at some length concerning his observations on the life-history of this insect and its natural enemies. He has reared no true parasites in Maryland, although Syrphus flies were abundant early in the season and Coccinellidæ late in the season. He stated that he is at a loss to predict with confidence concerning the abundance of this destructive pea enemy the coming season.

—Mr. Dyar then read the following paper:

LIFE HISTORY OF CALLIDAPTERYX DRYOPTERATA GRT.

By Harrison G. Dyar.

Not long ago I published a general account of the mature structure of this larva (Can. ent., xxx, 155), the first larva of the Epiplemidæ discovered in America. Last season I found the species near Washington, and was able to observe all the stages. Some unexpected points appeared. The Epiplemidæ are nearly allied to the Geometridæ, yet these larvæ would be taken for little Noctuids. The eggs, too, are of the vertical type, distinctly ribbed, and not at all suggesting Geometridæ or Drepanidæ. The larvæ are exposed feeders and gregarious. Evidently the Epiplemidæ have pursued as larvæ their own course of specialization, distinct from the allied families.

Eggs. Laid in a batch of 25 or more on the back of a leaf. Conical, but with a rounded top, nearly flat; base flat; micropylar area a little elevated, circular, finely reticulated; around this is an area, covering the rest of the top surface, coarsely reticulate, the cell areas strongly sunken; sides finely ridged, 40 or over, the ridges not decreasing in number except just at the top, the spaces between divided into quadrangular areas by fine cross striæ; diameter, .5 mm. On hatching, the larvæ cut off a cap at the vertex, which is left intact with the rest of the shell. Shells very thin, so that some collapse; white.

Stage I. Head rounded, bilobed, colorless; eye black, mouth brown; width, .25 mm. Body colorless, food green. The shape is a trace flattened, both joints 11 and 12 enlarged at the sides, the anal plate small and not colored, though bristly with setæ. Cervical shield likewise rather hairy, though only the primary hairs are present. Segments 2-annulate; tubercles small, slightly conic, faintly blackish. Setæ simple, colorless, rather long. Tubercles iv and v well separated. Feet normal, perfectly equal, slender.

Stage II. Head as in the next stage, but the tubercles all distinctly dusky; width, .3 mm. The larva is squarish, a little flattened, joints 11 and 12 a little enlarged at the sides; no shields; setæ pale. The larvæ feed freely exposed and are active, running about over the stems for new leaves. At first gregarious, later scattering, but remaining on the same plant. They eat the parenchyma from below in irregular patches till stage V, then the whole leaf.

Stage III. The same, tubercles a little dusky. Width of head, .4 mm.

Stage IV. Head, .6 mm. All pale greenish yellow, translucent; tubercles colorless, setæ dusky, normal, without secondary ones. Joint 2 a little collared, 11 and 12 slightly enlarged at the sides. Tubercles conic, rather large; no shields. There is no essential change since stage I.

Stage V. Head rounded, pale brown, not shining, tubercular spots and eyes dark brown, jaws brown; width, 1 mm. Tubercles i and iii broadly black, ii, iv, and v (which are exactly in line subventrally), vi and leg plate concolorous with body. No plates nor shields, the setæ of vii distributed on the conical slender legs. At the extremities more of the tubercles are black, on joint 2 including the prespiracular, on 11 to 13 tubercle ii and on 12, iv also, which is here widely separated from v, though still in line with it. Skin transparent, blood faintly green, food dark green. Body uniform, a little flattened dorso-ventrally, feet equal. Setæ distinct, short, pale, simple.

Stage VI. Head rather square, rounded, flat before, scarcely bilobed. Very pale brownish, quite heavily spotted with blackish brown, not only on the tubercles but also in clusters at the apex of clypeus, on sides and in ill defined transverse line across upper part of clypeus; width, 1.5 mm. Body short and thick, somewhat flattened, joint 12 slightly enlarged, feet normal. Color translucent whitish, appearing slightly green from the blood, and more strongly so from the food. Tubercles i and iii and most of those at the extremities, and also a varying amount of spotting, black. The spotting begins in subdorsal marks on joints 10 to 12 and 2, and may extend to a complete subdorsal line with a broad gray shade below and a narrow blackish dorsal line, the subdorsal line very heavy on joints 11 and 12. Tubercles distinct, setæ rather coarse, pale. Shields not cornified, their tubercles separate and distinct, resembling those on the body. Feet perfectly equal.

