SOME REMARKS ON THE EGGS OF NORTH AMERICAN SPECIES OF HEMIPTERA-HETEROPTERA.

PLATES IX—XII.

BY OTTO HEIDEMANN.

Eggs of Hemiptera-Heteroptera are exceedingly diverse in form. They vary from an oval, globular, or cylindrical shape to all sorts of modifications. Some eggs glisten in golden lustre or have other dainty coloring; many are ornamented with delicate, curious patterns, with short spines and long hair-like appendages. This strange appearance of the eggs makes their study very fascinating. Naturalists of former time have already called attention to these beautiful creations of nature, but it is to the credit of the investigators of our day that we have a more profound knowledge, in a morphological and biological sense, of the meaning and the various functions of some organs and appendages attached to these eggs.

Leuckart in his famous essay on the eggs of insects, published in Mueller's Archiv für Anatomie und Physiologie, 1855, considers certain peculiarly shaped organs about the upper pole of hemipterous eggs as a micropyle apparatus; he believed these had an opening through which the spermatozoa enter in order to fertilize the egg. He terms these organs seminal cups (Samenbecher). They are either microscopical in size or large enough to be seen even by the naked eye. Leuckart discovered five different types, which could be divided into two groups. In one group of eggs these organs stand free and erect on the outer surface around the rim towards the upper egg-pole; in the other group of eggs they are attached to the inner side of a band-like extension of the rim. (Fig. 1, *a* and *b*.)

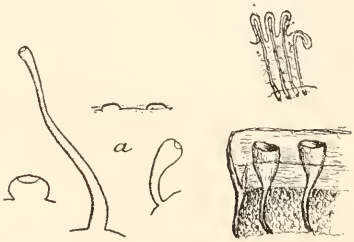

FIG. 1.

Julius Gross published an interesting paper on the ovaries of Hemiptera[1] wherein he disputes Leuckart's theory that these appendages are the transmitters of the sperm. He holds that they are a pneumatic device for ventilating the interior of the egg, keeping it in healthy condition. He calls these organs, being a part of the chorion, chorial processes

[1] Zeitschrift für wissenschaftliche Zoologie, p. 139, 1901.

(Chorion-Anhaenge). The well known biologist Heymons[1] expresses the same view in one of his papers. Some scientists still adhere to the older theory. It seems, therefore, that further research in this interesting matter may be necessary in order to state positively the real function of these peculiarly formed organs on the eggs of Hemiptera.

The egg-shell or chorion is formed, according to Dr. Korschelt,[2] by cuticular secretion of the epithelial cells in the oviduct. It consists usually of two layers, which differ in thickness and texture. The smaller eggs have the texture of the outer surface of the chorion more or less smooth or minutely granulated, while in the larger eggs it is very uneven, covered with polygonal cells, often spinous and tubercular, probably to give more consistency to the egg-shell. In the mature stage of the egg the head of the embryo is always directed towards the apical part or upper egg-pole, where in some groups of eggs a round or oval shaped lid or cap is noticeable; in other groups, mostly in those of a cylindrical form, this is absent. Globular eggs are affixed to their support often by a circular or bell-shaped plate; the round and oval forms in some of the groups are laid loose on the ground or in water, and the cylindrical eggs are usually deposited in the tissue of plants and in cracks.

According to Leuckart the shape of the processes before mentioned is characteristic for the eggs of certain groups and in doubtful cases may be of great value for the systematist.

Prof. O. M. Reuter[3] in a recent publication expressed repeatedly his opinion of the necessity also of studying the eggs as an aid to classification.

In recent years American writers, in working up the life history of hemipterous species, have greatly contributed to our knowledge of the eggs by publishing detailed accounts. There are, undoubtedly, several distinct types amongst these eggs whereby can be demonstrated the relationship of the species and genera to the families. For instance, all eggs of species belonging to the family Pentatomidæ are uniform, only slightly modified, generally barrel-shaped, or resembling very much the form of a tiny tin-can, as in *Pentatoma ligata*,[4] *Murgantia histrionica*,[5] and *Stiretrus anchorago*. All these eggs have a round apical

[1] Zeitschrift für wissenschaftliche Insectenbiologie, Band ii, 1906.

[2] Zur Bildung der Eihüllen der Micropylen und Chorionanhänge bei den Insecten. Nova Acta d. K. Leop. Carol. Acad., Bd. ii, 1887.

[3] O. M. Reuter, Phylogenie und Systematik der Miriden. Acta Societatis Scientiarum fennicae. Tom. XXXVII, No. 3, 1910.

[4] A. W. Morrill, U. S. Dept. of Agr., Bureau of Entomology, Bul. 64, Part I, pp. 4-8, 1907.

