

Article V.—NEW ACARINA.**PART I.—GENERAL CONSIDERATIONS AND DESCRIPTIONS OF NEW SPECIES
FROM MINNESOTA, WISCONSIN, AND MICHIGAN.**

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PLATES VII AND VIII.

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PREFACE.

The paper here presented constitutes the first of a series to be published dealing chiefly with the acarid fauna of North America; and, as the title suggests, the series will treat entirely of new material. In order that the work may be more uniform, more complete, and hence more helpful, the following rules will be used in the writing of the different parts. Each part will deal with the fauna of some particular geographical district. There will be given with each description the locality, situation, and the name of the collector, for each record made of the species. Keys will be published where more than one species are described in a single genus. Each description will be accompanied with either comparisons or with the naming of the most nearly related described species; and finally, extensive illustrations will be given.

Such a comprehensive work as this would be impossible without the aid of many collectors. Thus far several specialists working in other groups of Arthropoda have sent the writer an abundance of material collected from many places in North America. Special mention should be made of the following: Dr. J. W. Folsom, assistant professor in the University of Illinois; Mr. C. A. Hart, systematic entomologist of the Illinois State Laboratory of Natural History; Mr. J. Douglas Hood, now with the Bureau of Biological Survey, U. S. Department of Agriculture; Mr. James Zetek, Messrs. R. D. and Hugh Glasgow, students at the University of

Illinois; Mr. J. E. Guthrie, assistant professor in the Iowa State College of Agriculture and Mechanical Arts; Mr. R. L. Webster, assistant entomologist, Iowa Agricultural Experiment Station; Mr. C. R. Crosby, assistant professor in Cornell University; and Dr. A. O. Gross, recently a fellow at Harvard University.

In closing his prefatory remarks the writer would like to add that he realizes that a heavy burden has been shouldered in undertaking such a series, but hopes that the work can be carried on until much, if not the most, of our acarid fauna is made known to science.

INTRODUCTION.

Of the various orders which go to make up the class Arachnida none is richer in number of species or individuals than the order Acarina; yet concerning the life of these much yet remains to be learned. In this group are found species so minute that they are microscopic, yet others that are much too large to be mounted on microscope slides. The order includes the small, dark, hard-shelled beetle mites; the soft bodied cheese mites; the long-beaked snout mites; the bright, velvety harvest mites; and the brilliantly colored water mites. Among the mites of economic importance are the red spiders, which attack cultivated plants; the gall mites, which by their ravages cause the distortion of the leaves of trees, etc.; the ticks, several of which are now known to be carriers of deadly protozoan diseases; the itch mites, which cause the "scab" of sheep and swine and the "scaly leg" of poultry; the *Dermanyssidæ*, or mite lice, of birds and chickens. Not all the families which are of economic importance are detrimental, however; some are beneficial. Among these are the predaceous mites which destroy the eggs and young of some of our worst scale insects, and others which attack flies, aphids, etc. To such a class belong the *Bdellidæ*, *Eupodidæ*, many of the *Gamasidæ*, *Cheyletidæ*, etc.

Just how many species of Acarina there are in North America, it can only be very roughly estimated. At present considerably over 600 species have been described, but almost all of these have been collected in a haphazard way from the eastern part of the United States. These 600 species probably do not represent much more than one half the total number existing in this area, so that it is safe to say that an estimation of 1,000 species for that part of the United States east of the Rocky Mountains is none too high. Concerning the rest of the fauna, in the past, we have had too few data to make any reliable estimate. Recently, however, the writer has come into possession of large collections from the Pacific Coast. An examination of these has shown that the Pacific Coast fauna is about as

rich in numbers as that of the eastern United States, and that in a large majority of cases the species are new. From this we should expect almost 1000 species from that part of the United States west of the Rocky Mountains. Then there are left: Canada, Alaska, Mexico, the West Indies, and tropical Central America. The collections which I have examined from northern Minnesota indicate that in northwestern Canada a rich and varied fauna will be found. The fauna of southeastern Canada is similar in nearly all respects to that of New York, as has been revealed by Banks's work on collections from Ontario. Judging from our knowledge of the tropical fauna of Egypt and India we should not expect to find as rich and varied a fauna in Mexico and Central America as is found in the temperate zones, but of course the species would in the main be new, as but little collecting has been done in these parts. If the writer were to make an estimate of the total number of species in North America, he would certainly place it at not less than 3,000.

GENERAL STRUCTURE AND DEVELOPMENT.

EXTERNAL STRUCTURES. The body of an acarid consists of two parts, which may or may not show a constriction or suture at their junction. The anterior, usually the smaller part, is called the cephalothorax; the posterior, usually the larger part, is called the abdomen. The cephalothorax and the abdomen are broadly united, and in some instances it is impossible to tell where the one ends and the other begins. This character alone will separate the Acarina from the spiders and some of the other Arachnida.

Cephalothorax. The cephalothorax is large, and contains besides the mouth-parts and the two front pairs of legs, various sense organs, including the eyes and various kinds of tactile bristles. Internally it contains the brain, œsophagus, crop, tracheal trunks, salivary glands, and the large muscles controlling the mouth-parts and legs.

Abdomen. The abdomen may be either spherical, oblong-oval, or rectangular. It has various superior, lateral, and inferior structures which will be described in the next chapter. Although in some species the abdomen is densely clothed with hairs or plumose bristles, yet in other species it is glabrous and quite shiny. It is still a question as to whether the abdomen really bears the last two pairs of legs. In many families, the Trombidiidæ for example, it apparently does.

Legs. These vary greatly in shape and number of segments. Except in the Eriophyidæ, four pairs are always present in the adult. The number of segments found in a single leg varies from three to seven. In many of the genera, especially in the parasitic groups, the legs have become adapted

as clasping structures. In the Hydrachnidæ, the legs are adapted for swimming. Various tarsal appendages are present, which will be described later.

INTERNAL STRUCTURES. The internal organs found in the Acarina are very similar to those found in some of the other arachnid groups. As a whole they are simple, though this is not always true. They are compact, in conformity with the general shape of the body.

Respiratory System. The respiratory system when present consists of either a branched, tubular tracheal system opening through a few stigmata, as found in insects, or of an unbranched tubular system with each trachea ending in a minute air sac. Several families have no tracheæ.

Digestive System. The digestive system is the largest and most important of all the systems of internal organs found in the Acarina. It consists first of a sucking pharynx with walls more or less chitinized. Behind the pharynx is the œsophagus, a long, non-muscular, non-chitinous tube, which passes from the pharynx to the ventriculus, or stomach. Sometimes the posterior part of the œsophagus is enlarged into a crop, as in insects. The ventriculus is a very large, sac-like structure, which may bear from one to three pairs of pouches, or cæca, similar to those found in spiders or Phalangidea; but these pouches are not so prominent as they are in these other arachnids. Behind the ventriculus comes the small intestine, and at its junction with the large intestine, or the rectum, are situated the Malpighian vessels. The Malpighian vessels are not always present, however. The large intestine, or rectum, is the last region of the digestive tube. It is muscular and usually without secreting cells.

Excretory System. As has been mentioned, Malpighian vessels are present in some of the Acarina. These vessels are two in number, and are large in diameter as compared with those of insects. Their function has been demonstrated to be excretory, at least in part. Besides the Malpighian vessels there is in some of the Acarina an excretory organ which opens at the supposed anus. In such cases the intestine ends blindly and in part surrounds this excretory structure. Large, lateral hypodermal glands, which secrete a liquid substance have been demonstrated. Their function may be excretory.

Reproductive Organs of the Male. The male reproductive organs are very large. The most notable feature in regard to the male reproductive system is the frequent presence of enormous accessory glands, the functions of which in most cases are not known. The testes, usually two in number, are large and often are fused together; the vasa deferentia lead from the testes to the penis. The penis varies enormously in shape and structure in the different families. It may be fleshy and protrusible in much the same

manner as the ovipositor; or it may be hard and chitinous, and lance- or spear-shaped.

Reproductive Organs of the Female. The reproductive organs of the female consist of the ovaries, oviducts, oviducal glands, and the ovipositor. The ovaries are rather large and essentially paired. The oviducts are tortuous, convoluted structures which convey the ova to the ovipositor. There is present in some instances a large oviducal gland which apparently secretes much of the yolk of the egg. The ovipositor when present may be very long. In repose it lies within the body, but is protrusible, and often is trifid at its distal end.

Nervous System. The nervous system consists of large supra- and sub-oesophageal ganglia which may be fused, and of numerous nerves which radiate from this central mass. These nerves are distributed largely to the legs, the palpi, and the sense organs.

Many other organs, the functions of which are more or less doubtful, are found inside the body, and besides, much of the internal space is taken up by powerful striated muscles which move the legs, mouth-parts, digestive, and reproductive organs.

DEVELOPMENT. The following stages, or instars, are recognized in the development of practically all the Acarina: egg, larva, nymph, and adult. In some instances there may be two nymphal instars, and in others three. The eggs may be laid before the larva hatches, or the mother may give birth to living larvæ, or the larval stage apparently may be passed within the body of the mother.

The Egg. The eggs of mites are rather large as a rule in proportion to the size of the female. They are generally either spherical or oblong-oval, and are seldom furnished with spines or hooks. In number, the eggs laid by a single female may vary from 3 or 4 to as many as 10,000 according to the group or species.

The Larva. The larva has only six legs. As a rule the form of the larva suggests that of the adult. In many instances the larvæ of free-living parents are parasitic.

The Nymph. The nymph has four pairs of legs. It is not always easy, however, to distinguish the nymph from the adult. As a rule it is considerably smaller, and generally differs from the adult in having no external genitalia. Some nymphs are different from the adults in coloration. Such is the case in the nymphs of many of the Oribatoidea. Migratory nymphs are also known, for example the nymphs of many Tyroglyphidæ.