Cocoon. A very frail, slight net of silk on the ground among leaves, etc., but not drawing the material together.

Pupa. Rounded and compact with three movable incisures; cremaster a low cone without hooks; thorax and cases robust, abdomen smaller, conic. Dark brown, shining, the incisures of abdomen and the extreme tip paler; surface slightly shagreened, not punctured. Length, 5.5 mm.*

*Dr. T. A. Chapman, to whom the pupa was submitted without any indication of what species or family it belonged to, writes: "It is a fully obtect form and comes nearest, perhaps, to some Geometrid forms. It is structurally at the same level of evolution as the highest Noctuæ and Geometræ, that are impossible always to distinguish from one another." Dr. Chapman further expresses some doubt as to whether it is a form that "we generally include in the Macros;" but he cannot tell exactly why he thinks so. That is to say, apparently, that he thinks it essentially a Geometrid, but possessing generalized characters. This opinion is, I believe, entirely correct.

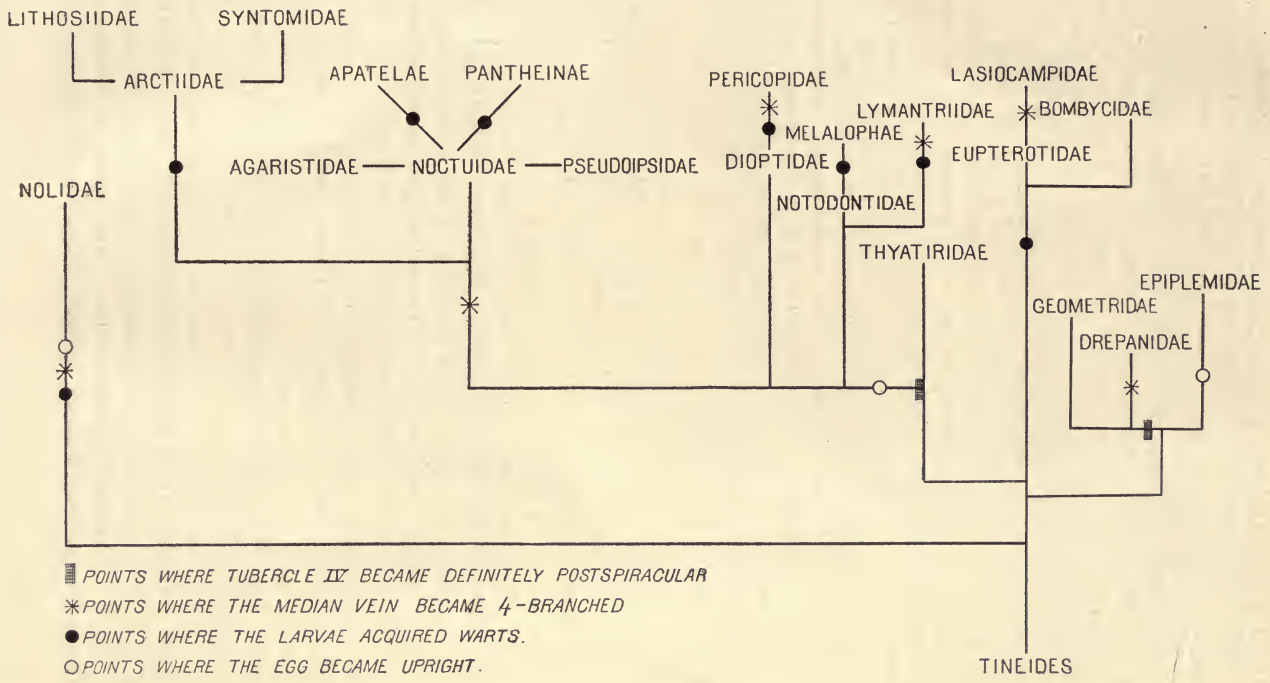
Food plant *Viburnum prunifolium*. The larvæ absolutely refused *V. lentago* and *V. dentatum*.

Found along Pimmit Run in Virginia and near Hyattsville, Maryland.

