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On some species of „*Lecanium*“ (Homoptera, Coccidae) in the collection of the Naturhistorisches Museum in Vienna; with description and illustration of the immature stages of *Parthenolecanium persicae*

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(Mit 4 Textabbildungen)

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By the courtesy of Professor Dr. MAX BEIER, some duplicate specimens of nine samples comprising 7 named species of “*Lecanium*” from the collection of the Naturhistorisches Museum in Vienna have been made available for study with permission to mount them for microscopical examination. Except for one sample with specimens on leaves of the hostplant pinned in the collection case, the material was preserved in glass tubes with dry insects removed from the host; one of the latter samples contained mixed specimens of two species. Six of the samples were determined by SIGNORET and one by an earlier author of the species (KOLLAR, 1848), and the collection data indicated that these seven samples represented part of the material on which SIGNORET based the conception of 5 species (including 3 described by him as new), out of the total of 52 species of “*Lecanium*” discussed in his “Essai sur les cochenilles, Pt. 11. 1874”. Of the remaining 2 samples, one was identified by LOEW, and the identification of the other was “uncertain”.

Altogether the material in fact comprised only four species as now understood, and microscopical examination generally confirmed the earlier synonymy of these species suggested mainly on the basis of SIGNORET’s descriptions (NEWSTEAD, 1903; MARCHAL, 1908; SANDERS, 1909; LINDINGER, 1912; BORCHSENIUS, 1957), or from examination of the external appearance of the specimens in SIGNORET’s collection (ŠULC, 1932: 101—2). The four species are *Eulecanium tiliae* (LINNAEUS, 1758), *Parthenolecanium persicae* (FABRICIUS, 1776), *P. corni* (BOUCHÉ, 1844) and *Filippia oleae* (COSTA, 1827). These identifications conform with the conception and nomenclature of the genera and species now accepted. Thus, *Filippia oleae* was redefined by BORCHSENIUS (1957: 189, 194—5). The conception of *Eulecanium tiliae* (= *coryli* L. of some authors) is based on the detailed redescription of this species by MARCHAL

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(1908: 295—304, *-coryli*), with subsequent supplementation by ŠULC (1932: 87—92 *-tiliae*), BORCHSENIUS (1957: 423—4, *tiliae*) and KAWECKI (1958a, *-coryli*); BORCHSENIUS (1957: 420—423) recognized *E. mali* (SCHRANK, 1871) — one of the many suggested synonyms of *tiliae* -L. — as a distinct species but it seems that the difference in the characters given by him lie within the range of individual variation of *E. tiliae*. The conception of *Parthenolecanium corni* (BOUCHÉ) (= *coryli* L., or *persicae*: auctt., nec FABRICIUS, 1776) and of *P. persicae* (Fab.) is also based on the detailed description of these species by MARCHAL (1908: 264—295); the identities of both species were later discussed by SANDERS (1909: 441), STEINWEDEN (1929), ŠULC (1932: 64—78) BRITTIN (1940) and BORSCHENIUS (1957: 350—370), and of *P. corni* alone by SCHMUTTERER (1954), HABIB (1953, 1957), KAWECKI (1958) and CANARD (1958). The identity of *P. persicae* is now established and agreed upon by all authors. With regard to *P. corni*, however, this does not seem to be quite clear, though MARCHAL's conception and description (which, incidentally, agree with specimens found in the samples) is here accepted as referable to the true or „typical“ *P. corni*. In the past both these species, as well as some other related species, have been confused and the following comments on their identity may be useful.

The adult female of *P. persicae* is well characterized: by the expanded inner part of the majority of submarginal ventral tubular ducts, by the conditions of the marginal setae, and by the presence of relatively numerous (24—42), large (25—35 μ in diameter) submarginal dorsal bicylindrical ducts sometimes called „tubercles“ (STEINWEDEN, 1929; BRITTIN, 1940). The specimens from the Vienna collection (originally from various localities in France on *Berberis vulgaris*, „*Genista anglica*“ and *Persica vulgaris*) showed a range of 28—32 bicylindrical ducts, and in all characters conformed well with the concept of the species.