Protonymph, Deutonymph, and Tritonymph. When more than one nymphal instar occurs there may be special names for each instar, the first being called the protonymph, the second the deutonymph, and the third

the tritonymph. These nymphs are usually much alike, however, and sometimes are very similar to the adult.

The Adult. When there is a marked metamorphosis of the nymph it is easy to distinguish the adult, after one knows the life history of a single species in the group. In other cases it is very hard to tell the nymphs from the adults. In the case of the female the presence of a mature ovum, which can usually be seen through the walls of the body, will show that the specimen is adult. The presence of the external genitalia also is a sign of maturity. When none of these characters are available, much can be told from the size, coloration, and texture of the integument, provided one is already acquainted with some of the members of the group to which the new individual belongs. The adults are as a rule larger and better armed than the nymphs. There is frequently a great difference between the sexes in size, form, etc., though in some groups the sexes are alike. As regards numbers, the two sexes appear to be about equal.

EXTERNAL ANATOMY AND TERMINOLOGY.

In order to make this work more complete, more understandable, and more accessible to the general student of entomology, short descriptions and figures of the most important external structures used in systematic work on the Acarina are given. A large number of these structures are found only in single families or in a few cases only in certain important genera.

Capitulum.

The anterior portion of the cephalothorax containing the mouth-parts and a few other structures, when this portion is constricted off from the rest of the cephalothorax is termed the capitulum. It is present in only the Ixodidæ and Tarsonemidæ. (See Fig. 3, A and C).

Cephalothorax.

MOUTH-PARTS (Fig. 2). The anterior ventral appendages of the cephalothorax which have the functions of touch, taste, and mastication.

Chelicerae (*chel.*, Figs. 1, 2, and 6). The most anterior paired appendages of the cephalothorax; typically chelate in form, frequently retractile, and used in grasping, tearing, cutting, and chewing.

Stylet (*sty.*, Fig. 2). One or both of the arms of one of the chelicerae when they have become modified into needle-like piercing structures.

Apopophyses (*apo.*, Fig. 3, A). Processes on the tips of the chelicerae in the ticks.

Maxillæ (*max.*, Fig. 2, A). The fused second pair of body appendages.

Maxillary Lip (*max. l.*, Fig. 2, A). The free projecting antero-lateral portion of the maxillæ.

Palpi (*p.*, Figs. 1, 2 A, 3 A and C, etc.). The segmented appendages of the maxillæ.

Palpal Claw (*p. cl.*, Fig. 1). A large claw at the end of the palpus, being developed on either the last or the next to the last segment.

Thumb of Palpus (*p. th.*, Fig. 1). The modified last segment of the palpus which opposes the next to the last segment.

SUPERIOR STRUCTURES OF CEPHALOTHORAX. The superior structures of the cephalothorax are quite numerous in some species and are frequently concerned with the development of special senses.

Eyes (*e.*, Fig. 1). Paired structures, either single or double, consisting each of a transparent cornea and a pigmented sense-area. Sometimes the eyes are stalked; more often they are absent.

Epistome (*epis.*, Fig. 5, A). A chitinous structure varying greatly in shape in different species, and projecting from the tip of the cephalothorax above the mouth-parts.

Dorsal Groove, or Crista (*cr.*, Fig. 1). A chitinous rod present on the median line in the upper wall of the cephalothorax. Its function is to furnish attachment to the powerful muscles of the mouth-parts.

Scutum (*sc.*, Fig. 3, C). A hard, corneous shield present in the Ixodidæ on the dorsal part of the cephalothorax.

Lamellæ (*lam.*, Fig. 4). Paired blade-like expansions of the chitinous integument of the dorsal wall of the cephalothorax. Found only in Scleroderma.

Translamella (not figured). A chitinous bar or blade joining the lamellæ at their anterior ends.

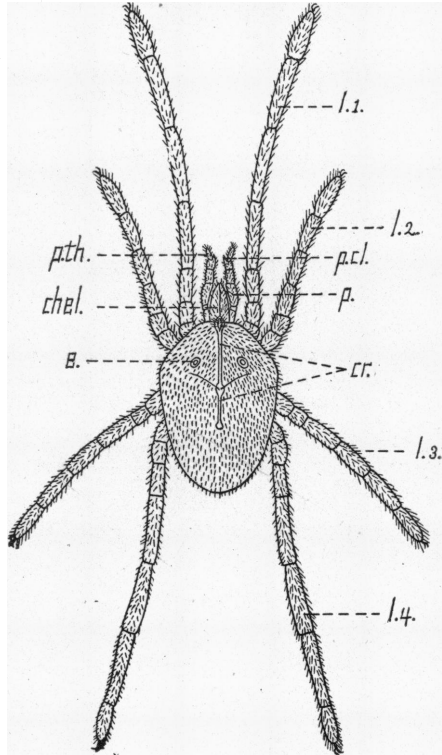


Fig. 1. *Rhyncholophus robustus* Banks; dorsal view. *chel.*, chelicera; *cr.*, dorsal groove, or crista; *e.*, eye; *l. 1.*, leg I; *l. 2.*, leg II; *l. 3.*, leg III; *l. 4.*, leg IV; *p.*, palpus; *p. cl.*, palpal claw; *p. th.*, palpal thumb.

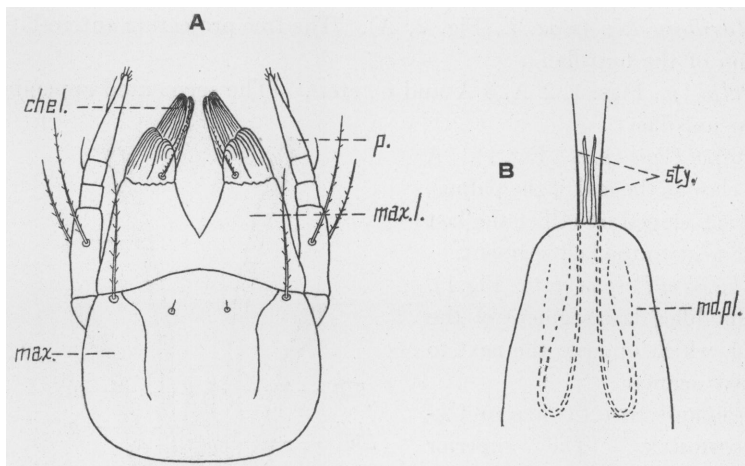


Fig. 2. A.—*Oribata maxima* Ewing; ventral view of mouth-parts. *chel.*, chelicera; *max.*, maxilla; *max. l.*, maxillary lip; *p.*, palpus. B.—*Tetranychus telarius* L.; mouth-parts as seen from above. *md. pl.*, mandibular plate; *sty.*, stylets.

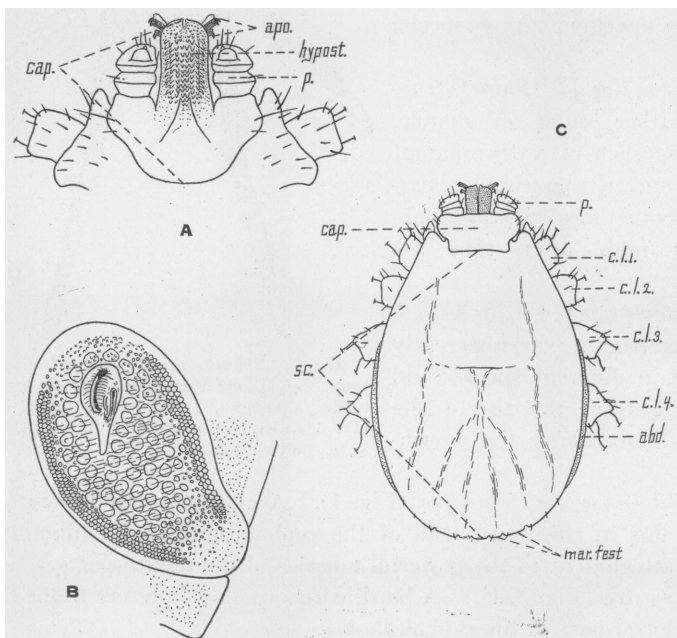


Fig. 3. A.—*Margaropus annulatus* (Say); capitulum of male as seen from below. *apo.*, apophyses; *cap.*, capitulum; *hypost.*, hypostome; *p.*, palpus. B.—*Dermacentor occidentalis* Neum.; stigmal plate of male. C.—*Margaropus annulatus* (Say); dorsal view of body. *abd.*, soft part of abdomen showing beyond edge of scutum; *cap.*, capitulum; *c. l. 1.*, coxa of leg I; *c. l. 2.*, coxa of leg II; *c. l. 3.*, coxa of leg III; *c. l. 4.*, coxa of leg IV; *mar. fest.*, marginal festoons; *p.*, palpus; *sc.*, scutum.

Pseudostigmata (*pstg.*, Fig. 4). A pair of large dorsal pores on the dorsal, posterior part of the cephalothorax in the beetle mites.

Pseudostigmatic Organs (*pstg. o.*, Fig. 4). Specialized setæ which arise, one from each of the pseudostigmata. They vary greatly in shape and size.

