THE PYRALID GENUS CRAMBUS IN TENNESSEE.

with descriptions of the moths,
notes on their habits and occurrence,
and keys to the adults and larvae.

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by

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The Pyralid genus Crambus in Tennessee.

While not favored by collectors as much as some of the groups of larger and more conspicuous insects, the genus Crambus affords plenty of opportunity for biological and systematic study and also for admiration of the exquisite beauty and harmony of the Creator's handiwork. Many of the species show color combinations of gold, silver, orange, yellow and the more somber grays and browns that could well be used by modistes as suggestions for costumes that would excite much more comment than they do when worn by their present humble posessors.

The moths of this group fly only at dusk or on cloudy days unless disturbed. Numerous night studies show that their activities continue without interruption from dusk to daylight. When at rest the wings of most of the species are folded tightly about the body and when in this position on a grass stem or beneath a leaf they are most effectually concealed, many times even from the practiced eye of the collector and undoubtedly also of hungry birds.

The larvae have a habit common to all the species, of concealing themselves in tubes of home-made silk constructed either in the ground or along the surface. Pl. I fig. 3. They remain concealed within these tubes except when actually feeding, and, even then, whenever possible the blade of grass or other food is cut off and drawn within the retreat to be consumed at leisure and in safety from unwelcome guests. Because of

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this habit, larvae of this genus are known generally as webworms, or, perhaps better because more definite, as sod webworms. The food of a great majority of the species is grass, and in most cases small distinction is made between any of the common small grains or any of the common smaller grasses, all being eaten with equal readiness. Bluegrass (Poa pratensis) probably heads the list of preferred foods and it is to pastures, meadows and lawns of this grass that the most serious injury is done. The hordes of small, but voracious larvae consume in the aggregate a great amount of food during their developmental period and this is a source of very real loss to the pasturage or hay value of the land. And especially in dry seasons, this loss may consist not only in a reduction of the pasture and hay to be obtained from a given area, but in the actual outright killing of the grass plants over large areas. Pl. I. fig 1. The constant and microscopic search of the hungry larvae for the slightest particle of green food gives the plants no opportunity to recuperate but every bit of new growth is consumed as soon as it makes its appearance.

A few of the larvae have been found to feed on mosses of several species, especially in their early instars, and others, among them the destructive corn webworm (Crambus caliginosellus) live by choice on the roots of various plants other than grasses and only eat corn, small grains or grass when forced to them by the lack of other available food.

When the feeding period is over and the larvae have

~~xkk~~ attained full size, they prepare a small silk-lined capsule in the earth and within this pass the pupal stage an d emerge as adult moths. The moths do not feed but enjoy an ephemeral existence for a few days, or at most a few weeks, During this time they produce many eggs, from 200 to 500 depending on the individual and the species, and scatter them indiscriminately while flying at dusk or during the night. Pl. I. figs.

The number of generations per year varies with the species and to some extent with the character of the season. The number varies in Tennessee from one to three, the last one being usually small and somewhat dependent on weather conditions for its appearance. All the species pass the winter as larvae usually closely ensconced in a tiny silken cade made for the purpose among the grass stems or roots. A few species remain active and feed during every favorable moment even during the winter.

Systematically this group offers opportunity for many interesting lines of study. While as a whole the genus is compact, without wide variations in form and structure, yet several distinct lines of development are indicated by the color patterns and especially in the genitalia. The female genitalia show some variations but not enough to be of use in differentiating species without further study. The male genitalia, however, are very valuable in systematic work and from them along all the species, with the exception of one small group of three species, can easily be specifically determined.

In the present paper an attempt is made to bring together careful and newly rewritten descriptions of the adult moths of all the species occurring in Tennessee. No previous attempt has been made to describe the genitalia altho Felt many years ago figured some of them. The notes on the habits, distribution and seasonal history of the various species are the result of numerous observations made during the past ten years in the writer's travels over the state.

For some of the species there is not previous record of any of the facts of their life histories and for none of them has any record been made of their habits in Tennessee except in a few articles published by the writer.