In contrast, the adult female of *P. corni* is, according to MARCHAL (1908: 269—272), characterised: by the thin and slender inner part of all submarginal ventral tubular ducts, by the different conditions of the marginal and body setae and spiracular spines, and by the absence of well developed submarginal dorsal bicylindrical ducts, except for 4 (or 5) pairs of scar-like rudiments of such ducts of the previous instar which are visible in young unsclerotized adults but completely obliterated in well sclerotized old adult females after oviposition. These conditions were found in all available specimens of this species from the Vienna collection and also obtained in the material examined by the author from various host-plant and localities in Great Britain as well as in those studied by HABIB (1953, 1957). Most authors, however, reported that in the material referred to *P. corni* some individuals may occur with 3—9 pairs of well developed bicylindrical ducts (ŠULC, 1932; ŘEHACEK, 1960; BORCHSENIUS, 1957), as well as some with no such ducts at all (SCHMUTTERER, 1954; CARNAD, 1958). Wide ranges of individual variation of other characters have also been described. It is true that this widely polyphagous species (KAWECKI,

1958, compiled a list of 350 recorded host-plants) exhibits a considerable variation in size, shape, colour and fecundity, largely dependent on the host-plant; hence there is a large number of synonyms (over 130 listed by LINDINGER, 1934) and the recognition of various ecological forms by some authors (SAVESCU, 1943, 1944). Several authors (MARCHAL, 1908; VOUKASSOVITCH 1930; SAVESCU, 1944) emphasized however, that the fundamental structures of these forms remain the same. This was also confirmed by HABIB (1953, 1955a, 1955b, 1957) in detailed studies which were carried out in Britain at the Imperial College Field Station, Silwood Park, Berks., and included series of controlled breedings, transfers and re-transfers to and from various hosts of specimens from both parthenogenetic and bisexual populations. Contrary results of transfer experiments in California by EBELING (1938) would suggest that the latter's material consisted of more than one species (BORCHSENIUS, 1957: 369); indeed, the recent revisionary work of RICHARDS (1958) and PHILLIPS (1965, 1965a) showed that the „*Lecanium coryli* L.“ of American workers (= *corni* BOUCHÉ of European workers) is in fact a complex of five species, one described as new (*putnami* PHILLIPS, 1965) and differentiated from the related *cerasifex* only by behavioural and genetic differences. In Europe *P. corni* has been, and sometimes probably still is, confused with some related species already recognized and possibly also with other species yet to be distinguished. Thus, it has been confused with *P. persicae* (cf. MARCHAL, 1908: 291; GREEN, 1930), as well as with *rufulum* CKLL., *fletcheri* CKLL. and *pomeranicum* KAWECKI (cf. KAWECKI, 1954). Recently one new subspecies (*orientalis* BORCHSENIUS, 1957) and one new species (*smreczynskii* KAWECKI, 1967) previously referred to *corni* have been described. Careful comparison of descriptions of *P. corni* by different authors (e. g. MARCHAL, 1908; ŠULC, 1932; SCHMUTTERER 1954; BORCHSENIUS, 1957; CANARD, 1958) reveal differences in some details regarding the characters of both adult females as well as of the immature stages. SCHMUTTERER (1954) in his comparative study of *P. corni* and related species, apparently considered the number of marginal setae as one of the most important characters distinguishing the species, and erroneously recognized *P. crudum* as a good and distinct species. As already pointed by HABIB 1955, 1956) and confirmed by my own examination of the type and the other specimens of GREEN's original material (on *Aralia* sp., Cambridge, England), the authentic *crudum* GREEN, 1917, conforms with MARCHAL's definition of *corni* and is its junior synonym. In concept, SCHMUTTERER's *crudum* is in fact a mixture of at least two forms, and refers partly to *P. pomeranicum* KAWECKI, 1954, (= *taxi* HABIB, 1955; = *crudum*: auctt., nec GREEN, 1917), and partly to *P. corni* (cf. BIELENIN, 1958: 97), but defined by him as a species with fewer and shorter marginal setae, and "usually" with 9 pairs of well developed and 5 pairs of reduced bicylindrical ducts. SCHMUTTERER may possibly be right in separating this form from *P. corni*, but his concept of the latter also appears to include a variety of forms. The frequency distribution of the number of bicylindrical ducts in the 2nd instar