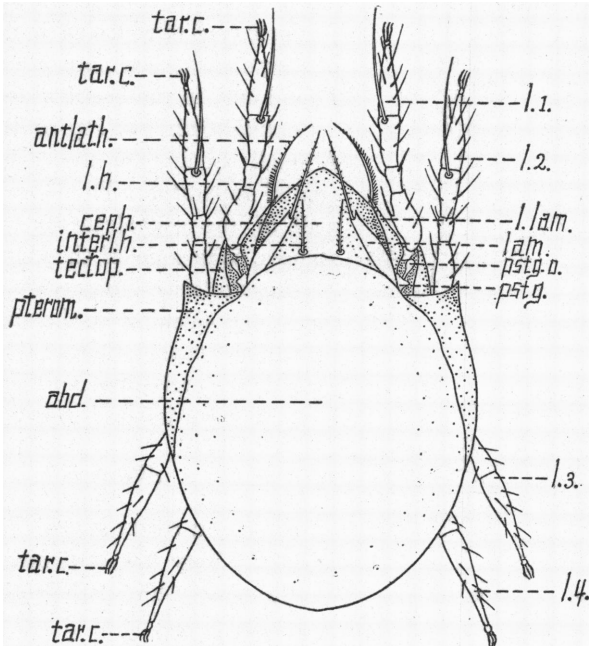


Fig. 4. *Oribata illinoisensis* Ewing; dorsal view. *abd.*, abdomen; *antlat. h.*, antero-lateral hair; *ceph.*, cephalothorax; *interl. h.*, interlamellar hair; *lam.*, lamella; *l. lam.*, lateral lamella; *l. h.*, lamellar hair; *l. 1.*, leg I; *l. 2.*, leg II; *l. 3.*, leg III; *l. 4.*, leg IV; *pstg.*, pseudostigma; *pstg. o.*, pseudostigmatic organ; *pterom.*, pteromorpha; *tar. c.*, tarsal claws; *tectop.*, tectopodium.

Interlamellar hairs (*interl. h.*, Fig. 4). A pair of large, erect setæ always situated between the lamellæ.

Lamellar hairs (*l. h.*, Fig. 4). A pair of large setæ, each being borne at the anterior end of one of the lamellæ.

Antero-lateral hairs (*antlat. h.*, Fig. 4). A pair of rather prominent setæ, usually strongly curved and pectinate, situated at the sides of the rostrum. Present only in the beetle mites.

INFERIOR STRUCTURES (Figs. 3, 5, 6, etc.). But few structures are found on the inferior surface of the cephalothorax.

Epimera (*epim.*, Fig. 6). These are chitinous bars, present in pairs on the ventral surface of the cephalothorax, and usually fused more or less at

the median line so as to form a skeletal support for the body and a means of attachment for the legs and the muscles which move them.

Hypostome (*hypost.*, Fig. 3, A). A chitinous ventral projection, extending forward below the chelicerae.

Tectopodia (*tectop.*, Fig. 4). One or more pairs of curved chitinous projections, each of which arises near the coxa of a leg and extends more or less around it. Found only in the beetle mites.

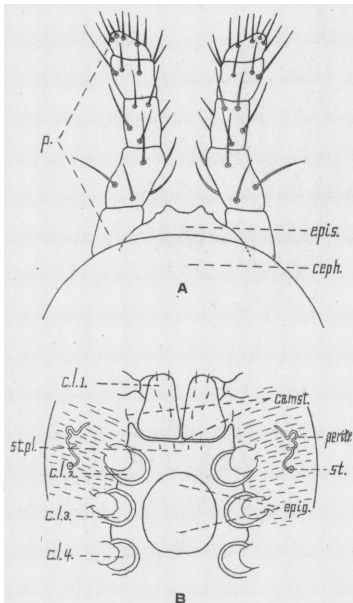


Fig. 5. A.—*Gamasus magnicornus* Ewing; palpi and anterior part of cephalothorax. *ceph.*, cephalothorax; *epis.*, epistome; *p.*, palpus. B.—*Uropoda pennsylvanica* Berlese; ventral view of central part of body of female. *camst.*, camerostome; *c. l. 1.*, coxa of leg I; *c. l. 2.*, coxa of leg II; *c. l. 3.*, coxa of leg III; *c. l. 4.*, coxa of leg IV; *epig.*, epigynum; *peritr.*, peritreme; *st. pl.*, sternal plate; *st.*, stigma.

Genital Opening (Figs. 5, B and 8, B). A small opening for the male or female genital apparatus. Found on the ventral wall of the cephalothorax in some instances, as in some of the Gamasidæ.

Camerostome (*camst.*, Fig. 5, B). A large body-opening at the antero-ventral part of the cephalothorax, through which extends the oral tube and the first pair of legs. Present in the Uropodidæ.

Abdomen.

SUPERIOR STRUCTURES (Figs. 1, 3, 4, and 7). Very few structures are found on the upper side of the abdomen in the Acarina.

Bristles (*br.*, Fig. 7). The arrangement and shape of the bristles on the dorsal side of the abdomen are of special importance. These bristles may be simple, singly pectinate, doubly pectinate, plumose, or foliaceous.

Dorsal Anus (*d. a.*, Fig. 7). In a few species, for example some of the itch mites and some of the harvest mites, the anus is dorsal. It is then very near the posterior margin of the body.

LATERAL STRUCTURES (Figs. 4, 8, etc.). The lateral structures of the abdomen are numerous and of considerable systematic importance.

Pteromorphæ (*pterom.*, Fig. 4). Chitinous wing-like expansions from the sides of the abdomen. Found only in the Oribatidæ.

Excretory Tubes (Fig. 8, A). Tubular integumentary processes from the sides of the abdomen which are in connection with hypodermal glands. Only present in a few of the beetle mites.

Peritreme (*peritr.*, Fig. 5, B). The chitinous structure enclosing one of the trunks of the tracheæ. Present only in the Peritremata.

Stigma (*st.*, Fig. 5, B). The external tracheal opening.

Stigmal Plate (Fig. 3, B). The chitinous plate which surrounds the stigma. Found in the ticks.

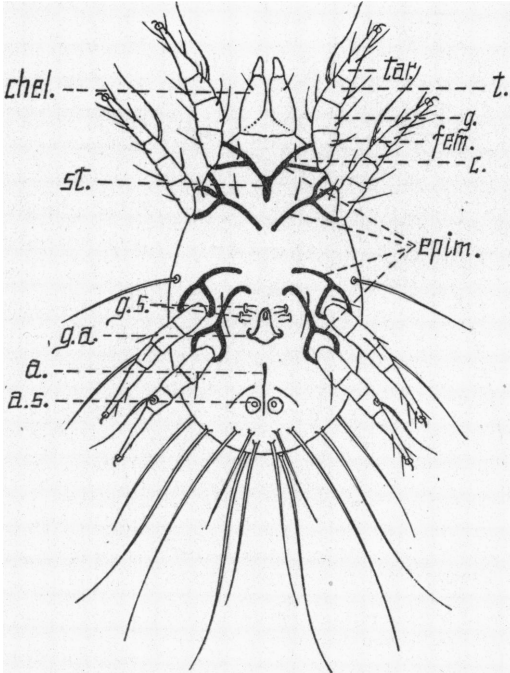


Fig. 6. *Tyroglyphus lintneri* Osb.; ventral view. a., anus; a. s., anal suckers; c., coxa; chel., chelicera; epim., epimera; fem., femur; g., genual, or patella; g. a., genital armature; g. s., genital suckers; st., sternum; t., tibia; tar., tarsus.

Marginal Festoons (*mar. fest.*, Fig. 3, C). A row of similar lobes, or festoons, formed at the posterior margin of the body by corrugations of the integument.

INFERIOR STRUCTURES (Figs. 6 and 8). Most of the inferior structures of the abdomen are related to the genital or the anal opening.

Epimera (*epim.*, Fig. 6). Chitinous supporting rods, or bands, for the legs. The posterior pair or the two last pairs may be present on the ventral side of the abdomen.

Genital Opening (Figs. 5, B and 8, B). The opening through which the genital organs or their products may be respectively protruded or emitted.

Genital Suckers (*g. s.*, Fig. 6). Suckers situated near the genital opening. Used for adhesion during copulation.

Genital Covers (*gen. c.*, Fig. 8, B). Chitinous folding plates which close the genital opening. Present only in the beetle mites.

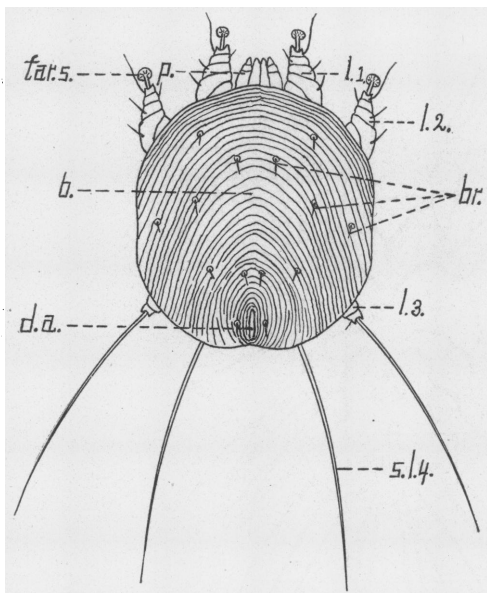


Fig. 7. *Notadres notadres* (Mégn.) dorsal view. *b.*, body, without demarcation between cephalothorax and abdomen; *br.*, bristles; *d. a.*, dorsal anus; *l. 1.*, leg I; *l. 2.*, leg II; *l. 3.*, leg III; *p.*, palpus; *s. l. 4.*, tactile seta of leg IV; *tar. s.*, tarsal sucker.

Genital Spines (*gen. sp.*, Fig. 8, B). Spines situated around the genital opening. Function unknown.

Anus (*a.*, Fig. 6). The posterior opening of the alimentary canal.

Anal Suckers (*a. s.*, Fig. 6). Adhesive suckers situated near the anus.

Anal Covers (*a. c.*, Fig. 8, B). Chitinous folding plates which close the anal opening. Present only in the beetle mites.

Anal Plate (not figured). A large chitinous plate, or sclerite, surrounding the anus. Present notably in the Gamasidæ.

Sternal Plate (*st. pl.*, Fig. 5, B). A large chitinous plate on the ventral wall of

the cephalothorax. It may or may not be perforated by the genital aperture.

Epigynum (*epig.*, Fig. 5, B). A chitinous plate which folds down over the opening for the female reproductive organs.

Legs.