The key to the moths is an adaptation and revision of the one published years ago by Fernald. The key to the larvae is entirely original with the writer. The moths are fairly easily arranged in a simple key but previous to this time the characters of the larvae have never been worked out and even yet it is possible to divide the larvae in many casesonly into groups, as sufficiently detailed studies of them have not been made to permit of their being specifically determined.

The keys to both adults and larvae apply only tothe species known to occur in Tennessee. It is a rather remarkable fact that prior to the publications of the present writer not a single record had been published of the occurrence of one of the species in this genus from Tennessee. Up to this time we have taken 17 species of the genus in the state. It is likely that a very few more rare species may occur here but for the time being this list can be considered complete.

KEY TO THE MOTHS OF THE GENUS CRAMBUS KNOWN TO OCCUR IN TENNESSEE.

A. Fore wings with white ground color.

B. Fore wings with longitudinal yellow stripe thru center, large species. girardellus

BB. Small species with brown color pattern. elegans

AA. Fore wings with ground color yellow, brown of gray.

B. Fore wing with longitudinal white stripe from base to middle or beyond

C. White stripe divided by longitudinal line into two parallel stripes.

D. Dots in terminal line preceeded by black lines. laqueatellus

DD. Dotes in terminal line not preceeded by black lines. agitatellus

CC. White stripe not divided by longitudinal line

D. Hind wings pure white.

E. White stripe wide, very near costa. leachellus.

EE. White stripe narrower, more remote from costa. praefectellus.

DD. Hind wings pale gray. alboclavellus

BB. Fore wings without white stripe.

C. Terminal line of three or four dots below and none above. trisectus

CC. Terminal line otherwise.

D. Terminal line of 7 distinct dots.

E. Fringes golden yellow.

F. Fore wings without median or subterminal line. vulgivagellus.

FF. Fore wings with median and subterminal lines more or less distinct.

G. Terminal area brighter yellow than rest of wing. decorellus

GG. Fore wing of nearly uniform color thruout. ruricolellus

EE. Fringes of fore wing not golden yellow.

F. Subterminal line finely dentate.

G. Fore wing bright golden yellow along submedian fold. hemiochrellus

GG. Submedian fold not bright yellow. mutabilis

FF. Subterminal line not finely dentate. teterrellus

DD. Terminal line more or less indistinct.

E. Fore wings nearly uniform dark brown in color, size small. caliginosellus

EE. Color of fore wings otherwise, larger.

F. Fore wings ashy gray, usually with rather distinct darker markings. zeellus

FF. Fore wings ochreous yellow without dark markings. luteolellus.

KEY TO THE KNOWN LARVAE OF THE SPECIES OF CRAMBUS KNOWN TO OCCUR IN TENNESSEE.

A. Head black.

Bar Larvae purplish, large species. vulgivagellus

BB. Larvae paler, dark yellowish, smaller ruricolellus

AA. Head otherwise.

B. Head yellowor amber without color pattern.

C. Head amber to honey yellow, large decorellus

CC. Head clear pale yellow, small. elegans

BB. Head yellow with more or less distinct color pattern on face.

C. Color pattern on face distinct.

D. Body of larva striped.

E. Body stripes orange or red. hemiochrellus

EE. Body stripes pale or whitish. mutabilis

DD. Body without stripes. praefectellus * alboclavellus agitatellus girardellus trisectus

CC. Color pattern on face faint or obscure.

D. Dorsal anterior pinacula on abdominal segments subquadrate with median margins straight and closely parallel teterrellus

DD. Dorsal anterior pinacula on abdominal segments elliptic and not closely opposed. laqueatellus * leachellus caliginosellus zeellus luteolellus

* The species in these groups are so arranged because the characters on which the larvae may be separated have not been sufficiently studied to enable us to define them definitely. There are differences and in some instances very obvious ones but they are variable and until the limits of these variations have been fixed it is impossible to use them in a key. In most cases some knowledge of the conditons under which a larva was found will help very greatly in deciding to which of the species of the group it belongs, such as the food plant, season of the year, character of the ground, etc.