nymphs given by CANARD (1958: 201) suggests that two, or possibly three forms were involved. Just over forty years ago FERRIS (1928: 47), referring to *P. corni* in California, voiced the necessity of thorough biological studies for establishing the actual relationships of various forms of this insect and the above mentioned works by RICHARDS and PHILLIPS have proved the point. It now seems that the same is true of the European forms, and to clarify the issue a detailed study involving well controlled breeding and transfer experiments similar to that of HABIB (1953, 1955a, 1957) but carried out on all known forms and on specimens from both bisexual and parthenogenetic populations is necessary.

One reason for the confusion of these closely related species is the fact that apart from being sympatric they may also be syntopic and occur in mixed populations on one individual host, often crowded side by side on the same twig. Such association of *P. corni* with *P. persicae* was reported by MARCHAL (1908: 275, 276, 293—4) in France on *Vitis vinifera* (Moulins, Dept. Allier) and on roses (Poitiers, Dept. Vienne and in the Paris area); one sample (No. 7 below) from the Vienna collection, originally from Clamart (Paris area) showed the same association on *Persica vulgaris*. MARCHAL (l. c.: 276, 294) also suggested that material of *persicae* on *Morus alba* from Northern Italy studied by RIBAGA (1901) may also have been a mixture of both species. Mixed populations of *P. corni* and *P. rufulum* were recorded by MARCHAL (l. c.: 308) on *Corylus avellana* in France (Moulins, Dept. Allier), and also found by myself in Britain on *Sarothamnus scoparius* (L.) at the Imperial College Field Station, Silwood Park, Berks. In the same locality it was also found associated with *Eulecanium franconicum* (LDGR.) on *Calluna vulgaris* L.

The following material from the Vienna Collection, listed according to the original labels of the samples, was examined:

1. *Lecanium aesculi* KOLLAR. det. KOLLAR. = *Eulecanium tiliae* (L.)
Aesculus hippocastani, A. R. Wien.
Material examined: 4 adult females.

This sample appears to represent part of the type material of *C. aesculi* KOLLAR, 1848, available to SIGNORET (1874: 402—403) who noted its great similarity with *L. tiliae* (L.). This synonymy already suggested by NEWSTEAD (1903: 105, — *L. capreae* L. = a synonym of *tiliae*) was never disputed although different names were applied to this species by various authors.

2. *Lecanium berberidis* SCHRANK. det. SIGNORET. = *Parthenolecanium persicae* (FAB.).

Berberis vulgaris, Annecy, Savoy.

Material examined: 2 adult females.

The origin of this sample indicates that it represents the material referred to by SIGNORET (1874: 403—404) and described under the name "*Lecanium berberidis* SCHRANK, Löw". It is obvious that SIGNORET based the conception

of this species on a brief description of "*Lecanium berberidis* SCHRANK" by LOEW (1862), the species which subsequently as *Lecanium berberidis* SIGNORET, 1874, was synonymized with *P. persicae* (FAB.) and this synonymy is here confirmed. SCHRANK's (1801) original description of his "*Coccus berberidis*" clearly indicates that it is a diaspid, *Chionaspis* or *Mytilaspis* (cf. MARCHAL, 1908: 291), possibly *Mytilaspis pomorum* (cf. SANDERS, 1909: 441). It is perhaps interesting to note that ŠULC (1932: 101) who examined the specimens in SIGNORET's collection does not mention *L. berberidis* at all.

3. *Lecanium genistae* SIGNORET. det. SIGNORET. = *Parthenolecanium persicae* (FAB.).

Genista anglica, Cannes.

Material examined: 2 adult females.

