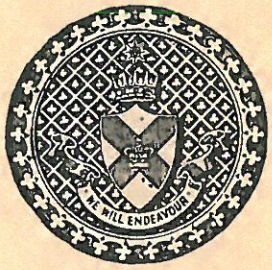
PROCEEDINGS

OF THE

ROYAL IRISH ACADEMY

VOLUME XXXV

SECTION B.—BIOLOGICAL, GEOLOGICAL, AND CHEMICAL SCIENCE.



DUBLIN: HODGES, FIGGIS, & CO.

LONDON: WILLIAMS & NORGATE

1919–1920

VII.

THE ACARINA OF THE SEASHORE.

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(Plates XXI–XXIII.)

Read May 10. Published July 28, 1920.

Introduction.

The object of this paper is to record a section of the work recently carried out by Mr. R. Southern, of the Irish Fisheries Branch, and myself on the fauna of the intertidal area. This work was mainly ecological, an attempt being made to study the associations of littoral forms, and for this reason it was necessary to examine a large number of "stations" in the various zones of the shore affected by the tides.

Meanwhile results of systematic importance were obtained in at least one group of animals, namely, the Acarina, or mites, which with the insects form an interesting element of the intertidal fauna. It is necessary to describe a number of new forms which have apparently escaped notice up to the present time. For this reason it seems advisable to report on these results, and so make a preliminary use of the large number of field observations which are now available.

The localities selected for examination are the rocky shore at Malahide and the adjoining estuary on the Dublin coast, and Ardfry, at the north-eastern extremity of Galway Bay, on the west coast of Ireland. At the first-mentioned place the work was greatly facilitated by the action of the Royal Irish Academy in lending us the hut bequeathed to the Academy by the late Mr. R. J. Usher, M.R.I.A.

The establishing of this hut on a suitable part of the shore at Malahide enabled us to explore the intertidal area fairly thoroughly during favourable tides, and without this help the work would have been much more difficult. During a short visit in the early part of June, 1916, to the Marine Laboratory maintained at Ardfry by the Fisheries Branch of the Department of Agriculture and Technical Instruction investigations of the littoral fauna were made on lines comparable to those in progress at Malahide.

A short experience of this kind of shore-collecting soon convinced us that some form of sub-division of the intertidal area would be a great help towards

a more exact study of the fauna. It was finally decided to adopt as a preliminary sub-division the zones occupied by certain lichens and seaweeds. Where there is sufficient foothold for the dominant plants these zones are usually present, and succeed each other as well-defined bands on the seashore. Beginning at the top and descending, the zones occur in the following order:

The Orange Lichen zone (species of *Physcia*, *Lecanora*, &c.).
The Pelvetia zone (*Pelvetia canaliculata* dominant).
The Spiralis zone (*Fucus spiralis* dominant).
The Vesiculosus zone (*Fucus vesiculosus* dominant).
The Serratus zone (*Fucus serratus* dominant).

The two uppermost zones were the most thoroughly examined, partly on account of their interest as a meeting-place of many terrestrial and maritime forms, and also their accessibility as less frequently covered by the tides. They represent approximately the part of the shore lying between high neap and high spring tides; and it follows that during the period of neap tides these two zones may be left uncovered for days; for this reason they are frequently almost dry, and the animals occurring therein must be capable of withstanding conditions varying from time to time within a wide range.

The Orange Lichen zone is bounded seawards by the Pelvetia zone. The landward limit is vaguely defined by the extreme range of the maritime species and the occurrence of purely terrestrial forms. In practice, however, there is usually little difficulty in demarcating it. The width of the various zones depends chiefly on the slope of the shore seawards. The more sheltered the coast, the more clearly they are defined.

Apart from descriptions of single species, the Acarina of the seashore have been but little studied, and such papers as have appeared on the subject are of limited scope. Excluding the family Halacaridae or marine mites, the following papers are noteworthy, as they contain references to the great majority of the intertidal Acarina. The numbers refer to the bibliography at end of this paper:—Barrois (1), Berlese and Trouessart (20), Brady (21, 22), Halbert (25), Hull (26), King (27), Laboulbène (30), Lohmann (32, 34), Michael (36, 37), Moniez (38), Tietze (46), Topsent and Trouessart (47), Trägardh (50), Trouessart (53).

The first paper in which an attempt is made to deal comprehensively with littoral species is that of Moniez (38) on the mites and insects observed by him on the seashore at Boulogne; with the exception of a few unnamed varieties the paper refers to previously known species. In 1889 Berlese and Trouessart published a joint paper (20) containing the original descriptions of six of our most characteristic shore mites. Ten years later Tietze 46 made observations on a few species found on the Venetian coast, and his paper

may be found incorporated in Canestrini's well-known "Prospetto" (23). King has published an account of four species of Acarina found on the coast at Millport, in the Firth of Clyde, with some interesting observations on their life-histories. During the recent Clare Island survey a good deal of attention was given to the littoral Acarina of the Mayo Coast, and some new forms were brought to light (25). Mr. R. Southern has already published a very useful analysis of the large amount of shore-collecting carried out during this survey, more especially from the ecological standpoint (R.I.A. XXXI.). A recent paper by Hull (26) contains a number of intertidal species found in the Tyne Province and elsewhere in the North of England.

The species included in the following list are such as can be reasonably considered as habitual denizens of the intertidal area. I am aware that many other species found in the vicinity of high-water mark might have been included, more especially in the families Oribatidae and Trombidiidae, but for the present it seems best to include only such species as appear to live in places directly affected by the tides. A few of the mites recorded in this paper, such as *Gamasus longicornis* Berl., the two species of Alicus, and some Oribatids, require verification as inhabitants of the intertidal area.

The question then arises—are these intertidal species specially modified to suit their peculiar mode of life? An examination of the genera represented shows that a fair percentage of them are characteristic of the shore, and when this is the case they are represented by but few, sometimes only one species, such are Halolaelaps, Hydrogamasus, Thinozercon, and others. Yet although these genera and species often possess peculiarities in the structure of their dorsal and ventral plates and in other characters, it cannot be said that they exhibit any striking modifications to suit them for even a semi-aquatic life. For instance, it is in the breathing organs that we should expect to find modification, but as far as one can judge these organs are not exceptional in the intertidal species. On the other hand, the possession of a smooth shining epidermis or a covering of fine hairs, to protect the creatures from wet surfaces would be of great use, for the reasons given below, and these are characters which the majority of them possess: in common, however, with a great many purely terrestrial species. A modification in the form of the tarsi and ambulacra certainly does occur in a few genera (Hydrolaelaps and others), and we find a similar change in these structures in certain species of the terrestrial Acari which frequent very wet places (25) away from the seashore.

It was at first believed that these intertidal mites lived freely on the shore, and on the approach of the tides betook themselves to crannies and

fissures, where there was sufficient air to support them during the time their haunts are covered with water. But a little observation of the creatures soon proves that this is an erroneous idea. It is quite true that the more active mites (Rhyncholophus, Bdella, &c.,) may often be seen moving about freely on the shore at low tides, more especially during bright weather, and they must necessarily seek retreats to protect themselves from the tides. Yet their habitual dwelling-places are in the sheltered spots, such as crevices, rock-fissures, and under embedded stones, as anyone who has collected these animals can easily observe. These habitats are always such as have been for long undisturbed, and where air is imprisoned during high tides, and there the mites and their associates are found even in places that have not been covered by water for several days, as in the Pelvetia and Orange Lichen zones. Indeed, a boulder for long embedded in sandy mud, or a flaking rock, often presents an interesting sight on being disturbed. It will be noticed that, although covered twice a day by the tides, the freshly exposed surfaces are not saturated with water, but are just moist, or in the higher zones fairly dry, and in the favoured places are peopled by a variety of insects, mites, and other animals. There may be found large colonies of the common shore springtail *Anurida maritima*, with myriads of their cast skins in a dry condition, and attendant predaceous mites, beetles (Aepus, Diglotta, Mieralymma), and false scorpions (*Obisium maritimum*).

Higher up on the shore in the gravel, sand, and shell association, at about high-water mark, Acarina are often found in places where there are no such retreats, but in this case the mites are only occasionally wet or sprayed, by the spring tides, and are evidently quite at home in their habitat. Comparatively few species have succeeded in establishing themselves here, though they may be numerous enough in individuals.

A glance at the table (p. 111) giving the zonal distribution of the intertidal Acarina makes it clear that the number of species becomes suddenly much less below the Orange Lichen zone, and in order to understand this it must be remembered that this zone is normally not covered by water for a large proportion of the tide-cycles. Apparently a majority of the species have not succeeded in penetrating lower than this zone, and, as might be expected, they are largely such as are not confined to an intertidal habitat; this applies in particular to the family Oribatidae. This is also a less marked falling-off below the Pelvetia zone, and here again there is less flooding than in the case of the lower zones, which are normally covered by the two daily tides. The list contains seventy-seven species, and of these (excluding the Halacaridae) we find that about twelve species range from the Orange Lichen down to the Serratus, and in a few cases even to the Laminaria zones. In the localities

examined three species were found only in the two lowest zones—namely, *Halolaelaps glabriusculus*, *Hydrogamasus littoralis*, and *Eupodes variegatus* var. *halophilus* nov.; the adult of *Cyrthydrolaelaps hirtus* Berlese was found in these zones, though its nymphal form is abundant on the higher part of the shore. No doubt these species, as well as others in the list, will be found to have a wider range when additional localities have been examined.

As already stated, these zonings are the result of observations carried out on the stretch of limestone rocks at Malahide. At Ardfry the shore is not rocky, at least in the localities examined; there the species were found chiefly under embedded stones in places where the botanical zones are present. The unmarked species are such as were found amongst stones and decaying seaweeds, or in estuaries, where the zones are more or less obliterated. Some estuarine species occurring on muddy flats are also found on the Orange Lichen zone of the open seashore.

Less attention was given to the Halacaridae, or marine mites, than to the terrestrial families; only the species noted on the rocky shore at Malahide are mentioned. Of these, *Agave brevipalpis* Trouess. occurred in a small pool in the Pelvetia zone (July, 1917); it does not seem to have been recorded from British shores, though it is known to occur on the French coast of the English Channel. The single representative of the Hydrachnidae, or fresh-water mites, found during our shore work is a widely spread form, *Eylais hamata* Koenike: a few specimens occurred in fresh and brackish pools in the bed of the Broadmeadow Water in the Malahide Estuary. These two families are included only at the end of the zonal list.

As regards the systematic result of our work, seventy-seven species of intertidal Acarina are recorded in this paper, and they are distributed in the following groups:—Gamasoidea, 28 species; Oribatoidea, 17 species; Sarcoptoidea, 2 species; Trombidioidea, 30 species. It is necessary to describe a new genus (Thinoseius), twelve new species, and three new varieties of known species. In order to make the list as complete as possible, such species as have been found in other localities besides Malahide and Ardfry, recorded or otherwise, are included, notably those found during the recent Clare Island Survey (25). It is anticipated that at some future date an account of the intertidal fauna of the Malahide and Ardfry areas from the purely ecological point of view will be published.

It is with pleasure I acknowledge my indebtedness to our leading European Acarologist, Dr. A. Berlese, of Florence, who has given me most valuable help in the identification of new and little known forms.

A complete set of the new forms described in this paper is deposited in the National Museum, Dublin.

LIST OF SPECIES, AND THE ZONES IN WHICH THEY ARE FOUND.