CRAMBUS AGITATELLUS Clemens

Wing expanse, 20-25 mm. Palpi outside ochraceous to pale fuscous, within whitish; head, thorax and patagia above ochraceous, the latter slightly darker; abdomen whitish above; antennae with whitish scales. Fore wings rich golden yellow paling to whitish along hind margin, costal margin narrowly golden fuscous along basal half, a broad silvery white stripe just behind costal margin ending acutely about 2/3 out from base of wing, this silvery stripe divided by a narrow yellow line running longitudinally thru it, the silvery stripe with a narrow border of fuscous scales and with a whitish area below and beyond its tip, the costal margin above its apex with two whitish patches separated by an oblique brown line and the intervenular spaces both above and below its apex with a line of silvery white scales bordered with fuscous, a subterminal line of shining silver scales bordered with orange on both sides originates at the costa about 1/3 from the tip, runs straight to a point opposite the tip of the white stripe and then with an abrupt angle a little greater than a right angle turns and runs straight to the anal angle of the wing, the area beyond the subterminal line with whitish patches and a few fuscous scales, a terminal line beginning at the apex as a solid fuscous line below breaks into 5 black intervenular dots, fringes golden, shining. Hind wings uniformly pale gray, fringes white. Beneath, the fore wings are decidedly brown paling at the tips and along anal margin, terminal line as above except with 6 black dots instead of five, hind wings brownish along costa quickly fading to white.

Genitalia. Male. Body of tegumen, long straight and narrow, limbs somewhat shorter, of moderate and nearly uniform width; uncus short, stout and straight, hirsute, ending rather abruptly and terminating in a very small downturned tooth; gnathos narrow and slender, considerably exceeding the undus, at its tip broadened and the margins upturned and inforlded forming a cup or pocket. Addoeagus cylindrical and straight, cephalic end slightly swollen and rounded, caudal end truncate with the opening slightly oblique, inside and toward the caudal end a large, stout, curved,heavily chitinized spine or cornutus, about 1/5 the length of the addoeagus. Harpes feebly chitinized, sacculus broad and long, forming the greater part of the organ, its length more than three times its greatest width, sparingly hirsute within especially along the inner margin, taperingly slowly from its broad oblique base on the vinculum to a narrow oblique tip which at the upper angle is drawn out into a slender blunt process; the cucullus overshadowed by the great development of the sacculus has been pushed to one side in the form of a feebly chitinized, strongly hirsute, tongue-shaped lobe above but cephalad of the spine-like tip of the sacculus; costal margin reduced to a chitinous hirsute lobe near the base of the sacculus between which and the cucullus it appears as a narrow, almost membranous margin along the upper edge of the sacculus. Vinculum present as two subtriangular plates supporting the sacculi and jointed at their apices by a small hastate plate.

I have in my collection specimens of this beautiful species which I have taken at Knoxville, Nashville, Chattanooga, Hurricane Mills and also on Blanket Mountain near Elkmont at an altitude of over 4000 feet, all within Tennessee. It undoubtedly occurs thruout the state.

It is a little difficult to separate this species from the very similar Crambus alboclavellus. In the latter species the yellow line dividing the silvery stripe on the fore wing is usually much less conspicuous than in the one under discussion altho a trace of it can be seen in well marked specimens. The very evident differences in the male genitalia settle at once the validity of the two species. C. agitatellus is usually taken in association with C. alboclavellus and no evident differences in habit or habitat have been noted.

CRAMBUS ALBOCLAVELLUS Zeller

Wing expanse 18-24 mm. Palpi ochraceous without, whitish within, head and abdomen white above, thorax and patagia orange-yellow, antennae pale with white scales. Ground color of fore wing orange-yellow shading to whitish along posterior margin, abroad silvery white stripe extending from base of wing just behind costal margin about 3/5 its lengt h and ending in an acute point, sometimes with a faint yellow longitudinal line dividing it, below and beyond its tip an other white band runs to margin of wing except where crossed by the subterminal line, the intervenular spaces between the end of the white stripe both above and below its apex and the subterminal line lined with silvery white and bordered with fuscous, those below the fold less conspicuously so, basal half of costal margin fuscous, above the end of the white stripe to oblique fuscous lines separated by white spaces meet the costa. The subterminal line, silvery white bordered with orange, leaves the costa about 4/5 out from the base, runs obliquely toward the distal margin and then turning abruptly runs nearly straight to the anal angle, terminal line fuscous fuscous and continuous above but below breaks into 5 velvety black intervenular dots, fringes shining golden. Hind wings pale gray, fringes white. Beneath, fore wings brownish fading to white at tip with terminal line as above, hind wings brownish along costa, rest white.