There are four pairs of legs in all adult mites excepting the Eriophyidæ. In general the legs consist of from five to seven segments.

Coxa (*c.*, Fig. 6). This is the most proximal of the segments. It is generally free, short, and stout; and is sometimes almost hidden inside of a large acetabulum.

Trochanter (Not figured). This segment may or may not be present. It is a short, stout segment situated next to the coxa.

Femur (fem., Fig. 6). The largest segment of the leg. It is the second segment from the body in legs of five segments, and the third segment in legs which have a trochanter.

Genual, or Patella (g., Fig. 6). This is the smallest segment of the leg, and the one at which the bend of the leg is greatest. It is the next segment distad to the femur.

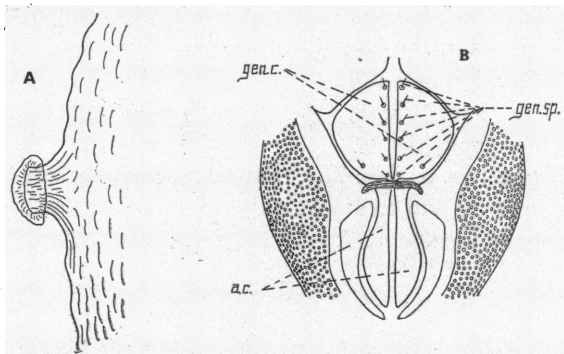


Fig. 8 A.—*Hermanniella subnigra* Ewing; a portion of the lateral part of abdomen showing one of the excretory tubes. B.—*Nothrus quadripilus* Ewing; ventral view of a large part of the abdomen a. c., anal covers; gen. c., genital covers; gen. sp., genital spines.

Tibia (t., Fig. 6). The penultimate segment. Long, usually stouter at the distal than at the proximal end, and frequently bearing a long tactile bristle.

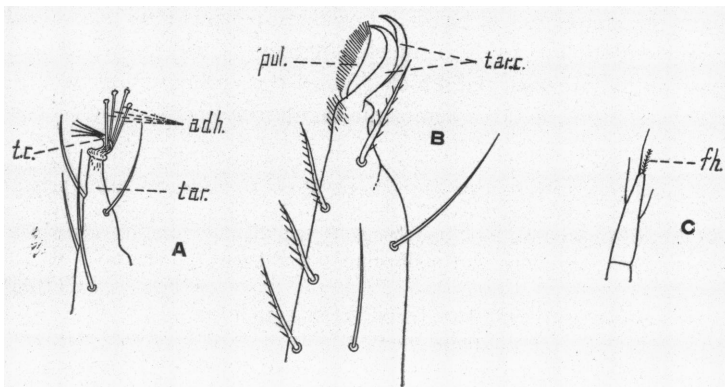


Fig. 9. A.—*Tetranychus telarius* L.; tip of tarsus of leg I. ad. h., adhesive hairs; tar., tarsus; t. c., tarsal claw, showing it four-cleft. B.—*Notophallus dorsalis* Banks; inside view of distal end of tarsus of leg I. pul., pulvillus, or caruncle; tar. c., tarsal claws. C.—*Eriophyes ulmi* Garman; tarsus of leg I. fh., feather-hair.

Tarsus (tar., Fig. 6). The last segment; nearly always provided at its distal end with claws, sometimes with a pulvillus, and other appendages.

Tarsal Claws (*tar. c.*, Figs. 4, 9). At the tip of the tarsus there are usually one or two claws; if there is only one claw, it may be two-, three-, or four-cleft.

Pulvillus, or *Caruncle* (*pul.*, Fig. 9, B). A pad, or sucker-like appendage, found at the tip of the tarsus. It is usually situated between two tarsal claws.

Adhesive Hairs (*ad. h.*, Fig. 9, A). Prominent hair-like appendages at the tip of the tarsus in the family Tetranychidæ supposed to be related in some way to the spinning habit.

"*Feather-hair*" (*fh.*, Fig. 9, C). A feather-like appendage at the tip of the tarsus in Eriophyidæ.

Tarsal Suckers (*tar. s.*, Fig. 7). Partial vacuum suckers found usually at the tips of the tarsi and on stalks, although in a few cases they are sessile on the sides of the tarsi.

CLASSIFICATION.

In 1909 the writer published a classification of the higher groups of the Acarina,¹ and took up the consideration of such work in some detail. Since that time several interesting new species have been described which throw a great deal of light upon the natural arrangement of the various genera and higher groups within the order. Berlese, especially, has added many such species to the fauna of the world. Also a considerable advance has been made in the study of morphological characters of the older forms and especially the characters of larvæ. For these reasons it is now possible to make some definite advances in the classification of the group. The following classification is suggested which divides the order into six well defined suborders and three of these again into eight sections.

A CLASSIFICATION OF THE SUBORDERS AND SECTIONS OF THE ACARINA.

- I 1. Adults with only four legs, body vermiform; very minute acarids which cause various discolorations and malformations of leaves of plants
Suborder TETRAPODA.
- I 2. Adults always with eight legs, body seldom vermiform.
 - II 1. Without tracheæ; palpi small, usually of only three segments, and fused more or less to the base of the lip; legs supported by epimera
Suborder ATRACHEATA.
 - III 1. Body vermiform, legs rudimentary, and composed of only three segments; living in the hair-follicles of mammals.
Section **Brachypoda.**

¹ A Systematic and Biological Study of the Acarina of Illinois. University of Illinois Bulletin, Vol. VII, No. 14. University Studies, Vol. III, No. 6, pp. 387-401.

- III 2. Body stout, not vermiform, legs composed of more than three segments.....Section **Epimerata**.¹
- II 2. Tracheæ when present opening ventrally either near the base of the rostrum or at the acetabula of the legs. At least two distinct types of tracheæ present, the branched and the unbranched. Some forms without tracheæ.....Suborder **HETEROTRACHEATA**.²
- III 1. With tracheæ which open on the ventral surface of the body near the rostrum; mouth-parts rudimentary, and situated on a cephalic papilla. Abdomen frequently segmented
- Section **Heterostigmata**.
- III 2. Tracheæ sometimes absent but when present opening at the acetabula of the legs; cephalothorax with two large dorsal pores, termed pseudo stigmata, from each of which projects a specialized seta called the pseudo stigmatic organ.
- IV 1. Without tracheæ; cephalothorax hinged to the abdomen, and capable of being folded down over the ventral surface of the same.....Section **Ginglymosoma**.
- IV 2. With tracheæ, though they are often rudimentary; cephalothorax immovably fused with the abdomen; integument usually well chitinized.....Section **Scleroderma**.
- II 3. Tracheæ opening on each side of the body and usually through a peritreme or stigmal plate, situated above the coxæ of the legs; integument provided with chitinous plates or else leathery
- Suborder **PERITREMATA**.
- II 4. Tracheæ opening through four stigmata situated on the dorsal surface of the abdomen. Abdomen segmented...Suborder **NOTOSTIGMATA**.
- II 5. Tracheæ opening at the base of the chelicerae. Abdomen not segmented.....Suborder **PROSTIGMATA**.
- III 1. Tracheæ often wanting; legs frequently provided with hairs adapted for swimming. Aquatic Acarina...Section **Hydracarina**.
- III 2. Tracheæ always present and opening near the bases of the chelicerae; legs not provided with swimming hairs. Terrestrial Acarina.
- IV 1. Last segment of palpus forming a distinct thumb, or finger, to the preceding segment which ends in a claw
- Section **Dactylognatha**.³
- IV 2. Last segment of palpus never forming a thumb, or finger, to the preceding segment; legs never with swollen tarsi. Very agile Acarina.....Section **Adactylognatha**.⁴

A CLASSIFICATION OF THE FAMILIES AND SUPERFAMILIES OF ACARINA.

Suborder TETRAPODA.

Contains only a single family; with the characters of the suborder

Fam. *Eriophyidae*.

¹ Epimera + ata.

² From *erepos* = other + tracheata.

³ From *δάκτυλος* = thumb, or finger, + *γνάθος* = jaw, or mouth.

⁴ From *a* = not + dactylognatha.

Suborder ATRACHEATA.

Section **Brachypoda**.

Contains only a single family.....Fam. *Demodecidae*.

Section **Epimerata**.

I 1. Skin with fine parallel folds; tarsi sometimes without claws; tarsal suckers when present stalked. Parasitic in all the developing stages

Superfam. SARCOPTOIDEA.

II 1. Without any specialized apparatus for clasping the hairs of mammals.

III 1. Small soft-bodied forms living in the skin of vertebrates, or upon insects.

IV 1. Inhabiting the living tissues of vertebrates.

V 1. Vulva longitudinal. Parasitic in the cell tissues of birds.

Fam. *Cytolichidae*.

V 2. Vulva transverse. Mouth-parts free. Usually on mammals.....Fam. *Sarcoptidae*.

IV 2. Parasitic on insects.....Fam. *Canestrinidae*.

III 2. Living as commensals in the feathers of birds. Sexual dimorphism sometimes very pronounced.....Fam. *Analgesidae*.

II 2. Either the under lip or some of the legs modified into clasping organs, which are used for holding on to the hairs of mammals

Fam. *Listrophoridae*.

I 2. Skin without fine parallel folds; tarsi without stalked suckers; in the adult state never parasitic.....Fam. *Tyroglyphidae*.

Suborder HETEROTRACHEATA.

Section **Heterostigmata**.

I 1. Hind legs of the female ending in long hairs; migratory nymphs sometimes present.....Fam. *Tarsonemidae*.

I 2. Hind legs of the female ending in claws and sucker. Females very prolific, often many times their normal size when pregnant....Fam. *Pediculoididae*.

Section **Ginglymosoma**,

Only one family included.....Fam. *Hoplodermidae*.

Section **Scleroderma**.

I 1. Abdomen usually segmented; integument thin and but little chitinized. Internal organs rather simple.....Fam. *Hypochthonidae*.