	Orange Lichen Zone.	Pelvetia Zone.	Spiralis Zone.	Vesiculosus Zone.	Serratus Zone.
GAMASOIDEA.					
Cyrthydrolaelaps hirtus *Berl.*,	—	—	Sp	V	Se
Gamasolaelaps aurantiacus *Berl.*,	O	—	—	—	—
Rhodacarus roseus var. pallidus *Hull*,	O	P	Sp	—	—
Halolaelaps glabriusculus *Berl. et Trouess.*,	—	—	—	V	Se
Halolaelaps celticus *Halbt.*,	—	—	—	—	—
Gamasellus inermis sp. nov.,	O	P	—	—	—
Gamasus Kempersi *Oudms.*,	O	P	—	—	—
Gamasus lunaris *Oudms.*,	O	—	—	—	—
Gamasus coleoptratorum (*L.*),	O	—	—	—	—
Gamasus immanis *Berl.*,	O	—	—	—	—
Gamasus Trouessarti *Berl.*,	O	P	Sp	V	Se
Gamasus crassipes var. longicornis *Berl.*,	O	—	—	—	—
Gamasoides spinipes (*C. L. Koch*),	O	—	—	—	—
Hydrogamasus littoralis (*G. et R. Can.*),	—	—	—	V	Se
Hydrogamasus Giardi (*Berl. et Trouess.*),	—	P	Sp	V	Se
Pachylaelaps littoralis *Halbt.*,	—	P	Sp	V	—
Macrocheles marginatus var. littoralis (*Halbt.*),	O	—	—	—	—
Laelaps dentatus sp. nov.,	O	P	Sp	V	—
Episeius grandis (*Berl.*),	—	—	—	—	—
Lasioseius salinus sp. nov.,	—	—	—	—	—
Lasioseius fucicola sp. nov.,	O	—	—	—	—
Thinoseius Berlesii gen. et sp. nov.,	O	—	—	—	—
Thinozercon Michaeli *Halbt.*,	O	P	—	—	—
Phaulocylliba littoralis (*Trouess.*),	—	P	Sp	V	—
Phaulodinychus repletus *Berl.*,	O	—	—	—	—
Phaulodinychus orchestiidarum (*Barrois*),	—	P	Sp	V	Se
Trachyuropoda minor (*Halbt.*),	O	P	—	—	—
Dinychus sp.,	O	—	—	—	—
ORIBATOIDEA.					
Oribata setosa *C. L. Koch*,	O	—	—	—	—
Oribata quadricornuta *Michael*,	O	—	—	—	—

LIST OF SPECIES, AND THE ZONES IN WHICH THEY ARE FOUND—*continued.*

	Orange Lichen Zone.	Pelvetia Zone.	Spiralis Zone.	Vesiculosus Zone.	Serratus Zone.
ORIBATOIDEA—*continued.*					
Oribata quadrivertex sp. nov.,	O	—	—	—	—
Oribata avenifera *Michael*,	O	P	—	—	—
Oribata Lucasii *Nicolet*,	—	—	—	—	—
Oribata parmeliae *Michael*,	O	—	—	—	—
Oribatula similis *Michael*,	O	—	—	—	—
Oribatula venusta *Berl*,	O	—	—	—	—
Oribatula saxicola sp. nov.,	O	—	—	—	—
Scutovertex bilineatus *Michael*,	O	P	—	—	—
Scutovertex Spoodi *Oudms.*,	O	P	Sp	—	—
Scutovertex corrugatus *Michael*,	—	—	—	—	—
Scutovertex maculatus *Michael*,	O	—	—	—	—
Scutovertex perforatus *Berl*,	—	—	—	—	—
Hermannia scabra *L. Koch*,	O	P	—	—	—
Hermannia reticulata *Thor.*,	O	—	—	—	—
Nothrus invenustus *Michael*,	O	—	—	—	—
SARCOPTOIDEA.					
Tyroglyphus littoralis sp. nov.,	—	—	—	—	—
Hyadesia fusca *Lohm*,	O	P	Sp	—	—
TROMBIDOIDEA.					
Lasiotydaeus brevistylus sp. nov.,	O	P	—	—	—
Rhagidia halophila *Lab.*,	O	P	Sp	V	Se
Eupodes variegatus var. halophilus nov.,	—	—	—	V	Se
Chromotydaeus ovatus (*C. L. Koch*),	O	P	Sp	V	—
Halotydaeus hydrodromus *Berl. et Trouess.*,	—	P	Sp	V	Se
Alicus oblongus sp. nov.,	O	—	—	—	—
Alicus latus sp. nov.,	O	—	—	—	—
Nanorchestes amphibius *Tops. et Trouess.*,	O	P	Sp	—	—
Bdella littoralis *L.*,	O	P	Sp	V	—
Bdella decipiens *Thor*,	O	P	Sp	V	—
Cyta latirostris *Herm.* [illegible] *C. L. Koch*,	O	P	[illegible]	—	—
Rhaphignathus scutatus sp. nov.,	O	P	—	—	—

LIST OF SPECIES, AND THE ZONES IN WHICH THEY ARE FOUND—*continued.*

	Orange Lichen Zone.	Pelvetia Zone.	Spiralis Zone.	Vesiculosus Zone.	Serratus Zone.
TROMBIDOIDEA—*continued.*					
Stigmaeus rhodomelas var. fissuricola nov.,	O	P	—	—	—
Rhyncholophus araneoides (*Berl.*),	O	—	—	—	—
Rhyncholophus Passerinii (*Berl.*),	O	P	—	—	—
Rhyncholophus rubripes *Berl. et Trouess.*,	O	P	—	—	—
Rhyncholophus tardus *Halbt.*,	—	—	—	—	—
Microtrombidium pusillum var. major nov.,	O	—	—	—	—
[1] Eylais hamata *Koenike*,	—	—	—	—	—
Rhombognathus setosus (*Lohm.*),	—	—	—	—	—
Rhombognathus notops (*Gosse*),	—	—	—	—	—
Rhombognathus pascens (*Lohm.*),	—	—	—	—	—
Rhombognathus seahami (*Hodge*),	—	—	—	—	—
Agaue brevipalpis *Trouess.*,	—	—	—	—	—
Halacarus actenus *Trouess.*,	—	—	—	—	—
Halacarus Basteri (*Johnst.*),	—	—	—	—	—
Halacarus oculatus *Hodge*,	—	—	—	—	—
Halacarus rhodostigma *Gosse*,	—	—	—	—	—
Halacarus tabellio *Trouess.*,	—	—	—	—	—
Halacarus Fabricii *Lohm.*,	—	—	—	—	—

Localities.—Malahide, Howth, Baldoyle, and Dollymount, on the coast of Co. Dublin. Ardfry, on the Galway coast. Westport and Mulranny, on the Mayo coast. Lough Hyne, Co. Cork.

Order ACARINA.

Sub-Order GAMASOIDEA.

Family **GAMASIDAE.**

Cyrthydrolaelaps hirtus Berl.

1899 *Gamasus sp.* Tietze **23**, p. 948; **46**. 1904 Berlese **8**, p. 19. 1915 Halbert **25**, p. 60. 1918 Hull **26**, p. 77.

A characteristic shore species occurring from the Pelvetia down to the Serratus zone. At Malahide it lives between limestone flakes, usually where

[1] The families Hydrachnidae and Halacaridae are included here merely for convenience of reference. The latter occur chiefly in rock pools.

there is a layer of damp sandy mud; occasionally seen running on the rocks at low tides. I have found adult and late nymphal forms well below tide marks in the Vesiculosus and Serratus zones; on the other hand, the early nymphal form (protonymph) occurs commonly on the upper parts of the intertidal area, usually in the Pelvetia zone. At Ardfry it occurred under stones resting on mud, June.

First described by Tietze (23) as an unnamed species of *Gamasus*, his figures leave no doubt that the species dealt with is the present one; subsequently described by Berlese from specimens collected by Trouessart on the coast at Finisterre. Both sexes, the protonymph and the *nympha coleoptrata*, are described in 25.

Gamasolaelaps excisus (L. Koch).

1879 *Seius excisus* L. Koch 22, p. 122. 1903 *Cyrtolaelaps* (?) *aurantiacus* Berlese 7a, p. 241. 1906 *Gamasolaelaps aurantiacus* Berlese 11, p. 101. 1915 Halbert 25, p. 58. 1918 Hull 26, p. 77.

The *nympha coleoptrata* form of this species occurred on the Mayo Coast at Westport and Mulrannny in July and September. The adult female was found under stones in a brackish place, a little above high-water mark, at Howth in September (25). The species has not been found since in Ireland, but I believe the localities are such as would correspond to the Orange Lichen zone.

There can scarcely be any doubt that this is the mite described and figured by L. Koch as *Seius excisus* (29), therefore the species is recorded as above.

Rhodacarus Oudms.

In his "New List of Dutch Acari" (43, p. 48) Oudemans described a very interesting acarid—Rhodacarus—and established a new sub-family for its reception. His chief reasons for doing so are that the genital aperture of the male is situated *in* the sternal shield instead of *on* its front margin, and the chelicerae are without appendages in both sexes. He also comments on the position and structure of the female genital foramen, and the division of the body into two distinct regions, "a true thorax and a true abdomen."

The occurrence of *Rhodacarus roseus* in Ireland has already been recorded (25, p. 81), and I have recently found a varietal form of it living in rock-fissures on the seashore at Malahide. Dr. Oudemans found the type in Holland amongst decaying leaves, and the Irish specimens occurred in a similar habitat in marshy places at Glendalough and in the Tolka valley, near Dublin.

In the male the genital foramen (Pl. XXI, fig. 1b) would at first sight appear placed at some distance from the front margin of the sternum, but a

closer examination makes it clear that the part of the sternum in front of the genital foramen is weakly chitinized, and is formed by a uniting and enlargement of the jugular plates. The genital foramen lies in the thickly chitinized margin of the true sternal shield, where it is fused with the jugular area, so that the position of the foramen is quite normal. With regard to the armature of the male chelicerae, it seems to me that the chitinous swelling at the outer side of each free chela represents the modified male appendages; it is absent from the female. The position of the female foramen is rather further back than is usual in the Gamasidae, but its position is really much as in certain other genera, such as in Gamasellus. A more important point, which is not referred to in the original description of Rhodacarus, is the presence of a small conical plate between the genital and sternal shields. It is placed immediately in front of the genital shield, as it possibly represents the fused paragynial plates.

Rhodacarus roseus, Oudms.

A few specimens found between damp flakes at the top of the Orange Lichen zone at Malahide are apparently identical with the typical form. Lower down, in the intertidal area, it is replaced by a variety which is, I believe, the same as the form recently described as a new species by Hull (**26**).

Var. **pallidus** Hull. (Pl. XXI, fig. 1 a, b.)

The original description is as follows:—"Translucent white, with the appendages tinted with brown. Considerably larger than *roseus*. Epistome with a simple acute tapering process without terminal plume or basal teeth; otherwise resembling *roseus*. West Allendale, under deeply embedded stones with *Pergamasus hamatus*. I have seen two males only" (**26**, p. 57). The length of the male is given as 440μ.

In the Irish specimens the measurements are: in the female (fig. 1 a), length about 550μ, breadth, 220μ; in the male, 518μ and 230μ, so that, as well as being considerably larger, it is also relatively narrower than the type form for which Oudemans gives the following measurements: length of female, 490μ; of male, 385μ. The colour is white tinged with pink, lyrate organs brown, and the mouth parts of a deeper brown. The legs are decidedly longer; those of the female are about 550μ, 330μ, 300μ, and 450μ respectively. The long median spine of the epistome is minutely spiculate at its apex, and there are one or two pairs of small finely pointed teeth close to the base; possibly the presence of these characters was overlooked in the original specimens. The armature of the tarsi appear to differ in the sexes; in

the male and female of the typical form the ambulacra and claws are missing from the first pair of legs, while in the variety fairly well-developed claws are present in the female, though they are absent or rudimentary in the male.

Habitat. The variety *pallidus* Hull occurs at Malahide in the Orange Lichen, Pelvetia, and Spiralis zones, usually between limestone flakes where there is some sandy mud, in from almost dry to moist situations. The dates of capture range from March to October.

Halolaelaps glabriusculus Berlese et Trouessart.

1877 *Gamasus* [illegible] Brady 21, p. 307. 1889 Berlese et Trouessart 20, p. 2. 1890 *Zercon curtus* Moniez 38, p. 13. 1902 *Parasites marinus* Oudemans 41, p. 281. 1906 Berlese 11, p. 109. 1914 King 27, p. 135. 1915 Halbert 25, p. 56. 1918 Hull 26, p. 77.

A characteristic species in the lower zones of the intertidal area. I have usually found it in crevices in between limestone flakes in the Vesiculosus and Serratus zones at Malahide. It may also be found under stones on estuarine and non-rocky shores, as at Ardfry and Westport in the West of Ireland.

Halolaelaps celticus Halbt.

1915 Halbert 25, p. 57. 1918 Hull 26, p. 77.

Found under stones just below high-water mark on the seashore at Westport July, 1911. It is very abundant at Howth in a similar habitat amongst decaying seaweeds September 1913. I did not succeed in finding it on the rocky shore at Malahide. Hull has recorded it from the Tyne province (26).

Gamasellus Berlese.

The genus Gamasellus was first established as a sub-genus of Cyrtolaelaps by Berlese in the supplement (3, p. 61) to his Monograph on Italian mites (2). No type species was specially indicated, though four species are referred to the new sub-genus, of these it is necessary to select *Gamasellus fulvipes* (G. et R. Can.) as the type of Gamasellus. The reason for this selection is that all of the four species are not congeneric, and Berlese makes it quite clear in a later reference (9) that Gamasellus is intended to include those species in which the sternal and ventro-anal plates are united in the male; such is the case in *Gamasellus fulvipes*, a good figure of which will be found in (2, Fasc. LXIII, n. 4).

The four species originally referred to Gamasellus are *G. fulvipes* (G. et R. Can.) *G. spiraeus* (G. et R. Can.), *G. capitatus* Berlese, and *G. cornutus*

Kramer. The two first-mentioned species are congeneric, but the others are evidently to be referred to Dendrolaelaps Halbt., described in 1915 (25, p. 68), with *D. Oudemansi* as the type-species. In the male of this genus the sternum is separated from the ventro-anal shield, and the latter is fused with the second dorsal plate. The chelicerae carry long processes, and the second legs are very stout, the tarsi being armed with a spur. Dr. Berlese has since raised Gamasellus to generic rank, and has established a new sub-genus as follows :—Digamasellus, "Characteres generis Gamasellus, sed scuto maris sternale ab anale distincto. Species typica. *G. perpusillus*" (9, p. 234). It would seem that a new species of Gamasellus found on the rocky shore at Malahide is to be referred to the sub-genus Digamasellus. At first I had some doubt on this point, but Dr. Berlese has seen specimens of both sexes, and refers them to this sub-genus, notwithstanding the fact that the second legs are unarmed on the male, while in the type species (*D. perpusillus*) they are armed; therefore the present species is exceptional in this respect.

