serious. It is the progressive increase of destroyers with the decrease of victims through successive mild seasons that is really to be dreaded.

"As a slight corroboration of this view, I may mention, that while this district of country is comparatively poor in all the species of which the larvae feed and hibernate in any exposed situation, several species of Noctuae, of which the larvae live underground, are always abundant, and the country is actually

rather rich in those species of Tortricina which feed and hibernate entirely within the stalks or roots of plants.

"It is worthy of notice, that there are a very few species which have appeared unable to cope with severe cold. *Lobophora viretata* was tolerably common here during the first three or four years of which I have been writing, but after the first cold winter it became scarce, and has since almost disappeared."

SALIVARY GLANDS IN BEES.

[Abstract of a dissertation by Paulus Schiemenz.]

BY GEORGE DIMMOCK, CAMBRIDGE, MASS.

Paulus Schiemenz' dissertation "Über das herkommen des futtersaftes und die speicheldrüsen der biene" . . . [Rec., no. 3337] gives many interesting facts in the anatomy of the honey-bee and of other bees. The beginning of this paper is a historical consideration of the subject, with a description of the digestive tract of *Apis mellifica*, in which the author follows Plateau's view that the proventriculus serves to arrest the too rapid flow of the contents of the crop (or honey-stomach, as Schiemenz here terms it) into the ventricle. Following the views of Leuckart, in whose laboratory Schiemenz prepared this paper, the author considers that the ileum of the bees, as of insects in general, has no other function than that of furnishing a suitable connection between ventricle and rectum, and he decides that the nutrient fluid used by bees to feed their queen, larvae and drones surely does

not come from the ventricle, as has been often supposed. The salivary glands are next described, and their secretions and histological structure discussed, in the order introduced for them by Siebold, i. e., as "system I, II, III, IV and v."

The gland of system I (Meckel's supramaxillary gland) is provided with a reservoir and discharges its strongly acid secretion by openings, one on each side of the "Schlundblättchen" [hypopharynx of Savigny]. This gland is absent in queens and drones. In six species of *Bombus* this system is well developed, and the author describes various modifications in other bees.

The glands of system II (Meckel's glandula sublingualis) are in the head, just above its lower or posterior chitinous walls, and are easiest prepared by first removing system I, and then the brain. The different efferent ducts of the parts

of this system of glands unite on each side, and the ducts resulting from their union join the duct from system III at right angles, forming a cruciform figure. The secretion of system II is slightly alkaline and leaves a fatty spot upon the test-paper. Queen bees have system II similar to that of workers, but in drones its place is occupied by a mass of yellow fat-cells, which cannot secrete and which the author follows Pagenstecher in regarding as results of degeneration. In the male of *Bombus* this system occupies nearly the whole head, while in the females and workers it is less developed proportionally than in *Apis*. System II is present in *Psithyrus*, *Megachile* and *Coelioxys*, but absent in all other bees examined by the author, e. g., in *Hylaeus*, *Dichroa*, *Dasygaster*, *Andrena*, *Osmia*, *Anthidium*, *Colletes*, *Melecta* and *Anthophora*.

System III consists of a pair of glands in the anterior part of the thorax, each gland having a reservoir, and each opening by a duct which passes forward into the head, the two ducts there uniting to form the common duct of this system, with which (as mentioned before) the two ducts of system II unite at right angles to form a cross, the combined efferent duct of systems II and III forming the fourth, or anterior, branch of the cross. The secretion of the glands of system III is slightly alkaline or neutral. In queens and drones, particularly in the latter, this system of glands is of similar structure, but not so strongly developed as in workers. The reservoir is differently proportioned in queen, drone

and worker, but in the latter its capacity is greatest. System III is not as well developed, relatively, in other bees as it is in *Apis*. This system of glands is described and figured by Spaulding (Amer. nat., Feb. 1881, v. 15, p. 113-119), whom Schiemenz incorrectly cites as Hyatt, but whose description he rightly says "gives only the crudest outlines and even these inaccurately."

System IV, described minutely by Wolff and noticed by Graber, consists of two glands, one on each side, opening by a short duct upon the inner side of the base of each mandible, and giving out a strongly odorous and very acid liquid. If a mandible is torn from a bee's head the gland usually hangs to the base of the mandible as a little sac. In queen bees system IV is very strongly developed, in workers well developed, but has suffered a degeneration in drones, in which the gland, altho still present, secretes nothing. System IV is present, more or less developed, in all bees.

System V, which is not present in *Apis mellifica*, but exists in *Bombus* and some other genera, consists of an unpaired gland which opens into the outlet of the common duct of systems II and III. This system was not very fully studied by the author, its function probably being only that of lubrication.

In studying the development of these glands, which he considers at length, Schiemenz shows that systems I and IV are entirely new formations from epidermal invagination, system III is partly developed from the silk-glands of the larva, and systems II and V are derived later from the duct of system III.

While pursuing the development of these glands opportunity was taken of proving that Engelmann's so-called "neuroid filaments" (Neuroidfasern) were not of a neural nature.

Under the heading "function" Schiemenz treats of some curious views that have been advanced by authors in regard to the different salivary glands of bees. Ramdohr at first mistook system II for an olfactory organ and system III for its continuation in open communication with the tracheae of the thorax. He later corrected this error. Fischer thought that system III was an "insect-lung." Wolff and Graber properly receive sharp criticism at the hands of Schiemenz because they

thought that system IV was a gland for moistening an olfactory organ beneath the labrum, the place where Wolff, in his wild search for analogies between vertebrates and insects, had located the olfactory organ of the bee. Schiemenz regards the glands of system IV as used in the preparation of food, and the glands of system I as producing, in part at least, the nutrient fluid used for the larvae. The functions of the other systems still remain doubtful.

As an appendix the author describes and figures the structures of the antennae of *Apis mellifica*, since it is now settled that the antennae are the seat of the olfactory sense.

CONTRIBUTION TO THE KNOWLEDGE OF PARASITIC LIFE IN GALLS.

[Translated, with some change, from G. Fr. Möllers "Bidrag till kännedomen om parasitlifvet i galläpplen och dylika bildningar" (Entom. tidskr., 1882, årg. 3, p. 182-186).]

BY B. PICKMAN MANN, WASHINGTON, D. C.

In his work, *Die ichneumoniden der forstinsecten*, bd. 2, p. 217 and 219, Ratzeburg gives a list of all the parasites which Tischbein, Nördlinger, Reising, and others had hatched from galls of species of *Cynips* and *Nematus*. Since however the list is very incomplete as regards our fauna I will here give a list of the parasites and inquiries which I have obtained from such gall-formations during several years' continuous investigations.

In the determination of the species I have followed exclusively Thomson's *Hymenoptera Scandinaviae* and *Opuscula entomologica*. Where the sex is

not mentioned it is to be understood that both males and females were obtained, and where the quantity of specimens is not mentioned that a moderate number were obtained; (a) indicates an abundance, (aa) a great abundance, and (r) a scarcity of specimens.

1. From galls of *Cynips folii*, collected in Scania, September 1868, were raised, in March 1869:—*Torymus viridissimus* (r), *T. cingulatus*, *T. flavipes* ♀ (unique); in April:—*Synergus vulgaris*; in May:—*Eurytoma appendigaster* ♀ (unique).

2. From galls of *Cynips longiventris*, collected in Scania, September