I 2. Abdomen never segmented; integument well chitinized. Internal organs better developed.

II 1. Abdomen without pteromorphæ; tracheæ usually large and without terminal air sacs.....Fam. *Nothridae*.

II 2. Abdomen with pteromorphæ; tracheæ small but ending in minute air sacs.....Fam. *Oribatidae*.

Suborder PERITREMATA.

I 1. Peritreme usually present, long, tubular; hypostome small, without recurved teeth; integument wholly or partially chitinized but not usually leathery

Superfam. GAMASOIDEA.

- II 1. First pair of legs inserted in the same opening with the mouth-parts; dorsum of body extending forward over the camerostome

Fam. *Uropodidæ.*

- II 2. First pair of legs inserted at one side of the mouth opening; dorsum not projecting beyond the camerostome.

- III 1. Chelicerae stout, with large chelæ. Rarely parasitic.

Fam. *Gamasidæ.*

- III 2. Chelicerae slender, fitted for piercing. Parasitic on vertebrates.

Fam. *Dermanyssidæ.*

- I 2. Peritreme a discoidal plate; hypostome large dart-like with recurved teeth; integument leathery..... Superfam. IXODOIDEA.

- II 1. Palpi cylindrical, composed of four segments; scutum absent; no tarsal pulvilli present..... Fam. *Argasidæ.*

- II 2. Palpi flat or grooved; scutum and tarsal pulvilli present.. Fam. *Ixodidæ.*

Suborder NOTOSTIGMATA.

But one family containing a single genus of four species..... Fam. *Opilioacaridæ.*

Suborder PROSTIGMATA.

Section **Hydracarina.**

- I 1. Mouth-parts situated on a distinct beak. Marine forms.. Fam. *Halacaridæ.*

- I 2. Mouth-parts not situated on a beak. Fresh water forms... Fam. *Hydrachnidæ.*

Section **Dactylognatha.**

- I 1. Last segment of palpus forming a distinct thumb to the preceding. Palpi moving vertically..... Superfam. TROMBIDOIDEA.

- II 1. Coxæ arranged into two groups.

- III 1. Palpi very large. Legs stout; tarsi swollen. Body thickly clothed with rather short hairs.

- IV 1. Chelicerae not styliform, but each bearing a falcate appendage at its apex; cephalothorax small, not on the same plane with the abdomen. Eyes frequently stalked.... Fam. *Trombidiidæ.*

- IV 2. Chelicerae styliform; cephalothorax large, on the same plane with the abdomen; dorsal groove present. Eyes sessile

Fam. *Erythraeidæ.*

- III 2. Palpi very small. Legs slender; tarsi never swollen. Body sparsely clothed with hairs. Spinning glands usually present

Fam. *Tetranychidæ.*

- II 2. Coxæ contiguous; arranged radially.

- III 1. Legs I and II without processes or spines; integument without shields
Fam. *Erythracaridæ.*

- III 2. Legs I and II with processes bearing large spines; integument with shields..... Fam. *Cæculidæ.*

- I 2. Last segment of palpus a short papilla bearing large claws or pectinate setæ; penultimate segment with a very large, stout claw. Palpi stout, moving horizontally..... Fam. *Cheyletidæ.*

Section **Adactylognatha**.

- I 1. Palpi raptorial or ending in long bristles, in which case they are geniculate; cephalothorax with four long tactile bristles above. Fam. *Bdellidæ*.
 I 2. Palpi not raptorial or geniculate. Legs often very long. Acarina with very agile movements, often sideways or backwards. Fam. *Eupodidæ*.

Thus the whole order is divided into six suborders instead of two as given in the writer's classification in 1909. The reasons for this are several, but only a few will be considered here. First, the old suborder VERMIFORMIA, including the Eriophyidæ and the Demodecidæ, is unnatural, for these groups certainly have had very different origins, and their resemblances are only superficial. The work of several acarologists and an extended investigation by the writer himself into the phylogeny of the Demodecidæ have convinced him that the mites of this family are only an offshoot of the older sarcoptid stem; while the Eriophyidæ had an entirely different origin, and may have come from the same stem as the red spiders, Tetranychidæ, as suggested by Oudemans. Second, the division of the ROBUSTIFORMIA, the other suborder given, into eight divisions of equal rank is hardly satisfactory; for after a more extended study some of these divisions have been found to have sufficiently well defined limits and to have characters of such importance as to entitle them to a higher rank than that which was given them. Others, for the opposite reasons, should be assigned an inferior rank. Hence the old groups ATRACHEATA, PERITREMATA, NOTOSTIGMATA, and PROSTIGMATA used in the writer's previous classification have been raised to the rank of suborders; while the groups BRACHYPODA, HETEROSTIGMATA, GINGLYMOSOMA, SCLERODERMA, and HYDRACARINA have been given as sections under their respective suborders. Of course the six suborders as given in the present classification do not have equal rank, and this very fact is clearly shown in the key to the suborders and sections; yet for the sake of simplicity they are given as such. No doubt the suborders TETRAPODA and NOTOSTIGMATA are more clearly defined than the other four.

The reasons for reducing the rank of the other groups are as follows. As has already been stated the affinities of BRACHYPODA with *Sarcoptoidea* are clear; hence it would seem better to place the two groups together as sections under ATRACHEATA. The group HETEROSTIGMATA, although raised to the rank of a suborder by Berlese and by Warburton, does not appear to deserve to be so raised because it is not a well defined group, and shows strong affinities with the old family Oribatidæ. The two groups formerly created by the writer, GINGLYMOSOMA and SCLERODERMA, have recently been shown to be closely related by Berlese's discovery of several

species which form connecting links between them. For these reasons the former groups HETEROSTIGMATA, GINGLYMOSOMA, and SCLERODERMA should be reduced in relative rank; and are here given as sections under a new suborder, HETEROTRACHEATA. There never has been any good reason of late years for giving the water mites, HYDRACARINA, the rank of a suborder as they are now known to be very closely related to the harvest mites. They should be placed with the latter under the suborder PROSTIGMATA. This has been done here and the old group PROSTIGMATA has been divided into three sections.

In regard to the families and superfamilies, no changes have been introduced in this classification, though I would like to suggest that the two families Trombidiidæ and Erythræidæ have so many of their characters dovetailing that it may prove better in the future to unite the two. However, in the character of their chelicerae these two families are quite distinct.

In closing my remarks upon the classification I might add that very recently Oudemans has suggested some radical changes and readjustments in the rank of some of the divisions of the Acarina, but it appears to me that in most of these instances he has given entirely too much weight to single characters rather than to the consideration of all the characters which are of systematic value. In a few of these instances these changes are based upon observations or study of some rare and exotic forms, and doubtless are logical. The writer prefers in a work of this kind, however, to be conservative, and to err, if need be, in favor of our older judgments rather than pass upon newly formed ones before an abundance of evidence has been submitted.

DESCRIPTION OF NEW SPECIES.

In this paper seventeen new species and two new varieties are described. These seventeen new species are distributed into twelve different genera. In one of these genera, *Oribata*, five new species are described, in another, *Bdella*, two new species are described, in each of the remaining ten genera a single species is described.

Genus *Bdella* Latreille.

Two new species and one new variety are described in this genus. The two new species may be separated by the following key.

- I 1. Integument of the body tessellated; beak about four times as long as thick
B. tessellata n. sp.
- I 2. Integument of the body not tessellated; beak about twice as long as thick
B. robustirostris n. sp.

Bdella tessellata new species. (Plate VII, Figs. 1 and 2.)

A rather large red species. Body red, darker at the posterior end; palpi red but lighter than the body; legs pale, pinkish, sometimes red. Integument of body tessellated, that is broken up into many small polygonal areas. These areas, irregular, red, granular, of about the same size over the whole upper surface of the body. Total length of palpi about the same as that of the beak; second segment more than two thirds as long as the beak; third segment subequal to the fourth in length; distal segment broadened at the tip, about one and a half times as long as segments three and four combined. Distal segment of palpus bearing five bristles; outer tactile bristle at its tip about as long as beak; inner tactile bristle about three fourths as long as the outer. On the outer margin of the distal segment slightly in front of the middle of the same is situated a bristle about as long as the segment itself; two other smaller and less important bristles are found not far from this one, one in front of it and one on the underside of the segment. Anterior pair of eyes situated about their diameter from the posterior pair. Shoulder bristles on abdomen about as long as tibia of leg I. Tibiæ of last pair of legs extending beyond the posterior margins of the abdomen by their whole length. Total length of the body including beak, 1.32 mm.; width, 0.54 mm.

From Portage, Wisconsin; under an old piece of wood which was lying on the ground; by the writer.

Several specimens obtained. This species is quite distinct from the other American species of the genus on account of the tessellated nature of the integument.

Bdella robustirostris new species. (Plate VII, Fig. 3.)

A rather small, stout species; reddish brown, with legs and palpi paler. Total length of palpi about one and a half times that of the beak; second segment of palpus about one half as long as beak; third segment of palpus about one and a half times as long as the fourth; distal segment somewhat broadened as you pass from the proximal to the distal end, slightly longer than three and four combined. Outer tactile bristles of palpus about as long as beak; inner tactile bristle about three fourths as long as the outer. A smaller bristle about one half as long as the distal segment itself, is situated on the outer margin of the segment at about one third the length of the segment from its distal end. Not far from this bristle is a smaller insignificant one. Beak short, stout, not more than one half as long as the body. Tibiæ of last pair of legs extending beyond the posterior margin of the abdomen by their entire length. Total length of body including beak, 0.70 mm.; width, 0.34 mm.

From Portage, Wisconsin; under a stone which was lying on the ground; by the writer.

This species is quite easily separated from the other American species on account of its short robust beak. According to palpal characters it appears to be more nearly related to *B. depressa* Ewing than to any other species.