Gamasellus inermis sp. nov. (Pl. XXI, fig. 2 a, d.)

An active orange-coloured species, which lives in fissures and between flakes on the seashore. *Female* (fig. 2 a): length, 470μ; breadth, 264μ; colour a shining orange; immature specimen yellowish. Body of the usual gamasoid shape, with three double rows of short hairs. Dorsal plates of almost equal breadth; the truncated posterior margin of the second plate reaches end of abdomen, and carries a pair of large pores (fig. 2 b). Sternum long, with bow-shaped front, and truncate end margins, sides deeply incised. Jugular plates absent, at least as separate plates; metasternal plates rudimentary, position indicated by paired hairs. Genital plate laelaptoid, longer than broad; a pair of hairs on the side margins. Ventro-anal shield large, flattened on its front margin, and it reaches the end of the body in some specimens. Inguinal shields are present, and there are also three or four pairs of very minute plates. Endopodial plates rod-like. Peritreme strongly sinuate, poststigmatic end partly encircling last pair of legs.

Capitulum quadrate, epistome with three short spines, maxillary lobes acute, and placed well in advance of the palp articulations. Free chela armed with two strong teeth, fixed chela with two teeth, and a smaller one placed near extremity. Palps (length 125μ) of normal structure, the second and third segments armed on their inner sides with a strong spine. Legs rather long and stout, with sparse hairs; the approximate lengths are 340μ, 286μ, 242μ, 298μ.

Male: Considerably smaller than the female, with which it agrees in the structure of the dorsal plate, peritreme, pedal plate, and other characters.

Length, 374μ; breadth, 130μ. Anterior part of the sternum (fig. 2 e) like that of female, but the plate is much longer, widening into a wedge-shape at the end margin of the fourth acetabula. Genital foramen large, with a thick chitinous border; sternal hairs, five. Ventro-anal plate very large, its flattened front margin lying close to the sternum, and the posterior margin reaching end of body.

Chelicerae (fig. 2 d) minute and curved; fixed chela with one strong tooth and a sinuate chitinous process rising from its base; length about twice that of the chela. In its natural position, as seen from below, the process points inwards and downwards, apex hooked. Free chela with one strong central tooth and two small teeth close to the apex of the segment. Legs as in the female; second pair a little stouter than the others; unarmed.

Habitat.—An undoubtedly intertidal species occurring in the Orange Lichen and Pelvetia zones at Malahide. It lives in fissures and between flakes in from dry to moist places where there is little silt, occasionally in spots that have not been covered by the tides for several days. The sexes appear to occur in about equal numbers, and females with eggs were collected in February and September, the earliest and latest months in which the species was noticed.

Gamasus Kempersi Oudms.

1902 Oudemans **43**, p. 26. 1906 Berlese **11**, p. 143. 1915 Halbert **25**, p. 49. 1918 Hull **26**, p. 83.

A species characteristic of the high-water mark level. It is often abundant there under stones and seaweed and amongst moist, shelly sand and gravel, in places where there are usually few other species of mites. On the rocky Malahide shore I did not find it below the Pelvetia zone, though it probably does occur in the lower zones. Also found in the Westport district, and very generally on the Dublin coast. The dates of capture range from February to November.

Gamasus lunaris Oudms.

1882 *Gamasus rubescens* G. et R. Can. "Gamasi Ital.," p. 42. 1892 *G. rubescens* Berlese **2**, Fasc. LXIX, n. 9. 1903 *G. rubescens* Oudemans **41**, p. 78. 1906 *G. lunaris* Berlese **11**, p. 147. 1915 Halbert **25**, p. 50. 1918 Hull **26**, p. 83.

Found under decaying seaweeds washed by the tides into the Orange Lichen zone at Malahide, August, 1915. It was found under similar conditions on the seashore at Westport. Possibly not a regular denizen of the intertidal area.

Gamasus coleoptratorum L.

The female of this common European species occurred under stones resting on sand, gravel, and shells in the Orange Lichen zone at Malahide, June, 1916. The nymph was also found, commonly under decaying refuse lying on the rocks in the same zone, May, 1918, and on Westport shore in September.

Gamasus immanis Berl.

1903 Berlese **7b**, p. 262. 1906 Berlese **11**, p. 179. 1915 Halbert **25**, p. 50. 1918 Hull **26**, p. 85. 1914 King **27**, p. 129.

This fine acarid, the largest of our native Gamasidae, was first recorded as a British species by King, who has published some interesting observations on its life-history (**27**). Subsequently I met with it on the coasts of Dublin, Mayo, and Cork (**25**) under stones, amongst shingle, and in decaying seaweeds at high-water mark. It has also been found at Ardfry under limestone boulders resting on damp sandy mud in the Orange Lichen zone, June, 1916.

Gamasus Trouessarti Berl.

1889 *Gamasus thalassinus* Berl. et Trouess. **20**. 1889 *G. fucorum* var. β **38**, p. 156. 1892 *G. Trouessarti* Berlese **3**, p. 67. 1915 Halbert **25**, p. 51. 1918 Hull **26**, p. 85.

An abundant and characteristic shore species, occurring in a variety of habitats, from the Orange Lichen down to the Serratus zone, as at Malahide and Ardfry. On the lower part of the shore it occurs chiefly in crevices and rock fissures, and under stones embedded in mud. It is often abundant under decaying seaweed at high-water mark, and I have found the adults and nymphs in the sand, gravel, and shell association, and in estuaries on the Dublin coast.

Gamasus crassipes L. var. longicornis Berl.

Under stones and decaying seaweeds at Ardfry, June. A common and widely distributed form, possibly not a regular inhabitant of the intertidal shore.

Gamasoides spinipes (C. L. Koch).

1844 *Gamasus spinipes* C. L. Koch **28**, Fasc. 39, fig. 18. 1885 *G. brachiosus* G. Can. **23**, p. 79. 1890 *Poecilochirus spinipes* Oudemans **44**, p. 134. 1892 *P. spinipes* Berlese **2**, Fasc. LXIX, n. 4. 1906 *Gamasoides spinipes* Berlese **11**, p. 288.

These are some of the more important references to this peculiar form, which is known only in the *nympha coleoptrata* stage, and it may yet prove

referable to some known species. Shore of oyster pond at Ardfry, in the Orange Lichen and Pelvetia zones, under stones on muddy soil in a spot flooded at high tides, June, 1916. At Mulranny it was found under stones on the shore, and also in old nests of Puffins and Black-backed Gulls on The Bill Rocks, off the coast of Mayo, June.

Hydrogamasus littoralis (G. et R. Can.). Pl. XXI. fig. 3.)

1851 ? *Gamasus salinus* Laboulbène **30**, p. 297. 1851 ? *Gamasus littoralis* Laboulbène **30** p. 298. 1885 *Gamasus littoralis* G. et R. Can. **23** p. 72. 1889 *Gamasus littoralis* Moniez **38** p. 186. 1892 *Hydrogamasus littoralis* Berlese **2** Fasc. LXVIII, n. 6. 1902 *Hydrogamasus salinus* Oudemans **41** p. 286.

In the above-quoted references it will be seen that Oudemans has revived "*salinus*" as the correct specific name for the present species, arguing that the mite figured by Laboulbène as "*Gamasus salinus*" is the nymphal stage of *H. littoralis* (G. et R. Can.) and he also refers to the similarity between the original figure of "*Gamasus salinus*" and Berlese's figure (2) of the nymph of the present species. Doubtless Laboulbène was dealing with a nymphal form of Hydrogamasus but there are at least three littoral species in this genus, and there is some uncertainty concerning the exact species dealt with by the French author. In a case of this kind it seems best to adhere to the first undoubted description of the species, which is that of the Italian authors, G. and R. Canestrini.

During our work at Malahide I was fortunate in finding what are apparently the protonymphal and deutonymphal forms of *H. littoralis*; they occurred on three occasions in the Vesiculosus and Serratus zones in company with the adult form. In the *protonymph* (fig. 3) the primitive arrangement of the dermal plates is well shown. It will be remembered that the adult Hydrogamasus has the entire dorsum protected by a strongly chitinized shield. In the protonymph there are two large dorsal shields, and between these there are no less than four pairs of very small plates; there are also three pairs of small plates on each side of the first shield. The second dorsal shield is placed at the extremity of the body, and it is continuous with the small anal plate on the ventral surface. The sternum is of the usual V-shape. The length is 640μ breadth 370μ.

The *deutonymph* (length 768μ breadth 460μ) occurred with the adults in October. In this form there are the usual two dorsal shields; the first of these is the larger, resembling that of the protonymph, except that the sides, from the humeral to the posterior corners, are parallel; the former are well

marked, and carry a long bristle. Second shield nearly as broad as the first, strongly narrowed to the end margin, which is straight, with a pair of long bristles, and on the inner side of these a pair of very short hairs. The hair armature of the dorsal surface is much as in the protonymph. Anal plate small, placed at end of body, and carrying two pairs of long hairs, and a terminal spine. This is the *nympha coleoptrata* form.

HABITAT.—A species of the lower intertidal area, occurring between limestone flakes and in crevices in the Vesiculosus and Serratus zones at Malahide. At Ardfry it was also found in these zones under boulders partly embedded in sandy mud and in moist places. Adults and nymphal forms were observed both in the summer and autumn months.

Hydrogamasus Giardi (Berl. et Trouess.). (Pl. XXI, fig. 4.)

1889 *Scius Giardi* Berlese et Trouessart **20**. 1889 *Gamasus Giardi* Moniez **38**, p. 193. 1892 *Hydrogamasus Giardi* Berlese **3**, p. 72. 1915 Halbert **25**, p. 65.

This species is found on a wider range of the shore than the preceding, occurring freely from the Pelvetia down to the Serratus zones on the rocky shore at Malahide, usually in crevices and between flakes in from moist to wet places. At Ardfry it occurred in the corresponding zones under boulders resting on sandy mud. The sexes are almost equally abundant, and the dates of capture range from April to October.

Frequently found in company with *H. littoralis* on the lower part of the shore. The two species are structurally very much alike, but they may be separated by the following characters:—

Hydrogamasus littoralis, larger; length of female, about 940μ; breadth, 560μ; length of male, 922μ; colour paler; form more oval; hairs of dorsum relatively longer. Fissure separating dorsum from anal shield reaching the end margin of body.

Hydrogamasus Giardi, smaller; length of female, 640μ; breadth, 312μ; length of male, 563μ; colour much darker; body hairs shorter. Fissure not reaching end margin of body.

The supposed difference in the fusion or otherwise of the anal and dorsal plates in these two species does not occur (**3**). As a matter of fact, these plates are fused at their end margins in both species. A figure of the male chelicerae of *H. Giardi* is given (Pl. I, fig. 4); those of *H. littoralis* are very similar.

Two other species of Hydrogamasus have been described, i.e., *H. Silvestrii* Berlese (**6**), from the Italian coast (Portici), and *H. antarcticus*, Träg., from Paulet Island.

Pachylaelaps littoralis Halbt. (Pl. XXI, fig. 5 a, d.)

1915 Halbert **25**, p. 64.

This species was described from the male found under embedded stones well below high-water mark in Bellacragher Bay, on the Mayo Coast, in September, 1913. As only a single specimen occurred, there was doubt as to whether the species is a true denizen of the intertidal zone. While at Ardfry in June, 1916, females of a Pachylaelaps, which are evidently to be referred to the present species, were met with in the Pelvetia and Spiralis zones.

Female (fig. 5 a): Length, 844μ; breadth, 460μ. Shape and hair armature as in the male (fig. 5 c), which it also resembles in the structure of the palps, legs, peritreme, and other organs. Colour, pale yellow. Sternum of the usual shape, end corners reaching to the fourth acetabula; hinder margin concave; the space between this and the genital plate is weakly chitinized. The genital plate is large, pointed in front, and evenly rounded behind, though occasionally somewhat truncate. Anal plate broader than long (breadth, 140μ; length, 120μ; extremity strigose. Peritreme enclosed in a plate forming a narrow margin on its outer side; end of plate acuminate, reaching well beyond the middle of ventral plate. All these plates are reticulate and punctured.

Maxillary plate narrow, with two pairs of long hairs on front margin and two shorter proximal pairs; maxillary lobes straight and very long, reaching end of hypostome. Epistome with about eight spines, some branched. Each chela armed with one strong tooth. Legs, second pair stout (length about 410μ), segment two, with a small conical tooth. The armature of the tarsus is figured (fig. 5 b).

The *male* of this species has a broad dagger-like process on the free chelicerae, and the femur of the second legs carries a stout conical spur (fig. 5 d).

Habitat.—Found on the shore of Mweeloon Bay, Ardfry, under stones on gravel and sandy mud in the Pelvetia and Vesiculosus zones, June, 1916.

Tietze records the occurrence of a single specimen of *Pachylaelaps pectinifer*, which he found under stones on the seashore at Venice (**46**).