Genitalia. Male. Body of tegumen long and slender, nearly straight above, the limgs also long and slender, only slightly shorter than the body, trundate at the tips; uncus hirsute, rather slender, enlarging somewhat toward the tip and terminating in a small down-turned tooth; gnathos long and very slender, exceeding the undus, terminating in an elongate, flattened, cup or pocket. Aedoeagus short and broad, nearly straight, cephalic end abruptly rounded, not enlarged, caudal end somwhat enlarged and with a shallow constriction abruptly before the apex, giving it the appearance of a swollen or bulbous end, opening slightly oblique and roughened inside with tiny papillae, the roughened lining of this bulbous end evidently evaginating during the extrusion of the intromittent organ. Hapres feebly chitinized, sacculus an elongate subtriangular area, sparingly hirsutetoward apex and along lower margin, with its base resting on vinculum and bearing at its tip the strongly hirsute, slipper shaped cucullus, the angle between the two on the upper or outer side being filled with a scarcely descernable membrans bearing a few small spicules and closer to the cucullus a number of stout hairs, the margin of this membrase along its lower portion to a point almost opposite the apex of the sacculus thickened and strongly hirsute, ending in two weak inturned teeth, at the point of division between the sacculus and cucullus on the lower or inner margin is a small heavily chitinized plate bearing two short blunt teeth. Vinculum consisting of a short but broad band to which are attached the bases of the sacculi.

One of the most common and widespread species in Tennessee, occurring thruout the state. The moths are found in pastures and meados lands wspecially where there are numerous taller broad leaved plants such as iron-weed, milkweek, golden-rod, etc, on the leaves of which the moths always alight by preference. Little is known about their food plants and this species has never been reported as an economic insect. In our laboratory larvae have been reared on several grasses and also on one or two species of moss. There seems to be but one generation each year. The moths first make their appearance in June between the 10th and 15th, quickly increase in numbers and then gradually decline thru the latter part of June and July, disappearing the latter part of that month. The larvae have pale yellow heads with distinct dark markings.

CRAMBUS CALIGINOSELLUS Clemens
CRAMBUS LUTEOLELLUS Clemens
CRAMBUS ZEELLUS Fernald

Crambus caliginosellus Clemens.

Adult. Wing expanse 13-20 mm. Palpi fuscous, the scales tipped with gray, head, thorax, patagia and abdomen cinereous. Fore wings uniformly dark fuscous with scattered orange, gray and plumbeous scales; median line of orange scales, originating near middle of costa and ending on the hind margin nearly opposite with a large outward angle at the end of the cell and a smaller one on the fold, the latter with a spur often running to subterminal line along the fold; subterminal line of similar color and bordered outwardly toward hind margin with shining poumbeus scales, originating at outer fifth of costa and running across the wing nearly parallel with distal margin with small outward angles at each intervenular space and a larger one on the fold; subterminal area an even mixture of fuscous and gray scales, terminal line a narrow line of dark fuscous scales, fringe ochraceous. Hind wings uniform fuscous, fringe concolorous at base, ochraceous at margin. Beneath both wings uniform fuscous except outwe edge of fringe of hind wing paler.

Crambus zeellus Fernald.