Bdella muscorum Ewing, var **minnesotensis** new variety.

Similar to *B. muscorum* Ewing in nearly all respects, but smaller, not so highly colored, and with shorter tactile bristles on the palpus. Outer tactile bristle of distal segment of palpus about one and a half times as long as the segment itself; inner tactile bristle about two thirds as long as the outer.

From Minnesota; by J. E. Guthrie.

Genus **Sciris** Hermann.**Scirus laricis** new species. (Plate VII, Fig. 4.)

A rather small light colored species. Palpi one and a half times as long as beak, segment two of palpus longer than broad, broader at its distal end than at its proximal end; segment three as broad as long, with a large spur, or spine, on its inner distal aspect, otherwise without hairs or spines; segment four with but a single stout bristle, or spine, which is situated on its inner side a little beyond the middle of the segment; distal segment with a long spine which is situated on its inside and slightly below the middle of the segment. Anterior pair of legs extending to the tip of the palpi. Posterior pair of legs extending beyond the posterior margin of the abdomen by the length of their tarsi. Length of body including beak, 0.44 mm.; width 0.20 mm.

From Portage, Wisconsin; under the bark of *Larix laricina*; by the writer.

Related to *S. setirostris* Herm., but differing from it in having a much stouter spur on the third palpal segment, in having shorter palpi, etc. The palpi in *S. setirostris* Herm. extend beyond the tip of the beak by the full length of the last two segments while in this species only about one half of the fourth segment extends beyond the beak.

Genus **Trombicula** Berlese.**Trombicula splendens** new species. (Plate VII, Fig. 5.)

A beautiful medium-sized species, well clothed with prominent plumose hairs which give it a splendid echinate appearance. Palpi somewhat longer than the first two segments of leg I; thumb of palpus cylindrical, not swollen, extending to the tip of palpal claw. Eyes absent. Dorsal groove extending the whole length of cephalothorax. Abdomen as broad as long; hairs on abdomen longest toward the tip; each hair composed of a straight central shaft, along which project many subequal barbules which apparently have no definite arrangement. First pair of legs about as long as the body excluding the beak; tarsus of leg I longer than the tibia, but slightly swollen. Second pair of legs about two thirds as long as the first pair. Last pair of legs barely reaching the tip of the abdomen; tarsi not swollen. Total length including beak, 1.04 mm.; width, 0.96 mm.

From Portage, Wisconsin; under stones; by the writer.

Only a few individuals found. This beautiful species is the first of the genus to be recorded from our country.

Genus **Gamasus** Latreille.

Gamasus bifurcus new species. (Plate VII, Fig. 6.)

Male. A rather small pale species. Palpi extending beyond tip of mandibles by about one third their length. Upper arm of the chelicera somewhat sword-shaped, with two, sharp, triangular, cusp-like teeth on its lower aspect. Abdomen sparsely clothed with small, simple bristles. A prominent pair of stout, straight shoulder bristles also is present. Femur of leg II of male, two thirds as broad as long, with a single large, bifurcate horn situated on its inside slightly proximad to the middle of the segment; arms of this horn unequal; genual, or middle segment, somewhat swollen on the inside from which portion projects a rather small spur; no other spurs present on this segment; tibia almost twice as long as broad, and with but a single spur which is situated on the inside near the middle; tarsus normal, not in the form of a claw. First pair of legs about as long as the body; tarsus about one and a third times as long as tibia. Length, 0.76 mm.; width, 0.40 mm.

Female. Very similar to the male except that the upper arms of the chelicerae, and the second pair of legs are normal. The two sexes are nearly equal in size.

From Minnesota; by J. E. Guthrie.

Several specimens of this species were obtained. The species is separated from all others of the genus by the very characteristic, bifurcate tubercle on the inner side of the femur of leg II of the male.

Genus **Macrocheles** Latreille.

Macrocheles tridentifer new species. (Plate VII, Fig. 7.)

Male. A small, pale, yellowish species. Palpi slightly over one half as long as the front pair of legs. Chelicerae long, stout; chela longer than tibia of leg I. Abdomen broadest behind the last pair of legs, evenly rounded behind, sparsely clothed with short simple bristles; shoulder bristles straight, stout, as long as tibia of leg II. Anterior pair of legs longer than the body; tarsus almost twice as long as tibia; tibia subequal to genual; genual slightly shorter than femur. Second pair of legs enlarged, curved somewhat, about two thirds as long as the first pair of legs; femur almost as broad as long, with a very large tubercle, or horn, on its inside; horn curved, with a tooth on its inner margin; genual without tubercles, or spurs, somewhat longer than broad; tibia about as long as genual but not so broad, without spurs; tarsus about one and a half times as long as tibia. Length, 0.72 mm.; width, 0.38 mm.

Female. Very similar to the male except for the second pair of legs which are normal. Hypostome very large, consisting of three large lance-like projections which are united at their bases. The two outer projections of hypostome about one half as long as the palpi, the middle one slightly shorter.

From Minnesota; in greenhouse; by J. E. Guthrie.

Described from two males and one female. The very large trifid hypostome of the female at once separates this species from the others which we have of the genus.

Genus **Podocinum** *Berlese.*

Podocinum guthriei new species. (Plate VIII, Fig. 8.)

A pale, yellowish species; body clothed with a few very small simple hairs. Chelicerae long, stout. Palpi extending to the distal ends of the femora of the first pair of legs. Body two thirds as broad as long and broadest behind the coxae of the posterior pair of legs. Anterior pair of legs fully one and a half times as long as the body; trochanter of leg I almost as broad as long, with a small bristle situated on its inner margin; femur apparently divided into two segments by a transverse suture near its base; genua slightly shorter than the femur; tibia about one and a third times as long as the genua; tarsus shorter than the tibia. Leg II slightly over one half as long as leg I; tibia and genua subequal; tarsus over twice as long as tibia. Posterior pair of legs extending beyond the posterior margin of the body by the whole length of the tarsus and one half the length of the tibia. Total length of body, 0.58 mm.; width, 0.38 mm.

From Minnesota; by J. E. Guthrie.

Described from three specimens.

Genus **Uroseius** *Berlese.*

Uroseius tumidus new species. (Plate VIII, Fig. 9.)

A large, stout, light brown species with small appendages. Chelicerae large, stout, when protruded extending much beyond the palpi. Palpi about one half as long as the anterior pair of legs, with several prominent hairs at their tips. Body almost as broad as long, sparsely clothed with simple, curved bristles, or setae, which are especially prominent on the sides. Epigynum two thirds as broad as long, rounded in front, extending from between the posterior coxae to the posterior margins of the coxae of the second pair of legs. Femur of leg I about three times as long as broad; genua slightly over one half as long as femur; tibia slightly longer than genua; tarsus longer than tibia, clothed with several long hairs at its tip. Second pair of legs similar but stouter than the first. The last two pairs of legs are hidden when the arachnid is viewed from above. Length, 1.18 mm.; width, 0.92 mm.

From Minnesota; by J. E. Guthrie.

Only a single individual, a female, obtained. This is a mature female with several developing eggs in her body. The great size of the body as compared with that of the appendages is the most striking feature of the species. This is the first species of the genus to be described from our country.

Genus *Pelops* C. L. Koch.*Pelops minnesotensis* new species. (Plate VIII, Fig. 10.)

Chestnut brown, legs paler; integument rough. Cephalothorax short. True lamellæ present, extending almost to the tip of cephalothorax. Pseudostigmatic organs clavate, slightly pectinate, directed forward. Abdomen almost as broad as long, evenly rounded behind; dorsum not pitted, hairless. Genital covers, rectangular, smaller than anal covers, situated their length in front of the latter. Anal covers triangular, situated two thirds their length from the posterior margin of the ventral plate. Anterior pair of legs about two thirds as long as the abdomen; tarsus longer than tibia; tibia one and a third times as long as the genu. Tarsus and tibia of posterior pair of legs subequal; tip of tarsus extending to the level of the posterior margin of abdomen. All the legs bear a few stout, pectinate spines. Ungues heterodactyle. Length, 0.40 mm.; width, 0.30 mm.

From Jordan, Minnesota; by J. E. Guthrie. From Shakopee, Minnesota; on weeds at the edge of a slough; by J. E. Guthrie. From near Lake Keuka, New York; in leaf mold; by C. R. Crosby.

Described from many specimens. This species is at once separated from almost all others of the genus by the absence of hairs on the dorsum of the abdomen. *P. bifurcatus* Ewing also has no hairs on the dorsum of abdomen, but in this latter species there is present at the anterior margin of the abdomen a pair of large flattened, bifurcate setæ, a character which is absent in *P. minnesotensis* n. sp.

Genus *Oribata* Latreille.

The five species described in this genus may be separated by the following key.

- I 1. Pteromorphæ long, rounded in front, and extending far beyond the anterior margin of the abdomen.
 - II 1. Head of pseudostigmatic organ, long, straight, almost rod-like yet becoming larger as you pass from its base to its tip. *O. salicis* n. sp.
 - II 2. Head of pseudostigmatic organ subcapitate, almost as broad as long; pedicel very long and recurved. *O. corticis* n. sp.
- I 2. Pteromorphæ short, truncated anteriorly, and not extending beyond the anterior margin of the abdomen.
 - II 1. Translamella absent.
 - III 1. Integument of body smooth, shiny; dorsum of abdomen hairless
O. minnesotensis n. sp.
 - III 2. Integument of body pitted; dorsum of abdomen clothed with short, stout, almost straight, pectinate setæ. *O. juniperi* n. sp.
 - II 2. Translamella present. *O. boletorum* n. sp.

Oribata salicis new species. (Plate VIII, Fig. 11.)

