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DESCRIPTION OF THE LARVA OF PLECTRIS ALIENA CHAPIN
AND EXPLANATION OF NEW TERMS APPLIED
TO THE EPIPHARYNX AND RASTER.

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The material on which the following description is based is in the U. S. National Museum and consists of:

(1) Two first-stage larvae, collected by E. A. Chapin on June 7, 1933, in Charleston, S. C.; one larva found in the ground at a depth of 6 inches, the other at an unobserved depth.

(2) Two cast skins of mature larvae; each skin attached to the end of a pupa. The pupae were found by Dr. Chapin on June 5 and 9, 1933, in Charleston, S. C., at a depth of 11 inches.¹

(3) Considerable material which consists mostly of full-grown larvae, and six sets of larval and pupal skins associated with reared adults, from Brunswick, Ga., collected in 1933 and 1934. This was submitted by the Division of Japanese and Asiatic Beetle Investigations, Bureau of Entomology and Plant Quarantine, Moorestown, New Jersey, after preliminary studies of the material had been made by R. J. Sim of that division.² The determination of the larval material had also been made by Mr. Sim, on the strength of reared adults.

DESCRIPTION OF LARVA.

Body (fig. 16) moderately curved. Length of first larval instar about 6 mm. Length of mature larva about 27 to 28 mm. Extreme width of cranium of first larval instar about 1 mm. Extreme width of cranium of mature larva 3.5 to 4 mm.

Cranium (fig. 2)³ narrower than prothorax, the width of the prothorax being about 5 mm.; cranium broader than long with length about 3 mm. in the mature

¹ For further information and description of adult, see paper "An apparently new scarab beetle (Coleoptera) now established at Charleston, South Carolina," by Edward A. Chapin. Proc. Biol. Soc. Washington, vol. 47, 1934, pp. 33-36.

² Robert J. Sim: Characters useful in distinguishing larvae of *Popillia japonica* and other introduced Scarabaeidae from native species. U. S. Dept. Agr. Circular no. 334, December 1934, p. 12, fig. 8.

³ The term *cranium* is used here for the capsule formed by the two immovable parts of the head, viz, the frons and the epicranium.

larva. Surface of cranium rugulose to shallowly reticulate, shining, pale cadmium-yellow. Clypeo-frontal suture (*CS*) well marked; frontal sutures (*FS*) (=“epicranial arms” of many authors) fine, whitish, anteriorly slightly convex toward the outside, posteriorly almost straight, meeting considerably in front of hind margin of head, forming an approximately right angle (*PA*); epicranial suture (*ES*) (=“epicranial stem” of many authors) about one-third the length of one of the frontal sutures, anteriorly with a small, slightly impressed, pale brownish enlargement, posteriorly fine and light. Anterior part of *frons* rather densely furnished with minute setae behind the entire clypeo-frontal suture; each anterior frontal angle (*AA*) with many minute setae and one long seta near antennal base; across middle of *frons* with a series of four setae, two on each side, almost equidistantly placed, each in a shallow pit. *Epicranium* with about six moderately long setae in a longitudinal series on each side of epicranial suture and posterior part of *frons*; behind antennal base with a tuft-like arrangement of about half a dozen fine, rather long setae, and with a small number of minute setae scattered over whole epicranial surface.

Clypeus (fig. 2) trapezoidal; divided into two transverse parts. Anterior part whitish and naked; posterior part somewhat larger, darker, sclerotized and limited in front by a low marginal ridge; on each side behind the ridge one anterior and one posterior long, lateral seta, between anterior lateral seta and sagittal line of head one long and one minute seta, between posterior lateral seta and sagittal line a transverse series of about five rather small setae.

Labrum (fig. 2) about as long as clypeus but slightly narrower, distinctly angular at middle of each lateral margin. Anterior margin with a series of three darkly sclerotized, obtuse tubercles on each side. Apex crenulate and somewhat projecting. Across labrum between lateral angles with a complete, heavy ridge which has an irregularly wrinkled, rounded crest. In front of this ridge and between corresponding tubercles of the anterior margin three similar, less complete, somewhat lower, transverse ridges. In apical projection two stiff setae on each side, one in front of the other, and close to the hindmost of the antero-marginal tubercles one large seta; on posterior complete ridge a series of four strong setae, two on each side; in posterior part of labrum behind posterior ridge two parallel, transverse series of small setae and a number of very minute setae; anterior series with about five setae on each side, posterior series with about four setae on each side at hind margin of labrum.

Ocelli completely absent.

Antenna (fig. 2) about as long as cranium, slender, four-jointed. Subapical joint produced on inner side into a well developed, conical process. Apical joint subelliptical, somewhat asymmetrical with inner side more curved than outer side, distally slightly constricted. Three semitransparent convex sensory spots (or sensilla placodea) on sides of apical joint and one on process of subapical joint. Constricted end of apical joint with several minute, tactile cilia.

Mandible (figs. 1, 3, 5, 8), slightly longer than cranium. Scissorial part (*S*), black, slender; cutting edge with a small notch and proximal edge of notch produced into a small tooth. Exterior part (*E*) convex and finely rugulose, subtriangular, limited by two apically converging carinae extending from base of mandible to posterior end of scissorial part, with about six setae (fig. 16).

Manducatorial (=mola bearing) part light yellowish with black molar struc-

tures; stridulating area completely lacking. Molar part of right mandible trilobed (*L1*, *L2*, *L3*, figs. 3 and 8); heel (=calx) (*CA*, figs. 3 and 8) subtrapezoidal, about one and one-half times as long as wide and posteriorly slightly emarginate in the middle. Molar part of left mandible (figs. 1 and 5), projecting anteriorly and retracted posteriorly, bilobed, with the anterior lobe (*L2*) strong and shielding a low, somewhat excavated posterior lobe (*L1*); posterior lobe with one obliquely transverse carina; heel (*CA*) small, rather indistinct, and characterized by a broad, piliferous dorsal hook (=hamus). A well developed brush of long bristles at base of both right and left molar parts.

Maxillary lobes (*lacinia* and *galea*) fused proximally into a single structure but distally free (fig. 6A). Ventral surface (fig. 4) lightly sclerotized and moderately setose, almost exclusively formed by galea; proximally marked by a well sclerotized, obliquely transverse, somewhat curved sulcus (*S*) indicating posterior boundary of galea, laterally provided toward buccal cavity with a longitudinal row of five to six strong, spine-like setae, and distally ending in a single strong galeal tooth (=uncus). Dorsal surface (fig. 9) lightly sclerotized and moderately setose, formed by both galea and lacinia; areas of galea and lacinia separated by a longitudinal, well sclerotized sulcus (*S*¹); galeal part with the single terminal tooth (uncus) mentioned above and three strong setae at its base; lacinial part with a terminal longitudinal row of three strong, lacinial teeth (=unci), a short, strong seta behind last tooth, and a longitudinal row of five strong, spine-like setae above teeth. Inner surface (fig. 6) subtriangular, membranous, with terminal portion split into free galeal and lacinial parts (fig. 6A); on galeal edge the above-mentioned single terminal tooth and series of five to six spine-like setae, and on lacinial edge the above-mentioned three terminal teeth and five spine-like setae. Proximal, united portion of maxillary lobes laterally limited by the above-mentioned dorsal and ventral longitudinal sclerotized sulci (*S* and *S*¹, fig. 6).