[5] C. V. Riley, 4 Ann. Report Ins. of Missouri, 1872, p. 37.

cap. Their color is usually whitish, sometimes a yellowish tint prevails. The harlequin cabbage-bug shows its fancy garment even on its eggs, which are decidedly ornamented in black and white; and in species of the genus *Podisus*[1] the eggs glitter in a metallic bronze color. A very interesting feature in the study of these eggs is the chorial processes, which always are present, and in this family they are placed in an upright position near the upper pole, where they are arranged around the circular cap.

On eggs of species of *Brochymena* these processes are microscopic in size; they stand singly, somewhat remote from each other, in number of about 30 to 40; the outer surface of the shell is strongly punctured in irregular rows (Pl. IX, fig. 3.)

In eggs of *Euschistus* the surface of the chorion is delicately punctuate; the processes are larger, abruptly thickened at the upper end, with a small opening; they number at least 60 or more (Pl. IX, fig. 4).

Eggs of *Thyanta custator* have the outer surface covered with minute, whitish, short bristles and the processes are less densely placed (Pl. IX, fig. 1).

The most characteristic shape of the chorial processes is exhibited on the eggs of the *Podisus* group and allied forms; they can even be observed by the naked eye and are about 1 mm. in length They are a little swollen at the base, then suddenly bent backward from the chorion, and taper gradually to the end; the tip is funnel-shaped.

Eggs of *Cosmopepla carnifex* are similarly formed, with the exception that the color is not of a deep bronze as in *Podisus* and the outer surface of the chorion less thorny in appearance (Pl. IX, fig. 2).

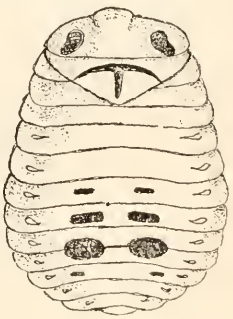

FIG. 2.

A striking feature in the hatched eggs of species of the family Pentatomidæ is the uniform presence of a little T-shaped instrument within the orifice. This has been left behind by the young larva; it seems to be attached dorsally at the pronotum to a delicate membrane which envelopes the young larva before its emergence from the egg (fig. 2). It is composed of a more or less convexly formed, transverse bar with a strong median spur, made of thickened layers of chitin and usually dark brown; the two points of the bar are connected with the

[1] C. V. Riley, 4 Ann. Report Ins. of Missouri, p. 20. A. H. Kirkland, Report of the Gypsy Moth Committee, Mass., 1896, p. 52.

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end of the median spur by a rather stiff, glassy, chitinous skin. It seems to vary a little in shape and color in different species. In *Brochymena* species it is entirely dark brown, in other species whitish. This strange instrument is evidently an egg-burster. After it has performed its function it glides over the head of the emerging larva and is usually retained in the empty shell with parts of the shed larval skin (fig. 3).

Kirby and Spence, in their Introduction to Entomology, vol. III, 1826, were the first observers to notice this strange form of an egg-burster, which they named a crossbow. Dr. Richard Heymons[1] published a most accurate study of this egg-burster and its function in the eggs of species of the family Pentatomidæ. Very recently Dr. A. W. Morrill[2] has also given a full account of his observation on this interesting subject.

It may be of some value to record that the occurrence of this peculiar form of an egg-burster is not limited to the eggs of species belonging to the family Pentatomidæ. The writer has found the same instrument, with slight variation of shape, in the eggs of species of the Coreidæ, which indicates the near relationship of these two families.

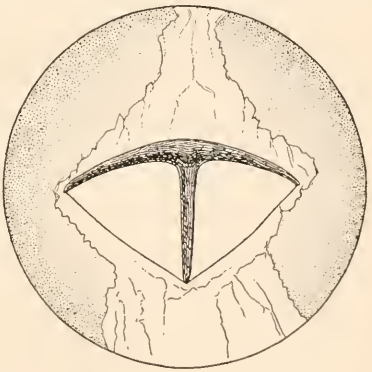

FIG. 3.

The eggs of the Coreidæ are another type of strange form. The species in this family deposit their eggs quite differently from those of the former. They are not laid in an upright position, as in the Pentatomidæ, but fastened lengthwise to the surface of the leaves. They are similar in form, mostly elliptical. Some resemble in outline a miniature oyster-shell, as in the genus *Anasa* and its allies. The cap is always present at one end of the upper side, somewhat oval shaped, and the rim that indicates the future opening of the egg is often quite indistinct in some species. The color of these eggs varies from a deep brown to a light reddish-brown or bronze; others are shining, brilliantly golden in hue, as in

[1] Zeitschrift für wissenschaftliche Insectenbiologie, Band ii, 1906, pp. 75-88.