Macrocheles marginatus, var. **littoralis** (Halbt.).

1915 *Holostaspis marginatus*, var. *littoralis*, Halbert **25**, p. 67.

The variety was described from females and an immature male found on the seashore at Westport. It has also occurred at Malahide under stones and refuse in the Orange Lichen zone, and at Ardfry under stones resting on mud in the same zone. It seems a rather common form at the high-water level.

Family **LAELAPTIDAE**.

Laelaps dentatus sp. nov. (Pl. XXI, fig. 6 a, c.)

A species remarkable for its very elongate shape, the dentate anterior corners of the sternum, and the armature of the last pair of legs in the male. The female resembles that of *L. oblongus* Halbt. (**25**), but is narrower and more elongate, and the peritreme is not joined with the pedal plates. The ventral plates also are differently formed. *Female* (fig. 6 a): Size rather variable, averaging about 660μ in length, and 360μ in breadth. Shape, elongate oval, with slightly marked shoulders, and the colour is yellowish, with darker lyrate organs. Dorsal shield large, very minutely punctured, and with indistinct scale-like markings; side margin even. There are four double rows of hairs; frontal bristles small. Sternum large, its rounded end margin reaching the third acetabula; front margin sinuate towards the corners. Jugular plates well developed, placed on a thinner and larger chitinous base. Tritosternum small and narrow, springing from a slightly crescentic basal piece, at each side of which is a chitinous piece. Genito-ventral shield very long and broad, gradually widening to beyond middle, and then narrowing to end margin, which is straight; four pairs of hairs. Metasternal plates very minute. Anal plate triangular, broader than long, front margin as broad as and lying close to margin of preceding shield. The metapodial plate encloses last pair of acetabula, beyond which it projects on a pointed lobe. Inguinal plates linear. Peritreme curved inwards towards the extremity, and it lies free of the metapodial shield.

Maxillary plate quadrate, four pairs of hairs; lobes straight. Epistome convex, armed with small sharp teeth. Fixed chela with four teeth, two of which are terminal. Legs long and robust; the lengths are about 616μ, 418μ, 384μ, and 550μ.

Male (fig. 6 b) considerably smaller than female, varying from 480μ to 550μ in length, and in breadth from 240μ to 280μ. Ventral shield of usual shape, almost reaching end of body, reticulate, with a double row of nine median hairs. The anterior side margins of the sternal part are distinctly dentate (fig. 6c). Each chela is armed with a strong triangular tooth; the fixed one is strongly arched. The male appendage (fig. 6 d) projects by about half its length beyond the apex of the segment, slightly sinuate, and bent upwards at the extremity. Palps of usual type. Legs, lengths about 528μ, 440μ, 330μ, and 528μ; second pair a little stouter than the others, outer margin of third segment (fig. 6 e) with a rounded prominence at base, ventral side with four hairs. Third segment (femur) of last pair of legs armed with

a large chitinous tooth placed near middle of ventral surface. In one abnormal specimen there are two such teeth on the left femur.

Habitat.—An abundant and characteristic intertidal species, usually occurring in crevices and between flakes where the coast is rocky, and also under stones on estuarine shores. At Malahide it is found in from almost dry to moist crevices in the Orange Lichen, Pelvetia, and Spiralis zones. Has also been found at Ardfry, where it extends down to the Vesiculosus zone at least. The males are less common than the females. The dates of capture range from February to October, and it probably occurs in all months of the year.

Lasioseius Berlese.

In my report on the Acarina of the Clare Island Survey (25) it was pointed out that the Scius group of the family Laelaptidae was badly in need of revision. The species there recorded were referred to the genera Sciulus (Berlese) and Paraseius (Tragardh). Dr. Berlese has since published a useful paper (16) in which new genera and sub-genera are established, either with brief diagnoses or by the naming of types.

Berlese indicates *Scius muricatus* (C. L. Koch) as the type of the genus Lasioseius, so it is necessarily also the type of the sub-genus Lasioseius (s. str.). In this species the tarsi and ambulacra are of the form usual in the Scius group of genera. It seems unsatisfactory, however, to include in the same genus such species as *L. italicus*, *L. serratus*, and *L. grandis*, in which the tarsi are much attenuated, and the ambulacra are modified into a bristle-like form. Such species should, in my opinion, be included in a separate genus, and as the name Episcius has been suggested for this purpose by Hull (26), with *E. serratus* (Halbt.) as the type, this name must be used. In a previous paper I endeavoured to establish Paraseius Träg. for the species with modified ambulacra, but unfortunately Trägardh indicated *Gamasus mollis* Kramer (49) as the type of his genus. Dr. Berlese is now convinced that Paraseius is the same as Epicrius Can. et Fanzago, for the reason that Kramer's species is nothing more than a nymphal form of *Epicrius geometricus*, Berl. (17).

Episcius grandis (Berlese).

1916 *Lasioseius grandis* Berlese 16, p. 34.

Habitat.—Salt marsh on Malahide Island, a few specimens found under shells and stones, May. The females are abundant in Malahide estuary, under stones in a partly dry channel of the Broadmeadow Water. It

also occurs on the open seashore at Malahide amongst wet moss growing on calcareous tuffa where a streamlet flows on to the shore, June.

Described by Berlese from Italian specimens found in moss and amongst dead leaves (**16**). It is rather a large species (about 670μ × 450μ), belonging to the group with modified tarsi and ambulacra. The dorsal shield has strongly squamose markings, especially towards the sides, and the hair armature is strong. The plates of the ventral surface greatly resemble those of *E. italicus* Berlese (figured in **25**), except that the ventro-anal plate is much smaller, and is of a roughly cordate shape (length, 220μ; breadth, 176μ). Not previously recorded from the Britannic area.

Lasioseius salinus sp. nov. (Pl. XXI, fig. 7 a, b)

A small species belonging to Leioseius, a sub-genus, briefly diagnosed by Berlese as follows:—"Ex genus *Lasioseius*. Pedes breves et robusti. Truncus elongatus, lateralibus subparallelis. Typus: *L. L. minusculus*, Berl." (**16**, p. 45).

Female (fig. 7 a): Length about 440μ; breadth, 260μ. Colour pale brown. Shape as is usual in Lasioseius. Dorsal plate sub-parallel, reaching end margin of body; sides weakly serrate; surface finely punctured and reticulate. Hairs weak; two pairs on the end margin stronger than the others. Sternum rather short; genital plate long and narrow, much as in *E. serratus*, Halbt. Ventro-anal plate large, broader than long, flattened on the front margin, rounded posteriorly, minutely punctured, and there are about six pairs of small hairs. Peritreme close to the legs, it is joined with the inner margin of a well-developed plate, post-stigmatic extremity curved inwards and partly enclosing the last pair of legs. Maxillary plate quadrate, hair armature normal. Chelicerae: the free chela is armed with two strong teeth; fixed chela with about four very weakly developed teeth. Legs short and stout, tarsus of last pair figured (fig. 7 b).

This species appears to differ from the two described European species, *L. minusculus* and *L. venustulus*, in the less elongate shape, the shorter sternal plate, the broader ventro-anal shield, and also in the relatively shorter first pair of legs.

HABITAT.—Found under dead shells in a salt marsh on Malahide Island, May, 1915.

Lasioseius fucicola sp. nov. (Pl. XXI, fig. 8 a, d.)

A very distinct species, which is chiefly remarkable for the long penicillate hairs on the margin of the body. The following is Dr. Berlese's diagnosis of the sub-genus Zercoseius, to which it belongs: "*Zercoseius* n. sub-genus.

Ex genus *Lasioseius*. Pili trunci plus minusve penicillate, vel dilatati. Typus *L. Z. spathuliger* Leon" (16, p. 43).

Male (fig. 8a): Length, of a Swanage specimen, about 768μ, breadth 537μ; of a Malahide specimen 614μ. breadth 476μ; the latter is probably not mature. Colour pale brown. Shape ovate, slightly flattened on end margin; sides indistinctly serrated. Dorsal surface minutely punctured, and with reticulate markings, becoming scale-like towards the end of the body On each side of the dorsum there is a row of seven strong marginal spines; these (fig. 8b) are straight and smooth, except at the extremities, which are somewhat flattened and penicillate. There are two pairs of stout frontal spines; two rows of minute hairs in the middle line of the body, and a few on the side margins. The ventral shield (fig. 8c) is V-shaped, with strongly pointed side processes, and bow-shaped front margin, and there are four pairs of minute hairs. Peritreme long and sinuate; apex reaching fourth acetabula: no shield. Anal plate small, semicircular in front, and suddenly narrowed to an obtusely pointed extremity, where there is a strong terminal spine.

Epistome armed with comparatively long spines, branched at the extremities; maxillary plate large and transverse; lobes small; there are three pairs of rather long hair on the front margin (fig. 8d). Palps of moderate size, with two strong conical teeth on underside of first segment; second segment with five short spines, three of which are on the dorsal surface.

Legs, with the exception of the first pair, long and robust; their upper sides carry penicillate hairs like those of the dorsum; the ventral hairs are long and pointed. Ambulacra stout, with two terminal hairs of moderate length. Free chelicerae, armed with a short process, which reaches a little beyond the end of the segment, seen in their natural position from above, the processes are straight, directed outwards, and are bluntly pointed. (The chelicerae of the unique Irish specimen have not been dissected.) Female unknown.

Habitat.—Some years ago Mr. A. D. Michael kindly sent me a few littoral mites which he found on the south-west coast of England. One of these, from the shore at Swanage, is referable to the present species. In July, 1915, I found a male, apparently not quite mature, under seaweeds washed into the Orange Lichen zone at Malahide. The weeds were in a moist decaying condition, and were resting on the bare limestone rocks.

Thinoseius gen. nov.

(*Female*). A form belonging to the family Laelaptidae: general structure resembling that of the genus Lasioseius, but in the adult the body is enclosed

in a continuous test, with the exception of the sternal and pedal regions. Sternum absent (though present in the *nympha colcoptrata* stage). Endopodial and metapodial plates well developed. Ambulacra on all pairs of legs. Type *Thinoseius Berlesii* sp. nov.

Thinoseius Berlesii sp. nov. (Pl. XXII, fig. 9 a, c.)

Female (fig. 9 a, b): Length about 760μ; breadth, 540μ, in the Malahide specimens (a Swanage specimen measures 845μ × 590μ). Colour during life, light brown, with a conspicuous darker spot on each side of the dorsum. Shape, broad and pyriform, end margin sometimes flattened. Epidermis very minutely shagreened, also marked towards margins with waved lines, and there are traces of a polygonal network on the dorsal surface. Hairs short and sparse. Sternum and jugular plates absent, the sternal region being very weakly chitinized; four pairs of hairs present. Tritosternum normal. Endopodial plates well developed, usually with sharp processes, as in the genus Halolaelaps; metapodial plate, a thin chitinous band, bounding the basal segment of the fourth leg. Peritreme sinuate, enclosed with and bordering the ventral plate. Genital plate of the usual trapezoidal form, slightly longer than broad; anal plate fused in the chitinized cuticle of the ventral region. The front margin of the last is sinuate, and placed near it is a pair of small ring-like structures embedded in the cuticle.

Capitulum, with a short and broad maxillary plate, rounded behind, with three pairs of moderately long hairs; maxillary lobes normal. Epistomal margin semicircular, armed with five or six long and stout spines, which are branched at their extremities. Chelicerae (fig. 9 c) very small. Palps robust (length, about 180μ); second segment with three short dorsal spines; inner and outer margins with one fine hair. Legs of moderate length, robust; hair armature weak; tarsi not attenuated, all pairs with ambulacra. The last (fig. 9 d) carry a pair of bristle-like lateral lobes resembling those of the genus Episeius. Male unknown.

Nympha colcoptrata (fig. 9c).—Length, about 500μ; breadth, 300μ. Shape, less strongly pyriform than in the adult; side and end margins flattened; hair armature relatively stronger. Epidermis minutely punctured and reticulate. Sternal shield of the usual V-shape; front margin strongly convex. Anal plate small and heart-shaped. Peritreme long and curved inwards; inner margin serrated near the extremity. A pair of small lunate inguinal plates are present.

The most interesting characteristic of this new genus is the absence of a sternal shield, a very rare feature in the Gamasoidea. Berlese has described

(13) and figured (15), an Italian form Asternoseius, in which there is no sternum; the only resemblance between this and Thinoseius is the general hardening of the body cuticle. There is little doubt that the loss of the sternum in the adult is here a case of retrogression, as it is present and is of the usual form in at least one nymph stage.

HABITAT.—Found in company with the preceding species under decaying seaweeds washed into the Orange Lichen zone, July, 1915. On another occasion it was found with numbers of the *nympha colcoptrata* form among damp sand and shells under a dry top layer in the same zone. Mr. A. D. Michael has taken it on the seashore at Swanage (Dorset).

Family **ZERCONIDAE**

Thinozercon Michaeli Halbt. (Pl. XXII, fig. 10.)