Stipes (figs. 6, 9), with a row of about 18 pointed, slender, stridulating teeth (*SD*) on dorsal side.

Maxillary palpus (figs. 4, 9), projecting beyond galea, four-jointed, with apical joint similar in form and vestiture to last antennal joint.

Epipharynx (fig. 11),⁴ almost regularly pentagonal, anteriorly projecting at middle. *Corypha* (*CO*) united with *Acroparia* (*ACR*) into a large apical region occupying between one-fifth and one-sixth of entire epipharyngeal surface; united region subtriangular in outline, with antero-lateral free margins following corresponding part of labrum, thus projecting somewhat anteriorly and having a series of three obtuse dilations on each side, posterior limitation not distinct, right and left clithrum and epizygum being absent, but approximately determined as being situated directly in front of plegmatia (*PL*) and zygum (*Z*): surface thinly sclerotized, with three spinelike setae of different sizes on each side of anterior projection, one seta below each marginal dilation and many strong and straight setae, interspersed with numerous minute ones, in space between anterior and marginal setae. *Plegmatium* (*PL*) well developed, consisting of about eleven transverse, long, sinuous, and sometimes interrupted,

⁴ The etymology and definition of the terms used in the present description of epipharynx are given on pages 175-176,

plegmata; no distinct *proplegmatium*. *Acanthoparia* (*A*) carrying about a dozen setae, the seven anterior coarse and cultriform, the rest straight and decreasing in length posteriorly; *gymnoparia* (*G*) poorly developed except anteriorly, where many oblique rows of minute granulae occur behind a faint and arched sclerome (*X*) suggesting a single proplegma; *chaetoparia* (*C*) large, with anterior chaetae somewhat coarser than the rest. *Haptomerum* (*HM*) complete and fairly distinct; *zygum* (*Z*) thinly sclerotized, transverse, subrectangular, slightly arched and about four times as wide as long; sensilla dark, more or less equidistant, about seven larger and a few minute, arranged in a single row on and along the entire zygum; heli five, large, projecting backward from zygum and arranged in a single transverse row. *Pedium* (*P*) somewhat longer than wide, somewhat asymmetrical and bent to the right. *Laeotorma* (*LT*) short, V-shaped with rounded pternotorma and inner branch entire (not divided at end into anterior and posterior epitormae). *Dexiotorma* (*DT*) almost straight. *Phobae* (*PH*) well developed, each phoba slightly shorter than dexiotorma; three present, two extending from near inner end of laeotorma, the one upward and inward, the other downward and inward, and one extending upward from near inner end of dexiotorma. *Haptolachus* (*HL*) complete but with the components weakly developed; *crepis* (*CR*) as thin as a hair, somewhat expanded behind end of laeotorma; two *nesia* (*N*) present, both small and only slightly different in size, one placed almost in middle line of epipharynx and the other nearer inner end of dexiotorma; four sensilla present, two between nesium in middle line and laeotorma, and two behind inner end of dexiotorma.

Glossa (lingua according to Schiödte) (*GL*, fig. 9), the dorsal surface of the ligula, fleshy, cushioned, densely set with both spine-like and fine setae.

Hypopharyngeal sclerome (fig. 9) asymmetrical, obliquely transverse and produced on right side into a strong process (*C*, fig. 7) appearing like the crown of a molar tooth. Right and left *angles of hypopharynx* (*RA* and *LA*, fig. 7) semimembranous and with many fine setae. *Hypopharyngeal fossae* (*F*, figs. 7 and 9) receiving accessory condyles of mandibles (*AC*, figs. 5 and 8), strongly sclerotized and placed laterally behind hypopharyngeal angles. Underside of hypopharyngeal sclerome imbedded in fleshy tissue, provided with three sets of thickenings shaped like roots of molar teeth and combined into a strong network (*R*, fig. 7) bracing crown and fossae.

Legs (figs. 12, 16) gradually and slightly increasing in length from first to third, with long, brown hairs scattered over entire surface and particularly densely set on trochanter, femur, and tibio-tarsus (*T-T*).

Claws (=unguli) (*U*, fig. 12) unequal in length, different in shape. On first and second legs about one-third length of tibio-tarsus, enlarged at base, straight and pointed distally; distal parts from one and one-half to twice as long as basal parts and about three times as narrow where they meet. Claw of third leg (*U3*, fig. 12) with base distinct, but not more than one-fourth to one-third as large as bases of first or second legs; distal parts virtually obliterated. Base of each claw armed with two long, spinelike setae of unequal length.

Body areas (fig. 16). *Prothorax* (*1*) with one dorsal area; *mesothorax* (*2*) and *metathorax* (*3*) with three dorsal areas each, namely, prescutum, scutum, and scutellum. Prescutum and spiracle-bearing part of mesothorax closely connected with prothorax and appearing as part of it. Prescutum of mesothorax

slightly asperate; scutum and scutellum of mesothorax and prescutum, scutum, and scutellum of metathorax each with a single transverse row of fine, fairly long setae and no asperities. Prescutum and scutum of *first abdominal segment* (*A*) each with a single transverse row of fine, fairly long setae and no asperities; scutellum of first abdominal segment with a long, narrow, transverse patch of short, brown asperities interspersed with long, fine setae in a single transverse row. Prescutum, scutum, and scutellum of *second (B) to sixth abdominal segments* each with a patch of short, brown asperities interspersed with a single transverse row of long, fine setae. Postscutellum (*PO*) present on first to sixth abdominal segments, laterally placed, not reaching back of larva, bearing only a few short, fine setae. Prescutum and scutum of *seventh abdominal segment* with transverse patches of short, brown asperities interspersed with a single transverse row of long, fine setae; scutellum with transverse patch of minute setae, a single transverse row of long, fine setae, but no asperities; postscutellum present, lateral, with a few fine, short setae. Prescutum, scutum, scutellum, and postscutellum of *eighth abdominal segment* rather indistinctly limited, furnished with both minute and long, fine setae, but with no asperities. Ninth and tenth abdominal segments not completely united; individual areas obliterated; dorsally with both minute and long, fine setae but with no asperities. *Anus* (figs. 14, 18) V-shaped; *upper anal lip* entire, *lower anal lip* with straight sagittal impression; both lips covered with moderately long, fine setae, and short, fine setae, and also with numerous asperities; a large barbula (*B*) of long, light-brown hairs on each side of anus.