[2] Plant-bugs Injurious to Cotton Bolls, U. S. Dept. Agr., Bureau of Entom., Bull. No. 86, 1910, pp. 38-39.

species of *Metapodius*[1] and in *Euthoctha galeator*.[2] It is interesting to note in this family the peculiar arrangement of the chorial processes, which encircle the egg so that they pass nearly midway over the cap as a row of small, extremely low knobs with a dark center.

In eggs of *Metapodius femoratus* these knobs are whitish and in the center reddish-brown; there are at least 40 such processes (Pl. IX, fig. 5). Those of *Euthoctha galeator* number about 22. The common squash-bug, *Anasa tristis*,[3] has 15 to 18. Eggs of *Spartocerus diffusus* (Pl. IX, fig. 6) and *Metapodius femoratus* are much alike; the former differs in having the chorial processes farther apart and, of course, less numerous. The surface of the eggs of the Coreidæ is usually finely reticulated. A somewhat aberrant form of a coreid egg appears in species of the genus *Leptoglossus*.[4] This probably is caused by the mode of laying the eggs in a string in firm contact with each other at the ends, whereby the sides of the egg become flattened. In *Leptoglossus magnoliæ*[5] the eggs have a metallic, copper-like lustre, and the surface of the chorion is finely shagreened. The chorial processes number from 16 to 18 (Pl. IX, fig. 7).

The eggs of *Archimerus calcarator* are laid in a row, but not joined at their ends; they are broader than high, nearly 3 mm. long and 1.5 mm. in width. The color is dark brown. The chorion very finely reticulated, with about 14 chorial processes, which are also dark brown (Pl. IX, fig. 8). These eggs seem to be an intermediate form towards the eggs of *Leptoglossus* species.

Very small eggs of a coreid are those in species of the genus *Corizus*. In *Corizus sidæ* these eggs are not quite 1 mm. in length. The general form is the same as in all eggs of this family, except that, seen from above, they have a somewhat triangular indentation just behind the cap. The color is dark brown, nearly black, with a few reddish marks, and the surface of the chorion irregular, strongly punctured; chorial processes are only a few (Pl. IX, fig. 9). The egg-burster in this family differs from that of the Pentatomidæ merely in having a more prominent dark tubercle at the middle of the crossbar.

[1] H. G. Hubbard, Insects affecting Orange, 1885, p. 162.
[2] l. c. p. 163.
[3] F. H. Chittenden, U. S. Dept. Agr., Bu. Ento., new series, Bull. 19, 1899, p. 22.
[4] H. G. Hubbard, Insects affecting Orange, 1885, p. 168.
[5] O. Heidemann, Proc. Ent. Soc. Wash., vol. XII, pp. 191-197 (1910).

At the present time the eggs of only a few species, belonging to the family Lygæidæ are known. Their eggs are essentially distinct from those of the former families in lacking a defined cap, and in having a few, more or less upright, chorial processes around the upper pole. The two layers of the chorion are very thin, and the outer surface is hexagonal. The eggs are yellowish-white, becoming reddish as the embryo develops. The first account of a lygæid egg, that of our common chinch bug, *Blissus leucopterus*, was published by Riley in the American Entomologist, 1868.[1] The accompanying drawing shows plainly four chorial processes on the upper end of the egg. Another author described and figured the egg of the species *Pamera vincta*.[2] The figure is not clear enough, but the short, concise description leaves no doubt that the egg of this species is a typical lygæid egg and reads as follows:

Egg—Length 0.88 mm., width 0.43 mm.; elliptical in shape; no marking; on the apical end are five short processes, each process ending distally in a thick hook, the hook projecting outward.

Not long ago the writer secured eggs of the lygæid species *Belonochilus numenius*.[3] The eggs are laid on the fruit of sycamore trees, in the crevices among the ovaries, where they hibernate. Length of egg nearly 1.5 mm.; very elongated; the lower end somewhat pointed; no apical cap; chorial processes 5 to 6, encircling the upper pole of egg, and shaped like stout, round hooks bending towards the center. Surface of chorion ornamented with hexagonal cells longer than broad (Pl. X, fig. 1).

Oncopeltus fasciatus has oval-elongate eggs, a little shorter in size than those of the preceding species. The chorial process is very short and thin at base and the round, downward-bent portion quite big; there are 12 processes surrounding the upper end of the egg. The outer chorion smooth, yellowish-red (Pl. X, fig. 2).