Light chestnut brown; integument smooth. Lamellæ without cusps, very low, situated near the sides of the cephalothorax, slightly over two thirds as long as the same; lamellar hairs slightly longer than the lamellæ. Translamella absent. Interlamellar hairs subequal to lamellar hairs, divergent, situated about half way from the lamellæ to the median line. Pseudostigmatic organ slightly pectinate, almost rod-like, slightly enlarged as you pass from its base to its tip, recurved at its base. Pteromorphæ rounded in front, extending two thirds the distance to the tip of the rostrum; integument of pteromorphæ showing radiating folds but these folds are not pronounced; ventrally pteromorphæ not emarginate. Abdomen oblong, dorsum hairless; no light or dark spots showing through the integument; at the posterior end of the abdomen on the ventral aspect is a pair of moderate bristles. Genital covers about twice their length in front of the anal covers. Femur of leg I without any chitinous expansion; femur of leg II without cusp-like projection. Ungues heterodactyle. Posterior pair of legs extending to about the tip of the abdomen. Length, 0.68 mm.; width, 0.46 mm.

From Baldwin, Michigan; under rotting willow bark; by J. D. Hood.

This species was found in association with the following, *O. corticis* n. sp., but differs from it in having long, almost rod-like pseudostigmatic organs instead of the subcapitate pseudostigmatic organs as are found in *O. corticis*. The pteromorphæ also are not so pointed anteriorly in this species as they are in *O. corticis*.

Oribata corticis new species. (Plate VIII, Fig. 12.)

Light chestnut brown, legs paler; integument smooth. Lamellæ without cusps, very low, situated at the sides of the cephalothorax, slightly over two thirds as long as the same; lamellar hairs slightly longer than the lamellæ. No translamella present. Interlamellar hairs divergent, about as long as the lamellar hairs. Pseudostigmatic organ with a long recurved pedicel and a subcapitate head. Pteromorphæ somewhat pointed in front and extending about two thirds the distance to the tip of the rostrum; integument of the pteromorphæ showing radiating folds; ventral margin of pteromorphæ not emarginate. Abdomen oblong, dorsum hairless, with no spots showing through the integument; no bristles found at the posterior end of the abdomen on the ventral aspect. Genital covers about twice their length in front of the anal covers. Femur of leg I without any chitinous expansion; femur of leg II without cusp-like projection. Ungues heterodactyle. Length, 0.70 mm.; width, 0.40 mm.

From Baldwin, Michigan; under rotting willow bark; by J. D. Hood.

Similar in nearly all respects to *O. salicis* n. sp., but differing from it so markedly in the form of the pseudostigmata, as well as in the shape of the anterior margin of the pteromorphæ, that it should be regarded as a distinct species. It is also closely related to *O. depressa* Banks, but is distinct from Banks' species because of the absence of the two pairs of large setæ on the

posterior ventral aspect of the abdomen, and in being larger than this latter species.

Oribata minnesotensis new species. (Plate VIII, Fig. 13.)

Body chestnut brown; legs paler. Lamellæ three fourths as long as the cephalothorax, broadest at their bases, free for the anterior one third of their length; lamellar hairs, straight, pectinate, about two thirds as long as the lamellæ. Translamella absent. Interlamellar hairs slightly curved, pectinate, converging, about one and a half times as long as the lamellar hairs and situated very close to the bases of the lamellæ. Pseudostigmatic organ slightly clavate, recurved at the base; head slightly pectinate. Abdomen globose; dorsum hairless, without light or dark spots. Posterior end of abdomen without four long, simple bristles toward the ventral aspect. Pteromorphæ short, truncated anteriorly, not extending beyond the anterior margin of the abdomen; integument of pteromorphæ almost smooth, without wrinkles; ventral margins of pteromorphæ not emarginate. Genital covers rectangular, slightly broader in front than behind, situated at least one and a half times their length in front of the anal covers. Femur of leg I without chitinous expansion. Femur of leg II also without a cusp-like expansion. Ungues almost homodactyle. Length, 0.74 mm.; width, 0.42 mm.

From Red Wing, Minnesota; under bark and chips on lowland; by J. E. Guthrie.

I can find no close affinities of this species. In my collection it goes next to my *O. albida*.

Oribata juniperi new species. (Plate VIII, Fig. 14.)

Uniform light chestnut brown; integument pitted; pits small, shallow, and rather uniform in size. Lamellæ without cusps, broadest in the middle, about one half as long as the cephalothorax; lamellar hairs curved, pectinate, somewhat longer than the lamellæ. Translamella absent. Interlamellar hairs straight, pectinate, shorter than the lamellar hairs. Pseudostigmatic organ short, slightly recurved, capitate, pectinate. Abdomen subglobose; dorsum with stout, slightly curved, pectinate setæ; no light or dark spots showing on the abdomen. Posterior end of the abdomen without four long simple bristles situated toward the ventral aspect. Pteromorphæ triangular, truncated anteriorly, not extending beyond the anterior margin of abdomen; integument of pteromorphæ not wrinkled; ventral margin not emarginate. Genital covers a little more than their length in front of the anal covers. Femur of leg I with a small chitinous expansion, but not in the form of a cusp. Femur of leg II with a small chitinous expansion on its inner side, but it is not in the form of a cusp. Ungues homodactyle. Length, 0.46 mm.; width, 0.30 mm.

From Portage, Wisconsin; shaken from *Juniperus nana* and *Quercus alba*; by the writer.

Described from three specimens no one of which showed all the characters sufficiently well to be selected as a type. This species is related to *O. banksi* Ewing, but is easily separated from *O. banksi* Ewing by its smaller

size, the more distinct pitting of the integument, and the presence of much shorter and stouter hairs on the notogaster, as well as in the character of the pseudostigmatic organs.

Oribata boletorum new species. (Plate VIII, Fig. 15.)

Light chestnut brown, legs much paler than the body. Lamellæ each with a prolonged free end, or cusp, which is bifurcate; lamellar hair situated between these two points of the free end of the lamella. Translamella present, blade-like, about two thirds as broad as one of the lamellæ. Interlamellar hairs straight, pectinate, situated close to the bases of the lamellæ, distinctly longer than the lamellar hairs. Pseudostigmatic organ very short, simple, subcapitate, directed forward and inward. Pteromorphæ short, truncated anteriorly, not extending beyond the anterior margin of abdomen, integument of pteromorphæ not wrinkled. Abdomen globose; dorsum with prominent, straight, stout, pectinate hairs. Posterior end of abdomen without four long, simple bristles toward the ventral aspect. Notogaster without any large light spots showing through the integument. Genital covers rectangular, situated one and a half times their length in front of the anal covers. Femur of leg I with a small chitinous expansion on its inner side; expansion not in the form of a cusp. Femur of leg II with a similar expansion which is not cusp-like. Ungues heterodactyle. Length, 0.62 mm.; width, 0.44 mm.

From Jordan, Minnesota; on decaying mushrooms; by J. E. Guthrie.

Four specimens at hand during the description; but chiefly one, the type, was used. This species is very distinct, and I can find no closely related species. It appears to belong next to my *O. figurata* according to natural arrangement, but differs from this species in many ways, one of which is in having rather prominent hairs on the dorsum of the abdomen, whereas *O. figurata* has no hairs on the dorsum.

Genus **Oribatella** Banks.

Oribatella achipteroides new species. (Plate VIII, Fig. 16.)

Dark reddish brown; integument smooth. Lamellæ very large and similar in shape to the common type found in *Achipteria*; each ending in a prominent cusp and each bearing on its anterior inner corner the lamellar hair. Lamellar hair stout, curved, pectinate, as long as the greatest width of the lamella. Interlamellar hairs two thirds as long as the lamellæ, curved, situated at the base of the lamellæ. Pseudostigmatic organs clavo-lanceolate, curved strongly inward and forward, tip of head slightly pectinate. Abdomen oblong, hairless; dorsum with three pairs of oval light spots. Pteromorphæ truncated anteriorly and without any cusp-like projection from the anterior margin, anterior ventral corner of pteromorphæ not ending in a cusp. Genital covers, almost semidisc-shaped, but little over one half as long as anal covers, and situated about twice their length in front of the latter. Ungues of tarsi tridactyle; dactyles unequal. Length, 0.54 mm.; width, 0.38 mm.

From Red Wing, Minnesota; under bark and chips on lowland; by J. E. Guthrie.

This species is entirely different from all the other species of *Oribatella*, but does not have the type of pteromorphæ found in *Achipteria*. Perhaps it should be made the type of a new genus, but for the present I place it in *Oribatella*.

Genus **Notaspis** Hermann.

Notaspis pyristigma Ewing, variety **fusca** new variety.

Similar to *N. pyristigma* Ewing but of a dark reddish brown color. In this variety the interlamellar hairs are very stout and are longer than the lamellæ; while in the type of the species the interlamellar hairs are very slender and shorter than the lamellæ. Pseudostigmatic organs more strongly capitate than in the type. Both the lamellæ and the translamella are broader than they are in the type, and there is an absence of rudimentary lamellar cusps.

From Portage, Wisconsin; under a stone lying on the ground; by the writer.

Genus **Lucoppia** Berlese.

Lucoppia boletorum new species. (Plate VIII, Fig. 17.)

Uniform light yellowish brown; integument uneven but not pitted. Lamellæ consisting of low, inconspicuous, chitinous ridges which are slightly less than one half as long as the cephalothorax. No bars on the cephalothorax between the lamellæ. Lamellar hairs pectinate, slightly curved, about as long as the lamellæ. Interlamellar hairs similar to lamellar hairs but longer, many times as long as pseudostigmatic organ. Translamella absent. Pseudostigmatic organ with a very short, straight pedicel and a subglobose, simple head. Abdomen subspherical; dorsum sparsely clothed with slightly pectinate, curved, stout setæ. Genital covers smaller than the anal covers, situated about twice their length from the latter. Anal covers situated less than one half their length from the posterior margin of ventral plate. Anterior pair of legs extending one half their length beyond the tip of the rostrum; tarsus and tibia subequal in length. Total length of the body, 0.60 mm.; width, 0.38 mm.