Raster (figs. 14, 18)⁵ consisting of a *septula*, a pair of *palidia*, and a pair of *tegilla*. *Septula* (*S*) Y-shaped, extending from entire base of lower anal lip to about middle of venter of tenth abdominal segment, limited laterally by a pair of palidia. Each palidium (*P*) distichous or tristichous in posterior half near anus and irregularly monostichous in anterior half remote from anus; pali separated by a distance about equal to width of their bases; tips of pali of opposing parts of the two palidia separated by a distance of about the length of a palus. Each tegillum (*TL*, fig. 14) well developed, covering venter between barbula (*B*) and the entire palidium (*P*), with strong, hamate setae interspersed with a few long and a few short, straight setae; hamate setae pointing outward or erect and arranged in three to four irregular, longitudinal rows (fig. 14).⁶ *Campus* (*C*, figs. 14, 18) large, about as long as raster.

Spiracles (figs 15, 17) with respiratory plate (*RP*) elongate, moderately arched, kidney shaped, and not surrounding bulla (*B*). Thinly covered holes of respiratory plate (fig. 15) angular-rotundate, irregularly distributed; trabeculae (*TRA*) branched and moderately strong; spiracular orifice arched and open; bulla subelliptical. Thoracic spiracle almost three times as large as abdominal spiracles; abdominal spiracles approximately of equal size; concavity of thoracic respiratory plate facing posteriorly, that of abdominal respiratory plates, anteriorly.

First larval instar with each palidium distichous, tristichous, or polystichous

⁵ The etymology and definition of the terms used in the present description of raster and its regions are given on pages 175-176.

⁶ Figure 18 is drawn from a microscope slide and the coverglass has pressed many of the setae out of their natural positions.

both near anus and remote from it (*P*, fig. 13); also with fewer hooked, outwardly directed spines in tegillum (*TL*) than found in mature larva.⁷ Otherwise like mature larva.

SYSTEMATIC RELATIONSHIPS.

The larva of the genus *Plectris* is remarkably different from the larval forms of the genera *Phyllophaga* and *Macrodactylus* with the one or the other of which a rather close relationship could be expected from the classification of the adults. It does, however, come nearer to the larva of the genus *Dichelonyx* which, according to the adult, has been placed in the tribe Macroductylini together with *Macrodactylus*. In the following synopsis, comprising larvae of the genera *Phyllophaga*, *Macrodactylus*, *Plectris*, and *Dichelonyx*, all the characters are listed which show their mentioned affinities.

SYNOPSIS.

Common characters:

Plicate abdominal terga with a single transverse series of long, fine setae and a number of short spines or asperities on individual tergal areas; angulate V- or Y-shaped anus; mandibles without a striate stridulatory area; stipes with a row of numerous, sharp, stridulating teeth.

Separating characters:

1. Epipharynx either with a pair of distinct proplegmata or with haptomerum armed with seven or more heli, or with both characters. [Claw of third leg much shorter than claws of first and second legs; mandible without stridulating granules; septula and palidia present or (as in *Phyllophaga portoricensis* Smyth, *P. vandinei* Smyth, and *P. citri* Smyth) absent, when present usually monostichous (in *Phyllophaga farcta* Lec. polystichous); either with teges or tegilla; each tegillum, when present, composed of widely spaced, hooked or straight, spine-like setae; spiracles strongly bent]⁸.....*Phyllophaga*
- Epipharynx without distinct proplegmata, haptomerum with less than seven heli.....2
2. Claw of third leg as large as claws of first and second legs; respiratory plate strongly bent, enclosing a circular bulla; calx (=heel) of right mandible with straight posterior edge. [Raster with septula and palidia, tegilla composed of widely spaced, hooked spines; epizygum present, haptomerum with thinly sclerotized zygum and with four, strong heli]⁸.....*Macrodactylus* (*M. subspinosus* Fab.)
- Claw of third leg much shorter than claws of first and second legs; respiratory plate moderately bent, enclosing only anterior (or posterior) margin of elliptical bulla; calx (=heel) of right mandible with emarginate posterior edge. [Haptomerum with distinct zygum]⁸.....3

⁷ Figure 13 is drawn from a slide and the cover glass has pressed many spines of the tegillum out of their natural positions.

⁸ Besides the strictly alternative characters of the key, others, guiding but not necessarily alternative, are given in brackets.

3. With septula and a pair of palidia; palidia distichous, tristichous, or polystichous near anus, monostichous remote from anus in mature larva (tristichous or polystichous in its whole extent in first-stage larva); a pair of tegilla present, each tegillum with three to four irregular rows of larger hooked setae; gymnoparia poorly developed, haptomerum with five strong heli; labrum with one complete and three incomplete transverse ridges.....*Plectris* (*P. aliena* Chapin)
- No septula and no palidia, but campus extending backward in middle line and teges prolonged forward on each side of it into a pair of elongate, large, subtriangular patches of small, short, outward-pointing asperities; gymnoparia well developed, haptomerum with three strong heli; labrum without well marked ridges.....
Dichelonyx (*D. backi* Kby.)

DESCRIPTION OF NEW TERMS APPLIED TO SPECIAL STRUCTURES OF EPIPHARYNX AND RASTER.

The structural details of the epipharynx have been described and named by *William Patrick Hayes* in his notable, very useful contribution: *Morphology, Taxonomy and Biology of Larval Scarabaeoidea* (Illinois Biological Monographs, Vol. XII, No. 2, 1929, pp. 22-33). Previous to Hayes' paper little special study had been given to these details, none of which had been used before for taxonomic purposes. Professor Hayes demonstrated their eminent taxonomic importance, and now they are used generally in recent American and foreign publications. However, the terms suggested by Professor Hayes are not sufficient for descriptions so detailed and precise as those I find it necessary to offer, and therefore a new series of terms is proposed for the epipharyngeal regions and single structures. I have chosen to derive these terms from Greek words merely by giving them Latinized endings in customary nomenclatorial fashion because the name epipharynx itself is a pure Greek word and because I have found it much easier and more satisfactory to coin new and euphonious terms from Greek roots than from Latin roots. The latter have been so heavily drawn upon for the formation of terms that their supply is almost exhausted and new combinations of frequently used Latin words are liable to cause confusion and are difficult to recollect.

Professor Hayes' terms have been added in parenthesis at the end of each of the definitions of the new terms for the convenience of those students who may prefer his set of terms or may want to compare the two sets.

The new terms applicable to taxonomically important parts of the raster I have derived from the Latin because the name raster itself is a pure Latin word.

There are two main types of epipharynges in scarabaeoid larvae, one more generalized and fundamental and one highly

specialized and complicated. The first is present in Troginae, Aphodiinae, the small subfamilies related to the Aphodiinae, and the Lucanidae. The presence and development of the regions, subregions, and scleromes of this type are considerably at variance with the ones found in the second type but deviate little, and are easily derived, from a type present in the dascillid larvae *Dascillus* and *Helodes* and in bostrichid larvae like *Psoa* in which the character of the single composing elements is still clearer and more explicable.⁹ The second epipharyngeal type in scarabaeoid larvae is present in the great majority of the Scarabaeidae. As all of the larvae with which the present paper is dealing possess this second, highly specialized type, the subsequent definitions of terms refer and apply only to this type.