1915 Halbert **25**, p. 82.

The male, female, and nymph of this interesting species were first found under stones on an estuarine part of the seashore flooded by the tides at Westport, in July, 1911. Subsequently both sexes occurred under stones a little below high-water mark on the south shore of Howth, April, 1913. More recently Mr. Southern collected it in the Orange Lichen zone at Lough Hyne, on the Cork coast, November, 1916. I did not succeed in finding it either at Ardfry or Malahide.

Berlese was under the impression that this genus is synonymous with Iphidinychus, a South American form (15), and is so recorded by him (16). He has recently seen specimens of Thinozercon, and agrees with me that they represent a very distinct genus (18). A figure showing the arrangement of the ventral plates of the female is given in the present paper (fig. 10); the presence of two paired sternal shields is of interest. There is considerable justification for making this remarkable form the type of a separate family (see **25**); for the present it is included in the Zerconidae.

Family **UROPODIDAE.**

The identification of the four species of this family living habitually between tide-marks, and in salt marshes on the Irish coast, has given some trouble, partly due to the fact that the "*Uropoda orchestiidarum*" of authors included two species belonging to different genera. I believe the correct names of the shore species have now been placed beyond doubt; and a table containing the more essential characters by which they can be separated may help to prevent further confusion.

A.—Marginal plates absent from the dorsum. First pair of legs without ambulacra and claws. Male genital foramen opposite fourth pair of legs. Size, about 690μ × 460μ (Pl. XXII, fig. 11).

1. *Phaulocylliba littoralis* (Trouess.).

B.—Marginal plates present. First pair of legs with ambulacra and claws. Male foramen opposite third pair of legs.

Ends of marginal plates not joined; their extremities removed some distance from the posterior margin of the dorsal shield. Form broadly ovate, with a few short marginal hairs. Metapodial line distinct. Size variable, averaging about 950μ × 720μ (Pl. XXII, fig. 12).

2. *Phaulodinychus repletus* Berlese.

Marginal plates more uniformly broad, and united by a narrow chitinous band behind the dorsal shield. Body margins with numerous strongly curved hairs. Metapodial line obsolete. Size about 690μ × 460μ (Pl. XXII, fig. 13).

3. *Phaulodinychus orchestiidarum* (Barrois).

Ends of marginal plates not joined, reaching, or almost reaching, the posterior margin of the dorsal shield. All plates strongly and regularly punctured. A row of T-shaped hairs on side margins of body. Size smaller, about 614μ × 440μ (Pl. XXII, fig. 14).

4. *Trachyuropoda minor* (Halbt.).

Phaulocylliba littoralis (Trouess). (Pl. XXII, fig. 11.)

1889 *Uropoda orchestiidarum* (partim) Berl. et Trouess. **20**, p. 125. 1902 *Discopoma littorale* Trouessart **52**, p. 41. 1915 *Phaulocylliba Berlesii* Halbert **25**, p. 86. 1917 Berlese **19**, p. 11. 1918 Berlese "Redia" xiii, p. 190.

Both sexes were found between damp limestone flakes in the Pelvetia and Spiralis zones on the rocky shore at Malahide, May and June. At Ardfry the male and nymphs occurred under boulders resting on gravel and shells in the Vesiculosus and Serratus zones, June. In these localities it seems the rarest of the four intertidal species of Uropodidae. The first recorded British specimens were found under stones in Howth Harbour in November, 1913. The ventral surface of the male is figured (fig. 11).

Phaulodinychus repletus Berl. (Pl. XXII, fig. 12 a, b.)

1903 Berlese **7b**, p. 269. 1915 *Haluropoda interrupta* Halbert **25**, p. 88 1916 Berlese **17**, p. 136. 1917 Berlese **19**, p. 11. 1918 Hull **26**, p. 50.

An abundant species in estuaries and salt marshes, and also on the open seashore under stones and decaying seaweeds, usually in the Orange Lichen

zone. Malahide estuary, Howth, Dollymount, Bray, &c., on the Dublin Coast. On the west coast of Ireland it is equally common at Ardfry, Westport, and Mulranny districts. The adult and *nympha homeomorpha* stages are figured (fig. 12 a, b).

Phaulodinychus orchestiidarum (Barrois). (Pl. XXII, fig. 13 a, d.)

1887 *Uropoda orchestiidarum* Barrois (nymph) 1. 1889 Berlese et Trouessart 20. 1902 Trouessart 52, p. 38. 1916 Berlese 17, p. 136. 1918 Berlese "Redia" xiii, p. 190.

Usually a common species where it occurs, ranging from the Pelvetia down to the Serratus zone. At Malahide it lives chiefly between moist limestone flakes where there is some sandy mud. At Ardfry the habitat is under stones partly embedded in damp mud.

The species was described by Barrois from the nymphal form which he found attached to the common shore Amphipods, Orchestes, and Talitrus (1). The female does not seem to have been described; it may be recognized by the characters indicated in the preceding table and the accompanying figures (Pl. XXII, fig. 13 a, d).

Trachyuropoda minor (Halbt.). (Pl. XXII, fig. 14.)

1915 *Haluropoda minor* Halbert 25, p. 90.

A fairly common species often found in company with *Phaulodinychus replotus* on estuarine shores. At Malahide it was observed in the Orange Lichen and Pelvetia zones between rather dry limestone flakes and on calcareous tuffa, where a small stream flows on to the seashore; also a single specimen, in the *nympha homeomorpha* stage, fixed on the under side of *Orchestia gammarus*. It occurs in the same zones at Ardfry under stones resting on mud. Many specimens were once taken from amongst the debris of old nests of Puffins and Gulls on The Bill rocks off the Mayo coast. Berlese refers (in litt.) this species to his sub-genus Dinychura, which is recorded in a short note in (15, p. 85).

Dinychus sp.

The only example of this genus found during our shore work is immature, and I have not succeeded in determining the species. It occurred under damp flakes in the uppermost Orange Lichen zone, immediately under the "grassy sward," and is possibly not a regular denizen of the intertidal shore.

Sub-Order ORIBATOIDEA.

Family **ORIBATIDAE.**

Oribata setosa C. L. Koch.

Malahide, under more or less dry flakes in the Orange Lichen zone; also under refuse lying on the rocks in the same zone, April and May. A widely distributed species.

Oribata quadricornuta Michael.

Found by Mr. Southern in the Orange Lichen zone at Lough Hyne, Co. Cork, November, 1916. At Mulranny it was also found under stones on the seashore in September.

Oribata quadrivertex sp. nov. (Pl. XXII, fig. 15 a, b.)

A small, compactly-formed species, standing nearest to the "*pyriformis*" group. It is remarkable on account of the short, strongly clubbed pseudostigmatic organs, the square vertex, and the peculiar form of the lamellae, which in the long, slender cusps bear some resemblance to those of *Oribata gracilis*. Occurs in salt marshes.

Length, about 450μ; breadth, 280μ, and slightly larger. Colour, yellowish brown; texture smooth and shining. Cephalothorax (fig. 15 a) rather short, about one quarter as long as the abdomen, and much narrower. Rostrum bluntly pointed; dorso-vertex quadrate, half hidden by the central extension of the dorsum. The lamellae are narrow, uniform bands connected by an equally broad translamella; cusps rather long and slender, and just broad enough at their extremities to carry the lamellar hairs; these are stout and curved strongly downwards over the rostrum. Interlamellar hairs long, very stout, and minutely serrated; they spring from a transverse bar which bounds the posterior margin of the dorso-vertex. Pseudostigmatic organs (fig. 15 b) close to the middle line of the body, short and strongly clavate, slightly incurved, and their stems are mostly hidden under the margin of the dorsum. The stigmata are cup-shaped, shallow, and their margins are but little raised. First tectopedium a long curved blade.

Abdomen oblong, shaped much as in *O. gracilis*, though less strongly narrowed in front, evenly rounded at end margin; pteromorphae weakly developed. Front margin produced at centre in a small rounded prominence, dorsum with about eight pairs of minute hairs, two pairs on end margin upturned and stronger than the others; there is a circular pore near the sides of the dorsum. Genital and anal plates large, of almost equal size, each enclosed by broad chitinous margins. Epimera without the distinct inner

borders present in *O. gracilis* and other species. Legs normal, last pair rather short, scarcely reaching the end of the dorsum; the lengths are about 495μ, 308μ, 462μ, 286μ; central claw much stronger than the others.

Habitat.—Not uncommon under dead shells in a salt marsh on Malahide Island, May, 1915. It also occurs under stones lying on mud at the mouth of a small stream flowing into the Malahide estuary, June, 1915. On the west coast it was found under stones on a grassy sward just above the Pelvetia zone at Ardfry in a place covered at high tides, June, 1916.

Dr. Berlese refers this species to his sub-genus Punctoribates, which was apparently established without diagnosis, and with *O. punctum* C. L. Koch as the type-species. Koch's figure shows a small globular species, with rather long, clubbed, pseudostigmatic organs. It is also recorded in the works of Canestrini and Fanzago. The former says (23, p. 19): "Setole stimmatiche mediocri claviformes." Yet it is figured by Berlese (2, fasc. xxx, No. 2) as a species with short lamellae, united by a broad translamella and long leaf-shaped pseudostigmatic organs. In a later reference (5, p. 66) he records *O. avenifera* Michael as synonymous with *O. punctum*, so there would seem to be a difference of opinion as to the characteristics of the last-named species.

Oribata avenifera Michael.

Found under limestone flakes in the upper Pelvetia zone at Malahide, June. Also under stones a little above high-water mark in the Orange Lichen zone, April.

As Michael (36) has pointed out, the cuticle of this species is very minutely punctured, but it is not correct to describe the notogaster as hairless: as a matter of fact there are four pairs of short hairs, as well as an equal number of paired pores on the dorsal surface. Not previously recorded from Ireland.

Oribata Lucasii Nicolet.

Found crawling on a green alga-like weed in the Broadmeadow Water estuary at Malahide, June, 1915. The species had been previously found under fir bark on Achill Island, and on Lambay (25). A generally distributed British species.

Oribata parmeliae Michael.

Common under lichens growing on large boulders on the seashore at Howth, in a place at least occasionally splashed by the tides. Apparently a coast species, Mr. Michael records it as feeding upon lichens (*Parmelia*) growing on granite rock at Land's End, Cornwall (36).

Oribatula similis Michael.

Found in the Pelvetia zone and upwards at Ardfry, under stones resting on a peaty soil, dryish when the tide recedes, but flooded at high tides. Also under stones on a grassy sward, just above the Pelvetia zone, June; occurs on the seashore at Baldoyle in a similar habitat. A generally distributed British species.

Oribatula venusta Berl.

1908 Berlese **12**, p. 8. 1910 Berlese **10**, p. 229. 1910 Halbert **25**, p. 102.

This is evidently a coast species in Ireland, though Berlese does not state the habitat of the original Norwegian specimens. It was first recorded as a British species from the Mayo coast (**25**), where it is quite common under stones a little above high-water mark, and also on the adjoining sandhill, in September. At Ardfry it occurs under stones resting on sand and decayed seaweed in the Orange Lichen zone, June, 1916. At Malahide under hard limestone flakes in the lower part of the Orange Lichen zone in company with *Ochthebius Lejolesii*, and other littoral species. I have also found it on Lambay Island in October, and amongst lichens and moss on the Portmarnock sandhills in January.

Oribatula saxicola sp. nov. (Pl. XXII, fig. 16 a, b.)

A small sluggish species belonging to the "*tibialis*" section of the genus Oribatula. Lives in rock fissures. Length, 490μ; breadth, 286μ. Colour light brown. Body strongly flattened, surface apparently smooth and shining, but in reality excessively minutely punctured. Cephalothorax (fig. 16a) comparatively large, rostrum bluntly pointed, lamellae narrow blades on edge and tapering to a point, placed partly on the marginal slope of the cephalothorax; lamellar hair long and minutely setose, it springs from a pore lying immediately in front of the extremity of the lamellae. Translamella absent, or a mere line. The pseudostigmata are hidden under the dorsum, though occasionally the corners project a little. Pseudostigmatic organs (fig. 16 b) with slender stalks and strongly clubbed extremities.

Abdomen with the shoulders evenly expanded; breadth about two-thirds of the length. On the dorsum there are three or four pairs of pores and short hairs, and at least three pairs of upturned marginal hairs are noticeable on the posterior third of the body. Legs robust and a little longer than in *O. tibialis*; claws unequal.

The following notes may be of use in separating the present from the allied species:—From *O. similis* (Michael) easily recognized by the tridactyle claws. From *O. tibialis* (Nicolet), to which it is nearly allied, by the shorter

and more strongly clubbed pseudostigmatic organs and the more expanded shoulders. From *O. exilis* (Nicolet) and *O. venusta* Berl., by the strongly narrowed lamellae and the more elongate form of the body.

Habitat.—Occurs in numbers under dry or slightly damp flakes in the Orange Lichen zone on the rocky shore at Malahide, often in company with *Rhyncholophus arancoides* Berlese. I have also found it under lichens growing on boulders on the seashore at Howth with such species as *Oribata parmeliae* and *Nothrus inrenustus*.

Scutovertex bilineatus Michael. (Pl. XXII, fig. 18.)