This sample is a part of the type material of SIGNORET's "*Lecanium genistae nobis*" (1874: 405) described as the largest species in the country (France) occurring on "génét épineux" = *Genista anglica* (SIGNORET 1877: 646); according to MARCHAL (1908: 293) the host is the misidentified *Calicotome spinosa*. The synonymy of *L. genistae* with *P. persicae* is generally accepted.

4. *Lecanium mori* SIGNORET. det. SIGNORET. = *Parthenolecanium persicae* (FAB.).
Persica vulgaris, Albertsvelle, Savoy.

Material examined: 4 adult females, 1 cast skin of 3rd instar and 5 1st instar nymphs.

5. *Lecanium mori* SIGNORET. det. SIGNORET. = *Parthenolecanium persicae* (FAB.).
Persica vulgaris, Montpellier.

Material examined: 1 adult female.

In the description of "*Lecanium mori nobis*" SIGNORET (1874: 407) refers to specimens from Albertsvelle, Savoy (as sample 4.) and other localities in Southern France, and in the final catalogue (1877: 646) he gives *Morus alba* as its host. It appears that SIGNORET's recognition of the species was usually influenced by the host-plant, so that his identification of specimens from *Persica vulgaris* as *L. mori* is rather puzzling, unless the record of the host on the labels is erroneous. MARCHAL (1908: 264) and LINDINGER (1912: 370) listed *L. mori* SIGN. among the synonyms of *L. corni*, while ŠULC (1932: 101) and BORCHENIUS (1957: 351) included it among those of *P. persicae*. MARCHAL (l. c.: 276, 293) reported that both *P. persicae* and *P. corni* occur on Mulberry, sometimes probably together in mixed populations; this would explain the difference of opinions regarding the synonymy of *L. mori*, both of which may be in part correct.

6. *Lecanium persicae* det. SIGNORET. = *Parthenolecanium persicae* (FAB.).
Persica vulgaris, Montreuil, France.

Material examined: 2 adult females and 1 3rd instar nymph.

7. *Lecanium persicae* det. SIGNORET. = 1. *Parthenolecanium persicae* (FAB.).
Persicae vulgaris, Clamart, France. 2. *Parthenolecanium corni* (BOUCHÉ).
Material examined:

1. 1 adult female, 1 2nd instar and several 1st instar nymphs.
2. 6 adult females, 2 2nd instar and several 1st instar nymphs.

Consistent with the notation in SIGNORET's (1874: 407—408) description of "*Lecanium persicae*" the authority for the species is also omitted on the labels of the samples; however, in the introductory list (1869: 864) and in the final catalogue (1877: 671) the full name "*Lecanium persicae* FAB." is given. Being identified by SIGNORET himself the samples represent part of the material on which his conception of *P. persicae* (FAB.) was based. The mixed composition of sample 7 from Clamart (Dept. Seine) supports MARCHAL's observation that both *P. persicae* and *P. corni* may occur together on one individual host.

8. *Lecanium vini* det. Löw. = *Parthenolecanium corni* (BOUCHÉ).
Vitis vinifera, Wien.

Material examined: 5 adult females.

The label gives no authority for the specific name but it is probably referable to *Lecanium vini* BOUCHÉ, 1851, which SIGNORET (1869: 875) synonymized with *L. (Pulvinaria) vitis* (LINN.). FERNALD (1903: 198) recognized it as a good species, but NEWSTEAD (1903), MARCHAL (1908) and LINDINGER (1912) included *vini* BOUCHÉ among the synonyms of *P. corni* which conforms with the examined specimens of this sample.

9. *Lecanium pistaciae* SIGNORET. (det. uncertain). = *Filippia oleae* (COSTA).
Leaf of ?, Dalmatien.

Material examined: 2 females dissected from their ovisacs.

The specimens were preserved on a fragment of leaf of an unidentified host-plant, which may have been *Pistacia* sp. on which *F. oleae* has been recorded. As I was unable to trace any reference to this species in the literature, it is probably a manuscript name only.