Acanthoparia (-ae) (Greek; from *acanthos*, a spine, and *pareia*): Spiny marginal part of *paria* (see *Paria*).

Acroparia (-ae) (Greek; from *acron*, top or extremity, and *pareia*): Anterior part of *paria* bearing, usually long, bristles (see *Paria*).

Apotorma (-ae) (Greek; *apo*, off or from, and *torma*): Process extending forward from *torma* between *pternotorma* and interior end of *torma* (or base of *epitorma*); always located exterior to *phobae*.

Barbula (-ae) (Latin; meaning a small beard): Tuft or patch of hairs or short bristles at sides of abdomen near anal region. (*Barbated*, meaning with fascicles of hairs or bristles.)

Campus (-i) (Latin; meaning an unoccupied field): Bare, or almost bare, ventral region ("regio intecta") of tenth, or fused ninth and tenth, abdominal segment in front of an entire or anteriorly split *teges* (text fig. 2, *B* and *D*), or in front of the paired *tegilla* (text fig. 2, *A* and *C*). *Palidia*, with *septula* between, sometimes found extended into *campus* medianly (text fig. 2, *A* and *C*). Not a component region of *raster* but closely combined with it.

Chaetoparia (-ae) (Greek; from *chaite*, a bristle, and *pareia*): Inner part of *paria* covered with bristles; bristles strongest toward *pedium*, gradually decreasing in size toward *gymnoparia* (or toward *acanthoparia* when *gymnoparia* is absent (see *Paria*).

Clithrum (-a) (Greek; from *kleio*, to confine or limit): Paired, short sclerome in anterior part of margin of epipharynx; separating *corypha* and *paria*; *clithra* often absent.

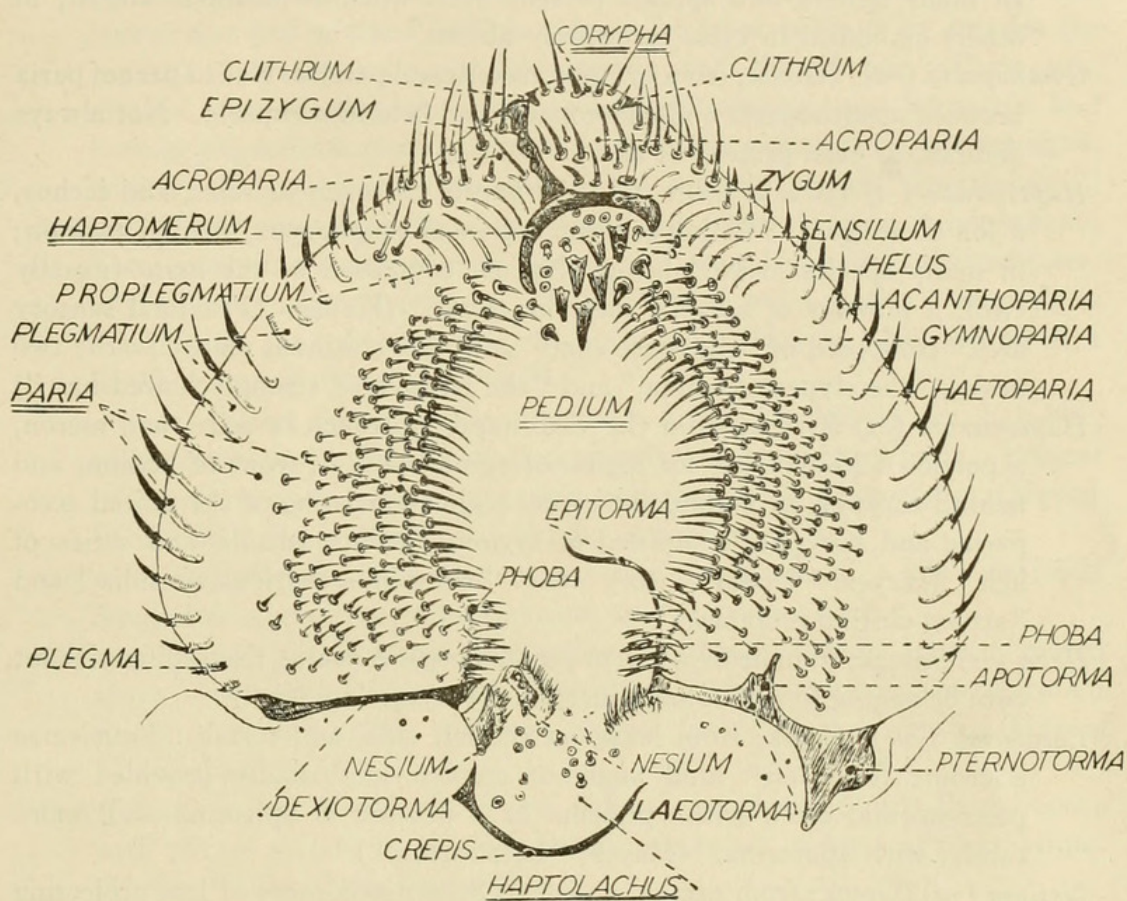
Corypha (-ae) (Greek; from *koryphe*, top of a helmet): Unpaired anterior region of epipharynx between the *clithra*; bearing a small number of setae; often merged with *acropariae* into a common apical region when *clithra* are absent. (Hayes: "Median lobe.")

Crepis (-ides) (Greek; from *krepis*, genitive *krepidōs*, an enclosing wall): Thinly sclerotized, anteriorly concave, median cross bar pertaining to the region

⁹ A cursory examination of epipharynx in larvae of other coleopterous families reveals a new field for comparative morphological and taxonomic research which may produce important results.

haptolachus; usually asymmetrical and often indicated only by a fine line, or completely absent. (Hayes: "Transverse, strongly bowed bar.")

Dexiotorma (-ae) (Greek; from dexios, at the right side, and torma): Transverse, usually slender sclerome extending inward from right¹⁰ hind angle of epipharynx; sometimes provided with a heel-shaped pternotorma. (Hayes: "Right torma.")



TEXT FIGURE 1

Epipharynx (-ges) (Greek; from epi, at or upon, and pharynx): Complex buccal area forming inner or under lining of labrum and extending back below clypeus. When fully developed, comprising the following regions, sub-regions, and scleromes:

- I. *Corypha*.
- II. *Paria*, subdivided into *acanthoparia*, *gymnoparia*, *chaetoparia*, and *acroparia*; bearing *plegmatium*, *proplegmatium*, and *phobae*; posterior margin strengthened, to the right¹⁰ by *dexiotorma*, and to the left¹¹ by *laeotorma*.
- III. *Haptomerum*, composed of *zygum*, a series of *heli*, and a number of *sensilla*; in some species and genera united with *epizygum* into *tylus*.
- IV. *Pedium*.
- V. *Haptolachus*, composed of the *nesia* (usually two), a number of *sensilla*, and the *crepis*.