Adult. Wing expanse 16-22 mm. Palpi ash-gray, the individual scales fuscous at base and pale at tip, head, thorax and abdomen luteous to pale gray. Fore wings pale luteous to ochraceous with scattered fuscous and orange scales. In general these scales are arranged in a pattern indicating

the median and subterminal lines altho in some specimens these are indistinguishable; median line of fuscous and orange scales runs from the middle of costa across the wing with a large outward angle at the end of the cell and a smaller one on the fold; the subterminal line of similar color runs from just behind the tip of the wing nearly parallel with the margin, with several small serrations in the first half of its course and a broad rounded inward angle at the fold; terminal line dark fuscous to black in some specimens gathered into rather indistinct intervenular dots, fringe pale fuscous. Hind wings dark fuscous, in some specimens paler, fringes pale fuscous at base, paler outwardly.

Crambus luteolellus Clemens.

Adult. Wing expanse 20-26 mm. Palpi luteous, some of the scales pale fuscous at base, head, thorax and abdomen luteous. Fore wings luteous, with a tinge of orange and sometimes a few scattered pale fuscous scales, in some specimens no markings whatever, in others the median and subterminal lines are faintly indicated by orange lines, in such the median line originates on the sosta about 2/3 out from the base and runs across the wing parallel with the distal margin with a large outward angle near the end of the cell and a smaller one on the fold; subterminal line leaves the costa about midway between the median line and the tip of wing, runs obliquely inward to the fold and thence to the hind margin with an outward angle just below the fold; terminal line merely indicated by small fuscous intervenular dots along margin; fringe cinerous. Hind wings pale gray, fringe concolorous or slightly paler.

Genitalia. Female. Valves with margin almost perfectly straight, dorsal angle slightly more broadly rounded than ventral angle, margin with numerous long haris.

Male. Body of tegumen long and straight, of moderate width, its length almost exactly that of the limbs which are rather narrow, taper slightly to the rounded tips and extend from the body at an angle somewhat greater than 90°; uncus stout, more heavily chitinized than the tegumen, only moderately curved, clothed with slender, retrorse hairs except at tip which draws down from the top to an acute point on a line with the lower margin; gnathos without chitin, very weak, almost membraneus, enlarged or gibbous just beyond base and thence tapering to an acute apex not equalling uncus. Aedoeagus very short and small, cephalic end beyond opening for penis much reduced and rounded at tip, main body short and cylindrical, apical opening very oblique and the lower margin produced into a long slender tip, somewhat depressed. Harpes rather feebly chitinized, sacculi elongate, subtriangular, clothed except at base with long hairs, separated from cucullus only by a slight chitinous carina; cucullus long and very slender, hirsute; costal margin more heavily chitinized than rest of organ, attached as far as base of cucullus, thence free and appearing as a long, slightly curved, longitudinally ridged spine, sparingly hirsute especially on dorsal margin, not quite equalling the cucullus and terminating in a smalll, stout, acute spine. Vinculum a narrow crescent-shaped plate forming a common base fot the two sacculi.

The three species just described comprise the most confusing group in the whole genus and one hat has not yet thoroly been worked out. Typical specimens of each are easily separable but between them are many others forming all stages of intergradations so that a series could easily be selected showing a continuous progression from the very small dark forms which we call caliginosellus, thru the larger but still plainly marked specimens classified as zeellus to the large pale yellow or orange forms known as typical luteolellus. Except for the fact that there seem to be biological as well as morphological differences the group might well form one variable species. The genitalia of all three are practically identical with only such minor variations as might eacily be found within a variable species.

Aside from the purely scientific interest of this complex it has great economic importance especially to the farmers of Tennessee for it is the small dark form, designated here as Crambus caliginosellus, that is known as the corn webworm (Pl. I. fig. 2, 3.) and is the cause of a large and constant loss to the state especially the middle portion. Corn planted on land following pasture, meadow or fallow is almost certain to be seriously injured if not entirely destroyed by this pest and often replantings on the same land to the number of two or three are also destroyed. Methods have been worked out to avoid this continued injury but the only way to avoid the original attack is to plow such land intended for corn very early the preceeding fall, not later than the first of September and keep it in a clean fallow the rest of that season, or else to delay

planting in the spring until the last of May when the larvae will have either starved or completed their growth on other plants.

Numerous weeds and wild plants aredused for food by these larvae and in fact they do not thrive on grasses and corn until they are partly grown. This fact explains why the most serious trouble from this insect comes in sections where there is much untillable and hence weedy land for it is from such areas that the meadow. pasture and fallow lands are continually reinfested.