The eggs of no more than two species belonging to the family Pyrrhocoridæ are described as yet. They are similar in shape to the foregoing family, except that the chorial processes are low and not narrowed toward the base. The egg of the cotton stainer, *Dysdercus suturellus*, is still a desideratum. In an exhaustive article on the life history of this species, by Riley and Howard,[4] it is stated that neither the

[1] C. V. Riley, The American Entomologist, vol. I, 1868, p. 173.
[2] A. L. Quaintance, Strawberry Insects, Florida Agr. Exp. Sta., Bull. No. 42, 1897.
[3] O. Heidemann, Proc. Ent. Soc. Wash., vol. v., No. 1, p. 11, 1902.
[4] Riley and Howard, Insect life, vol. IV, p. 346, 1892.

egg figured in Glover's manuscript notes nor Comstock's description of an egg, both referred to *Dysdercus suturellus*, are really the eggs of the cotton stainer, but belong to another family, probably Coreidæ. The only reliable source is a short note by Hubbard[1] in his report on the orange insects, 1885. Later, Morrill[2] gives an account on the same subject, but no special description of the egg.

Another pyrrhocorid egg is the species *Largus succinctus*.[3] Egg, 1.5 mm. in length; width 0.8 mm.; ovoid; chorion amber-colored, smooth, very delicate hexagonal; chorial processes small, white, cup-shaped tubercles with an opening on top. There are nine choral processes encircling the upper egg-pole (Pl. X, fig. 3).

The eggs of the family Aradidæ appear to be more nearly related to the two preceding families than to any of the others. They have quite the same shape, and are also without a defined cap. Eggs may be found during the time of hibernation under loose bark of trees or in rotten stumps.

Lugger has given a very short note on the eggs of *Aradus robustus*.[4] The writer has found the common species *Neuroctenus simplex* under bark of a pine-tree stump, literally covering the same. Among them were some clusters of eggs. Egg about 1 mm. long; 0.5 mm. width; laid in a heap, numbering from 20 to 60 or more. Chorion whitish, irregular, coarse, hexagonal; no apical cap; the chorial processes seem to be wanting. (Pl. X, fig. 4.)

The eggs of the Reduviidæ and related families show a very typical form, distinct from all the others. They form a group of eggs in which the chorial processes are placed inside the extended rim of the egg-shell and attached to its wall along their entire length (fig. 1, *b*). The eggs are mostly ovate-elongate and possess an apical cap; the color varies from clear white to a dark shaded brown; the eggs are usually laid in clusters, cemented together with a sticky secretion.

Conorhinus sanguisuga.[5]—Egg 1 mm. long; ovate; chorion somewhat flattened near lower end; the inner side of the

[1] H. G. Hubbard, Orange Insects, U. S. Dept. of Agr., Div. Ento., 1885, pp. 165-168.

[2] A. W. Morrill, Plant-bugs Injurious to Cotton Bolls, U. S. Dept. of Agr., Bu. Ento., Bull. No. 86, 1910.

[3] L. c., p. 94.

[4] O. Lugger, State Exp. Sta. of Minnesota, Sixth Ann. Rep., 1900, p. 43.

[5] C. L. Marlatt, Dept. Agr., Bur. Ent., Bull. 4, new series, p. 41, 1896.

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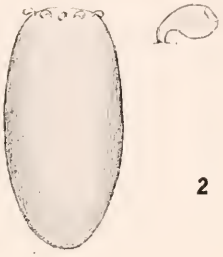

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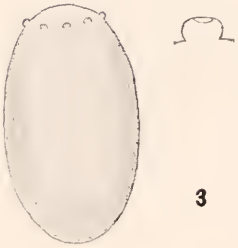

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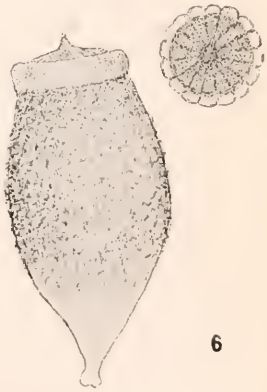

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extension of the rim shows the chorial processes plainly; outer surface very fine granulate, pearly white. (Pl. XII, fig. 5).

The egg of *Zelus luridus* is originally described and figured by Kirkland[1] in his notes on the life history and habits of certain predaceous Heteroptera. The sticky secretion the insect uses for protecting its eggs covers sometimes also the cap, leaving only in the center a small opening; chorial processes close together, club-shaped. (Pl. XI, fig. 3.)

Sinea diadema.—Egg 1 mm. in length; ovate-elongate; color light brown; outer surface fine granulated; the extension of the chorion at the outside rim consists of numerous yellowish, short and longer scales, turning down over the egg like a beautiful Dutch collar; cap considerably raised, narrowing and rounding at top, resembling somewhat the cap of an oak tingitid. (Pl. XII, fig. 4.)