- Epitorma* (-ae) (Greek; from epi, at or upon, and torma): Rod extending from inner end of laeotorma, often barely indicated or completely absent. Epitorma designated as *epitorma anterior* when directed toward apex of epipharynx and as *epitorma posterior* when directed the opposite way.
- Epizygum* (-a) (Greek; from epi, at or upon, and zygon): Elongate plate or bar extending from zygom toward clithrum on right¹⁰ side of epipharynx. In many genera and species present even when clithrum is absent, in others embodied in tylus or entirely absent.
- Gymnoparia* (-ae) (Greek; from gymnos, naked, and pareia): Naked part of paria between acanthoparia and chaetoparia and behind acroparia. Not always distinct, or even present at all.
- Haptolachus* (-i) (Greek; from the verb hapto, to touch or seize, and lachos, a lot or section): Medio-posterior region of epipharynx, behind pedium; in many species located below clypeus; composed of the *nesia* (usually two), a number of sensilla, and the *crepis*. (Hayes: "Proximal sensory area" composed of "the sense cone" and "the chitinous plate" [=the two nesia], "the clypeal sensillia," and "the transverse, strongly bowed bar.")
- Haptomerum* (-i) (Greek; from the verb hapto, to touch or seize, and meron, a portion): Medio-anterior region of epipharynx, in front of pedium and behind corypha, or behind the apical region consisting of the united acropariae and corypha; composed of *zygom*, various sensilla and series of heli. (Hayes: "Distal sensory area" "containing various sensillia" and "strong chitinous spines.")
- Helus* (-i) (Greek; from helos, a nail or pointed peg): A coarse, fixed spine without cup; belonging to region haptomerum. (Hayes: "spines.")
- Laeotorma* (-ae) (Greek; from laios, on the left side, and torma): Transverse sclerome from left¹¹ hind angle of epipharynx, usually provided with pternotorma, often with epitorma or a portion of epitorma and, more rarely, with apotorma. (Hayes: "Left torma.")
- Nesium* (-a) (Greek; from nesion, an islet): Sclerotized, more or less projecting mark in space between inner ends of tormae; anterior to crepis. Usually one or two nesia present. When one nesium is present, a larger, thin, plate-shaped sclerome often occurs in front of it; when two nesia are present, one is located at inner end of dextortorma, and another to the inside of this right nesium; both nesia components of region haptolachus. (Hayes: Right nesium named "chitinous plate," and the other nesium, "sense cone.")
- Palidium* (-a) (Latin; derived from palus, and meaning a row, or rows, of pointed sticks, a palisade): Group of pali arranged in a single row (text figure 2, C), or two or more rows (text fig. 2, A), either medianly placed across the venter in front of the lower anal lip (text fig. 2, B), or paired and extending forward and inward from one of the ends of the anal slit (text fig. 2, A), or paired and extending straight, arcuately, or obliquely forward from *inside of* one of the ends of the anal slit (text fig. 2, C). Pali usually recumbent, with their apices directed toward septula. Palidium characterized as monostichous, distichous, tristichous, or polystichous

¹⁰ At left on drawings.¹¹ At right on drawings.

according to whether there are, respectively, one, two, three, or many rows of pali. Component of raster.

Palus (-i) (Latin; from palus, genitive pali, a pointed stick): Straight, pointed spine. Component of palidium.

Paria (-ae) (Greek; from pareia, a cheek-piece of a helmet): Lateral paired region of epipharynx extending from clithrum, epizygum, and haptomerum (or in their place, tylus) back to the parietal elements dextotorma and laetotorma, and marked off intero-laterally from pedium by bristles (or asperities) of the subregion chaetoparia and the phobae. *Paria* subdivided into *acanthoparia*, *gymnoparia*, *chaetoparia*, and *acroparia* and bearing *plegmium*, *proplegmium*, and *phobae*; posterior margin strengthened by *dextotorma* and *laetotorma*. (Hayes: *Paria* named "lateral lobe.")

Pedium (-a) (Greek; from pedion, an open plain): Central region of epipharynx; bare; extending between haptomerum and haptolachus and limited laterally by intero-lateral features of right¹⁰ and left¹¹ pariae. Sometimes marked, on the left hand side, by epitorma. (Hayes: "Non setose area in the center of the epipharynx.")

Phoba (-ae) (Greek; from phobe, a mane): Fringe of densely set, hair-like, often forked projections located posteriorly at inner edge of paria. Present in many species; often appearing together with apotorma. (Hayes: "Cluster or group of delicate, slender, fixed spines.")

Plegma (-ata) (Greek; from plegma, genitive plegmatos, n., a plait or fold): Single fold pertaining to plegmium and proplegmium.

Plegmium (-a) (Greek; from plegmation, anything plaited): Lateral, paired space with plicate, somewhat sclerotized surface; bordered by marginal spines of *acanthoparia*, with one plegma inside of each spine. (Hayes: "Lateral striae.")

Proplegmium (-a) (Greek; from pro, before, and plegmium): Paired space with plicate surface inside and usually somewhat in front of plegmium. (Hayes: "Submarginal striae.")

Pternotorma (-ae) (Greek; from pterna, a heel, and torma): Curving, stout process at outer end of laetotorma, and sometimes of dextotorma.

Raster (*rastrum*) (Latin; meaning a small rake): A complex of definitely arranged bare places, hairs, and spines on ventral surface of last abdominal segment, in front of anus. The different features of the raster are separable into the following categories:

- I. *Septula*.
- II. *Palidium*.
- III. *Teges*.
- IV. *Tegillum* (instead of *teges* in many species).
- V. *Campus*.

(Hayes applies the term "Radula" to the complex here named raster.)