The moths reared from larvae attacking corn in Tennessee have proved almost invar8ably to be the small dark form, C. caliginosellus Moths of zeellus and especially of luteolellus have been reared from larvae feeding on the roots of various weeds and wild plants. The moths of C. caliginosellusoalso appear earlier in the season than the larger and paler lut@olellus Whether food plants, seasonal development or distinct specific characteristice make the differences between the three forms is a question still to be worked out.

CRAMBUS DECORELLUS Zincken

Adult. Wing expanse 19-28 mm. Palpi, head, thorax above white, palpi beneath, patagia and abdomen pale ochraceous, antennae brown. Fore wings with veins mostly pale ochraceous, interspaces shining plumbeus, a median line of bright orange scales arising at middle of costa, running to tip of cell and then nearly straight across the wing with an angle at the lower fold, a similar subterminal line arising two thirds of rht distance from the origin of the median line to the outer angle of wing and following much the same course across it with the angle on fold less pronounced and bordered outwardly by a plumbeus line which is divided near the costa by a small crescent of orange, rest of terminal area orange, a terminal line of 7 black intervenular dots, the lowest four the largest. Fringes shining dark plumbeus, paler at lower angle. Hind wings white or very pale gray, fringes white. Beneath fore wings brownish with terminal line of dark dots visible, hind wings brownish above, paling to white at hind margin.

Genitalia. Male. Body of tegumen rather short, arcuate dorsad, its limbs broad and squarely truncate, shorter than the length of the body; uncus straight of nearly uniform size thrucut, hirsute above, terminating in a long strong curved tooth or claw; gnathos feebly chitinized, broad and thin with unturned strongly arcuate margins forming a broad deep trough in which the uncus lies for nearly its full length when closed. Aedoeagus rather shortand stout, nearly straight, the cephalic end narrower than the rest and with its end rounded, enlarged and more highly chitinized beyond the opening

for the entrance of the penis, distal end oblique and with a long, strong curved or twisted tooth or process extending caudad from the upper margin of the opening. Harpes strong and well developed, the cucullus rather short and tapering to the tips narrowly rounded and incurved, heavily clothed within with hards and some stout sharp spines and with a dense tuft of large spines on outside; sacculus nearly square in outline, concave, naked but with a row of short stout spines marking the separation between it and the cucullus; costa free and apparent as a stout, flattened, heavily chitinized arm or process from the upper angle of the sacculus and terminating in two teeth one very small, the other much larger. Vinculum a broad plate connecting the bases of the sacculi and with a stronger, sandal-shaped plate at the junction.

This beautiful species merits a place in the list of Tennessee species because of the capture of two specimens, a male and a female at Kingston, Tenn. on June 25,1918 by the writer. No other records appear to have been made for the state tho other records show that the species is known to occur from Massachusetts to Louisiana and from Florida to Iowa. Biological data are very meager but indications are that there are two generations annually, the moths of one appearing in June and of the other in Spptember or early October. Larvae reared in the laboratory fed readily on bluegrass, sorn, timothy, orchard grass and rye. The eggs of this species assume a terra cotta color during incubation. The larvae have clear yellow heads during most of their life

darkening somewhat during the last one or two instars but at no time developing a color pattern.

CRAMBUS ELEGANS Clemens

Adult. Wing expanse 13 mm. Palpi whitish, pale fuscous outside and beneath, head above and patagia white, thorax and antennae fuscous. Fore wings white, basal third of costa brassy yellos, a small brown spot near base toward hind margin and a larger spot at middle of hind margin which when the wings are closed form a crescent shaped patch concave posteriorly, a broad fuscous band across wing, widest on costa where it encloses a whitish spot and changing to golden yellow at its outer margin, then a narrow transverse band of silvery white followed by a similar narrow straight band of golden yellos, remainder of wing white or with some fuscous scales except for the terminal line of 7 deep fuscous intervenular spots, fringe shining yellow. Hind wings uniformly pale gray. Beneath both wings gray, paler toward tips. Individuals vary considerably in the depth and intensity of the color pattern. This species does not fold its wings closely when at rest as do the larger species.