The nymphal stages of *Parthenolecanium persicae*

The number and morphology of the nymphal stages of *P. persicae* has been the subject of some controversy. Most authors recognized only two nymphal stages, but SILVESTRI (1940: 722) correctly described three. It appears either that the 2nd instar was overlooked (or ascribed to *P. corni*) and the 3rd considered as the 2nd instar (MARCHAL, 1908), or the 2nd instar was identified correctly but the 3rd overlooked altogether (ŠULC, 1932). KAWECKI (1962) briefly reviewed the position regarding the differences of the 1st and 2nd nymphal instars of *P. persicae* and *P. corni*, assuming that there are only two nymphal stages in both species, but was unable to differen-

tiate the 1st instar nymphs of the two species; in the postscript to his paper however, KAWECKI (l. c.: 24) confirmed SILVESTRI's view that there are three nymphal stages in *P. persicae*. The most accurate but apparently overlooked account of the nymphal stages and life history of *P. persicae* in New Zealand, was published by BRITTIN (1940).

The available material of *P. persicae* from the Vienna collection supplemented by the material in my collection from three localities in England and one from Sicily (coll. C. WILKINSON, 1962), yielded a number of immature specimens of all stages including some individuals in the process of moulting (pharate state) and the cast-skins; it was thus possible to establish the exact sequence and number of the instars. Examination of adult females from these different localities and different host-plants showed that the ranges of individual variation of corresponding characters were very similar and consistent with the definition of the species.

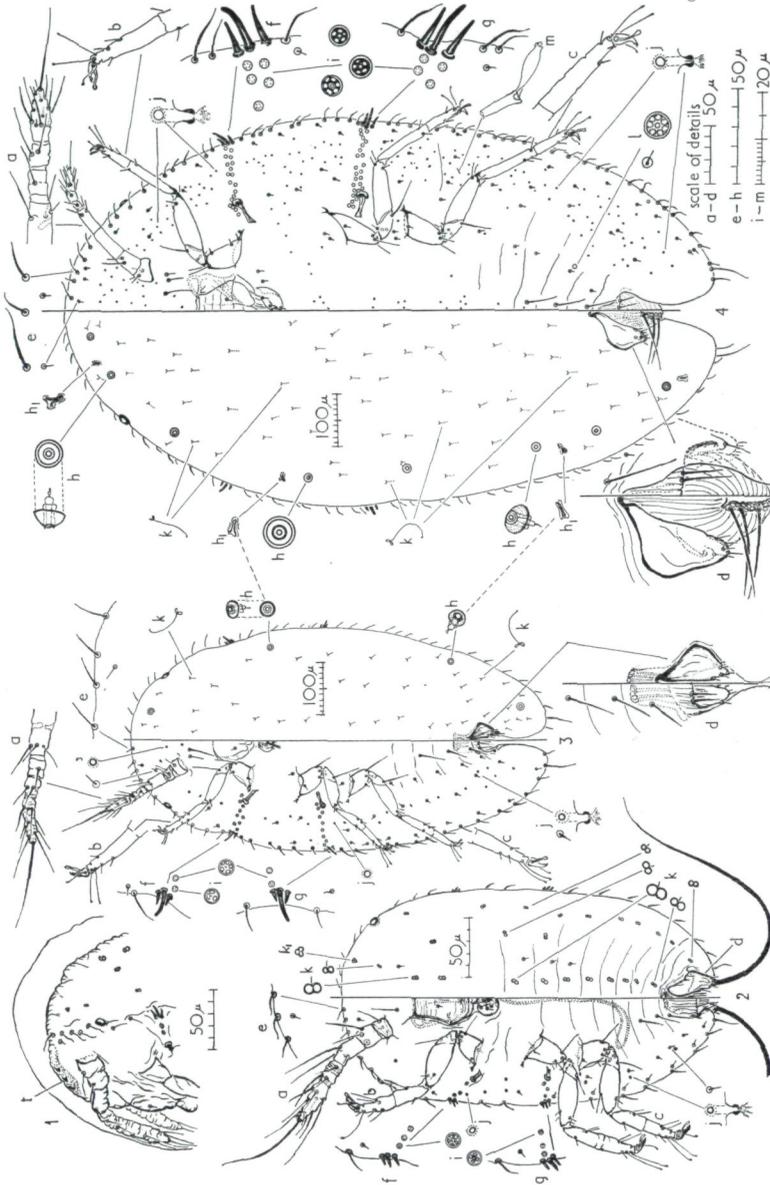
All three nymphal stages drawn by camera lucida are illustrated in 4 figures and show all observed structures, with the structural details drawn to larger scales as indicated by the scale lines; to facilitate comparison the corresponding details of all stages are labelled by the same letters and drawn to the same scale, which also gives the actual size of these details. The following comments and description are supplementary to the illustrations.