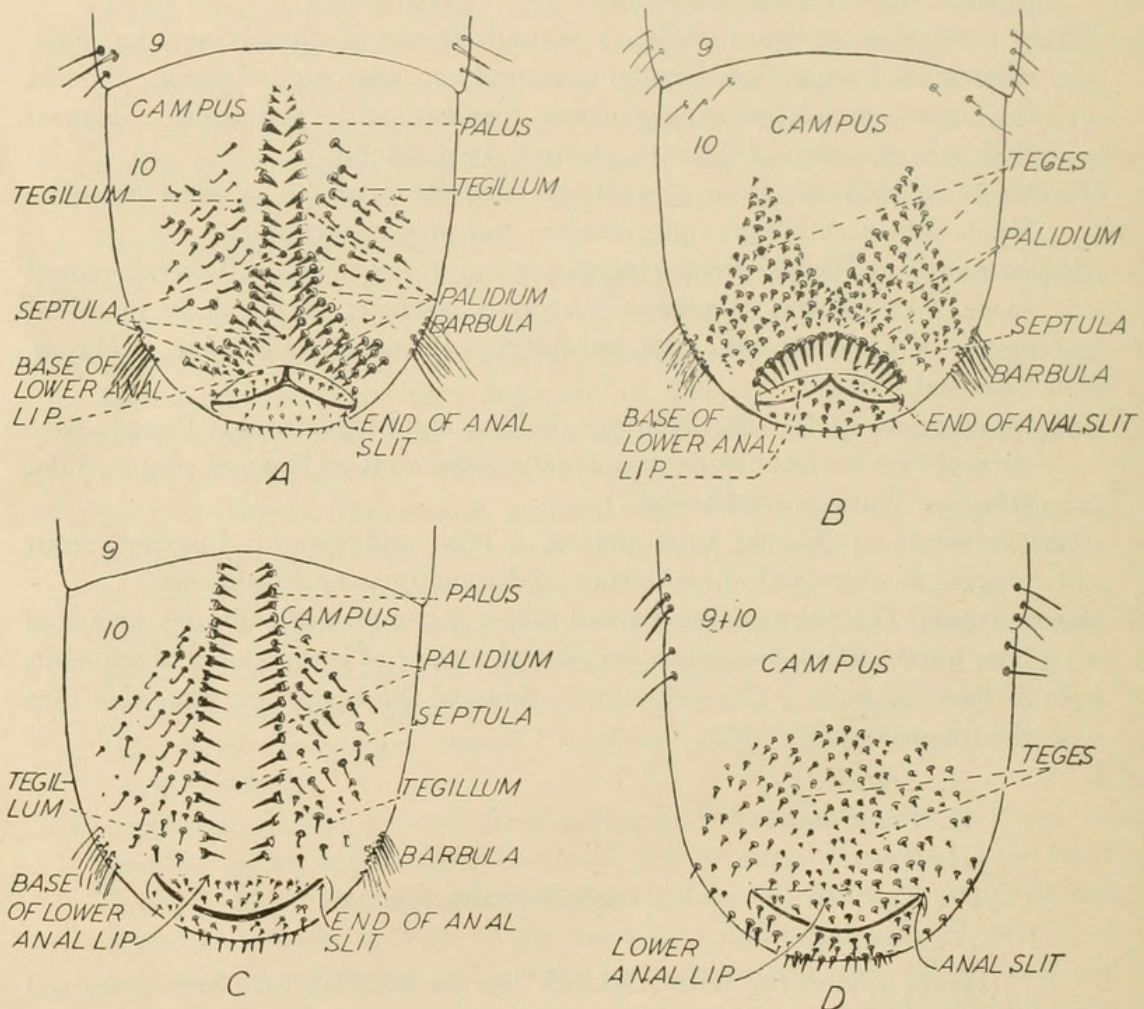
Sensillum (-a) (Latin; meaning a sense organ.)¹²

¹² For information about the different types of sensilla see Snodgrass, R. E., *Principles of Insect Morphology*, first edition, 1935, pp. 514-525. (The term *sensillum* (-a), n., is used by Snodgrass, Folsom, Weber, and others. Unfortunately, however, the terms *sensillum* (-ia), n., and *sensilla* (-ae), f., have also been applied to the same structures.)

Septula (-ae) (Latin; meaning a small enclosed place): Narrow, bare region of raster between a single transverse palidium and base of lower anal lip (text fig. 2, *B*), or between a pair of oblique palidia diverging backward to the ends of the anal slit (text fig. 2, *A*), or between a pair of backward-diverging, or parallel, or curved palidia to inside of ends of anal slit (text fig. 2, *C*).

Teges (-ites) (Latin; from *teges*, genitive *tegitis*, f., meaning a covering or a mat): Continuous, dense or sparse, patch of hooked or straight, larger or minute, outward pointing or erect setae; occupying the hind part, or almost the whole, of the tenth abdominal venter when the palidium is absent, or single and transverse, or paired, longitudinal and short. Occasionally divided toward head into two portions with a median intact field, the *campus*, between. Component of raster.

Tegillum (-a) (Latin; meaning a small mat or carpet): Paired patch on each side of venter of tenth abdominal segment; consisting of hooked or straight outward pointing or erect setae on each side of a paired and well developed set of palidia. Component of raster.



TEXT FIGURE 2

Torma (-ae) (Term created by Alex D. Macgillivray, External Insect-Anatomy, Urbana, Illinois, 1923, p. 31, and generally adopted by subsequent authors, for instance by *H. Weber* in his "Lehrbuch der Entomologie," Jena, 1933,

p. 53, and by R. E. Snodgrass in his "Principles of Insect Morphology," New York, 1933, p. 113. Etymology of term uncertain; possibly derived from the Greek words tormos, torma, or torme, a place in which a door turns): Dark sclerome at each end of clypeo-labral suture, extending transversely toward middle line of epipharynx; varying in size and shape according to the different species. Two asymmetrical tormae present, one to the right,¹⁰ dextortorma, and one to the left,¹¹ laeotorma. (Hayes: "Torma"; no special names for right and left torma.)

Tylus (-i) (Greek; from tylos, a callosity): Sclerome covering, completely or partly, the fused epizygal, coryphal and haptomerale elements; produced toward pedium into a single obtuse point or a few rounded lobes. (Hayes: No corresponding term; structure described as "projection" or as "chitinous portion of the distal sensory area.")

Zygon (-a) (Greek; from zygon, a yoke or cross-bar): Sclerome pertaining to region haptomerum and forming its anterior margin. When typically developed, appearing as a convex cross-bar in front of sensilla and heli, but often enlarged and carrying these structures.

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- (1) HAYES, W. P. 1929. Morphology, Taxonomy, and Biology of Larval Scarabaeoidea. Illinois Biological Monographs, vol. 12 (no. 2), 119 pages, 15 plates. Published by the University of Illinois; Urbana, Ill. (Important monograph, notably containing fundamental studies on the epipharyngeal structures and the raster applicable to the classification of scarabaeoid larvae, also larval keys to families, subfamilies, about 30 genera of Scarabaeidae, and 33 species of the genus *Phyllophaga*. 196 figures. A bibliography with references to 65 papers.)
- (2) MALOUF, N. S. R. 1932. The morphology of the head of a "white grub." Bulletin de la Société Royale Entomologique d'Égypte 1932, pp. 66-87, 37 figs.
- (3) SIM, ROBERT J. 1934. Characters useful in distinguishing larvae of *Popillia japonica* and other introduced Scarabaeidae from native species. U. S. Dept. Agric., Washington, D. C., Circular No. 334, 20 pages, 8 plates.
(The circular gives characters, mainly referring to epipharyngeal structures and raster, convenient to use in distinguishing the mature larvae of 24 species. *Phyllophaga ephilida* Say, *Phyllophaga tristis* Fab., *Macrodactylus subspinosus* Fab., *Dichelonyx* sp., and *Plectris aliena* Chapin are among the described larvae. Brief notes on behavior and habitat of the larvae. 51 clear and exact figures.)
- (4) GARDNER, J. C. M. 1935. Immature Stages of Indian Coleoptera (16) (Scarabaeoidea), Indian Forest Records (New Series) Entomology, vol. 1, No. 1, 1935, pp. 1-33. 78 figures.
(An important paper containing morphological discussions of taxonomic characters; the hatching spines in the first-stage larvae of three species mentioned; larval keys given to families, sub-families, genera, and species; full taxonomic descriptions of about 50 different larval species;

keys and descriptions to the pupae of many species; biological information and rearing reports; numerous instructive figures; many references to literature given both in the text and in a special list.

EXPLANATION OF FIGURES.

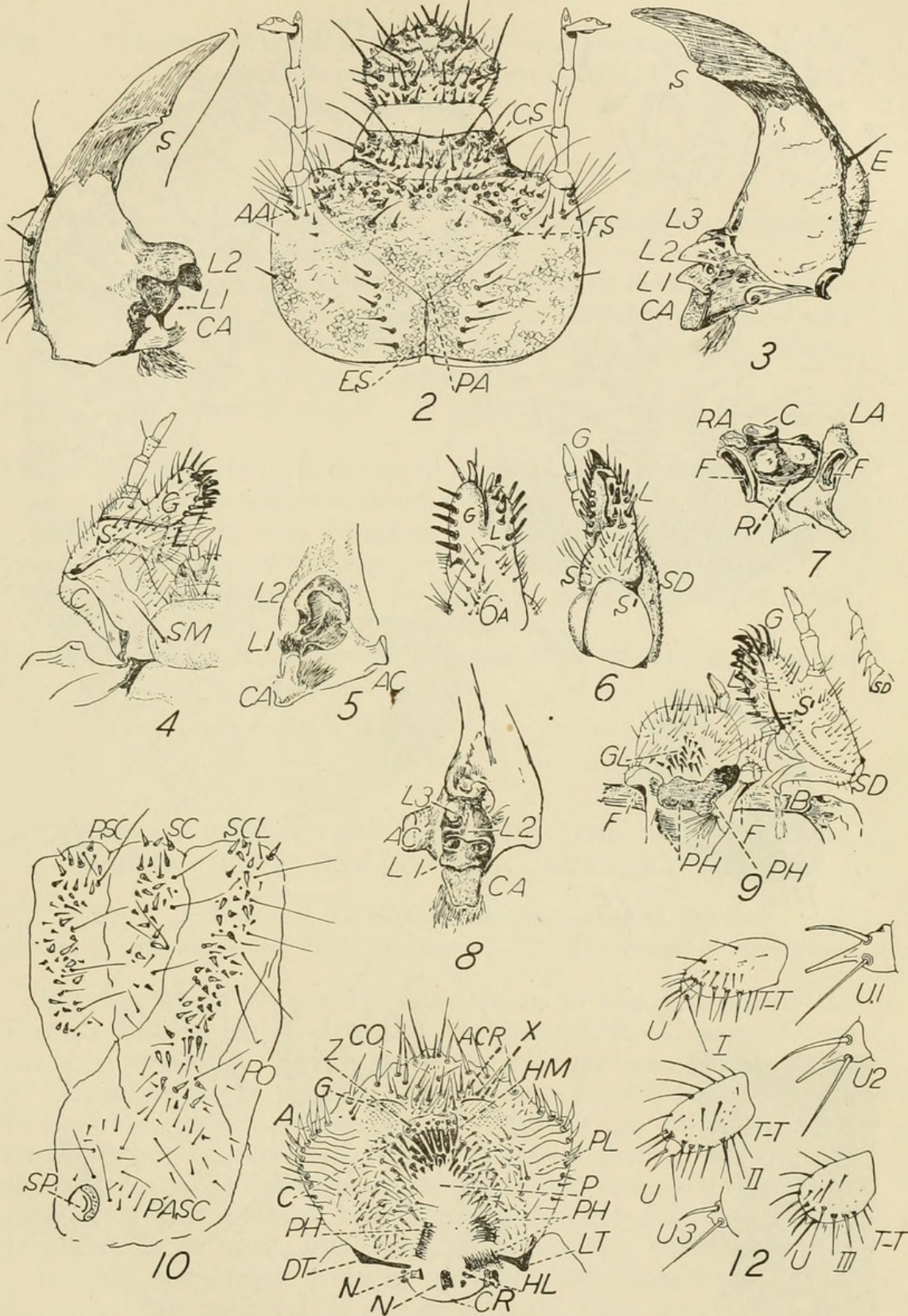
PLATES 9 AND 10.

(Drawn by the author.)

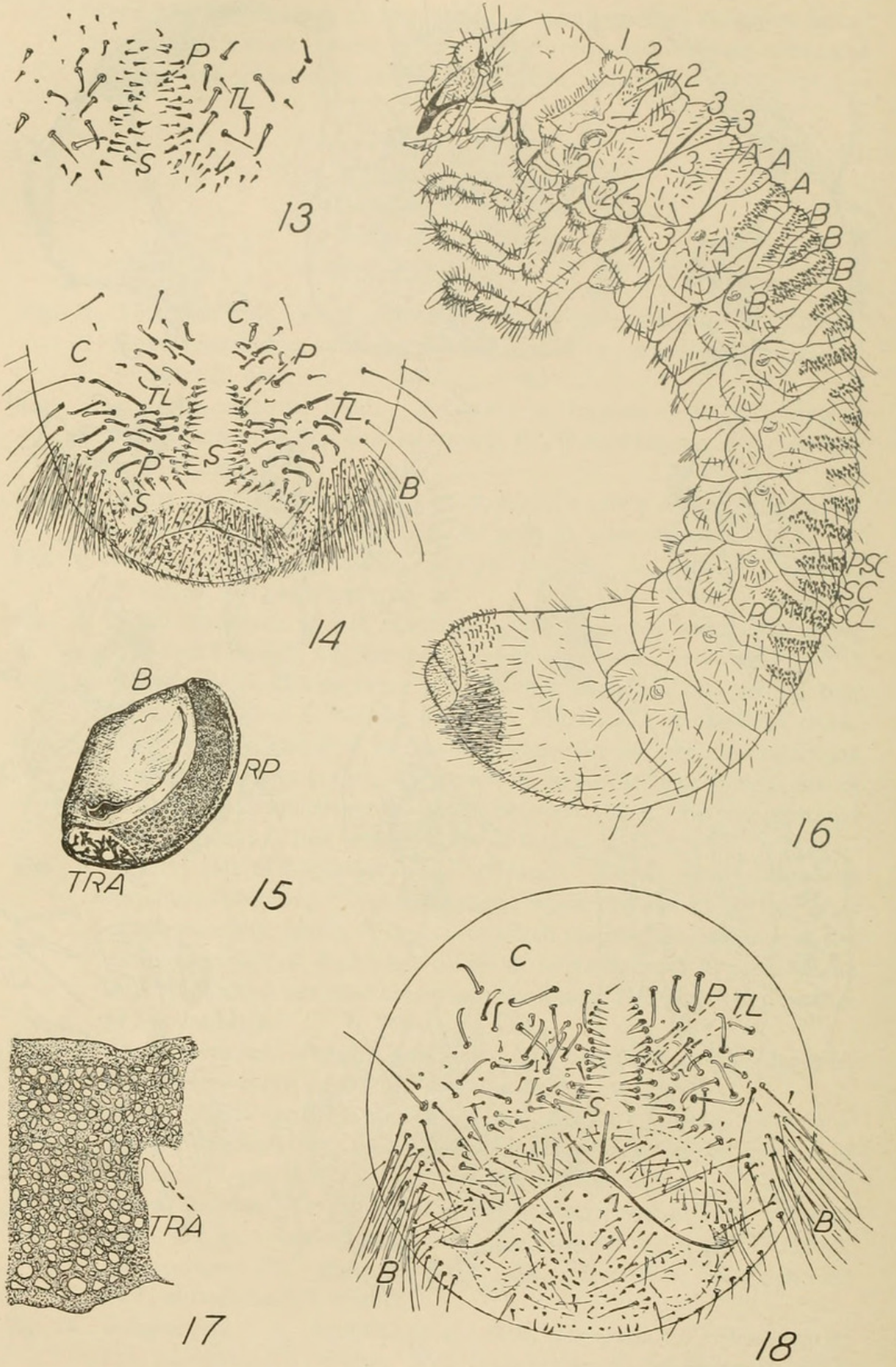
Plectris aliena Chapin.