Apiomerus crassipes.—Egg 1.8 mm., oval-elongate; color dark brown; the extension of the chorion at upper egg-pole composed of longitudinal fine scales connecting with each other, yellowish around the rim and white at the edge; the cap rather low, crowned with white scales, of which those on the inside circumference are brown. (Pl. XI, fig. 2.)

Eggs of *Arilus cristatus* have been described and figured by Glover in his manuscript notes, page 61, 1876 (Hemiptera-Heteroptera). The eggs are oval-elongate; dark brown; chorial processes inside of the extended rim, club-shaped. (Pl. XI, fig. 1.)

A most interesting article has been published by J. H. Fabre,[2] in his Souvenirs Entomologiques, on the egg of the cosmopolitan species *Reduvius personatus.* He observed a young larva in the act of emerging from its egg. The following is a translation.

". . . The opening of the cover widens and through the crack I perceive something shining. It is an iridescent skin, globe-like, that pushes the cover. Now emerges out of the shell a spherical vesicle, which, by degrees, enlarges itself like a soap-bubble, blown at the end of a straw. More and more, pushed by the enlargement of the bladder, the cover is displaced. Then the bomb explodes, that is to say that, swollen beyond the limits of its resistance, the bubble ruptures at its summit. This envelope-membrane of extreme tenuity remains, generally adhering to the brim of the orifice, where it makes a high and white margin. At other times the explosion detaches it and

[1] A. H. Kirkland, Rep. Gypsy Moth Committee, 1896, Appendix pp. 60.
[2] J. H. Fabre, Etudes sur l'Instinct et les moeurs des Insects, Souvenirs Entomologiques, 18 serie, p. 99, 1903.

throws it out of the shell. Now the way is free; the little one can come out either by breaking the skin set in the opening or by throwing it over, or else by finding the way out when the bursted bubble has detached itself from the egg. It is simply marvelous! To come out of its coffer the pentatomid has invented the mitre and the push of of the hydraulic ram. The reduviid has constructed the explosive engine.

This performance, going on in the egg at the time of hatching, acts as another style of an egg-burster and is accomplished evidently by the air pressure within. For further information on this subject one ought to read Frederick Knab's instructive paper on "The rôle of air in the ecdysis of insects," published in volume XI of the Proceedings of our Society.

Eggs of the family Phymatidæ (= Macrocephalidæ) are evidently related to those of the Reduviidæ. They have the same peculiar chorial processes, which are attached to the inner side of the egg-rim, instead of standing free upon the outside. (See fig. 1, *b*.)

Phymata erosa, subsp. *jasciata*.[5]—Egg, oval and stout; length 1.6 mm., covered with a sticky secretion nearly up to the neck; apical cap present, very thin and flat; outer surface of the chorion coarsely granulated, color black; chorial processes form numerous small channels on the chorion inside the extension of the rim. (Pl. X, fig. 5.)

Since studying the different types of egg forms, the writer has come to the conclusion that the family Tingitidæ ought really to be placed in the Reduviidæ group, after the Phymatidæ. The tingitid eggs have very much in common with the eggs of the Reduviidæ; they possess channel-formed chorial processes inside the extended rim of the egg-shell, and have also an apical cap.

The original description and figure of a tingitid egg of the species *Corythuca arcuata*, was published by Comstock.[1] Later Morrill[2] in his exact paper "On the immature stages of some tingitids of the genus *Corythuca*," pointed out the marked difference in the manner of depositing the eggs existing between the oak tingitid, that of the hawthorn, and that on the buttonwood.

In the Tingitidæ the depositing of the eggs occurs always on the underside of the leaves. In some species they are par-

[5] G. C. Champion, Biol. Centr. Amer., vol. II, p. 50 (1901.)
[1] J. H. Comstock, Rep. Comm. Agri. 1879, 1880, p. 221.
[2] C. A. Morrill, Psyche, 1903, p. 127.

tially inserted into the tissue and covered with a sticky, brown substance, as in the species *Corythuca arcuata crataegi* Morrill and in the Christmas berry tingitid,[1] *C. incurvata*. The oak tingitids lay their eggs free and erect, in smaller or larger groups, fastened to the surface of the leaves. The sycamore tingitid, *C. ciliata*, hides them beneath the pubescence on the leaf. Eggs of the rhododendron species *Leptobyrsa explanata*[2] are inserted entirely into the epidermis of the leaf, protected there while hibernating. Eggs of the species *C. marmorata*[3] are described as being thrust under the epidermis along the larger veins of the leaf, leaving only the small, yellowish, conical cap in sight.