Under moist limestone flakes in the Orange Lichen zone at Malahide, in places where there were also black encrusting lichens, February. The adults and nymphs were clustered round the edges of the flakes. At Ardfry it occurs under stones resting on mud in the Pelvetia zone and upwards to the sward above the Orange Lichen zone, June. Common at Westport under stones on the seashore at a little above high-water mark, July.

Scutovertex Spoofi Oudms. (Pl. XXII, fig. 17 a, b.)

1900 Oudemans, **39**, p. 112. 1901 *S. bilineatus* Oudemans **40**, p. 79.

Described by Oudemans from specimens found in Finland by Dr. A. R. Spoof "in spawn of Lymnaea in sub-saline water" (**39**). In a later paper he records it as synonymous with *S. bilineatus* Michael (**40**). At Malahide I have found both *S. bilineatus* and *S. Spoofi*, which I consider is a distinct species. Apart from other differences, they may be readily separated by the structure of the claws. Michael has accurately described these in the case of *S. bilineatus* (fig. 18*f*): "The claws are monodactyle, but there is a minute projection at each side of the claw, and two long fine hairs sharply hooked at their distal ends," &c. (**36**). On the other hand, the claws, though of unequal thicknesses, are undoubtedly three in number in *S. Spoofi*, and are just as we find them in *S. sculptus* and other tridactyle species. It would appear likely that the lateral claws are rudimentary in *S. bilineatus*, and are represented by the minute projections on each side of the middle claw, as described by Michael. These can be seen distinctly under a high magnification; and it may be noted that the hooked hairs are also present in *S. Spoofi*. The latter species also differs from *S. bilineatus* in the following characters:—The cephalothorax (fig. 17a) is larger, and the central furrow is more defined; the abdomen is more strongly narrowed in front, so that it is less regularly oval than in *bilineatus*; it is also less coarsely punctured and the longitudinal

ridges are much less distinct. Beyond the middle there are two large pores which are very conspicuous.

HABITAT.—Occurs between moist limestone flakes on the rocky shore at Malahide in the Orange Lichen and Pelvetia zones, and somewhat doubtfully in the Spiralis zone. In these habitats they were in small colonies round the outer edges of the flakes, sometimes in company with the Tyroglyphid mite *Hyadesia fusca*; also under stones resting on sandy mud at the mouth of a small stream flowing into Malahide estuary. At Mulranny it occurred under stones on the seashore. The dates of capture range from May to September. Not previously recorded from the Britannic area.

Scutovertex corrugatus Michael.

Adults and nymphs common under stones on the Island saltmarsh in Malahide estuary, May. At Mulranny it is very abundant under stones at the mouth of a small stream flowing into Bellacragher Bay, September (**25**).

Scutovertex maculatus Michael.

Under tufts of a lichen (*Lichina pygmaea*) growing on exposed rock surfaces at Malahide, in places washed by high tides; with it were numbers of a small green Amphipod (*Hyale Prevostii* M.E.). Has also occurred on Lambay Island (**25**).

Scutovertex perforatus Berl. (Pl. XXII, fig. 19.)

1910 Berlese **13**, p. 265. 1913 Berlese **15**, p. 98.

A few specimens were found under stones on a grassy sward amongst Sea Purslane (*Atriplex portulacoides*) and other estuarine plants within reach of high tides at Baldoyle, on the Dublin coast, November, 1917. This is by far the smallest known species of Scutovertex; the Irish specimens, measuring $353\mu \times 176\mu$, are even a shade smaller than the Italian ($390\mu \times 210\mu$). Notable features are the long setiform pseudostigmatic organs and the clear circular spot near the front margin of the dorsum. In the brief description of the species (**13**) Berlese says: "Derma dorsi aeque punctulatum." The dark spots on the dorsum are really raised granules; these are replaced on the cephalothorax (fig. 19) by ridges. Not previously recorded from Britain.

Hermannia scabra (L. Koch).

Amongst calcareous tuffa on a wall where fresh water flows through at Malahide, probably washed by high tides, June; also under flakes in the Orange Lichen zone, dry to moist, August. At Ardfry it occurred under stones resting on sandy mud and gravel in the Orange Lichen and Pelvetia

zones. At Mulranny, on the Mayo coast, it is abundant under stones just above high-water mark, September; and it was found in the debris of old nests of sea birds on the Bill Rocks, as recorded in (25).

Hermannia reticulata Thor.

Malahide estuary, found crawling on a green alga-like weed on bank of the Broadmeadow Water, with *Oribata Lucasii* Nic. Recorded from Clare Island and the Westport district in 25.

Nothrus invenustus Michael.

Found under lichens (*Lichena pygmaea*) growing on large boulders on the south shore of Howth, Co. Dublin. Splashed by high tides, though probably not intertidal.

Sub-Order SARCOPTOIDEA.

Family **TYROGLYPHIDAE**.

Tyroglyphus littoralis sp. nov. (Pl. XXII, fig. 20 a, d.)

The discovery of an undescribed species of this family living on the sea-shore is of interest. As far as I am aware, the only previously known Tyroglyphids found in this habitat are the species of Hyadesia, all of which are intertidal. (I once found a colony of *Tyroglyphus longior* living between limestone flakes in the Orange Lichen zone at Malahide, though probably in this case the mites were introduced with debris deposited on the shore. It is a species of varied habitats, and is of almost world-wide distribution.)

Female.—Length about 616μ; breadth, 418μ. The entire animal is pyriform. Texture smooth; hyaline, the expulsory vesicles appearing as large brown spots. Cephalothorax of the usual shape, distinctly narrower than abdomen, strongly constricted in front, so that the rostral part is rather long and narrow, and much as in *T. heterocomus* Michael (37, Pl. XXXIII, fig. 1). Cephalothoracic hairs in a row: the two outer ones are very long, inner ones short (length about 66μ), rostral hairs reaching a little beyond end of mandibles. Abdomen with rather prominent humeral corners, slightly constricted behind these, thence widening gradually to beyond the middle, and diminishing to the end margin, which is produced at the centre in a pointed process. Apparently this process is not homologous with the tubular *bursa copulatrix* found in the genus Glycyphagus. On the dorsum there are five pairs of long plain hairs, three of which are marginal, and there are four pairs of comparatively short hairs placed on or near the anterior margin.

The epimeral area and the genital foramen are much as in *T. siro*; close to the end margin of the ventral side are two long hairs, and there are a few pairs of short hairs. Legs normal; the fourth segments carry the usual long hair, and a strong curved spine springs from the fifth segment of first two pairs.

Male.—The only male found was mounted in glycerine medium, so that the shape cannot be exactly described. A drawing (fig. 20 e) made shortly after capture is probably sufficiently accurate. Much smaller than female, length about 360μ; breadth, 220μ; broadest across the fore part of the abdomen; the posterior margin is clearly indented at the centre, and immediately over the notch is a small papilla. All the hairs of upper surface as in female, but relatively much longer. Expulsory vesicles very large. The genital plates form a semicircular shield, and there are two copulatory discs closely resembling the same structures in *Histiogaster entomophagus* (**37**, Pl. XXVII, fig. 20 d). Legs robust and characteristic of the genus, except for the last pair; the tarsal segments of these, instead of having two small raised discs near the middle of the segment, have only one dise, which is placed close to the base on the upper and inner surface (fig. 20 d).

Habitat.—Two females and a male found in moist decaying seaweeds amongst shingle close to the harbour at Howth, Co. Dublin. The locality is slightly above high-water mark, and evidently within reach of high tides. September, 1918.

Family **HYADESIDAE**.

Hyadesia fusca (Lohm.).

1894 *Lentungula fusca* **32**, p. 86. 1899 Canestrini and Kramer **24**, p. 136. 1901 Michael **37**, p. 196. 1907 Lohmann **34**, p. 368. 1915 Halbert **25**, p. 108.

Adults and nymphs occurred in numbers at the edges of rock crevices in the Pelvetia and Spiralis zones at Malahide, June, 1916. In the same locality it was found fairly commonly in rock-pools containing much Enteromopha, in the Orange Lichen zone, July and September. First recorded as a British species from Clare Island, where it is abundant amongst coralline seaweeds in rock-pools. Lohmann gives its distribution as the North Sea and the Baltic.

Sub-Order TROMBIDOIDEA.

Family **EUPODIDAE.**

Lasiotydaeus brevistylus sp. nov. (Pl. XXIII, fig. a, b.)

The genus Lasiotydaeus was founded by Berlese in (**12**), the type-species being *L. glycyphagiuus* Berl. In a later paper (**10**) he establishes a new sub-genus Melanotydaeus, in which the rostrum is well below, or hidden by, the cephalothorax, and the body hairs are short. The present species belongs to this sub-genus, of which Berlese describes five species as occurring amongst mosses in Italy.

In general structure *L. brevistylus* is allied to *L. styliger*, described and figured in (**10**), so much so that with comparative notes and a figure a detailed description is not necessary. A good structural difference occurs in the palpi; in *L. styliger* the two terminal processes of the last segment are very long and slender (see **10**, fig. 12a), and are much longer than the basal part of the segment. In the present species these processes are stouter and much shorter (fig. 22b), about equalling the basal part in length. In some female specimens the processes are even shorter than is figured. The lower process is stouter than the upper one, which is curved. Cephalothorax about a third as long as abdomen, and the rostrum is generally hidden, though in some specimens the apex is visible. The legs are a little stouter. The colouring appears to be a very dark olive, and the legs are red. The size ranges from about 250μ to 280μ in length, by 150μ in breadth.

Habitat.—A fairly common species in the Orange Lichen and Pelvetia zones on the rocky shore at Malahide, under flakes in from dry to moist situations. The dates of capture are in May and June.

Rhagidia halophila (Lab.)

1851 *Gamasus halophilus* Laboulbène **30**, p. 295. 1889 *Nerneria halophila* Moniez **38**, p. 270. 1915 Halbert **25**, p. 110. 1916 Hull **26**, p. 35.

This active, orange-coloured Acarid is one of the most characteristic species of the intertidal area, occurring from the Orange Lichen down to the Serratus zone at Malahide and Ardfry. Its favourite haunts are between rock flakes and under stones embedded in sandy mud in from moist to wet places. During low water it may be seen running with great speed on the rock surfaces. The dates of capture range from March to November, and it probably occurs throughout the winter months.

Eupodes variegatus Koch var. **halophilus** nov.

In the Serratus zone at Ardfry there occurs a form of Eupodes which seems to be a variety of the common European species *E. variegatus* Koch. The general structure is the same as in the typical form. The ovigerous female measures about 666μ in length, and the breadth at the shoulders is about 310μ. Colour pale rose. It differs from the typical form in the shorter body hairs; the group at extremity of abdomen number six or seven hairs, the longest measuring not more than 70μ. All hairs minutely setose. The first pair of legs measure about 666μ, and the remaining three pairs are a little longer and more slender than in the type, and the femora of the last pair are less thickened. In the male, of which only one specimen was found, the body is smaller than in the female, the length being 530μ. The size is apparently somewhat larger than in the type. A male of *E. variegatus*, found in the west of Ireland, measures 400μ.

Chromotydaeus ovatus (C. L. Koch).

1838 *Penthaleus ovatus* C. L. Koch **28**, Fasc. 18. 1886 Canestrini **23**, p. 225. 1891 Berlese **2**, Fasc. LX., n. 2. 1912 Sig. Thor **45**, p. 237. 1915 Halbert **25**, p. 111.

The occurrence of this species under stones on the seashore at Mulranny has already been recorded (**25**), and I have since found it commonly as an intertidal species at Ardfry, in the Pelvetia and Spiralis zones. It has not been found at Malahide, so that it may possibly be a species of western range in Ireland. The specimens would seem to be uniformly longer than the Italian form; both Berlese and Canestrini record the length as 400μ, while the Irish shore specimens are about 640μ in length, and the breadth varies from 410μ to 460μ. Dr. Berlese, who has seen the Irish form, says it is the present species.

Thor records its occurrence on the western shores of Norway in the *Balanus balanoides* zone, and under *Fucus vesiculosus*.

Halotydaeus hydrodromus (Berl. et Trouess).

1889 *Notophallus hydrodromus* Berlese et Trouessart **20**, p. 21. 1891 *Halotydaeus hydrodromus* Berlese **2**, Fasc. LX, n. 10. 1915 Halbert **25**, p. 111. 1918 Hull **26**, p. 33.

Usually a common species on the seashore, ranging from the Pelvetia down to the Serratus zone at Malahide and Ardfry. Though less agile than *Rhagidia halophila*, it is almost as great a rover on the rock surfaces when the tide recedes; and it also occurs in colonies between flakes. On the west

coast of Ireland, at Mulranny, it is represented by a well-marked colour variety, *albolineatus* Halbt. (25), which was found in large colonies under deeply embedded stones well below high-water mark.

Family **ALICHIDAE**

Alicus oblongus sp. nov. (Pl. XXIII, fig. 23 a, c.)

A very distinct species, which may be recognized by the form of the body and the hair armature of the cephalothorax.