First instar nymph (Fig. 1 & 2). Before hatching the fully formed nymphs within the egg-shell (Fig. 1) are provided with usually three ecdysial teeth (*t*) arranged in a longitudinal row between the antennae; these are absent in the hatched nymphs and are apparently shed immediately after ecdysis, though I was unable to establish if this moult is complete or only partial. The newly hatched nymphs (Fig. 2) oval, broadly rounded at both ends. Antennae (*a*) apparently 6-segmented but the terminal segments not well separated. Legs (*b* & *c*) stout, tarsus about as long or somewhat longer than tibia and one unguis thicker than the other; claw with small plantar tooth. Anal complex (*d*): anal plates with one long apical and 4 small subapical setae; anal ring with 6 setae; fringe apparently with only one pair of fringe setae. Spiracles small, with 2—4 (usually 3) dermopores (*i*) with 3—5 loculi; spiracular spines (*f* & *g*) small, the middle one slightly larger. Marginal setae (*e*) flagellate, the last but one posteriormost longer. Venter with paramarginal row of smaller setae around the whole margin of the body, composed of one seta each on the abdominal and thoracic segments and one on the head; on the abdomen also with a sublateral row of similar setae composed of one seta each on the abdominal segments. Between the antennae one pair of longer interantennal setae, and on each of the last three abdominal segments anterior to the anal complex a pair of longer submedian preanal setae. The setae of the sublateral row of abdomen often accompanied by dark-rimmed pores (*j*), with a few of these pores also on the sublateral ventral area of the thorax and on the head. Dorsum: with

a pair of trilocular pores (k_1) on the head, and with 8-shaped pores (k) arranged in three longitudinal series: the median series composed of 11 pairs of pores, extending over cephalothorax and abdomen, the pores of the anterior-most pair being smaller and situated more lateral than the others; the sublateral series composed of three pores, one each on the three thoracic segments; and the marginal series composed of 8–11 pores. The median thoracic pores are the largest and gradually decrease in size towards the posterior end and towards the margin of the body. There are also three small setae arranged in a longitudinal row, one each on the meso- and metathorax, and on the 1st abdominal segment. This description was based on about 60 specimens, including some fully formed but still enclosed within the egg-shell.

The arrangement and number of 8-shaped pores appears to constitute a character differentiating the 1st instar nymphs of *P. persicae* and *P. corni*, the latter having only the median series composed of 10 pairs of pores (KAWECKI, 1958; HABIB, 1953, 1957); from my observation, however, it appears that occasionally a few (one or two) such pores of the submarginal series may occur in some individuals of *P. corni*, but never in full complement as it is apparently normal in *P. persicae*. These pores are more distinct in the fully formed nymphs which are still enclosed within the egg-shell, thus suggesting that the moult immediately after hatching perhaps may be complete.