Leptostyla clitoriæ, new species.

Egg about 0.5 mm. in length; laid singly, upright, on the underside of leaf; ovate, narrowing toward the lower egg pole; the chorion thick and hard, covered with numerous coarse granules; color black, except the lower end of the egg, which is whitish; chorial processes channel-formed, arranged vertically around the extension of the rim on inner side, continuing inside on the conical cap to its center. These processes may be noticed even on the outside bulging as corresponding narrow ripples, which are usually covered with a white substance. (Pl. X, fig. 6.)

Of the large family Capsidæ (= Miridæ) eggs of only three species are well known. The family is an ally of the Reduviidæ group, according to Leuckart, having the chorial processes channel-formed on the inner side of the extended rim. Slingerland, in his excellent essay on the life history of the four-lined leaf-bug *Pœcilocapsus lineatus*,[4] gives a detailed account of the eggs. They are laid in slits cut into the stems of the plants, closely packed together, usually in number of 6 to 8 eggs. The egg-scars, with the white tips of the eggs projecting from them, are quite easily seen. He describes the egg as follows:

Egg, 1.65 mm. in length, smooth, cylindrical, slightly curved or flask-shaped. and of a light yellow color with the upper third capped by a white, finely striated portion; the lower end is rounded and the upper irregularly flattened.

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[1] C. Pemberton, Journal of Economic Entomology, 1911.
[2] O. Heidemann, Proc. Ent. Soc. Wash., vol. x, p. 105, 1908.
[3] E. P. Felt, New York State Museum, Bull. 76, p. 125, 1903.
[4] M. V. Slingerland, Bull. 58, Cornell University Agr. Exp. Sta., 1893.

Lately eggs of the species *Lygidea mendax* and *Heterocordylus malinus* have been described by G. R. Crosby,[1] found on the leaves of the apple. The egg is rather strongly curved, slightly compressed, and dull whitish in color.

The representative of the family Cimicidæ is the worldwide-known *Cimex lectularius*. Leuckart in his account of the bedbug has proved, by the existence of chorial processes arranged on the inner side of rim, that the Cimicidæ belong to the group of the Reduviidæ. They are laid in concealed places in heaps of 6 to 50 eggs, color clearly white; terminated by a cap; chorion somewhat coarsely hexagonal; channel-shaped chorial processes.

In recent years several American authors[2] have given the life history of species of this family and have also described and figured the eggs.

Acanthia (=*Hæmatosiphon*) *indora*.—The egg was first described and figured by Dugès. Later described by Osborn[3] in his publication on "Insects affecting domestic animals." The eggs of this species are also mentioned by C. H. Tyler Townsend[4] in his "Note on the coruco, a hemipterous insect."

Cimex (=*Œciacus*) *hirundinus*.—Eggs are figured originally by Lugger in his Sixth Annual Report, Division of Entomology, Minnesota, 1900, page 50.

About the eggs of the Family Anthocoridæ we are not yet sufficiently informed. The family is considered by Reuter and other authors as being allied to the group of the Reduviidæ. The egg of *Triphleps insidiosus*[5] is figured in Folsom's Entomology. According to the illustration, the egg has a strong resemblance to the egg of *Cimex*. (Pl. XII, fig. 6.)

Eggs of the aquatic and semi-aquatic species of Hemiptera are ovate or more or less elongate. According to Prof. O. M. Reuter[6] these eggs of the aquatics have no apical cap, and at the upper egg-pole centrally two or more chorial processes.

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[1] C. R. Crosby, Notes on the life-history of two species of Capsidæ, Can. Ent., 1911, p. 17.