Colour, white, tinged with rose. Length, about 350μ; breadth, 160μ. The body is of an elongate oval shape: shoulders not prominent, and but slightly constricted. Hair armature sparse, of short, strongly plumose spines (fig. 23 c). Epidermis minutely striated. The cephalothorax (fig. 23 a) is relatively large and wide at the base. Eyes small, placed on sinuous ridges close to the side margins. There are the usual two pairs of long sensory hairs, bearing secondary hairs, and springing from well-marked pores. Behind these there is another pair of short and more strongly "feathered" hairs placed on a small circular plate, and there is another minute pair placed in a line with the long sensory hairs. All of these hairs are enclosed in an oblong area defined by two sub-cutaneous chitinous rods, which run forward to the front margin. The five segmented palpi (fig. 23 b) are rather short, with stout basal segments, a few plumose spines; and there is a stout adpressed spine on the upper surface of fourth segment. The mandibles are rather slender, chelae armed with a few minute teeth, a single hair on outer surface.

Legs decidedly short; the three first pairs are of about equal length, last pair the longest (130μ). All segments with a few plumose hairs; sixth segment has also a bent spine on the dorsal side.

Habitat.—Two specimens found between dry limestone flakes in the uppermost Orange Lichen zone at Malahide (24th May, 1915). Apparently this and the following species of Alicus occur only in the upper limit of the Orange Lichen zone, and it is possible they are not really denizens of the intertidal area.

Alicus latus sp. nov. (Pl. XXIII, fig. 24 a, c.)

A species belonging to the sub-genus *Leptalicus*, Berlese. Length, about 220μ (not including mandibles); breadth, 100μ. Colour, during life, a very pale rose. The body (fig. 24 a) is robustly formed and sub-quadrate. Epidermis finely lined, and there is a very spare covering of plumose hairs (fig. 24 b, c), which are longer and more distinctly clavate towards end of body.

Cephalothorax relatively small and much narrower than abdomen; front margin slightly concave, with a small central papilla. There are two long plumose hairs, and a much shorter third pair near the middle line; outside of these are three pairs of very short, fine, marginal hairs. Eyes small, placed on a ridge running from posterior margin to anterior corner of cephalothorax; the latter are pointed.

Abdomen, shoulders wide and prominent; lying between them is a central wedge-shaped area; anterior part marked off by a constriction. Mandibles very broad. Legs comparatively long and robust, with weak plumose hairs, and without the clavate hairs present on the body.

This species is allied to *A. elongatus* Berlese and *A. Paolii* Berlese. It is apparently nearest the latter species, differing from it in the much smaller cephalothorax and shorter sensory hairs. Dr. Berlese has kindly sent me a drawing of *A. Paolii*, which shows these characters much clearer than they appear in the published figure (**9**, Pl. XVIII, fig. 17). It differs from both of these species in the more robust build and more uniform breadth of the abdomen. The body hairs are not so long, and the legs are apparently shorter and stouter. The sub-genus Leptalicus was established by Berlese (**9**) without a diagnosis; *A. Paolii* is the type species.

HABITAT.—I found this fragile species on at least four occasions, during May and June, in the Orange Lichen zone at Malahide. It appears to live in small colonies between rotten flakes where there is clay detritus.

Nanorchestes amphibius Top. et Trouess.

1890 Topsent et Trouessart **47**.

An abundant species in the Orange Lichen, Pelvetia, and Spiralis zones on the rocky shore at Malahide. Large colonies of the larvae, nymphs, and adults may be found during the summer and autumn months; and clusters of the salmon-coloured eggs are noticeable deposited round the edge of rock fissures in the early summer. At Ardfry it was found on the margin of a small saline pond close to the seashore.

This is one of the few saltatorial mites, and it both runs and jumps with great activity in bright weather, even on the surfaces of rock pools. It was observed at various dates from February to November. Hirst has recorded it from the Isle of Wight. A figure of the peculiar modified hairs of this species is given in the present paper (Pl. XXIII, fig. 25).

Family **BDELLIDAE.**

Bdella littoralis (L.).

A common and characteristic shore species. At Malahide and Ardfry it was found from the Orange Lichen down to the Vesiculosus zones, living in

rock fissures, and it may often be seen running on the rocks. The shore records under the name *B. capillata* Kramer in (25) should refer to the present species. Thor records this as the type-species of the genus Molgus, and gives the following synonymy: *Molgus littoralis* (Linné), 1758. *M. arcticus* (Thorell), 1871. *M. villosus* (Kramer), 1883. *M. Basteri* (Michael), 1896 (Zool. Anz. XLII, p. 30).

Bdella decipiens Thor.

Equally common with the last at Malahide, and frequenting the same zones in from almost dry to moist places. It often occurs in company with the preceding species, and both have been observed feeding on Nanorchestes on the rocky shore at Malahide. The synonymy and distribution are recorded in (25).

Cyta latirostris (Herm.).

A few specimens found under stones in Malahide estuary, May, 1915; shore of Mweeloon Bay at Ardfry, June, 1916.

The typical form of this species is figured by Berlese (2, Fasc. LIX, n. 4) of a rosy-red colour, while the specimens from the above localities are of a dull yellow; they are also larger, the length being at least 900μ, not including the mandibles. It is a widely distributed species.

Family **RHAPHIGNATHIDAE.**

Rhaphignathus scutatus sp. nov. (Pl. XXIII, 26 a, b.)

Colour, bright red. Length, 518μ; breadth, 330μ; shape, a rather broad oval; epidermis striated, except on the dorsal shields, which are minutely punctured, and are only very faintly reticulate. Cephalothorax covered by a large shield, with three pairs of strong marginal hairs; immediately behind the first pair are the single-lensed eyes; the hinder margin of the shield is weakly emarginate. The abdomen is also protected by a large dorsal plate, carrying six pairs of hairs: front margin straight; end margin evenly rounded, leaving a rather broad uncovered area at the end of the abdomen, where there are two pairs of hairs. The shoulder bristles are placed on small oval plates. Epimera much as in *R. siculus*. Anal plate rounded in front and tapering to a point at end, rather distinctly reticulate on its anterior part (length, 170μ; breadth, 125μ). Mandibles a little shorter and more robust than on *R. siculus*. Palps (fig. 26 b) stout; a strong hair springs from the upper surface of second and third segments. Terminal appendage about reaching to end of fourth segment, with four hairs and a trifid hair.

This species stands nearest to *R. siculus* Berl. (2 Fasc. XXII, n. 3), from which it differs in the larger size, less elongate shape, longer legs, and the

polygonal reticulation is very faint; it is clearly marked only on the front of the anal shield.

Habitat.—Occurred under stones on the salt marsh on Malahide Island, 30th May, 1915. I have also found it on a marshy sward just above the Pelvetia zone at Ardfry, County Galway.

Stigmaeus rhodomelas var. **fissuricola** nov. (Pl. XXIII, fig. 27 a, c.)

A species belonging to Stigmaeus (s. str.) as recently defined by Berlese (**10**).

Length variable, ranging from 330 to 380μ in mature specimens; breadth 150μ; colour a shining orange; form elongate (fig. 27 a). Cephalothorax with rounded sides, well marked off from abdomen in most specimens; central shield oblong, almost reaching the front and hinder margins, carrying three pairs of hairs (fig. 27 b), the second pair very long. Abdomen with pronounced "shoulders," and marked lateral indentations, one beyond the middle, the other close to the end of the body. Central shield long, oval, with two pairs of hairs; behind this is a small plate, equally broad, but less than one-third as long as the preceding shield. On each side of the second plate are two pairs of small hair-bearing plates. End of body truncated and bordered by a narrow plate, carrying two long hairs. There are also two pairs of marginal hairs on the anterior part of the abdomen. The genito-anal shield is truncated in front, not quite reaching the last pair of epimera, with three stout marginal hairs on its anterior part.

The mouth parts (fig. 27 c) are large, and the mandibles (length about 70μ) robust. The five segmented palpi are long and stout; third segment as long as the three terminal ones together, with three long hairs; the terminal appendage reaches well beyond the claw. Legs comparatively long and robust; hair armature as in figure. The fourth segment of the last two pairs without hairs.

Appears to differ from the typical form in the more elongate shape, in the absence of lateral plates at each side of the large central abdominal shield, and by the fact that this shield is followed by a smaller transverse plate. The hair armature is longer. I cannot find any trace of pigmented eyes in my specimens.

Habitat.—An active, orange-coloured species, which is common in the Orange Lichen and Pelvetia zones at Malahide. It lives chiefly in horizontal fissures in the limestone rocks, in from almost dry to damp places. The dates of capture range from February to October.

Family RHYNCHOLOPHIDAE.

No attempt has been made to refer the following species of Rhyncholophus to any of the genera or sub-genera described in recent years. Authors are evidently at variance as to their application, and in one or two recently published papers the confusion has been increased. It seems to me that many questions of synonymy and priority must be definitely settled before these names can be used with certainty.

The first three species recorded here have been referred to the genus Achorolophus by Dr. Berlese, either in the original descriptions or *in lit.* This was diagnosed as a new sub-genus in his Monograph on Italian Mites (2, Fasc. LIX. n. 1), and *Rhyncholophus neerorum* is the type-species. It was subsequently (4, p. 87) raised to generic rank, and applied to a group of species of which the first mentioned is *R. quisquiliarius* (Herm.), but the earlier reference must apply, consequently the name Achorolophus, whatever may be the fate of this genus, cannot be used for the "*R. rubripes*" group of species.

Rhyncholophus araneoides (Berl.). (Pl. XXIII. fig. 28 a, b.)

1910 *Achorolophus araneoides* Berl. 14, p. 349.

An abundant species during the summer months on the limestone rocks at Malahide, usually in the upper part of the Orange Lichen zone.

An active, bright-red coloured mite. The body is comparatively small (length about 1000μ) and of a rather quadrate shape. The legs are robust and very long, the first pair measuring about 1460μ, not including the projecting part of the epimera. The crista is rudimentary, consisting of a very thin median rod, of which there is sometimes scarcely any trace in the adult form. Both the anterior and posterior sensory hairs are present, but they are not so distinctly enclosed in chitinous extensions of the median rod as they are in other species. The most interesting feature of this species is the presence of a pair of large, lens-like tubercles lying behind the true eyes close to the hinder margin of the cephalothorax. Hair vestiture moderately dense, short and bearing exceedingly minute secondary hairs.

The active nymphal form was observed in great numbers, running on the rocks during bright weather in May and June. When fully grown, it is about 950μ in length by 614μ in breadth. The shape is subquadrate, and the hairs are much more sparse than in the adult. The legs also are much shorter, feeble, and of more uniform length. The prodorsal tubercle, which is so conspicuous in the adult, is present, but is less developed.

The legless, quiescent form of the nymph occurs between dry flakes in the Orange Lichen zone. It is very similar in shape and size to the active

nymph, except for the double indentations of the front margin, characteristic of the encysted stage. The structure of the adult can be seen through the enclosing skin.

Originally recorded from Sicily (Palermo) by Berlese. Figures of the crista and thoracic tubercle are given in the present paper.

Rhyncholophus Passerinii (Berl.). (Pl. XXIII, fig. 29 a, b.)

1904 *Erythraeus Passerinii* Berlese, **8**, p. 16.

Found between rather dry flakes in the Pelvetia zone on the rocky shore at Malahide, June and July, 1916. Also at Ardfry, in the Pelvetia zone, under stones resting on mud, June, 1916.

A sluggish species, of a dark purplish-red colour, and dense, silvery hairs. It may be easily recognized by the very elongate shape (fig. 29 a), and the strongly plumose hairs. The legs and palps are short, and rather weakly developed. The size varies in the Irish specimens from about 1160μ to 1300μ; breadth 560μ. The median rod of the crista is rather long, and a chitinous part projects beyond the hinder sensory area (fig. 29 b). In the original figure (**8**, Pl. I, fig. 17) of this species there are only three hairs on the frontal sensory area; possibly the drawing was made from an immature specimen; in the fully developed form about ten long "feathered" hairs are present. Recorded from the Italian coast by Berlese, and found under rocks sometimes covered by the tide.

Rhyncholophus rubripes Berl. et Trouess. (Pl. XXIII, fig. 30.)

1889 *R. mineatus* var. *rubripes* Berlese et Trouessart **20**. 1889 Moniez **38**, p. 196. 1910 *Ritteria hirsuta* George, "The Nat.," p. 182. 1915 Halbert **25**, p. 115. 1918 Hull **26**, p. 26.

An abundant and conspicuous species on the intertidal shore at Malahide and Ardfry, occurring in fissures and running on the rocks at low tides. Apparently it was noted only in the Orange Lichen and Pelvetia zones, but there is little doubt that it occurs also in the lower zones. A short description of this species was given in (**25**), and the crista is figured in the present paper (fig. 30).

Rhyncholophus tardus Halbt. (Pl. XXIII, fig. 31.)

1915 Halbert **25**, p. 116.

Found under stones on the seashore near Mulranny, Co. Mayo, September.

A species of an orange-yellow colour and long oval shape (length, 1638μ; breadth, 844μ). Body with a sparse covering of rod-like hairs, which are

minutely spiculate. Crista (fig. 31) long and slender, the anterior extremity is distinctly pointed, and there is only one bristle in front of the long sensory hairs. Eyes small, and set close to the side margins of the cephalothorax. Legs slender, rather feebly developed, the first pair much longer than the others.