Second instar nymph (Fig. 3): Elongate oval, with the posterior end somewhat narrowed; immediately after hatching about 1 mm long, but later longer and larger. Antennae (a) apparently 7-segmented but the segments 6 and 7 very indistinctly separated. Legs (b & c) slender, with tarsus somewhat shorter than tibia. Anal complex (d): anal plates with 5 small apical and subapical setae, all of about the same size; fringe with two pairs of fringe setae. Spiracles with small narrow opening and long slender bar; each spiracle with a row of 8–11 spiracular pores (i), these usually 5-locular, but occasionally 3- or 4-locular; spiracular spines (f & g) with the middle spine large, twice or more as long as the lateral ones. Marginal and paramarginal setae (e) as in the 1st instar, but more numerous, the marginal ones being rather setiform. Venter: on each side with two longitudinal rows of small setae, the sublateral extending over abdomen and cephalothorax as in the 1st instar, and the submedian over the abdomen and meta- and mesothorax; there are two pairs of larger interantennal setae, the median being larger than the lateral one, and there are also three pairs of larger submedian preanal setae, as in the 1st instar. Dark-rimmed pores (j) more numerous than in the 1st instar, scattered over the whole submarginal ventral area of the body including the head. Dorsum: with inconspicuous 8-shaped pores (k) scattered over the whole dorsal surface, each pore with the small weakly sclerotized component loculi somewhat inclined in relation to each other and with a very fine long inner filament; they probably represent a modified form of the 8-shaped pores of the 1st instar. Submarginal dorsal



Parthenolecanium persicae (FABRICIUS, 1776) — nymphal stages. Fig. 1. 1st instar nymph before hatching, the anterior end showing three ecdysial teeth (*t*) between the antennae. Fig. 2. 1st instar nymph after hatching, dorsal and ventral views. Fig. 3. 2nd instar nymph, dorsal and ventral views. Fig. 4. 3rd instar nymph, dorsal and ventral views. The details for all instars: *a* = details of the antenna; *b* & *c* = details of the anterior and posterior legs, respectively; *d* = anal complex; *e* = setae of the anterior margin of the body; *f* & *g* = details of the marginal areas of the anterior and posterior spiracles, respectively; *h* = marginal bicylindrical ducts (in 2nd and 3rd instars only); *h*₁ = the atrophied bicylindrical ducts of the 2nd instar in the 3rd instar; *i* = spiracular pores; *j* = ventral setae and the “dark rimmed pores”; *k* = dorsal 8-shaped pores; *k*₁ = trilobular pores on the head of the 1st instar only; *l* and *m* = occasional multilocular pores and tubular ducts, respectively, which may occur in the 3rd instar nymphs. Corresponding details are drawn to the same scale.

area usually with four pairs of bicylindrical pores of about 10 μ in diameter: one pair on the head, one pair between the spiracular spines and two pairs on the posterior part of the body. In one of the available specimens the posteriormost pore on one side of the body was missing. There are no dorsal setae at all.

This description was based on 19 specimens of the 2nd instar, including two in pharate state and one cast-skin.

As already suggested by ŠULC (1932) and KAWECKI (1962) the number and arrangement of the bicylindrical ducts appears to be characteristic of this stage of *P. persicae*; in the 2nd instar of *P. corni* there are always two pairs of these ducts anterior to the anterior spiracular spines and two behind the posterior spiracular spines, the interspiracular duct usually being absent (HABIB, 1957; BIELENIN, 1957; KAWECKI, 1958). MARCHAL (1908) overlooked this stage in *P. persicae* altogether and probably confused it with that of *P. corni*.