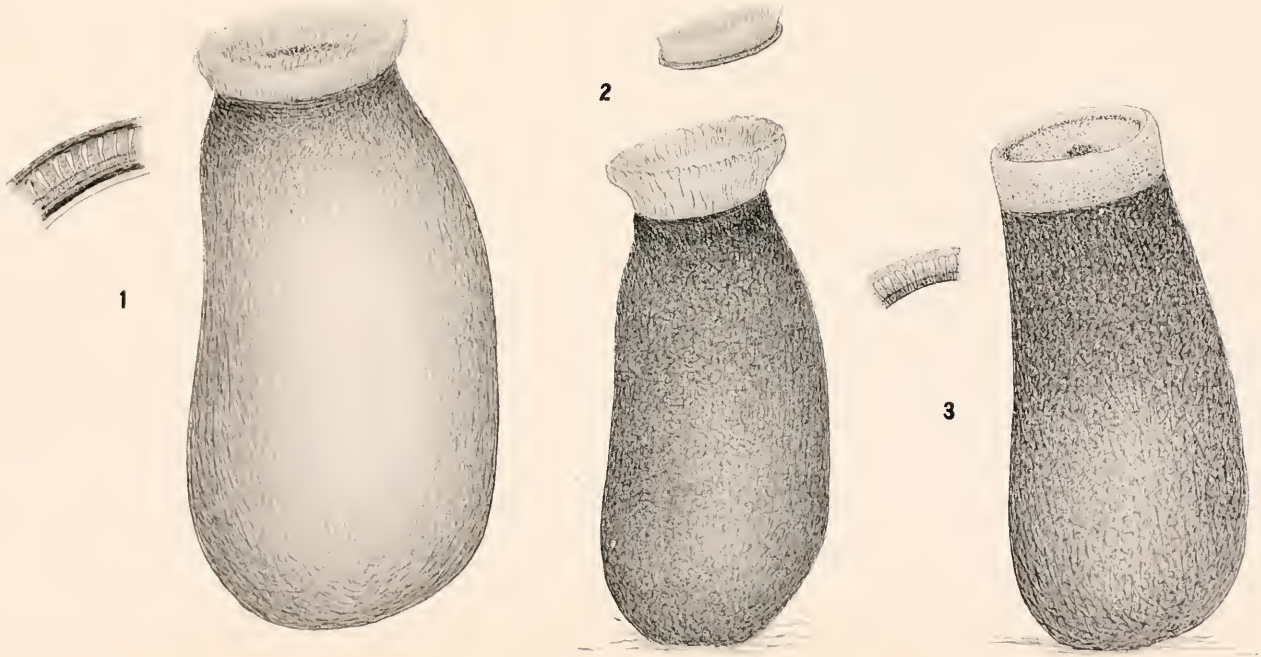
[2] O. Lugger, Sixth Ann. Rep. University Minnesota Agr. Exp. Sta., 1900; L. O. Howard, Insect book, 1901, p. 289; C. L. Marlatt, Bull. 4, n. ser., Div. Ent., Dept. Agr.; J. B. Smith, N. Jersey Agr. Exp. Sta., 1907, p. 20; C. V. Riley, Insect Life, II, p. 105, (1889-90); A. Girault, Psyche, 1905, p. 61; l. c., p. 117.

[3] H. Osborn, Bull. 5, n. s., U. S. Dept. of Agr., Div. Ent. 1896.

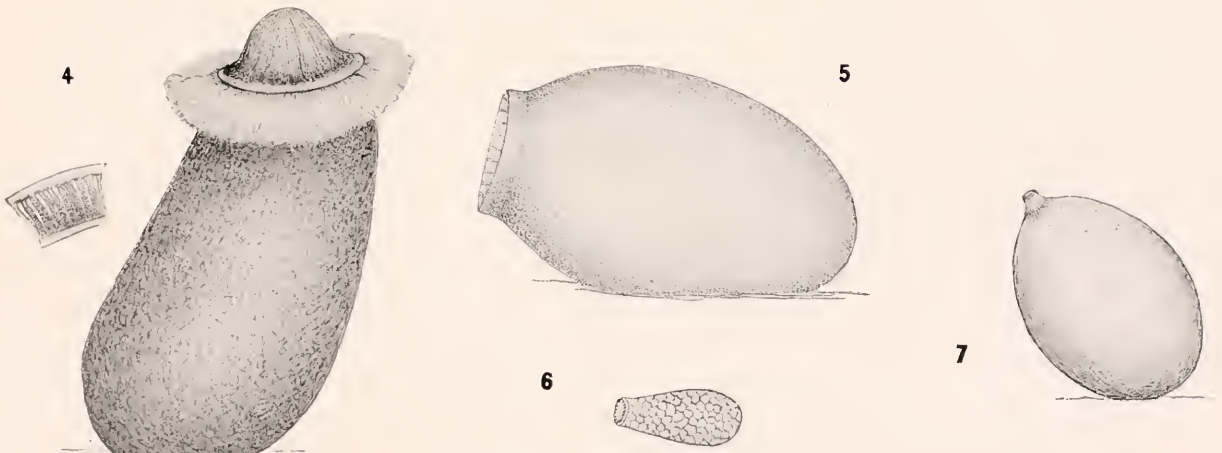
[4] C. H. Tyler Townsend, Proc. Ent. Soc. Wash., vol. III, No. 1, 1894, p. 40.

[5] Folsom's Entomology, p. 159, fig. 207 (1906).

[6] O. M. Reuter, Phylogenie and Systematik der Miriden, 1910, pp. 35, 60. (Act. Soc. Scie. Fenn., XXXVII, 3.)