PLATE 9.

- Fig. 1. Left mandible, dorsal side. *CA*, heel (=calx); *L1* and *L2*, lobes of molar (=grinding=manducatorial) part of the mandible; *S* scissorial (=cutting) part.
- Fig. 2. Dorsal surface of head. *AA*, anterior frontal angle; *CS*, clypeo-frontal suture; *ES*, epicranial suture; *FS*, frontal suture; *PA*, posterior frontal angle.
- Fig. 3. Right mandible, dorsal side. *CA*, heel (=calx); *E*, exterior part of mandible; *L¹*, *L²*, *L³*, lobes of molar part; *S*, scissorial part.
- Fig. 4. Right maxilla and labium, ventral surface. *G*, galea; *L*, lacinia; *S*, sulcus; *SM*, submentum.
- Fig. 5. Molar structure of left mandible. *AC*, accessory ventral condyle; *CA*, heel (=calx); *L1*, and *L2*, lobes of molar part.
- Fig. 6. Right maxilla showing inner side of lacinia and galea, also stridulating teeth. *G*, galea; *L*, lacinia; *S* and *S¹*, sulcus; *SD*, stridulating teeth.
- Fig. 6a. Free terminal parts of lacinia and galea; under natural conditions pressed closely together, as shown in figure 6; here forced out of position to demonstrate the split between them. *G*, free terminal part of galea; *L*, free terminal part of lacinia.
- Fig. 7. Ventral side of hypopharyngeal sclerome. (Fleshy tissue below the structure removed.) *C*, crown against which the first molar lobe (*L1*) of left mandible works; *F*, fossa into which the accessory condyle of the mandible fits; *LA*, fleshy left corner of hypopharynx; *R*, roots of the crown and the sclerotized bottoms of the fossae; *RA*, fleshy right corner of hypopharynx.
- Fig. 8. Molar structure of right mandible. *AC*, accessory ventral condyle; *CA*, heel (=calx); *L1*, *L2*, *L3*, lobes of molar part.
- Fig. 9. Right maxilla and hypopharynx, dorsal surface. *B*, brace (=trabs=bracon, Hopkins); *F*, fossa; *G*, galea; *GL*, glossa (dorsal surface of ligula); *PH*, phoba; *SI*, sulcus; *SD*, stridulating teeth.
- Fig. 10. Tergal parts of the third abdominal segment, lateral view, showing the different types of setae and asperities of the region. *PASC*, parascutum; *PO*, postscutellum; *PSC*, prescutum; *SC*, scutum; *SCL*, scutellum; *SP*, spiracle.
- Fig. 11. Epipharynx. *A*, Acanthoparia; *ACR*, acroparia; *C*, chaetoparia; *CO*, corypha; *CR*, crepis; *DT*, dextiotorma; *G*, gymnoparia; *HM*, haptomerum; *HL*, haptolachus; *LT*, laeotorma; *N*, nesium; *P*, pedium; *PH*, phoba; *PL*, plegmatium; *X*, reduced proplegmatium (?); *Z*, zygum.



II
PLECTRIS ALIENA CHAPIN



PLECTRIS ALIENA CHAPIN

- Fig. 12. Tibiotarsi and unguli of the first to third thoracic legs *I*, *II*, *III*. *T-T*, tibiotarsus; *U*, ungulus (or claw); *U1*, *U2*, *U3*, unguli of first, second, and third legs, respectively.

PLATE 10.

- Fig. 13. Raster with septula, palidium, and parts of tegilla of first stage larva. *P*, palidium; *S*, septula; *TL*, tegillum.
- Fig. 14. Terminal part of abdomen of full-grown larva showing anus, upper lip, medianly divided lower lip, pair of barbulae, and raster with septula, pair of palidia, pair of tegilla, and campus. *B*, barbula; *C*, campus; *P*, palidium; *S*, septula; *TL*, tegillum.
- Fig. 15. First abdominal spiracle. *B*, bulla; *RP*, respiratory plate; *TRA*, trabecula.
- Fig. 16. Full-grown larva, lateral view. *1*, prothoracic areas; *2*, mesothoracic areas; *3*, metathoracic areas; *A*, areas belonging to first abdominal segment; *B*, areas belonging to second abdominal segment; *PO*, postscutellum; *PSC*, prescutum; *SC*, scutum; *SCL*, scutellum.
- Fig. 17. Part of respiratory plate showing form and arrangement of (thinly covered?) holes. *TRA*, one trabeculum.
- Fig. 18. Terminal part of abdomen of full-grown larva. *B*, barbula; *C*, campus; palidium; *S*, septula; *TL*, tegillum.

ADDITIONAL COLLECTION RECORDS FOR *PHYLLOPHAGA SPRETA* (HORN) (COLEOPTERA : SCARABAEIDAE).

By P. O. RITCHER, T. R. CHAMBERLIN, AND LEE SEATON,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The report of Milton W. Sanderson, in the *Journal of the Kansas Entomological Society*, Volume 9, No. 1, page 30, on the collection of a single male of the rare species of May beetle *Phyllophaga sprete* (Horn), near Platte City, Mo., in April, 1935, indicates that the time is appropriate for publishing additional records of this species obtained during research on the white grubs that is being conducted cooperatively by the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, and the University of Wisconsin.

In 1934 one female from hickory and one male from an unrecorded host were taken at Gay's Mills, Wis., on May 3 and May 20, respectively. This pair, determined by Philip Luginbill, was deposited in the U. S. National Museum. This is the first record of the collection of the female, which has not been described.

In 1935 one pair of a lot of seven individuals, taken from cultivated cherry at Gay's Mills on May 12, was also sent to



Böving, Adam Giede. 1936. "Description of the larva of *Plectris aliena* Chapin and explanation of new terms applied to the epipharynx and raster." *Proceedings of the Entomological Society of Washington* 38(8), 169–185.

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