Third instar nymph (Fig. 4): In general appearance and shape similar to the 2nd instar but larger, up to 3 mm long when fully grown, with larger antennae, legs, spiracles and anal complex, and with more numerous structures of the derm vestiture. Antennae (*a*) 7-segmented with all segments well separated; legs (*b* & *c*) slender, with tarsus about $\frac{2}{3}$ rd length of tibia. Spiracular pores more numerous, in double band or irregular row composed of 20–25 pores, these usually 5-locular, sometimes 6-locular. Spiracular spines large, the lateral ones about $\frac{2}{3}$ rd length of the middle one. Marginal setae numerous, arranged in a single marginal row, subequal or usually longer than the lateral spiracular spines, flagellate, with the apices bent backwards. The smaller paramarginal and ventral setae arranged as in the 2nd instar, but more numerous, the sublateral series forming a wide band. Between the antennae there are three pairs of interantennal setae, the median one being the longest and the lateral the shortest. Dark-rimmed pores (*j*) more numerous, forming a wide submarginal band and also scattered in some numbers in the median sternal area of the abdomen and thorax. Dorsum: with 8-shaped pores (*k*) similar to those of the 2nd instar, but more numerous, scattered over the whole dorsal surface. The submarginal dorsal area usually with 8 pairs of bicylindrical ducts (*h*) about twice the size of those of the 2nd instar; they are arranged as follows: three pairs anterior to the anterior spiracular spines, one pair between the spiracular spines and four pairs behind the posterior spiracular spines. Among the 8 available specimens one showed only seven pores on one side of the body and the other two specimens had 9 and 10 pairs of these pores, respectively; the missing or supernumerary pores occurred in the posterior part of the body. It is apparent that the bicylindrical ducts of the 3rd instar develop independently of those of the 2nd instar; this is shown by the presence in the 3rd instar of scar-like rudiments (*h*₁) of these ducts of the 2nd instar, similar to those of — and the only ones present in — the adult female of *P. corni*; these scar-like

rudiments correspond in number and position to those of the 2nd instar nymph. Setae or spines on dorsum are absent. It is interesting to note that in some 3rd instar nymphs a number of multilocular pores (*l*) and of the tubular ducts with expanded inner part (*m*), characteristic of the adult female, may occur. Out of 6 specimens available for this study one showed 2 multilocular pores in the posterior sternal area of the abdomen, and the other one had about 32 such pores in the same area and about 25 tubular ducts scattered in the submarginal ventral area of the body. In both cases no rudiments of the genital opening was observed. In the adult females the multilocular pores and the tubular ducts are very much more numerous and the spines on dorsum are present. It appears that the 3rd instar nymph of *P. persicae* represents a form intermediate between the nymphal and adult stages in which a reduced number of adult characters may occur (prothetely). Similar conditions have been observed by me in the 3rd instar nymph of *Pulvinaria regalis* CANARD, 1968, which recently appeared in this country causing serious damages to horse chestnut, but also occurring on lime, holly, ivy, sycamore (HARRIS, 1968; FLETCHER, 1968) and on some other trees.

The above description of the 3rd instar nymph is based on 6 specimens including one in the pharate state and two cast skins.

This instar was described by Marchal as the 2nd instar of *P. persicae*, but recognised correctly as the 3rd instar by SILVESTRI (1940) and BRITTIN (1940). ŠULC (1932) may have confused this instar with the adult female of *P. corni*.

The adult female: The characters of all 30 adult females (13 from France, 3 from Sicily and 14 from England) examined in connection with this work were similar and consistent with the accepted conception of the species, i. e. with multilocular pores extending over the sternites of the abdomen and on thorax near bases of the legs; with a crowded submarginal ventral band of tubular ducts, most of which have the expanded inner part; with short, spine-like dorsal setae; and other characters identical with those already mentioned. The ranges of individual variation of the number of large bicylindrical ducts in specimens from all localities (and various hosts) were much the same, the totals being: from France 28—32; from Sicily 24—31; from England 27—36. It should be pointed out that during the last moult, i. e. of the 3rd instar into the adult female, the nymphal bicylindrical ducts do not degenerate but remain well developed and in the same position but appear to be smaller than the newly formed ones which are usually larger and interpolated between the former. This may explain differences in the description of size of these ducts in adult females given as varying from 25 to 35 μ in diameter.

It is perhaps interesting to note SCHMUTTERER's (1954) report that in specimens of his "*crudum*" with bicylindrical ducts the size of these is variable which may possibly suggest that as in *P. persicae* this form also has 3 nymphal stages.

The life cycles of *P. persicae* as given by MARCHAL for France and by BRITTIN for New Zealand are almost identical, except that they differ by almost exactly six months:

Stages	France (MARCHAL, 1908)	New Zealand (BRITTIN, 1940)
Oviposition	end of May—June	end of November
Crawlers (1st nymphs)	July	middle of December
2nd nymphs	(overlooked)	from February
3rd nymphs	October—April	middle of April—October
Adult females	April—May	October—November

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