The life history of this species is very interesting in connection with Tutt's classification of Lepidoptera (J. W. Tutt, A Natural History of British Lepidoptera, 1899, p. 113). Tutt divides the order into three main lines of descent, all of which show both the generalized and specialized characters of the several stages, except the egg. The egg Tutt regards as absolute. He quotes approvingly Chapman's suggestion, who "thinks it is probable that the various forms of the upright egg had a common origin, though very low down." While not disputing Chapman's valuable generalizations, it seems scarcely more probable that the upright form of egg should have been developed but once in the evolution of the Lepidoptera than that the obtect pupa, or the four-branched median vein, or the post-spiracular position of tubercle iv should have been so developed. All of these Tutt freely derives more than once in his genealogical tree, but not so with the egg. Now, however, with regard to Callidapteryx. We have here a moth that has been classified with the Geometridæ and bears so close a relation to them that Hulst still lists it in a subfamily. Hampson separates it as an adjacent family, but only on a character of venation of seemingly secondary importance. Judging from the moth, this insect would fall in Tutt's "Geometro-Eriocranid stirps." The larva, as I have shown, possesses some peculiar generalized characters. I can hardly tell where Tutt would place it on his tree, but presumably in the stirps just mentioned. The egg, on the contrary, is upright and ribbed and would come high up in the "Noctuo-Hepialid stirps." I think that the occurrence of this generalized form connecting the Geometrids and Noctuids shows that Tutt's "stirps" are not entirely natural ones; his genealogy of the Lepidoptera has been too much influenced by Chapman's brilliant results on the egg. If these egg characters be given a less important possition, similar to that of the other characters, it is possible to recast Tutt's tree so as to bring the larvæ together more in harmony with the ideas that I have expressed. I add a chart, showing the derivation of the families of the Bombyces which is the same as that recently published (Proc. Bost. Soc. Nat. Hist., 27, 146) but modified to exclude the contradiction in egg characters to which Tutt rightly objects.

The tree is supposed to start from some generalized Tineid-like form. The Nolidæ branch off first, being really of separate origin from the Bombyces and possessing Tineid characters, yet so highly evolved as imagines as to parallel the Arctiid structure. The Geometridæ, Drepanidæ, and Epiplemidæ form a closely

GENEALOGICAL TREE OF THE BOMBYCID FAMILIES.



allied group, all having flat eggs except the Epiplemidæ, which parallel the Noctuidæ in this respect. Tutt places the Thyatiridæ on the Geometrid stem, but they seem to me to have certain Notodont and Noctuid affinities. The eggs show a certain suggestion of the vertical type and tubercle iv of the larvæ is somewhat specialized. I formerly placed the Melalophid Notodontiæ with the Eupterotidæ, but this is contradicted by the eggs. I infer from Tutt that the Eupterotid egg is of the flat type, while the Malalophid egg is of the vertical type and in Apatelodes highly specialized. I have transferred the Lymantriidæ to the Notodontian stem on the characters of the eggs, though I am not sure that this is their best place. In the Eupterotidæ, Bombycidæ, Lasiocampidæ, Melalophæ, and Lymantriidæ, all of those larvæ which have developed warts, there are three warts on the thorax above the stigmatal wart. This is a low character and shows the same type of wart formation as in those Micro families which have warts (except the Pterophoridæ and Nolidæ, which in this respect parallel the Arctian phylum, having but two such warts). The rest of the tree comprises the Arctian phylum. The only change that I have made here is to separate the group formerly called Apatelidæ into Apatelæ and Pantheinæ, separately derived from different points in the Noctuidæ.

The paper was discussed at length by Messrs. Gill, Matthis, Dyar, Ashmead, Ulke, and Howard, the discussion taking the direction of a consideration of the value of the egg stage in the classification of insects.

Mr. Ashmead, referring to the position of the spiracles, stated that this character is very valuable in the parasitic Hymenoptera. The slightest variation in the position of the spiracle and in its shape is of great importance. As to the eggs, he referred to the careful descriptions and figures given by Scudder of the eggs of butterflies and called attention to the characteristic forms of the eggs in the different groups of Heteroptera, in which order families, and in some cases genera, are readily distinguished by the egg. Natural groups will generally be found to have characteristic eggs and larvæ.

Dr. Dyar said that while Scudder deserves great credit for his egg studies, to Dr. Chapman, of England, is due the credit for the important generalization regarding upright and flat eggs.

Dr. Gill doubted the great value of the eggs in a consideration of the genealogy of insect families. It is true that the shape and