From Jordan, Minnesota; on decaying mushrooms; by J. E. Guthrie.

Similar to *L. pilosus* (Banks), but with the abdomen almost circular in outline when viewed from above, also with shorter lamellar hairs than those of Banks' species.

Genus **Damæus** C. L. Koch.

Damæus globifer new species. (Plate VIII, Figs. 18 and 19.)

Chestnut brown; legs paler than the body. Cephalothorax two thirds as long as the abdomen. Pseudostigmatic organ long, stout, slightly pectinated, setiform.

Just inside of the pseudostigmatic organ is situated a long, stout, simple seta. Abdomen spherical; seta on notogaster stout, simple, curved. From the anterior end of the abdomen there projects a pair of spine-like spurs; these are curved inward. Genital covers rectangular, subequal to anal covers, situated about one third their length in front of the latter. Anal covers situated more than one half their length from the posterior margin of ventral plate. All of the segments of the legs with a swollen portion; second pair of legs subequal to the others. Femora of legs with a thin proximal part; distally suddenly enlarged. Anterior pair of legs about as long as the whole body. Distal end of tibia of leg I without a large tubercle bearing a tactile hair. Femur of leg IV with a very long, tactile bristle at its distal end. Length, 0.74 mm.; width, 0.50 mm.

From Jordan, Minnesota; on decaying Mushrooms; by J. E. Guthrie.

Similar to *D. sufflexus* Mich., but the hairs or setae on the dorsum of the abdomen are different, being curved and about twice as long as those of *sufflexus*. There are other differences between the two species.

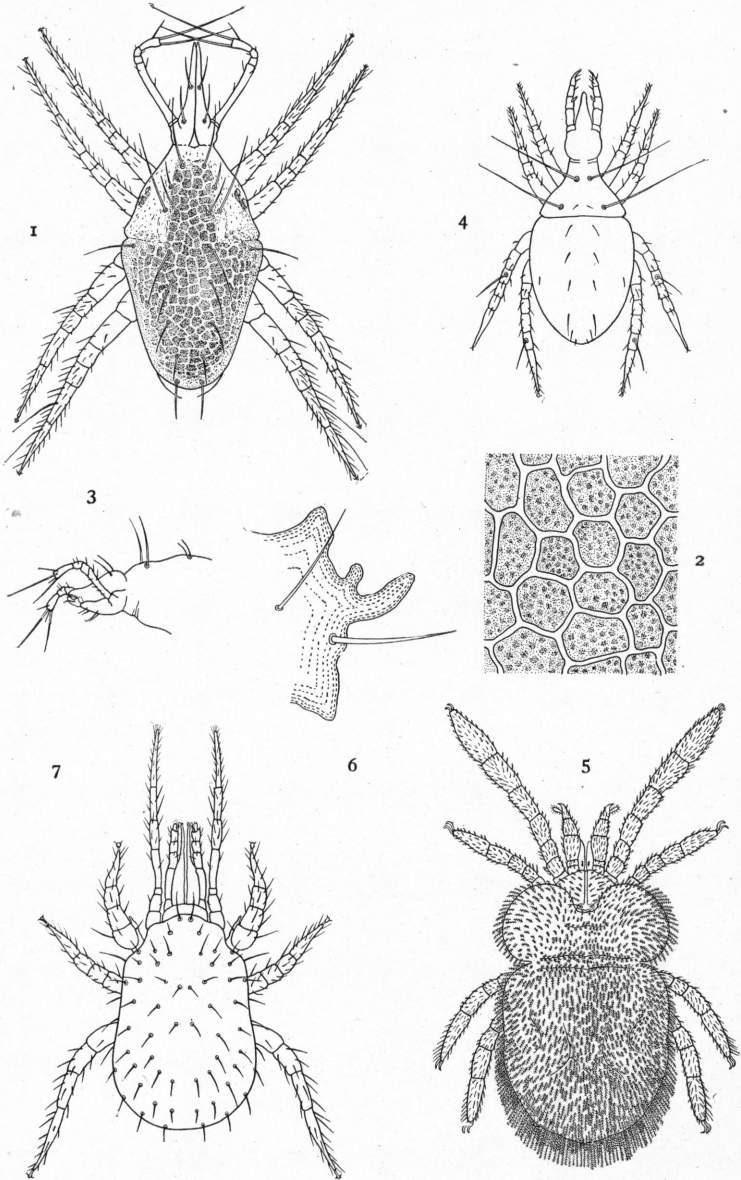
EXPLANATION OF PLATES.

PLATE VII.

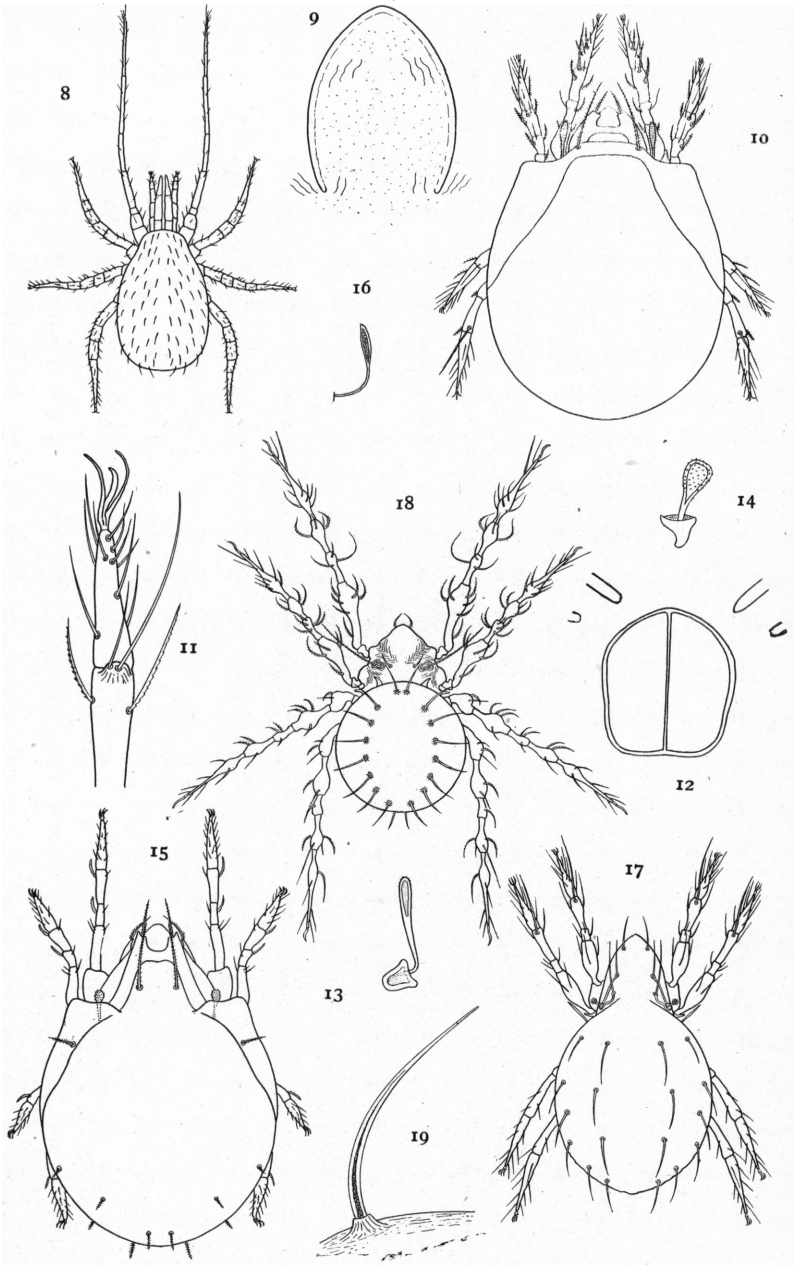
- Fig. 1. *Bdella tessellata* n. sp. Dorsal view, $\times 36$.
 Fig. 2. *Bdella tessellata* n. sp. A section of the integument from the dorsal part of the body, $\times 240$.
 Fig. 3. *Bdella robustirostris* n. sp. Side view of the anterior part of the body, $\times 36$.
 Fig. 4. *Scirus laricis* n. sp. Dorsal view, $\times 72$.
 Fig. 5. *Trombicula splendens* n. sp. Dorsal view, $\times 36$.
 Fig. 6. *Gamasus bifurcus* n. sp. Tubercle on the under side of femur of second leg of male, $\times 240$.
 Fig. 7. *Macrocheles tridentifer* n. sp. Dorsal view of male, $\times 48$.

PLATE VIII.

- Fig. 8. *Podocinum guthriei* n. sp. Dorsal view, $\times 36$.
 Fig. 9. *Uroseius tumidus* n. sp. Epigynum of female, $\times 140$.
 Fig. 10. *Pelops minnesotensis* n. sp. Dorsal view, $\times 100$.
 Fig. 11. *Oribata salicis* n. sp. Tarsus and tibia of leg I, $\times 240$.
 Fig. 12. *Oribata corticis* n. sp. Genital covers and tips of epimera II and III, $\times 240$.
 Fig. 13. *Oribata minnesotensis* n. sp. Pseudostigma and pseudostigmatic organ, $\times 140$.
 Fig. 14. *Oribata juniperi* n. sp. Pseudostigma and pseudostigmatic organ, $\times 240$.
 Fig. 15. *Oribata boletorum* n. sp. Dorsal view, $\times 72$.
 Fig. 16. *Oribatella achipteroides* n. sp. Pseudostigmatic organ, $\times 140$.
 Fig. 17. *Lucoppia boletorum* n. sp. Dorsal view, $\times 60$.
 Fig. 18. *Damaeus globifer* n. sp. Dorsal view, $\times 34$.
 Fig. 19. *Damaeus globifer* n. sp. Seta from posterior end of abdomen, $\times 120$.



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