EGGS OF HEMIPTERA-HETEROPTERA



EGGS OF HEMIPTERA-HETEROPTERA

However, this does not hold good in our species of the family Belostomidæ, where the eggs show a distinct cap, which is somewhat obliquely placed at the upper egg-pole and pushed off at hatching, as stated by Needham in his description of the eggs of *Benacus*. Bueno also observed in his careful study of the life history of *Belostoma flumínea*, how the nymph comes out through a round lid that splits off the top of the egg and is attached thereto by a hinge extending about one-quarter the circumference.

In recent years some American authors, foremost among these J. R. de la Torre Bueno, a keen observer, interested themselves in the study of the formerly much neglected aquatics and semi-aquatics. Excellent accounts of the life-history and accurate descriptions of the eggs of water-bugs have been published; thus the writer will refrain from repeating the same and refers to the original descriptions, viz:

Family Hydrometridæ: The egg is described and figured by J. O. Martin in his "Study of *Hydrometra lineata*" =*martini* (Can. Ent., 1900, p. 75). In addition Bueno has given his observations in "Notes on *Hydrometra martini*" (Can. Ent., 1905, p. 13).

Family Gerridæ, subf. Veliaini: Description and figure of eggs of *Microvelia americana*. Life Histories of North American water-bugs, by Bueno (Can. Ent., 1910, p. 182).

Family Naucoridæ: Egg described and figured by Bueno in his publication "Brief notes toward the life history of *Pelocoris femorata*, with a few remarks on habits" (Journal N. Y. Ent. Soc., vol. XI, 3, 1903).

Family Belostomidæ: The egg of *Belostoma flumínea*, described in "Life-histories of North American water-bugs," by Bueno (Can. Ent., 1906, p. 193).

Pedinocoris macronyx: "A ferocious water-bug." Eggs described by G. W. Harvey. (Can. Ent., 1907, p. 19.)

"The eggs of *Benacus* and their hatching," by James G. Needham (Ent. News, 1907, vol. XVIII, No. 4, p. 114).

Eggs of *Lethocerus* (*Belostoma*) *grandis*: "Belostomidæ and some other fish-destroying bugs," by George Dimmock. (Ann. Rep. Fish and Game Commissioners, 1886).

Family Nepidæ: "The egg of the water scorpion" (*Ranatra fusca*), by R H. Pettit (Can. Ent., 1902, p. 213). An additional description of the egg of *Ranatra quadridentata*, by Bueno, in his Life histories of North American water-bugs. (Can. Ent., 1906, p. 247.)

Family Notonectidæ: "The genus *Notonecta* in America north of Mexico," by Bueno. Egg described of the species

Notonecta undulata. (Journal N. Y. Ent. Soc., vol. XIII, No. 3, 1905, p. 154.)

Family Corixidæ: "Egg of *Corixa mercenaria*," by L. O. Howard, Insect Book, 1901, p. 273. Egg ovate; chorion minutely chagreened, yellowish-white, shining; at the upper egg-pole, centrally, a short, but rather robust, conical-shaped chorial process. (Pl. XII, fig. 7.)

Some European entomologists are now adopting the characteristic egg-types as a medium for the phylogenetic and systematic arrangement of the families. Our authors, describing the life histories of North American hemipterous species, investigated the eggs mostly in relation to biological and economic entomology, overlooking the important rôle these remarkable egg-forms may play in the systematic study of the order. But neither part should be neglected. For this reason the writer thought it worth while to take an interest in the study of North American hemipterous eggs, and describe forms hitherto not known. This work is simply a summary, a step in the direction of finding some new and valuable characters for our classification. There opens a wide field for further investigations; and the writer hopes that young students may become interested in this subject, and fill up the gaps in our scant knowledge of these beautiful forms of hemipterous eggs.

Up to the present time no eggs have been observed of the following families:

Acanthiadæ = Saldidæ.
Ochteridæ = Pelogonidæ.
Nerthridæ = Galgulidæ.
Gerridæ.
Mesoveliadæ.
Naeageidæ = Hebridæ.
Henicocephalidæ.
Emesidæ.
Nabidæ.
Dipsocoridæ = Ceratocombidæ.
Isometopidæ.
Piesmidæ.
Neididæ = Berytidæ.
Scutelleridæ.
Cydnidæ.
Thyreocoridæ = Corimelænidæ.

The original descriptions in this paper and accompanying drawings are taken from eggs belonging to the U. S. National Museum collection, from material of my own, and from an additional, small, but valuable collection sent by Dr. W. D. Hunter, to whom I feel much indebted.