Genitalia. Female. Valves with the margins slightly and evenly rounded and bearing a row of stout bristles, dorsal angle not produced.

Male. Body of tegumen long, broad and only slightly arcuate above, 1 1/2 times the length of the linbs which are very broad and taper only gradually toward an obtuse, slightly recurved point; uncus broad and rather stout, hollowed beneath, cconstricted on the ventral side just beyond the base and at

the tip tapering into a stout down-curved tooth or claw, with a fringe of long hairs along ventral margins and scattering smaller bristles above; gnathos small and weak shorter than the uncus and gradually tapering to an acute tip ending in a small tooth. Aedoeagus long and slender, ten times as long as wide, feebly chitinized, the cehpalic end rounded, slightly larger than the rest and at a slight angle with the longer portion, the distal portion smaller and tapering rather gradually to the oblique tip which ends in a downwardly-bent lip or process, the interior passage lined toward the tip with minute conical teeth, no cornuti. Harpes lightly chitinized with the regions plainly distinguishable, distal portion or cucullus narrow and elongated, about three times as long as wide, rounded at tip, hirsute within with 3 or 4 especially long slender hairs near the tip, the whole porcess bent at an angle of about 45° with the msin axis of the orgsn; sacculus large and with the disk very lightly chitinized, inner margin almost straight with a group of short stout spines or teeth at the inner distal angle; costa more heavily chitinized than the rest and toward the distal portion produced into an outward turned long stout spine, nearly as long as the cucullus, this spine with a few small hairs on its basal half. Vinculum large, broadly crescent-shaped and enclosing within its horns the produced bases of the sacculi.

This small but beautiful species is found almost always in low or damp places where some broad leaved plants, such as golden-rod, iron-weed, etc., are gorwing. It seldom alights on grasses but usually on the broader leaves of taller plants.

It occurs thruout Tennessee and is of no economic importance. After much experimentation it was found that the larvae feed on moss and will eat grasses only as larger larvae and when forced to it.

The moths appear first in Tennessee about the first of June and are continuouslu present until the last of September. There may be more than one generation but if so they are not distinct. The larvae are rather dusky yellow in general color with pale yellow heads without markings.

CRAMBUS GIRARDELLUS Clemens

Adult. Wing expanse 22-32 mm. Palpi silvery white within and above, outwardly golden yellow, head above white, thorax white abovem the patagia golden yellow, abdomen white. Fore wings silvery white, costal margin narrowly ochraceous to fuscous especially toward base, from the base of the wing a broad golden yellow band bordered above with a narrow fuscous line and below shading into the white of the wing, extends just beneath the cell nearly to the distal margin, toward the tip widening at the subterminal line into an upward triangle which in fully colored speciemsn is continued at an angle back toward the costa by a dark-bordered yellow band (this continuation usually faitn or obsolete) Subterminal line arising at outer fourth of costa runs diagonally toward the distal margin, then turning at a right angle runs toward the anal angle runs toward the anal angle of the wing until just before reaching the margin it turns and parallels it closely, finally reaching it about two thirds out from the base of the

wing. An oblique pale fuscous dash in the ipper angle of the wing,; terminal line narrowly fuscous and with four linear intervenular blackish dashes on lower half of margin, fringes silvery white. Hind wing white or sometims slightly gray on disk, fringes white. Beneath, fore wings golden brown except tips white, hind wings white exept for a littel brown along anterior margins.

The color pattern of this species is very variable, all the markings often obsolete except a faint longitudinal streak of yellow in themiddle of the fore wing and the dark marginal dashes.

Genitalia. Male. Body of tegumen short, nearly straight above, the limbs about twice the length of the body, narrow, extending at an angle of 45° with the axis of the body, and ending in a narrow apex: Uncus almost obsolete, reduced to a blunt rounded nose bearing a few slender bristles and apparently not articulated with the tegumen; gnathos long, slender, cylindrical, a little longer than the body of the tegumen, its end smoothly rounded, enlarged and deflected. