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On Australian and New Zealand Peloridiidae
(Homoptera: Coleorrhyncha)

BY

T. E. WOODWARD, M.Sc., Ph.D.

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On Australian and New Zealand Peloridiidae (Homoptera: Coleorrhyncha)

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A new species, *Hemiodoecus donnae*, is described from Victoria, Australia, and a new subspecies, *Oiophysa fuscata pendergrasti*, from Coromandel Peninsula, New Zealand. The abdomen and terminalia of the Australian and New Zealand species are described and compared and further data given on distribution, venation and measurements. The affinities of the genera and species are discussed. The Australian genus *Hemiodoecus* China comprises two species groups which could be considered as subgenera or even genera: the *leai* group, including *leai* China, *veitchi* Hacker, and probably *wilsoni* Evans, and the *fidelis* group, including *fidelis* Evans and *donnae* sp. n. The eggs of a Peloridiid are described for the first time; these are mature oviducal eggs of *Xenophyes cascus* Bergroth.

Venation

The tegminal venation of the Peloridiidae was elucidated by Evans (1939) on the basis of a study of nymphal tracheation and of the veins in macropterous adults of *Peloridium hammoniorum*. Evans's terminology is applied throughout this paper. In specific accounts, the numbers of radial cells refer to the total number of closed cells behind R, including any cellules cut off from the main cells by cross-veins. It is possible that at least the apical cell of this series might eventually prove to be a median cell, depending on whether or not M has fused for some distance apically with R.

In all known species of the family R is a simple vein widely separated from C at the base, thence running more closely and more or less parallel to it as far as or to near the apex. A series of cross veins between R and C delimit a variable number of costal cells. Except basally, R is fused with C in *Hemiodoecus veitchi* Hacker and is partly fused with and in part very closely parallels C in the Chilean *Peloridora kuscheli* China; true costal cells are restricted to the base. In both species this is evidently a secondary and independent specialization to which no phylogenetic weight can be attached. Even between species of the same genus the distance between R and C may differ considerably (e.g., *Xenophyes cascus* and *X. stewartensis*). There is a series of three or more radial cells.

Sc is a short simple vein curved back to end on R, enclosing a single basal subcostal cell. The two main branches of M (M1+2 and M3+4) may each variously branch again, their apices usually all ending on R. There may be only a single median cell (the common condition in *X. cascus*) or as many as five median cells. The variable nature of the median region in *X. cascus* is described and discussed under that species.

The basal part of Cu1 (CuA) runs closely parallel to Cu2 (CuP)+1A, usually leaving a very narrow, linear cell between them, commonly about one puncture-width across. The width of this space varies intraspecifically, particularly in *X. cascus*. The cell may also widen apically. Sometimes it is not readily apparent until treatment of the tegmen with potash. In the South American *Peloridium hammoniorum* the basal part of Cu1 is contiguous with Cu2+1A in the macropterous form, completely fused with it in the subbrachypterous form (Evans, 1939). The more apical

part of Cu1 is always joined to M4 or M3+4. In macropterous *P. hammoniorum* the apices of Cu1a and Cu1b continue as long, free veins; in other species one or both are often represented by shorter, hook-like extensions.

The clavus is fused with the corium and is usually pigmented with brown. 2A is obtusely angled at or usually before the middle, the basal part running along the base of the anal margin, the apical part nearly straight and some distance from the posterior anal margin and meeting Cu2+1A near the apex of the claval region. The anal angle is thickened (except apparently in *P. hammoniorum*) by a marginal extension from 2A. In the Australian and New Zealand species at least, the tegmen (except anterior to R and near posterior apical margin) is finely shagreened.

The New Zealand genus *Xenophyes* differs in a number of features from other known genera: (1) The punctation is much reduced, the punctures often being restricted to a few along inner margin of base of 2A and a few obsolete ones between base of R and base of M; at the most, there are punctures along each side of 2A, less well defined punctures margining Cu1, and obsolete punctures along the branches of M appearing as indistinct marginal crenulations. In all other genera except apparently the South American *Peloridium* there are strong punctures margining all or most of the veins behind R. In *Peloridora kuscheli* punctures are also present within the cells themselves (China, 1955). (2) The apical radial cell is relatively small, usually smaller than the subapical. In all other genera the apical cell is larger than any of the others in the radial series. (3) There is usually only a single median cell, the largest cell of the tegmen. (Occasionally in *X. cascus* a more generalized and complete venation is retained and the median cell is divided into two, rarely into three.) In all other genera there are always three to five median cells. (4) The apex of M4 ends on C (? or C+R) a short distance before apex of tegmen and beyond the point of junction of R with C. In *Peloridora* M4 ends freely before the margin; in the other genera it ends on R (some specimens of *Hemiodoecus veitchi* have M4 forked, the posterior branch then ending on C; R and C, in any case, are often so completely fused at this point as to make their limits uncertain).

The other New Zealand genus, *Oiophysa*, also differs from *Xenophyes* in the following characters additional to those given above: (1) The costal margin is more or less sinuate, instead of broadly convex or nearly straight. (2) The veins are more strongly raised. (3) The tegmen is more heavily and extensively pigmented toward the base and at margins of veins. Undue weight should not be given to the development of a sinuate costal margin, which can apparently arise independently. The costal margin is strongly sinuate in *Peloridora kuscheli* and in *Hemiodoecus wilsoni*, while in *H. veitchi* and to a lesser extent in *H. leai* there is a less marked and rather variable tendency to sinuation. This widespread tendency may be related to the loss of flight in the Peloridiidae. Nevertheless, the difference as between *Oiophysa* and *Xenophyes* is a constant one.

Specific characteristics and notes on intraspecific variation are given below in the accounts of the species.

The Abdomen

In an earlier paper the writer (1952), remarking on the plasticity of many of the taxonomic features of the Peloridiidae, noted the importance of the genitalia as systematic criteria at the generic and specific level and indicated an intention to compare these structures in more detail. Since then sufficient material has

accumulated to make a beginning in this comparison and to indicate certain probable evolutionary lines among the Australian and New Zealand members. The pregenital abdominal region has also been considered.

In view of this importance of the abdominal structures, particularly the terminalia, in trying to elucidate generic and specific affinities, a general account is first given for the family. This is based on a study of all the known New Zealand and Australian species except *Oiophysa ablusa* and *Hemiodoecus wilsoni* and the female of *Xenophyes stewartensis*. Unfortunately very few details are yet known of the terminalia of the South American species, of which collected material is very scanty.

The basic work on the Peloridiid terminalia has been done by Myers and China (1929, *H. leai*, male) and Helmsing and China (1937, *H. veitchi*, male and female). The fundamental structure in all species examined is similar to that described by these authors.

Pregenital region and Sternum VIII.

Female: Short and broad. Dorsal surface flattened; ventral surface convex. Segments I and II much reduced, without connexiva. Terga I and II largely membranous, rather weakly sclerotized mainly in their anterior median portions. Sternum I largely membranous, sclerotized anteriorly. Segments III-VII with well developed connexiva separated from the sterna on each side by a line of well marked sutures on the ventral surface a good distance from the lateral margins. A dorsal, sublateral pair of spiracles in the membranous part of tergum I at or near its posterior margin; a ventro-lateral pair on each of segments III-VII, shortly laterad of the connexival sutures; a further pair, in line with the preceding five, but more obscured (owing to absence of connexiva), near ventral margin of tergum VIII. Segment III with the antero-lateral angles produced forward. Terga III-VII subequal in length; tergum VIII longer and with postero-lateral angles more or less produced backward. Sterna III-VI subequal in length; sternum VII more than 3 times as long as each of the preceding, with posterior margin more or less produced in middle as a subgenital plate. Sternum VIII much reduced to a short, sclerotized half-ring concealed between tergum VIII and sternum VII.

Male: Differs from female in the much smaller sternum VII and the exposed and very much larger sternum VIII. Except that its anterior and posterior margins are more strongly curved, sternum VII is similar in form to the preceding three sterna. Sternum VIII is the longest, with its posterior margin nearly straight or slightly and broadly convex between the posterior connexival angles. The connexiva of tergum VII are well developed and the ventro-lateral pair of spiracles they bear are fully exposed.

Although no clear-cut and universal differences have been detected between the pregenital abdominal region of the New Zealand species and that of the Australian, several divergent evolutionary trends are evident. In both sexes the antero-lateral angles of segment III are narrower in the Australian species (except in *H. leai*); the spiracles of segment I are usually larger in the Australian species and set closer to the anterior margin of the sclerotized part of tergum II; in the New Zealand species the median sclerotization of tergum I tends to be shorter (about 4 times as wide as long) and more sharply tapered at the sides (about 2.5 times as wide as long in *Hemiodoecus*). In the female the posterior margin of

sternum VII is usually more strongly produced in the middle in the New Zealand species, except that in the widespread *X. cascus* this character is very variable; the abdomen tends to be proportionately narrower in the New Zealand species, but *O. fuscata* has similar proportions to *H. fidelis* and *H. leai*. In the male the New Zealand species (except *X. stewartensis*) have tergum VIII rather longer in proportion to its width, but (except in *X. cascus*) rather shorter in proportion to tergum VII; the posterior margin of tergum VIII is excavated in a broad U between the lateral projections in the Australian species, not deeply excavated but convex in the middle in the New Zealand species (except *X. stewartensis*); in the Australian species the venter of segment VIII is somewhat shorter in proportion to sternum VII and (except in *H. veitchi*) somewhat shorter in proportion to its width. Actual measurements and ratios are noted below for each species.

The *fidelis* group of *Hemiodoecus* (*fidelis and donnae*) differs from the *leai* group (*leai* and *veitchi*) in having the anterior margin of sternum III convex at the sides, forming a sinuate line with the inner margin of the antero-lateral projections, whereas in the *leai* group (as in both New Zealand genera) these margins form a rounded obtuse angle; in the *fidelis* group the postero-lateral projections of tergum VIII are narrowly acute or subacute, in the *leai* group and in both New Zealand genera apically rounded.

Genital region.

Female: All the species examined have an ovipositor of the generalized type described and figured by Helmsing and China (1937) for *Hemiodoecus veitchi* and segment IX has the same general form. The dorsal surface of this segment is flattened and divided into two halves by a median dorsal membranous suture behind the anal tube. Potash treated specimens are easily divided along this line, and it is such bisected material that is figured in this paper. The postero-lateral angles are extended backwards into a pair of laterally flattened processes, one on each side of the anal tube. Ventrally the segment is widely open in the middle for the reception of the ovipostor, which has the complete set of three pairs of well developed valvulae.

The second valvifers are large, laterally flattened plates, always longer than the third valvulae, which are also flattened and either more or less rounded or subtruncate at the apex and minutely denticulate on the outer surface. The first valvifers are much smaller, less heavily sclerotized plates. The first and second valvulae are flattened and acuminate; the second much the broader, laterally flattened but set obliquely, so that the dorsal margins are mesial, the ventral margins directed outward; the first valvulae are flattened more or less dorso-ventrally. The second valvulae are conjoined at their base by a small, black, dorsal sclerotization; their dorsal margin is thickened as a single longitudinal ridge; their ventral margin bears two closely parallel ridges, the outer one finely serrate. The first valvulae bear an outer (lateral) and an inner (mesial) ridge, each supporting a variable number of ventral teeth. Most of these terminalia structures have systematic value at the generic or specific level.

The first valvifers have the double attachment characteristic of the Hemiptera, being connected behind to sternum VIII and in front to the base of segment IX. The outer dorsal margin of each of the second valvifers is attached by membrane to the outer ventral margin of segment IX and, at the base, to the ventral margin of the first valvifer. The postero-ventral angle of segment IX and the antero-

ventral angle of the first valvifer together form a small process articulating with a concavity on the dorsal margin of the second valvifer. The broad second valvifers and third valvulae act as a sheath for the first and second valvulae.

In both sexes segment X forms a large, separate, heavily sclerotized anal tube, subfusiform or subcylindrical, with both ends truncate, the surface finely denticulate. Segment XI, as shown by Helmsing and China (1937) for *H. veitchi*, has the form of a narrow tube which is completely invaginable within segment X. Its apex bears a circlet of fine hairs.

The New Zealand genera *Xenophyes* and *Oiophysa* resemble each other and differ from the Australian species in the dentition of the first valvulae. In the former these bear a scattering of denticles on the apical half of the ventral surface and a series of serrations on the apical part of the inner margin, both lacking in the Australian species. The outer ventral margin of the first valvulae in the Australian species is distinctly sinuate or sigmoidally curved toward the apex, whereas in the New Zealand species it is not or only obsoletely sinuate. In the New Zealand species the apex of the third valvulae, in lateral view, is obliquely subtruncate, in the Australian species more narrowly rounded. The ventral margin of the second valvifers is nearly evenly convex in the New Zealand species, excavated basally in the Australian. In the female the anal tube of the New Zealand species is relatively short and wide, broadest near the middle, subfusiform; in *Hemiodoecus* it is relatively long and slender and subcylindrical. The New Zealand species also differ from the Australian in having relatively broader second valvulae (about 4.3 times as long as wide at base in *Oiophysa*, about 3.3 times in *Xenophyes*, about 5.7 times in *Hemiodoecus*), with very short teeth on the dorsal margin, lacking in *Hemiodoecus*; in both New Zealand genera the dorsal margin is concavely excavated before the apex but not angled before the excavation, in the *fidelis* group of *Hemiodoecus* it is neither excavated nor angled, while in the *leai* group it is convexly obtusely angled at about 2/5 from apex and not or only very shallowly concave beyond the angle.

Characters differing in the two New Zealand genera: apex of posterior lateral extensions of segment IX narrower in *Xenophyes* than in *Oiophysa*; viewed from the side, in *Oiophysa* the ventral margin of segment IX forms a nearly straight line with the ventral margin of the posterior lateral extension, with only a slight incision between them, whereas in *Xenophyes* there is a deep, obtusely angled concavity between the ventral margin of the segment and that of its posterior extension.

Of the Australian species, the *fidelis* group has the posterior lateral extension of segment IX broader (dorso-ventrally), forming a large triangular plate well developed dorsally; in the *leai* group this extension forms a narrower, more finger-like lobe less developed dorsally. In the *fidelis* group the inner ventral margin of the first valvula bears only about 6 or 7 teeth located within the basal half; in the *leai* group there are about 11 to 13 teeth on the basal two-thirds. In the *fidelis* group the outer ventral margin of the first valvula is more shallowly sinuate than in the *leai* group, *i.e.*, approaching more closely the condition in the New Zealand species.

Male: In all the species examined the pygophor and terminalia are of the same general type as those described and figured by Myers and China (1929) for *Hemiodoecus leai* and by Helmsing and China (1937) for *H. veitchi*. Segment IX

forms a large sclerotized genital capsule (pygophor). The harpagones (parameres) are large and symmetrical, with large, arm-like basal plates fused anteriorly. The pygophor is attached to segment VIII by a highly extensible intersegmental membrane; which can be exserted in the form of a tube. On the apex of this the pygophor can be carried backward and also flexed so that its dorsal surface faces forward, the ventral surface backward, and the apex dorsad, projecting between the apices of the tegmina. The shape of the pygophor, the harpagones (claspers) and the aedeagus are of taxonomic value at the specific and sometimes at the generic level.

The New Zealand genera *Xenophyes* and *Oiophysa* differ from all the Australian species studied in having harpagones of a short, stout, lobe-like form, not strongly laterally flattened, and in having a simpler form to the posterior ventral margin of the pygophor, which is not trifid as in *Hemiodoecus*, but bears a single median process. The aedeagus in both New Zealand genera has the apex rounded and not upcurved and the basal plates are relatively short. In *Hemiodoecus* the basal plates are longer, and in all species examined except *leai* the apex of the aedeagus is hook-like and upcurved. In lateral view the aedeagus is nearly straight in *Xenophyes*, sigmoidally curved in *Oiophysa* and in the *fidelis* group of *Hemiodoecus*, while in the *leai* group it is nearly straight (*leai*) or only very slightly sigmoidally curved (*veitchi*).

The harpagones are strikingly different in the two Australian species groups. In the *leai* group they are unbranched and laterally flattened toward the apex; in the *fidelis* group they have an inner flattened arm and an outer curved subcylindrical arm. The posterior ventral margin of the pygophor also differs. In the *leai* group the two processes laterad of the large median process are well developed, in the *fidelis* group very small and tubercle-like.

Discussion of Affinities

A study of the structure of the abdomen and particularly the terminalia of both sexes indicates that the two New Zealand genera, *Xenophyes* and *Oiophysa*, are more closely related to each other than to any of the Australian species. This is doubtless a reflection of the long continued separation of the two Peloridiid populations on opposite sides of the Tasman. Much of the available evidence suggests that each of these populations is derived from a single form which entered Australia and New Zealand respectively, spread, and subsequently diverged as the result of isolating factors. However, a detailed study has yet to be made of the relationships of the Australasian genera with the South American. This is particularly important in view of the relationship indicated by China (1955) between *Oiophysa* and the Chilean genus *Peloridora*. Thus it is yet possible that the ancestors of *Xenophyes* and *Oiophysa* might prove to have differentiated before their entry into New Zealand.

The characters and trends which are shared by these two genera and in which they differ from the known Australian species are described on pp. 33, 35 and 36. The New Zealand species would seem to be the more generalized in respect of the simpler form of the ventral margin of the second valvifers and of the outer ventral margin of the first valvulae of the female and the simpler harpagones and posterior pygophor margin of the male. The relative primitiveness, if any, of the other distinctive characters is less easily evaluated. A detailed study of the terminalia of the South American species would probably make it easier to decide what should

be considered primitive for the family and what secondary. The main value of the terminalia is that such a large series of characters is available for comparison. However, as regards abdominal characters there seems little doubt that the New Zealand species have retained a considerably more generalized condition than the Australian. Despite this relationship, *Xenophyes* and *Oiophysa* constitute two readily separable natural groups. Differences in venation and terminalia have been given in the preceding sections.

In tegminal venation *Oiophysa* accords down to most points of detail with the Australian *Hemiodoecus* and in this respect is certainly more generalized than the other New Zealand genus *Xenophyes*. A similar relatively generalized venation obtains also in the two South American genera *Peloridium* and *Peloridora*, macropterous individuals of the former having the most complete venation of all known Peloridiids. The partial fusion of R and C in both *Peloridora kuscheli* and *Hemiodoecus veitchi* is undoubtedly secondary. The apparently secondary nature of the development of a sinuous costal margin, such as occurs in *Oiophysa*, has been noted above. This tendency may vary in intensity both intraspecifically and intragenerically; it is much stronger in *O. distincta* than in *O. abluса* or *O. fuscata*. Notwithstanding all this, one cannot overlook the well-known phenomenon of an evolutionary trend being present, sometimes incipiently, in an ancestral population and being developed to varying degrees in the descendants. The development of sinuosity in certain species in all three areas where Peloridiids are known to occur might have been an independent one, or it might have been based on some such ancestral trend.

The venation of *Xenophyes* is specialized mainly by reduction. The widespread occurrence of strong punctures margining the post-radial veins in Peloridiids, including *Oiophysa*, indicates that their obsolescence in *Xenophyes* is a secondary loss. The marked though variable tendency to venational reduction in the median region is also without doubt secondary.

The phylogenetic weight to be attributed to the excavation of the anterior margin of the head and to branching of the veins of the paranota remains rather uncertain. This will be easier to evaluate when it is known whether or not the presence or absence of these characters is correlated with type of terminalia in the South American genera. On present evidence form of head seems to have value in helping to assess species groups and genera, but may or may not indicate relationships at a higher level. In *Xenophyes*, *Peloridium* and the *fidelis* species group of *Hemiodoecus* the anterior margin is not or only slightly notched in the middle and the degree of notching can vary intraspecifically. In *Oiophysa* and *Peloridora* it is distinctly though variably emarginate and the ocular areas are carried forward, as on broad stalks, away from the paranota. In the *leai* group of *Hemiodoecus* the head is distinctly emarginate in *H. leai* and *H. wilsoni*, but the eyes are not carried forward, while in *H. veitchi* the condition approaches that in *Oiophysa*.