Family **TROMBIDIIDAE**.

Microtrombidium pusillum (Herm.) var. **major** nov. (Pl. XXIII, fig. 32 a, c.)

Length, 1400μ to 1700μ; breadth, about 900μ. Colour red; shape ovate; in the ovigerous female it is more elongate; shoulders not prominent. Epidermis reticulate and densely covered with plumose spines (fig. 32a); these are slightly bent, constricted at the base, and have bristle-like extremities; their length varies from 35μ to 50μ. Cephalothorax very small; the crista (fig. 32 b) is strong; anterior extremity with a striated expansion at each side: sensory area rather small, with a thick chitinous border, surrounded by a ring of pulmose spines. A chitinous process of the median rod projects into the proximal sensory area. Eyes small, lying close to the crista.

The palps are of normal length, first two segments equalling those of first pair of legs in breadth (55μ); last segment with a short appendage and an inner comb of at least five strong spines (fig. 32 c); distal extremity slender. Legs short and stout; the first pair measure about 760μ in length. The last segment has an almost straight dorsal and a rather convex ventral outline (length, 180μ; breadth, 85μ).

This variety appears to differ from the typical form in the larger size, longer body hairs, the form of the terminal segment of the first pair of legs, and in the presence of a distinct inner comb of spines on the fourth palp segment. In his synopsis of the type, Berlese remarks "spinis pectinis in latere segmenti quarti internis nullis," though in his remarks on the species he says there is a comb of very minute (pochissimi) spines present.

Habitat.—A few specimens occurred under stones in the Pelvetia zone, just below high-water mark, at Ardfry, Co. Galway, June, 1916.

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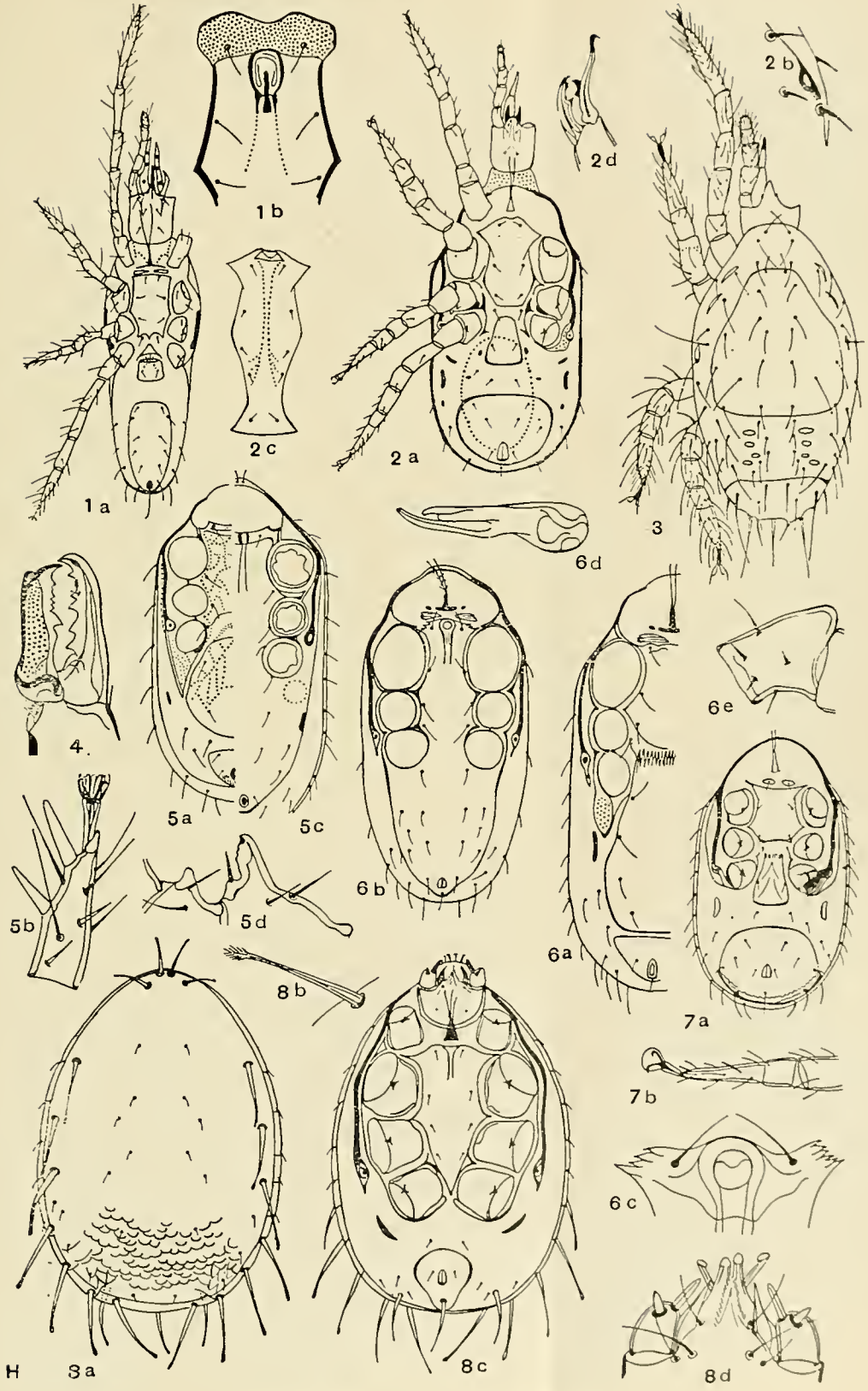

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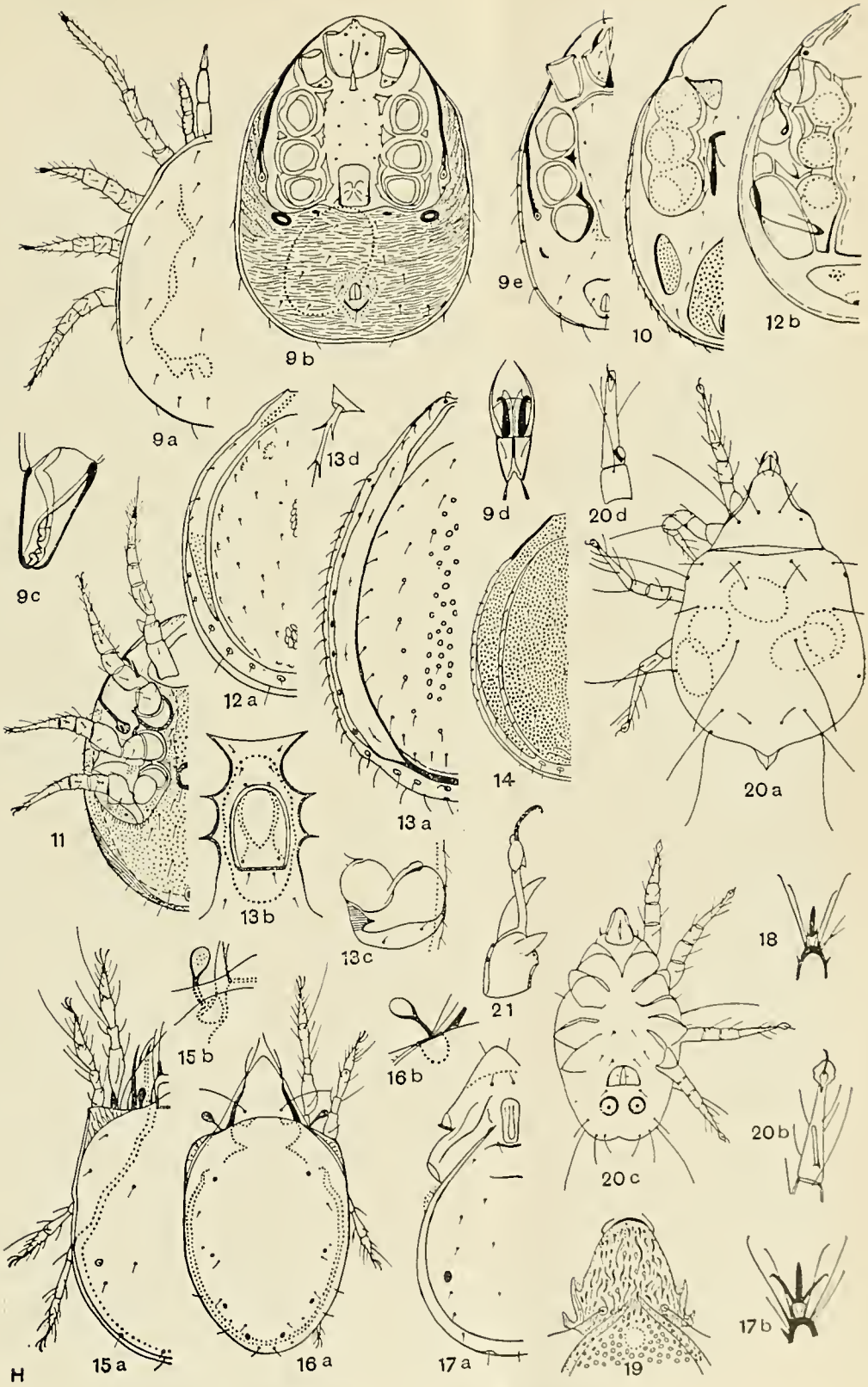

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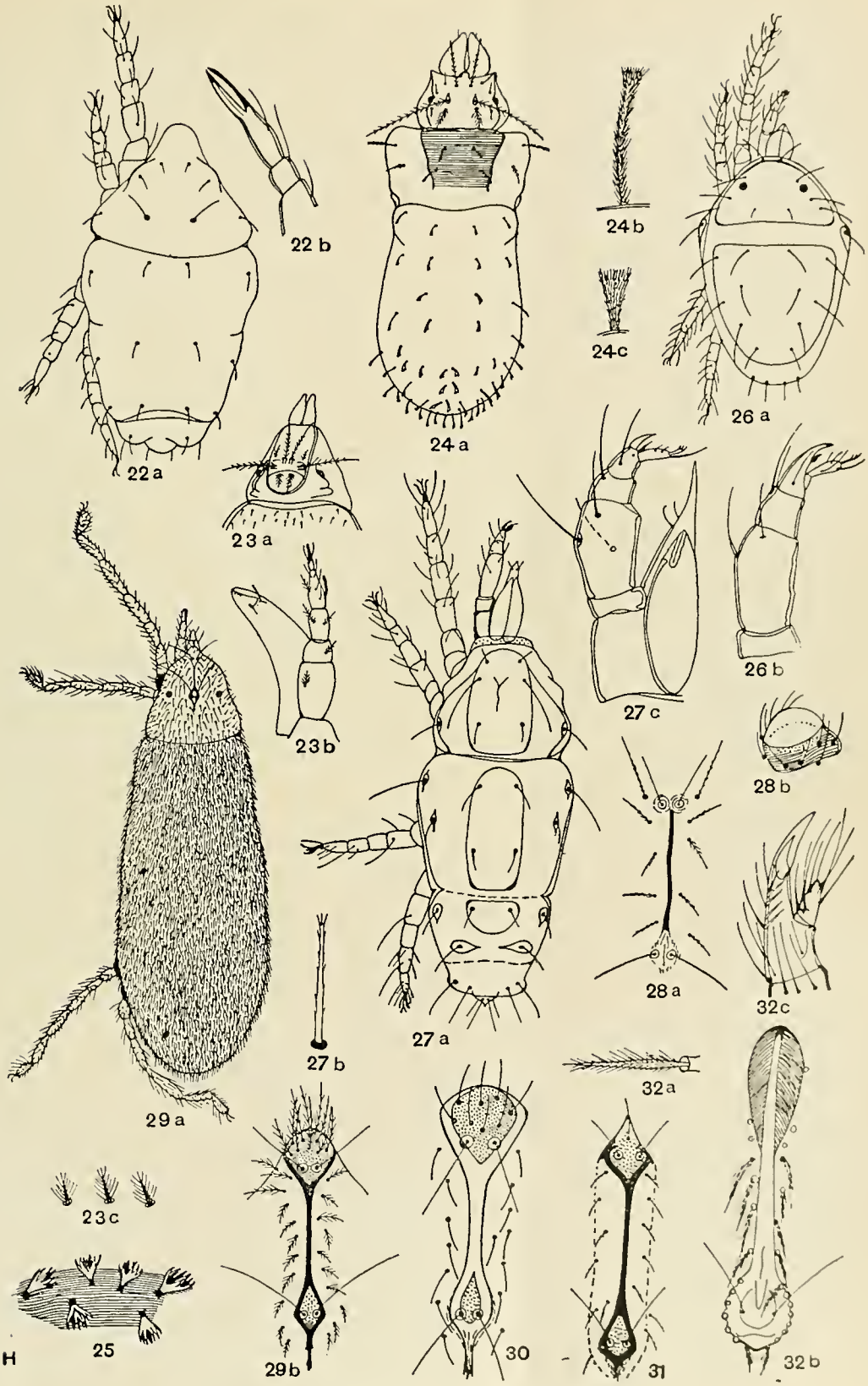

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