Mill, 8.x.1950 (*D. J. Williams*); Oxfordshire, Goring, 25.ii.1914 (*E. E. Green*); Somerset, Bath, Ashrey Gullywood, 24.ii.1978; Surrey, Frimley, 23.v.1921 (*E. E. Green*), Wisley, on *Syringa* sp., 1958, 6.vii.1983 (*D. J. Williams*), Woking, 1914, vii.1915 (*E. E. Green*); Yorkshire, Adel, 2.vii.1963 (*D. J. Williams*). **Wales (N.):** 1976. **Belgium:** intercepted in England, 31.i.1967 (*S. H. Blore*). **Hungary:** Galgamocsa, 26.iv.1981 (*Nagy*).

DISCUSSION. Newstead's single original slide of *Eriococcus fraxini* contains nine whole specimens and a few pieces. The lectotype selected is clearly marked and the remaining eight whole specimens are labelled paralectotypes.

Affi (1968) has described and illustrated the adult male of this species. It is always minute, wingless and degenerate.

Apart from incursions into Iran, this species is European where its favourite host-plant is *Fraxinus excelsior*, but it is known on other species of *Fraxinus*. It is often found in enormous numbers in the crevices of the bark. The record on *Syringa* is not surprising because this genus and *Fraxinus* both belong to the family Oleaceae. Furthermore, *Syringa* has been mentioned from Germany by Lindinger (1938) who also listed *Sorbus* sp. *S. aucuparia* (as *Pirus aucuparia*) was previously listed by Lindinger (1912). The record on *Populus tremula* is based on specimens collected at the same time as others on *F. excelsior*. There seems to be every reason that the insects were feeding on *Populus* and that *P. fraxini* may yet be found on other host-plants.

The species is probably widespread in Britain on ash. Harrison (1944) recorded it from Inverarish in the Isle of Raasay, Scotland.

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