Reticulate branching, producing numerous small areolets, occurs in the paranota of the *fidelis* group of *Hemiodoecus*, but in *fidelis* at least it is highly variable (Evans, 1939) and in the simplest condition most of the "veins" are longitudinal and most of the areolae relatively large. Even in such instances, however, the number of "vein" branches is large (6 or more). In the *leai* group of *Hemiodoecus* and in *Peloridium* and *Peloridora* there are only 2 or 3 "veins". The condition

in *Xenophyes* and *Oiophysa* usually approaches the simplest type found in *fidelis*, with 3 to 5 main "veins" which may be variously branched and fused, enclosing a number of larger areolae and commonly also several small areolets. In this character the New Zealand genera are thus intermediate between the *leai* and *fidelis* groups. There is great intraspecific variability in the amount of branching, particularly in *X. cascus*, and occasionally in this species and *X. stewartensis* the veins are not branched at all. The "veins" are usually less branched and more parallel in *stewartensis* than in most *cascus*, but as has been noted this is not a constant difference between the two species. The extreme variability of this branching places it rather in the nature of a "tendency", shared by the two New Zealand genera and the *fidelis* group of *Hemiodoecus*. Again it is difficult to decide which is the more primitive condition for the family, and the considerations raised in discussing costal sinuation could well apply here. The fact that in the *fidelis* group alone reticulation also appears in the cephalic areolae, indicates that reticulated thickenings can arise secondarily and independently.

As seen from previous discussion, the Australian genus *Hemiodoecus* is divisible into two well marked species groups, the *leai* group, including *leai* China in Tasmania, *veitchi* Hacker in S.E. Queensland, and probably *wilsoni* Evans in Victoria, and the *fidelis* group, including *fidelis* Evans in Tasmania and *donnae* n. sp. in Victoria. The detailed structure of the terminalia of *H. wilsoni* is not yet known, but in the form of the head and the structure of the cephalic and paranotal areolae it accords with the *leai* group. The two groups differ in a number of abdominal and terminalia characters in both sexes (pp. 34, 35 and 36). The *fidelis* group also differs from the *leai* group in having the cephalic areolae reticulate, the paranota with more numerous veins and usually reticulate, and the head not strongly emarginate in front.

By analogy with the differences between *Oiophysa* and *Xenophyes*, those between the *leai* and *fidelis* species groups would justify the division of *Hemiodoecus*, as at present constituted, into two genera or at least subgenera. However, in such a small group as the Peloridiidae taxonomic splitting is not urgent, the elucidation of relationships being the main present interest.

In certain respects the *fidelis* group is structurally closer than is the *leai* group to the New Zealand genera, viz., the branched "venation" of the paranota, the only shallowly sinuate outer ventral margin of the first valvulae, and the minute processes at the sides of the posterior ventral prolongation of the pygophor. It is difficult to estimate to what extent these resemblances are significant of relationship or due to convergence. On the balance of evidence it seems likely that the *fidelis* group is a southern one originating in Tasmania, being separated at an early stage from the ancestors of the *leai* group on the mainland. On this hypothesis, at a later period of land-connection ancestral *leai* would have entered Tasmania and in comparatively recent times a *fidelis*-type population entered Victoria to diverge as *donnae*.

Hemiodoecus China

Hemiodoecus China, 1924, *Ent. mon Mag.* **60**: 199.
Type Species: *Hemiodoecus leai* China, 1924: 200-201

Fidelis SPECIES GROUP

Hemiodoecus donnae sp. n. (Figs. 1, 1a, 7-10, 17-20, 24, 28)

Subbrachypterous.—Length (to apex of tegmina): 3.3 mm., 3.5 mm. (2 males); 3.4 mm.,

3.8 mm. (2 females). Width of head across eyes: 1.27-1.30 mm. Width of pronotum across paranota: 1.70-1.87 mm. Width across tegmina: 1.97-2.17 mm.

Colour.—Head, pronotum and veins of tegmina ochraceous; head, pronotum and margins of veins more or less infuscated; head and pronotum with a more or less distinct pale median band. Antennal ridges black. Scutellum pale except at base. Cells of tegmina and areolae of head and paranota transparent, almost colourless; those of inner basal part of tegmina (beyond radius) brown. Eyes red or reddish brown. Legs and rostrum ochraceous, more or less rufescent, margins infuscated. Abdomen and venter of thorax reddish brown, more or less infuscated.

Head.—3.0–3.5 times as wide across eyes as long in middle (excluding "neck", which is variably retracted into prothorax); anterior margin shallowly but distinctly concavely emarginate in middle; postero-lateral margins (between eyes and base) concave, with a row of very short dark bristles, shortly removed from or touching anterior margins of paranota (depending on degree of retraction of head). Surface micro-punctate. The two areolae transverse, reticulate, ovate, narrowing towards eyes, each more than twice as wide as long (2.2-2.4), nearly 1/3 as wide as head (0.29-0.31) and about 2/5 as long as head. Post-areolar bar half or usually more than half as long as head in middle (0.50-0.58). Rostrum reaching base of abdomen. Clypeus not prominent. Antennae extending laterally to about half way across eyes. Body length (as above) more than eight times length of head (8.4-8.8).

Thorax.—*Pronotum* more than three times as wide across paranota as long in middle (3.5-3.7), 1.3-1.4 times as wide as head; anterior margin (between paranota) straight; posterior margin very shallowly and broadly concave. Shape of paranota as in *fidelis* Evans, except that the antero-lateral angles are more broadly rounded. Paranota reticulate, with numerous small areolets; margins with extremely short dark bristles. *Tegmina* with antero-lateral angles broadly rounded, not produced, costal margins thence nearly straight and parallel for about basal 3/5, thence convergent, not or only very shallowly sinuate, with extremely short bristles. Form and size and usually number of cells differing in the two tegmina; the veins behind radius margined with colourless punctures; 8-12 costal cells in the four specimens seen; 4-6 closed radial cells; radius closer to costa than in *fidelis* and costal cells thus narrower; costa continued beyond the last closed costal cell around the rather narrow apex. Maximum width across tegmina rather greater than width across paranota (1.1-1.2).

Abdomen.—In female about 1.4 times as wide as long between anterior margin of sternum III and apex of sternum VII (117 : 85). In male about 1.25 times as wide as long (112 : 90). Anal tube (segment X) covered with minute denticles and spine-like bristles; no pronounced dorsal swelling near base; in male subfusiform, about 2.25 times as long as wide, with both ends truncate; in female relatively narrow, subcylindrical, widened slightly at about 1/3 from apex, narrowing to truncate apex, about three times as long as wide (23 : 7.5). Segment XI long, narrow, tubular, connected with X by a short tube; both completely invaginable within anal tube. *Male Terminalia.*—Tergum VIII with posterior margin excavated in a broad U; width about 4.5 times median length (90 : 20); about 1.5 times as long as tergum VII (20 : 13). Sternum VIII with posterior margin slightly concave in middle; segment VIII below about 2.9 times as wide at base as long in middle (90 : 31), about 1.9 times as long as sternum VII (31 : 16). Pygophor with surface finely granular; considerably broadened posteriorly; sides shallowly biconcave; postero-lateral angles narrowly rounded, considerably produced backward and outward; posterior ventral margin produced in middle as a conspicuous lobe with rounded apex, and on each side of it a very small rounded projection; posterior dorsal margin emarginate so as to extend much less posteriorly than ventral margin, sinuate on each side, further excavated in middle with base of emargination nearly straight. Harpagones (claspers) and aedeagus very

similar to those of *fidelis*, but longer. Aedeagus sigmoidally curved; with two upwardly curved basal arms of about half its total length, their apices forming condylar articulations with a pair of small plates, which are also attached to the bases of the harpagones; apex of adeagus acute, spine-like, upwardly curved; at base of spine a pair of submembranous lateral processes, conjoined above and below; main stem of aedeagus with a strong longitudinal ventral groove. Harpagones large, symmetrical, bifurcated; the outer arms curved, rod-like, conspicuous, backwardly directed, nearly circular in cross-section, narrowing towards the rounded apex; inner arms closely applied to sides of anal tube, rather narrow as seen from above, flattened and plate-like from inner aspect; micropunctures toward base near junction of the two arms. *Female terminalia.*—Posterior margin of sternum VII shortly and rather narrowly produced in middle. Venter of segment VII about 2.4 times as wide across base as long in middle (105 : 43). Postero-lateral angles of tergum VIII shortly and narrowly produced. Posterior lateral extensions of segment IX large, triangular, laterally flattened plates, with apex in side view forming an angle of about 60° and more acute than in *fidelis*; both dorsal and ventral margins straight. Seen from side, ventral margin of outer wall of segment IX concave, angulate with base of posterior extension. Inner margin of first valvulae with only 6 or 7 strong, ventral, thorn-like teeth, restricted to basal half; outer margin only shallowly sinuate toward apex, with a saw-like row of about 28 teeth, much smaller than the inner row and extending to apex, the more apical ones scarcely decreasing in size. Ventral margin of second valvifers strongly excavated at base. Apex of third valvulae more broadly rounded than in *fidelis*. Second valvulae about 5.7 times as long as wide at base (60 : 10.5) dorsal margin without teeth, neither excavated nor angled before apex.

Locality of types. Holotype male, allotype female, paratypes (1 male, 1 female), Mt. Donna Buang, near Warburton, Victoria, Australia (18.i.1955, ex moss in mixed forest, including *Nothofagus*, T. E. Woodward). Holotype and allotype deposited in National Museum of Victoria, Melbourne, paratypes in Australian Museum, Sydney, and Dept. of Entomology, University of Queensland.

H. donnae is very closely related to the Tasmanian species, *H. fidelis* Evans. The two are very similar in the general form of the head pronotum and tegmina, the venation, and particularly in several characters by which they differ from all other known species of *Hemiodoecus*. These are the reticulate cephalic areolae, the numerous small areolae of the paranota, and the strongly bifurcated harpagones of the male. Except for those listed in the next paragraph, proportionate measurements fall within a range similar to that found in *fidelis*.

H. donnae differs from *fidelis* mainly in the following respects: head with anterior margin more distinctly and deeply incised in middle, shorter in proportion both to head width and to body length (in *fidelis*, head width is only 2.5-2.8 times head length and body length is less than eight times head length (7.0-7.7)); the post-areolar bars of the head rather longer in proportion to total head length (in *fidelis*, 0.44-0.50); the antero-lateral angles of the paranota broader; the costal areolae narrower; in male, the postero-lateral angles of the pygophor considerably more produced; the excavation of the posterior dorsal margin of the pygophor straight along its base (U-shaped in *fidelis*); abdominal tergum VIII of female with postero-lateral angles more shortly and narrowly produced; abdominal sternum VII of female with posterior margin more narrowly rounded in middle; the posterior lateral extensions of segment IX in female sharper at apex and their ventral (inner) margins straight, instead of concave; third valvulae of female more broadly rounded at apex.

Peloridiids in general display considerable intra-specific variability in number and shape of areolae and cells, and asymmetry in respect of these characters is common. Such variation in *H. donnae* has been indicated in the above description. Evans (1939: p. 148) has figured the range of variation met with in the paranotal areolae of *H. fidelis*. The paranota of the four available specimens of *donnae* are all of the reticulate type, none approaching the simpler condition shown in Evans's Fig. 7f, but it is not unlikely that such would be found on examination of a larger series. The range in number of tegminal cells is close to that in nine specimens of *fidelis* examined. These had 8-13 costal cells and 3-7 radial cells.

H. donnae is very distinct from the other described Victorian species of *Hemiodoecus*, *H. wilsoni* Evans, which was described from material collected at Beech Forest and since collected near Lorne (Evans, 1941). From the very close affinities of *donnae* and *fidelis*, it is evident that these two forms have diverged from a common stock in relatively recent times. Because of the flightless condition of these insects and their restricted habitat, it may be assumed that continuity of the ancestral population or movement of part of it between Tasmania and Victoria probably occurred during a quaternary period of land-connection between the two areas, perhaps that of the Pleistocene.

Hemiodoecus fidelis Evans (Figs. 2, 2a, 25)

Hemiodoecus fidelis Evans, 1937: 107-110, figs. 1-9 (incl. male terminalia, structure of head, notes on internals, habits, environment and nymphs). Evans, 1938: 1-3, 12-19; figs. 1-3 (morphology of head). Evans, 1939: 143-150; figs. 1-8 (morphology of thorax). Evans, 1941: 95-97 (general review, localities). China, 1955: 82, 84 (keyed out).

Adult.

Length (to apex of tegmina): 3.0-3.5 mm. (7 males); 3.4-3.6 mm. (2 females). Width of head across eyes: 1.08-1.33 mm. Width of pronotum across paranota: 1.50-1.87 mm. Width across tegmina: 1.63-2.10 mm.

The single male from the Crater Lake area is smaller than any of the other specimens, but does not differ significantly in any proportionate measurements. The figures for this male, with, in brackets, the minimum figures for the other specimens (in each instance of a male); length, 3.0 mm. (3.25 mm.); head width, 1.08 mm. (1.17 mm.); width across paranota, 1.50 mm. (1.60 mm.); width across tegmina, 1.63 mm. (1.78 mm.).

Characters in which *fidelis* resembles and differs from the closely related *donnae* are given on pp. 39-40. The pygophor and anal tube are illustrated in figs. 2 and 2a.

Localities.—Dove R., near Crater Lake, Cradle Mt. National Park, Tasmania (ex moss, beech (*Nothofagus*) forest, 21.ii.1955, 1 male, 1 nymph, T. E. Woodward). Mt. Wellington, Hobart, Tasmania (ex moss, rain forest with *Nothofagus*, near O'Grady's Falls, 19.i.1955, 6 males, 1 female, T. E. Woodward). Russell Falls, Mt. Field National Park, Tasmania (ex moss, rain forest with *Nothofagus*, 12.ii.1955, 1 female, T. E. Woodward).

Leai SPECIES GROUP

Hemiodoecus leai China (Figs. 3, 21)

Hemiodoecus leai China, 1924: 200-201; figs. A-E, 1927: 622-625; fig. f. Myers and China, 1929: 282-294; figs. 1-5 (morphology of skeletal structures, including terminalia; general relationships). China, 1932: 392-395; fig. a (habitat, distribution). Evans, 1939: 143, 145-149;

figs. 7h, 8d (thorax, venation). Evans, 1941: 95-96 (general review). China, 1955: 82, 84 (keyed out).

Adult.

Median length (to apex of tegmina): males, 3.03-3.33 mm.; females, 3.20-3.67 mm. Width of head across eyes: males, 1.18-1.37 mm. (av., 1.26 mm.); females, 1.23-1.43 mm. (av., 1.33 mm.). Width across base of paranota: males, 1.73-1.90 mm.; females, 1.73-2.03 mm. Width across tegmina: males, 1.82-2.00 mm.; females, 1.90-2.20 mm.

Venation.—As China noted in his description and showed in his figure, the number of costal cells is variable and frequently differs on the two tegmina of the same specimen. In the specimens examined the number varies between 6 and 11. Including a very narrow basal cell immediately inside the subcostal cell, there are usually 4 radial cells; 6 of the 44 tegmina have 5. On one side of one specimen M1+2 fuses for some distance with R before the apex, so that the outer part of cell 2 m is aligned with the radial series. All but one of these 22 specimens have 3 large areolae on each of the pronotal paranota, the other (a large female) having 4 on each, *i.e.*, with 3 complete cross-bars instead of the usual 2. One paranotum of another specimen shows an intermediate condition, with the second and third bars fused except at the apex, leaving a small submarginal areolet between them. This is the condition of both tegmina of China's type specimen. It is also the usual condition in *H. veitchi*, except that in this species the submarginal cell is usually larger.

Abdomen about 1.25-1.3 times as wide as long between anterior margin of sternum III and apex of sternum VII in female, VIII in male (115 : 92; 111 : 85). Segment III with antero-lateral angles narrowly rounded; anterior margin of sternum III nearly straight, not sinuate at sides, forming a rounded obtuse angle with inner ventral margin of antero-lateral projections. *Female.*—Postero-lateral projections of tergum VIII small, narrow, but rounded at apex, outer margin markedly concave. Posterior margin of sternum VII very weakly convex in middle. Venter of segment VII about 2.5 times as wide at base as long in middle (97 : 38). Segment IX, second valvifers and second and third valvulae with a covering of fine hairs. Seen from above, posterior part of mesial dorsal margin of segment IX distinctive in being produced backward as a rounded lobe; a deep excavation between this and base of postero-lateral extension. Ventral margin of outer wall of segment IX nearly straight in lateral view, only very shallowly sinuate; ventral margin of postero-lateral extension slightly notched at base. Inner margin of first valvulae with about 12 or 13 ventral teeth on basal 2/3, the more apical ones smaller; outer margin sinuate at apex, with a saw-like row of about 35 teeth extending to apex, the more apical ones not smaller, the row of teeth following a sinuate course near apex. In side view, ventral margin of second valvifers rather shallowly and broadly excavated at base. Third valvulae with ventral margins shallowly sinuate; apices rather narrowly rounded, down-curved. Second valvulae about 5.6 times as long as width at base (62 : 11); dorsal margin obtusely produced at about 2/5 from apex, not concave beyond this angle, but slightly sinuate just before apex. Anal tube long and narrow, subcylindrical, tapering slightly to truncated ends; no appreciable dorsal swelling.

Male.—Tergum VIII with postero-lateral angles very broad, scarcely produced back, apex approximating a somewhat rounded right angle; posterior margin excavated as a broad U; basal width: median length :: 77 : 20 (ratio 3.85); length: length of tergum VII :: 20 : 14 (ratio 1.43). Posterior margin of sternum VIII nearly straight between lateral angles. Posterior margin of sternum VII broadly concave. Venter of segment VIII, width at base: length in middle :: 75 : 26 (ratio 2.89); length: length of sternum VII :: 26 : 17 (ratio 1.53). Pygophor, anal tube and harpagones with longer and more conspicuous hairs than in other species of Peloridiidae examined. Pygophor: the two small processes laterad of the median ventral process

of the posterior margin, though much larger than in *fidelis* group, are much shorter and the apices much more rounded than in *veitchi*; the median ventral process narrow but less acuminate than in *veitchi*; the excavation in the middle of the concave posterior dorsal margin shallowly U-shaped. Harpagones laterally flattened but with apices narrowly rounded, not expanded. Aedeagus narrow, nearly straight in side view, not sigmoidally curved; apex bluntly rounded, not upwardly curved and produced into a spine. Anal tube widest near base, thence tapering toward apex; thus elongate ovate with ends truncate; dorsal surface swollen near base.

The male terminalia of *leai* have been figured in detail by Myers and China (1929; figs. 4, 5). In the present paper, therefore, the only figure shown is that of the dorsal aspect of the pygophor with the anal tube, claspers and aedeagus removed, for comparison with the other species dealt with. Abdominal and terminalia characteristics of the *leai* species group have been given above (pp. 34, 35, 36).

Localities.—Russell Falls, Mt. Field National Park, Tasmania (ex moss, rain forest, including *Nothofagus*, 12.ii.1955, 14 males, 6 females, 17 nymphs, T. E. Woodward). Mt. Wellington, Hobart, Tasmania (ex moss, rain forest with *Nothofagus*, near O'Grady's Falls, 29.i.1955, 2 males, 2 nymphs, T. E. Woodward).

Hemiodoecus veitchi Hacker (Figs. 22, 26)

Hemiodoecus veitchi Hacker, 1932: 262-263; pl. China, 1932: 392-395; fig. b (habitat, variability). Helmsing and China, 1937: 477-489; figs. 1-3 (ecology, life history, genitalia, localities). Evans, 1939: 143, 144. Evans, 1941: 95 (general review). China, 1955: 82, 84 (keyed out).

Helmsing and China (1937: 478-480) have described the relatively much drier conditions generally obtaining on Mt. Hobwee and nearby heights as contrasted with the wetter, more humid conditions in the Mt. Wanungara area, which is Hacker's type locality and that in which Helmsing later took large series of the species. Of the localities listed below, Mt. Wanungara also proved the best collecting area, and the relative dryness of Mt. Hobwee and Mt. Merino was noted. The dependence of Peloridiids on moss or lichens growing in continuously humid conditions is now widely attested in the literature. On a recent excursion to Lamington National Park (28-31.x.1955) the author collected and extracted moss and leaf mould from a number of other localities, in some of which *Nothofagus* was growing, in some not. No Peloridiidae were found. All the moss collected was wet or moist, but collection followed a period of heavy rain and for a large part of the year these areas are probably much drier. The areas included the main Coomera Gorge, a number of localities along the main Coomera Track and Dave's Creek Track, Lower Ballunjui Falls, Nagarijoon Falls, and Tallawallal. China (1955) notes that "it seems likely that Peloridiids pass uncongenial, rather dry periods by seeking shelter in leaf-mould." Such movement from the normal moss habitat may well account for the presence in leaf mould of the two specimens recorded below from Mt. Hobwee; at this time the mosses and the area generally were very dry.

Adult.

Median length (to apex of tegmina): males, 2.53-3.07 mm.; females, 2.67-3.10 mm. Width of head across eyes: males, 1.07-1.15 mm. (av., 1.12 mm.); females, 1.00-1.23 mm. (av., 1.15 mm.). Width across paranota: males, 1.40-1.70 mm.; females, 1.43-1.75 mm. Width across tegmina: males, 1.47-1.78 mm.; females, 1.50-1.90 mm.

Venation.—The outstanding peculiarity of the tegminal venation of this species is the fusion of R with C except at the base. This, however, is only an extreme instance of a tendency found in other Peloridiidae, the closeness of R to C varying considerably in different species. The effect is to restrict the costal cells to a basal group (outside the subcostal cell) and usually one small preapical cell, commonly in the form of a narrow slit where R and C have not completely fused. Less often the preapical cell is lacking (in 9 of 42 tegmina examined), and rarely there are two narrow cells (2 tegmina). The number of basal costal cells is most commonly 4 (20 tegmina) or 5 (14), less commonly 3 (5), 6 (2) or 7 (1). There are usually 4 or 5 radial cells, less commonly 6, rarely 7. The usual number of paranotal areolae is 4 (26 paranota), less often 3 (7) or 5 (9). In all these venational features asymmetry is common.

Abdomen in female about 1.6 times as wide as long between anterior margin of sternum III and apex of sternum VII (115 : 73), in male about 1.15 times as wide as long to apex of sternum VIII (107 : 92). Segment III with antero-lateral angles acute; anterior margin of sternum III nearly straight, not sinuate at sides, similar to *leai*. *Female.*—Postero-lateral projections of tergum VIII as in *leai*. Posterior margin of sternum VII broadly and not strongly convex in middle, but rather more prominently produced than in *leai*. Venter of segment VII about 2.4 times as wide at base as long in middle (103 : 43). Seen from above, posterior part of mesial dorsal margin of segment IX not produced backward as in *leai*; obtusely angled at junction with base of postero-lateral extension. In lateral view, ventral margin of outer wall of segment IX concave before base of posterior extension, forming a continuous sigmoidal curve with ventral margin of latter. Inner margin of first valvulae with about 11 or 12 ventral teeth on basal 2/3, the more spical ones smaller; outer margin markedly sigmoidally curved toward apex, with a saw-like row of about 30 teeth extending to apex, the more apical ones somewhat smaller, the row of teeth following a marked sigmoidal curve near apex. In side view, ventral margin of second valvifers excavated at base. Third valvulae similar to those of *leai*, except that apices are not down-curved. Second valvulae about 5.6 times as long as wide at base (61 : 11); dorsal margin obtusely produced at about 2/5 from apex, very shallowly concave beyond this angle. Anal tube long and narrow, subcylindrical, tapering only slightly to ends; a dorsal swelling near middle. *Male.*—Tergum VIII with postero-lateral angles more prominent and more narrowly rounded than in *leai*; posterior margin excavated in an even broader U than in *leai*; basal width: median length :: 81 : 19 (ratio 4.26); length: length of tergum VII :: 19 : 12.5 (ratio 1.38). Posterior margin of sternum VIII broadly and slightly convex between lateral projections. Posterior margin of sternum VII more narrowly and deeply concave than in *leai*. Venter of segment VIII relatively longer than in *leai*; width at base: length in middle :: 80 : 32 (ratio 2.50); length: length of sternum VII :: 32 : 16 (ratio 2.0). Pygophor: the two processes laterad of the median ventral process of the posterior margin considerably longer and more acuminate than in *leai*; the median process narrow, more acuminate than in *leai*; the excavation in the middle of the concave posterior dorsal margin more deeply U-shaped than in *leai*. Harpagones with apical half strongly flattened laterally, much expanded dorsally above level of basal half; dorsal margin between the two halves strongly concave; apical half with ventral and apical margins straight, dorsal margin convex. Aedeagus much broader than in *leai*, in side view nearly straight except at apex which is upcurved as a short spine; ventral membrane long and conspicuous. Anal tube widest about 1/3 from base; dorsal swelling at or a little beyond 1/3 from base.

The male terminalia have been figured in detail by Helmsing and China (1937: 485) and are therefore not illustrated in the present paper. The same authors (p. 486) have figured the intact female terminalia in dorsal and ventral aspects; in the present paper only isolated structures are shown. Additional abdominal features common to the *leai* species group have been described above (pp. 34, 35, 36).

Localities.—Lamington Plateau, S. Queensland: Mt. Hobwee, McPherson Range (leaf mould, beneath *Nothofagus*, 27.viii.1953, 1 male, 1 nymph, T. E. Woodward; moss and lichens, on and near *Nothofagus*, 7.x.1953, 1 male, 2 nymphs, T. E. Woodward; 31.x.1953 (similar habitat), 1 female, 17 nymphs, F. A. Perkins). Mt. Merino, McPherson Range (moss and lichens, on and near *Nothofagus*, 27.viii.1953, 1 female, 6 nymphs, T. E. Woodward). Mt. Wanungara, Cainbable Range (moss, on and near *Nothofagus*, 1.vi.1955, 9 males, 4 females, 25 nymphs, T. E. Woodward; 15.xi.1955 (similar habitat), 2 males, 2 females, 25 nymphs, L. Yeo). Border range, Springbrook (moss, ca. 3000 ft., 10.iv.1955, 1 nymph, T. E. Woodward).

Xenophyes Bergroth, 1924: 180.

Type species: *Xenophyes cascus* Bergroth, 1924.

Xenophyes cascus Bergroth (Figs. 4, 4a, 11-14b, 16, 30-32, 34-38)

Xenophyes cascus Bergroth, 1924: 180-181; fig. Myers, 1926: 465-468 (description of nymphs, habitat). China, 1927: 622, 623, 625; figs. d, e (adult and nymph figured). Myers and China, 1929: 291 (absence of scent-gland openings in nymph). China, 1932: 394 (reference to habitat). Evans, 1936: 102. Helmsing and China, 1937: 474-477 (historical review). Evans, 1939: 143, 146, 150, fig. 7g (venation of paranota). Evans, 1941: 95 (historical and general discussion). Drake and Salmon, 1948: 63-67; figs. 1, 2 (habitat, localities, comparison with *forsteri* n. sp. (see below)). Carter, 1950: 167-170; figs. 1-3 (localities, habitat; male and female terminalia; adult figured). Woodward, 1952: 183-184, 186-188 (localities, habitat; differences from *X. stewartensis* n. sp.). China, 1955: 82, 84 (historical review; keyed out; *X. forsteri* regarded as "almost certainly synonymous with *X. cascus* Bergroth.").

In an earlier paper (Woodward, 1952) the author considered that *X. cascus* Bergroth, *X. forsteri* D. & S., and the *Xenophyes* occurring on Coromandel Peninsula were probably three distinct though very close species. Individuals can be selected which do differ considerably in certain features. But with the much larger number of specimens now available, from a much greater range of localities, these differences are found to intergrade and the writer has been unable to find any set of correlated characters by which more than one species might be distinguished. It is concluded that, if two or more species are involved, they cannot be separated with certainty on a morphological basis. Thus, unless and until interbreeding experiments show otherwise, it is considered that *X. forsteri* is best regarded as a junior synonym of *X. cascus*. This conclusion had already been reached by China (1955, and some years earlier in a personal communication).

X. cascus, in this wide sense, is now known to range from the Coromandel Peninsula in the north to Stewart Island in the south. Like other Peloridiids, it is a considerably variable species in such features as width across head, pronotum and tegmina, venation, size and shape of tegmina, and the areolation of the paranota. There is also a considerable range in the number and size of the ventral teeth of the first pair of valvulae of the female and in the degree of convexity of the anterior margin of the head and the size of the median incision.

Adult.

Median length (to apex of tegmina); males, 2.47-3.19 mm.; females, 2.50-3.47 mm. Width of head across eyes: males, 1.07-1.29 mm.; females, 1.07-1.40 mm. Width across paranota: males, 1.47-1.88 mm.; females, 1.50-1.98 mm. Width across tegmina: males, 1.53-1.94 mm.; females, 1.60-2.13 mm.

Venation.—Number of costal areolae usually 8-11, less commonly 7, 12, or 13; sometimes an additional cell divided off internally. Radial cells 3 or 4, the narrow basal one commonly divided again by 2-6 cross-bars. Punctation reduced, distinct punctures confined to margins of 2A and extreme base of M. Brownish infuscation restricted to membrane of anal area and variously extending into base of median cell. Basal part of Cu1 often rather weak, running very closely parallel to Cu2+1A as far as apex of claval region, but not fused, leaving a very narrow, linear and often rather poorly defined cell between them, best developed apically, where the veins are more widely separated. Claval region reaching to about 1/3 of the way along posterior margin. Apical radial cell usually smaller than the preapical, but sometimes subequal, rarely larger. Venation in posterior median region usually reduced; usually a single median cell, the largest cell of the tegmen. Sometimes a more complete venation is retained and the median cell divided into two, rarely three. The development of the additional venation is very variable; some examples are shown in figs. 34-38. It may take the form of an extra longitudinal vein connecting the basal part of Cu1 to M well before the junction of the apex of Cu1 with M. At first sight this appears to be a branch of Cu1a, but at its extreme base is separate from the latter and arises from the base of M. It seems likely, therefore, that this vein is the true base of M3+4, which may become lost or fused in part to Cu1 (cf. the loss of the stems of M within the basal cell of Lepidoptera). This stem is fused basally to Cu1 in all other genera. Rarely in *cascus* the additional vein sends off a posterior branch to end on the apical part of Cu1, thus dividing the median cell into three. In a more reduced condition, there may be a short, pale, obscure vein apparently from base of M, and another from Cu1, the two meeting within the median cell but not bisecting it.

Abdomen about 1.1 to 1.2 times as wide as long between anterior margin of sternum III and apex of sternum VII in female, of sternum VIII in male (*e.g.*, 80 : 70). Segment III with antero-lateral angles broadly rounded; anterior margin of sternum III nearly straight, forming a rounded obtuse angle with inner margin of antero-lateral projections. *Female.*—Postero-lateral projections of tergum VIII narrower than in *Oiophysa*, apex rounded to subacute, variably produced. Posterior margin of sternum VII produced to a very variable extent in middle, less prominently so and much more broadly convex than in *Oiophysa*. Venter of segment VII about twice as wide at base as long in middle (70 : 34, 80 : 40). Seen from above, posterior part of mesial dorsal margin of segment IX deeply concave before base of posterior lateral extension. Viewed from side, ventral margin of outer wall of segment IX nearly straight or forming more or less of a concavity with base of posterior lateral extension; outer dorsal margin convex at base, thence straight to apex; posterior extension narrower (dorso-ventrally) than in *Oiophysa*, apex rather narrowly rounded to subacute. First valvulae with 12-19 ventral teeth on basal 2/3 of inner margin, apical 1/3 with smaller teeth or denticles; apical half of ventral surface with a scattering of teeth or denticles; outer margin not or scarcely sinuate toward apex, with a saw-like row of about 24 teeth extending to apex, the more apical ones not or scarcely smaller. In side view ventral margin of second valvifers evenly convex, basal half not excavated. Third valvulae with apices broad, truncate; ventral apical angle slightly down-turned; apical margin usually slightly concave in middle. Second valvulae about 3.2-3.3 times as long as wide at base (52 : 16, 44 : 13.5); dorsal margin with small teeth, concavely excavated before apex, not obtusely angled before the excavation. Anal tube short, widest near middle, more or less swollen dorsally near middle. *Male.*—Tergum VIII with postero-lateral angles rather narrow, well produced back; posterior margin broadly and variably convex; basal width about 3.7 times median length (62:17); about 1.6 times as long as tergum VII (17:11). Posterior margin of sternum VIII nearly straight, of sternum VII broadly concave. Venter of segment VIII about 2.6 times as wide at base as long in middle (62 : 24), about 2.4 times as long as sternum VII (24 : 10). Posterior ventral margin of pygophor with a single median process, which is short, broad at base, acute at apex; posterior dorsal margin excavated in a

deep U. Harpagones short, finger-like, not strongly flattened laterally; apical half bent inward at a rounded obtuse angle from basal half; dorsal and ventral margins shallowly sinuate; apex narrowed and rounded. Aedeagus broad, sigmoidally curved; apex widely rounded, not upcurved or spined; ventral membrane bifid at posterior apex, divided into a broad, ventral foot and a dorsal finger-like lobe. Anal tube broad, widest near base, tapered considerably to truncate apex, dorso-ventrally flattened with a dorsal swelling near base.

There is a tendency for the teeth and denticles of the first valvulae to be larger in specimens from the more southern parts of the South Island and from Stewart Island.

The undissected male and female terminalia have been figured by Carter (1950; 169, figs. 2, 3).

Eggs.

The female taken at L. Hankerson (23.ii.1953, G. Ramsay) contained two "ripe" eggs. These were ellipsoid; length 0.63 mm., 0.61 mm.; width 0.31 mm. The chorion had no apparent surface sculpture.

Localities of specimens examined.—The records listed are additional to those noted by the author (1952: 186-187) under the names of *X. cascus*, *X. forsteri* and *Xenophyes* sp. STEWART I.—Ulva (12.i.1951, 20 males, 19 females, 17 nymphs, G. Knox (C.M.)). SOUTH I.—Lake McArthur, Dusky Sound (ex moss, 30.iii.1953, 2 males, 3 nymphs, T. Riney (C.M.)). Lake Hankerson, Te Anau (leaf mould, 23.ii.1953, 1 male, 1 female, 1 nymph, G. W. Ramsay (C.M.)). Cascade Creek, Eglinton Valley (ex moss, 23.i.1951, 9 males, 5 females, 6 nymphs, R. R. Forster (C.M.); ex moss, 10.ii.1955, 9 males, 10 females, 1 nymph R. R. Forster (C.M.)). West of Lake Poteriteri, Otago (3,000-4,000 ft., 13.ii.1953, 1 female, G. W. Ramsay (D.M.)). Lake Poteriteri, Otago (ex moss and leaf mould: 9.ii.1953, 3 males, 2 nymphs; 14.ii.1953, 1 male, 1 female, 5 nymphs; G. W. Ramsay (D.M.)). Bruce Bay (10.i.1954, 2 males, 6 females, 2 nymphs, W. Clark (C.M.); leaf mould from boggy white-pine forest (*Podocarpus dacrydioides*), 27.i.1954, 1 male, J. T. Salmon (V.U.C.)). Alex Knob Track, Waiho (1,500 ft., 25.i.1954, 1 female, J. T. Salmon (V.U.C.)). Waiho Gorge (leaf mould and mosses, 26-27.i.1954, 2 males, J. T. Salmon (V.U.C.)). Okarito, Westland (moss, 7.xii.1949, 1 male, 1 female, R. R. Forster (C.M.)). Kanieri Saddle (Styx side), Southern Alps, Westland (21.xi.1952, 2 males, 2 females, 4 nymphs, J. S. Dugdale (C.M.)). Arthur's Pass (Rough Creek, ex moss, 28.viii.1954, 1 female, J. S. Dugdale (C.M.)). NORTH I.—Tararua Ranges (ex moss and lichen: below Field's Hut, 1.xii.1952, 2 males, 2 females, 2 nymphs; 8.xii.1952, 1 female, 1 nymph; just above Field's Hut, 3.xii.1952, 2 females; B. A. Holloway (D.M.)). Tararua Ranges (Totara Flats, moss and leaf mould, 19.vii.1953, 1 male, V. Stout (D.M.)). Mt. Egmont (Dawson's Falls: ex tree trunk, 12.xi.1945, 1 nymph, M. W. Carter (P.D.D.); leaf mould, subalpine forest, 3,100 ft., v.1954, 1 male, 1 nymph, M. P. Buchier (D.M.)). Mt. Egmont (northern slopes: ex *Psilopilum crispulum*, 21.iv.1946, 1 female, B. E. Molesworth (P.D.D.); ex moss, 7.iv.1947, 1 male, 1 nymph, M. W. Carter (P.D.D.); ex moss, 18.iv.1954, 2 males, 2 females, 1 nymph, D. V. Holloway (D.M.)).

Dr. J. G. Pendergrast, Zoology Dept., Auckland University College, has kindly sent me a male and two nymphs of this species taken during a collecting trip to Mt. Te Aroha by Dr. and Mrs. Pendergrast and Mr. J. S. Edwards (ex moss, *Nothofagus* forest, ca. 2,800 ft., iii.1956). I am much indebted to Dr. Pendergrast for the opportunity of seeing material from this new locality, which helps to bridge the gap in the known distribution between Coromandel and the S. Auckland area.

Xenophyes stewartensis Woodward (Figs. 5, 5a, 12, 12a)

Xenophyes stewartensis Woodward, 1952: 182-184; fig. 1.

China, 1955: 82-84 (keyed out).

Adult males.

Median length (to apex of tegmina): 2.83-3.07 mm. Width of head across eyes: 1.30-1.35 mm. Width across parantoa: 1.67-1.73 mm. Width across tegmina: 1.78-1.93 mm.

Venation.—Number of costal areolets about 10-15, usually indistinctly defined. R much closer to costal margin than in *cascus* and the costal veinlets thus much shorter, most of them usually poorly defined. Subcostal cell smaller than in *cascus*; cell 1r broader. Radial cells 3 or 4 (due to division of 1r or 2r); 2r, when undivided, much larger than 3r. The single median cell narrower (antero-posteriorly) than in *cascus*. Claval region longer than in *cascus*, reaching about ½ the way or more along posterior margin. Punctation as in *cascus*. Brown colouring extending from clavus into base of median cell. Cu1 and Cu2+1A separated by only one puncture-width.

The narrow costal area, with its relatively indistinct veins, is, together with the broad head, one of the easiest characters by which to distinguish this species from *cascus*. The general coloration is usually a darker brown than in *cascus*.

Abdomen (male) about 1.25 times as wide as long between anterior margin of sternum III and apex of sternum VIII (107 : 84). Segment III with antero-lateral angles and anterior margin similar to *X. cascus*. Tergum VIII with posterior margin straight, deeply excavated between the postero-lateral projections; relatively much shorter than in *cascus*, basal width about 5 times median length (82 : 16), about 1.3 times as long as tergum VII (16 : 12). Posterior margin of sternum VIII broadly and slightly convex. Posterior margin of sternum VII rather more narrowly concave in middle than in *cascus*. Venter of segment VIII relatively longer than in *cascus*, about 2.3 times as wide at base as long in middle (82 : 35), about 2.7 times as long as sternum VII (35 : 13). Pygophor broader than in *cascus*; posterior median process broader at base, less acute at apex; postero-lateral shoulders broader, less rounded, more truncate; posterior dorsal margin more broadly concave. Harpagones short and lobe-like as in *cascus*, but dorsal margin much more strongly concave, with a prominent dorso-lateral convexity on basal half; apex much more broadly rounded. Aedeagus differs markedly from that of *cascus* (which is similar to that of *Oiophysa*) in being linear, much narrower, somewhat flattened laterally, not sigmoidally curved, narrowly rounded though not spined or upcurved at apex, and having the ventral membrane not bifid at apex but expanded into a pair of lateral wings. Anal tube broad, dorso-ventrally compressed, with a dorsal swelling near base; differs from that of *cascus* in not being widened at base nor tapering strongly to apex; sides nearly parallel; apex broadly rounded.

Locality.—Since the single type male was described, 8 more males and 2 nymphs have come to hand from the type locality: Ulva, Stewart Island, New Zealand (ex leaf mould, 12.i.1951, G. Knox (C.M.)). Unfortunately the female is not yet known.

Oiophysa Drake and Salmon, 1950: 3-4

Type Species: *Oiophysa ablusa* Drake and Salmon, 1950: 4-5

Oiophysa fuscata Drake and Salmon

Oiophysa fuscata Drake and Salmon, 1950: 6-7; fig. 2. Woodward 1952: 186 (comparison with *O. distincta* n. sp.). China, 1955: 82, 84 (historical review, keyed out).

Oiophysa fuscata pendergrasti subsp. n. (Figs. 6, 6a, 13, 13a, 33)

This subspecies differs from typical *fuscata* and can be readily distinguished from it by the much more deeply incised anterior margin of the head, which has in the middle a pronounced U-shaped excavation. Thus the anterior "membrane" is only about half as long in the middle as at its longest point just outside the U. All three available specimens also have cell 2m of the tegmen much smaller. In typical *fuscata* this cell is considerably larger than either the apical radial cell or the main preapical radial cell (including any smaller subdivisions). In *pendergrasti* it is much smaller than the apical radial and subequal to or smaller than the preapical.

In other structural details of head, pronotum and tegmina the new subspecies resembles typical *fuscata*, although it is likely that when further material of the latter has been collected and dissected relatively minor differences will become apparent among the abdominal structures. The tegminal colour pattern, so distinctive of *fuscata*, is of the same type in its subspecies *pendergrasti*. All three specimens to hand are smaller than the holotype of *fuscata*, but until larger series are available it cannot be certain that size is a reliable criterion for separation.

Adult.

Median length (to apex of tegmina); 2.50-2.57 mm. Width of head across eyes: 1.10-1.12 mm. Width of pronotum: 1.37-1.40 mm. Width across tegmina: 1.48-1.55 mm.

There are 8-10 costal areolae; in one specimen there is an additional inner series of 2 on one tegmen and 1 on the other. Radial cells, 3-5. The irregular branching of the main "veins" of each of the pronotal paranota results in some 7-11 areolets of greatly varying size and shape.

Abdomen about 1.2-1.3 times as wide as long between anterior margin of sternum III and apex of sternum VII in female, of sternum VIII in male (female, 86 : 87; male, 83 : 67). Segment III with antero-lateral angles broadly rounded; anterior margin of sternum III nearly straight, forming a rounded obtuse angle with inner ventral margin of antero-lateral projections. *Female.*—Postero-lateral projections of tergum VIII broad, not strongly produced back; apex rounded; outer margin straight. Posterior margin of sternum VII subacutely produced in middle. Venter of segment VII about 2.3 times as wide at base as long in middle (76 : 33). Seen from above, posterior part of mesial dorsal margin of segment IX deeply and widely concave before base of posterior lateral extension. Viewed from side, ventral margin of outer wall of segment IX only very slightly incised before base of posterior lateral extension; dorsal part of posterior extension much smaller than in *O. distincta* and its dorsal margin forming a straight line with outer dorsal margin of rest of segment. First valvulae with about 16 ventral teeth on basal 2/3 of inner margin, apical 1/3 with much smaller denticles; apical 1/2 of ventral surface with a scattering of minute denticles; outer margin scarcely sinuate toward apex, with a saw-like row of about 30 teeth extending to near apex, where smaller. In side view ventral margin of second valvifers nearly evenly convex, basal half not excavated. Third valvulae with apices broad, subtruncate. Second valvulae about 4.3 times as long as wide at base (47 : 11); dorsal margin with very short teeth, concavely excavated before apex, not angled before the excavation. Anal tube short subfusiform, widest in middle, with slight dorsal swelling near middle. *Male.*—Tergum VIII with postero-lateral angles broader and less produced backward than in *O. distincta*; posterior margin not deeply excavated, distinctly convex in middle; basal width; median length :: 61 : 16.5 (ratio 3.70); length: length of tergum VII :: 16.5 : 12 (ratio 1.38). Posterior margin of sternum VIII nearly straight between lateral projections. Posterior margin of sternum VII broadly concave.

Venter of segment VIII, width at base: length in middle :: 61 : 24 (ratio 2.54); length: length of sternum VII :: 24 : 10 (ratio 2.40). Posterior margin of pygophor with a single median ventral process, which is short, broad at base, not narrowly acuminate though subacute at apex; posterior dorsal margin excavated in a deep U. Harpagones short, lobe-like, not strongly flattened laterally; apical half bent inward with a rounded obtuse angle from basal half; dorsal and ventral margins shallowly sinuate; apex rounded, not expanded. Aedeagus short and broad, sigmoidally curved; apex widely rounded, not upcurved or spined; with a large subapical ventral sac. Anal tube short, stout, ovate with ends truncated, widest toward base, thence narrowing considerably to apex; dorsally swollen at base.

Locality.—Coromandel Peninsula, N.I., New Zealand; on ridge leading to Little Moehau (ex moss, *Weinmannia* forest, 24.x.1954, 2 males, 1 female, 1 nymph, J. G. Pendergrast).

Types.—Holotype male deposited in Auckland Museum; allotype female in Dominion Museum, Wellington; paratype male in Department of Entomology, University of Queensland.

Discussion.—The type of *Oiophysa fuscata* was taken by Dr. Salmon on lichens inside a cave on the Mt. Arthur Tableland, Nelson, South Island. The discovery of a closely related form by Dr. Pendergrast at the northernmost limit for Peloridiidae in New Zealand was somewhat surprising. The two forms seem to represent relict populations of a once more widely distributed species. The moist, high altitude requirements of these bugs and their inability to fly has resulted in a discontinuous distribution comparable in many ways to that seen in the separation of a land mass into an archipelago of islands. To my knowledge this is only the second time that Peloridiids have been searched for in the Coromandel area. In contrast, the southern half of the North Island has been much more intensively collected in those areas and in those ways which would be expected to yield Peloridiidae, and it seems rather unlikely that *O. fuscata* now occurs in this intermediate zone. For this reason, and because the morphological differences between the two forms, though distinctive, are few, the Coromandel form has been considered to fulfil the requirements of a geographical race and therefore designated as a subspecies. There are, of course, numerous examples of species which are very close morphologically; whether *fuscata* and *pendergrasti* are such forms could be determined only by attempts at interbreeding.

Xenophyes cascus has also been collected in the Moehau area, but this species occurs throughout New Zealand in all regions where Peloridiids have been found. As would be expected, this wide distribution has resulted in considerable morphological variation, but not to the extent of producing recognisable geographical races. Apparently, from time to time, sufficient "gene flow" has been possible to prevent this. In contrast, the reduction of the *fuscata* populations to two widely separated areas has made such exchange impossible.

Oiophysa distincta Woodward (Figs. 15, 15a, 23, 27, 29)

Oiophysa distincta Woodward, 1952: 184-186; fig. 2. China, 1955: 82, 84 (keyed out; relationship to *Peloridora kuscheli* n. sp. from S. Chile).

This species was described from a single female taken by Dr. Forster at Caswell Sound, in the S.W. of the South Island of New Zealand. The additional material since collected by Dr. Forster has extended the known distribution further

inland in the same general area and has enabled a more detailed description to be made of certain structures, particularly the abdomen and terminalia of both sexes.

Adult.

Median length (to apex of tegmina): males, 2.77-3.03 mm. (av., 2.88 mm.); females, 2.93-3.17 mm. (av., 3.05 mm.). Width of head across eyes: males, 1.22-1.32 mm. (av., 1.28 mm.); females, 1.30-1.38 mm. (av., 1.33 mm.). Width across paranota: males, 1.48-1.73 mm.; females, 1.70-1.78 mm. Width across tegmina: males, 1.88-2.07 mm.; females, 2.07-2.20 mm.

The Lake Te Au specimens are all larger than the holotype, but whether or not size is correlated with locality is uncertain until the collection of further material. There are no structural differences.

Venation.—Number of costal areolae usually 8-11, rarely 7 or 12; sometimes an additional inner series of 1 or 2 cells. Usually 4 radial cells, less commonly 3 or 5. About 5-9 areolets on each paranotum, variable in size and shape, formed by the irregular branching of the main "veins". All these features commonly differ on the two sides.

Abdomen about 1.15-1.25 times as wide as long between anterior margin of sternum III and apex of sternum VII in female, of sternum VIII in male (females, 100 : 88; 102 : 84; male, 97 : 77). Segment III with antero-lateral angles broadly rounded; anterior margin of sternum III as in *fuscata*. *Female.*—Postero-lateral projections of tergum VIII with apex rounded; narrower and more produced than in *fuscata*. Posterior margin of sternum VII more roundly and rather more prominently produced in middle than in *fuscata*. Venter of segment VII relatively longer than in *fuscata*; about 2.15 times as wide at base as long in middle (90 : 42). Segment IX with posterior part of mesial dorsal margin as in *fuscata*; outer ventral margin, viewed from side, shortly but rather more strongly incised than in *fuscata* before base of posterior lateral extension; dorsal part of extension much larger than in *fuscata*, and outer dorsal margin of segment convex, obtusely rounded beyond middle. First and third valvulae and second valvifers similar to those of *fuscata*. Second valvulae about 4 times as long as wide at base (58 : 14); dorsal margin as in *fuscata*. Anal tube short, stout, subfusiform, with no pronounced dorsal swelling. *Male.*—Tergum VIII with postero-lateral angles narrower and more produced back than in *fuscata*; posterior margin as in *fuscata*; basal width: median length :: 66 : 17.5 (ratio 3.85); length: length of tergum VII :: 17.5 : 13 (ratio 1.35). Posterior margins of sterna VII and VIII as in *fuscata*. Venter of segment VIII, width at base: length in middle :: 66 : 25 (ratio 2.64); length: length of sternum VII :: 25 : 11 (ratio 2.27). Pygophor with posterior median process as in *fuscata* except that apex is rather more acute; posterior dorsal margin as in *fuscata*. Harpagones similar in form to those of *fuscata* except that apices are more narrowly rounded. Aedeagus as in *fuscata*. Anal tube short, stout, ovate with ends truncated, widest near basal 1/3, narrowing less strongly to apex than in *fuscata*; dorsally swollen at base.

Localities.—Lake Te Au, near south arm of Lake Anau, South Island, New Zealand (12-24.i.1953, 10 males, 7 females, R. R. Forster (C.M.)).

Specimens are to be deposited in the Canterbury Museum, Christchurch, the Dominion Museum, Wellington, the Auckland Museum, the Australian Museum, Sydney, and the British Museum (Nat. Hist.).

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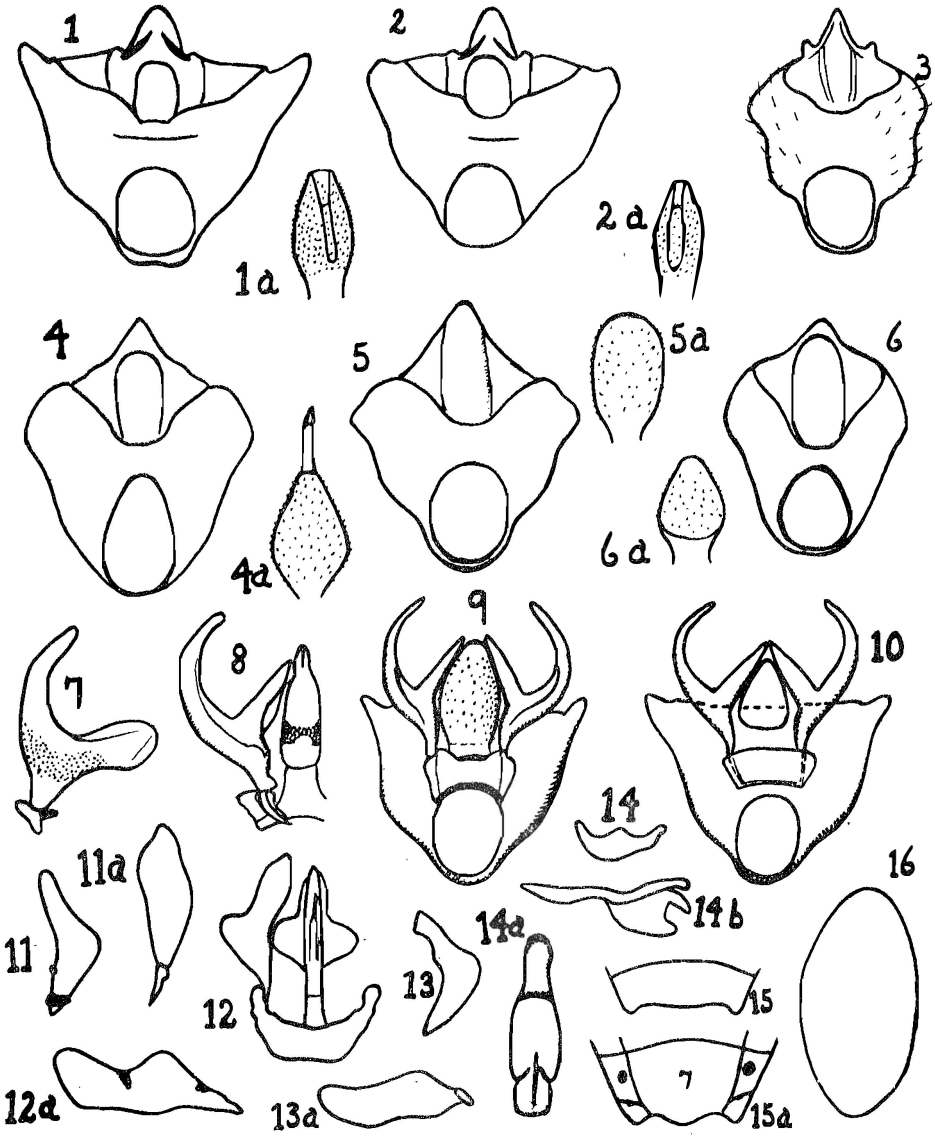


FIGS. 1-6—pygophor of male, dorsal: 1, *Hemiodoecus donnae* sp n.; 2, *Hemiodoecus fidelis* Evans; 3, *Hemiodoecus leai* China; 4, *Xenophyes cascus* Bergroth; 5, *Xenophyes stewartensis* Woodward; 6, *Oiophysa fuscata* Drake & Salmon *pendergrasti* subsp. n.

FIGS. 1a-6a.—anal tube of male, dorsal (segment XI inverted in 1a, 2a, everted in 4a): 1a, *H. donnae*; 2a, *H. fidelis*; 4a, *X. cascus*; 5a, *X. stewartensis*; 6a, *O. fuscata pendergrasti*.

FIGS. 7-10.—male terminalia of *H. donnae*: 7, right clasper, inner aspect, with basal sclerite for attachment to basal plate and aedeagus; 8, aedeagus, right clasper and basal sclerite, dorsal; 9, pygophor, anal tube and claspers, dorsal; 10, pygophor and claspers, ventral.

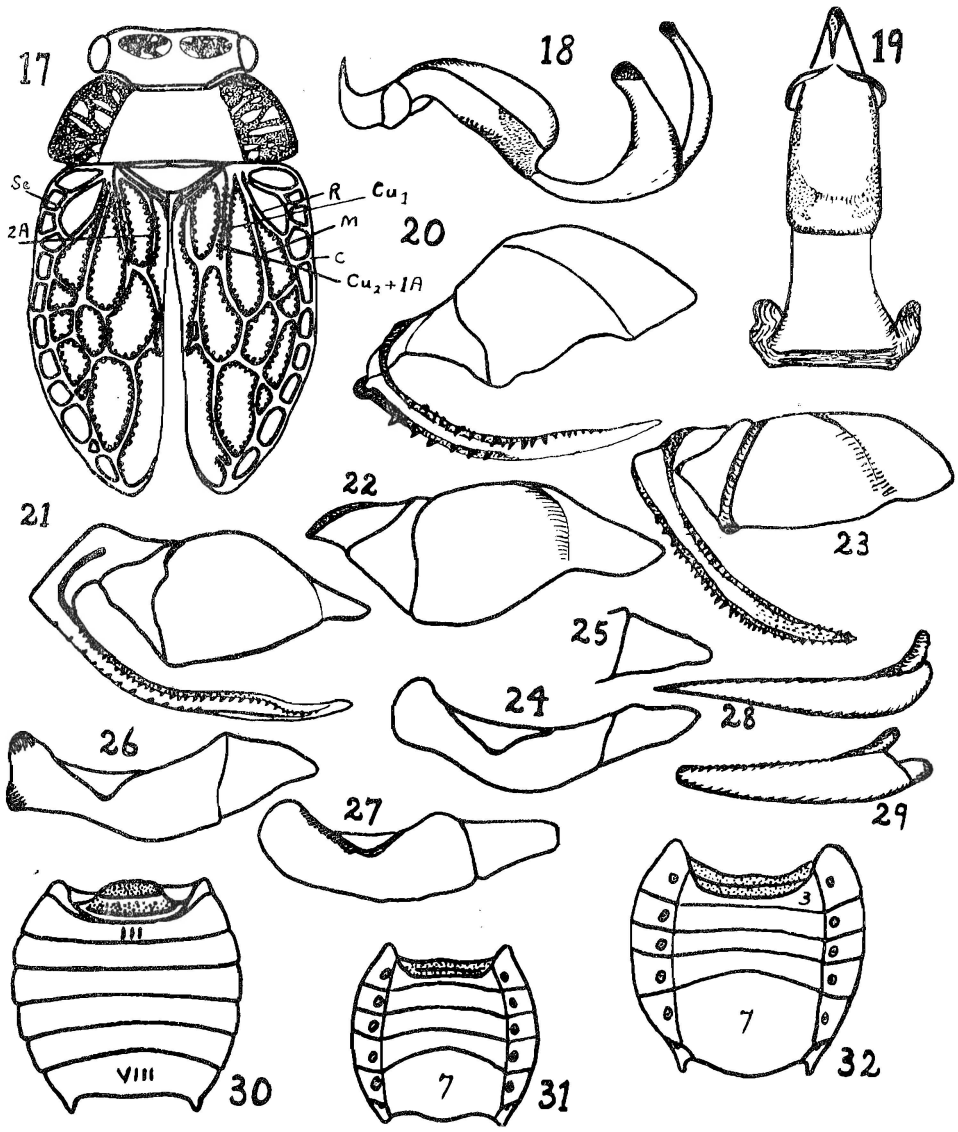
FIGS. 11, 11a, 14, 14a, 14b.—*X. cascus*, male: 11, left clasper, dorsal (apex uppermost); 11a, right clasper, lateral, with basal sclerite for attachment to basal plate; 14, right basal plate, lateral (apex to left); 14a, aedeagus, dorsal; 14b, aedeagus, lateral (apex to right).

FIGS. 12, 12a.—*X. stewartensis*, male: 12, aedeagus, basal plates and right clasper, dorsal; 12a, right clasper, lateral (apex to left).

FIGS. 13, 13a.—*O. fuscata pendergrasti*, male: 13, left clasper, dorsal (apex uppermost), 13a, right clasper, lateral.

FIGS. 15, 15a.—*O. distincta*, female: 15, 8th abdominal tergum; 15a, 7th abdominal sternum and connexiva of segments VII and VIII.

FIG. 16.—*X. cascus*, egg.



FIGS. 17-19.—*Hemiodoecus donnae*, male: 17, dorsal; 18, aedeagus and basal plates, lateral; 19, aedeagus and basal plates, dorsal.

FIGS. 20-23.—9th abdominal segment of female and left first valvifer and first valvula, lateral: 20, *H. donnae*; 21, *H. leai*; 22, *H. veitchi* (first valvula not shown); 23, *Oiophysa distincta.*

FIGS. 24-27.—left second valvifer and third valvula, lateral: 24, *H. donnae*; 25, *H. fidelis* (apex only); 26, *H. veitchi*; 27, *Oiophysa distincta.*

FIGS. 28, 29.—left second valvula, inner aspect: 28, *H. donnae*; 29, *O. distincta.*

FIGS. 30-32.—*Xenophyes cascus*, female, abdomen with terminalia removed: 30, dorsal; 31, 32, ventral aspect of two specimens.

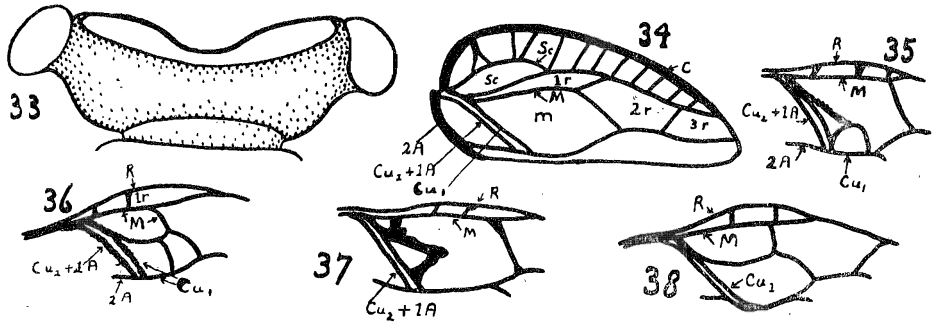


FIG. 33.—*O. fuscata pendergrasti*, male: head, dorsal

FIGS. 34-38.—*X. cascus*, venation of tegmen, to show variation in posterior median region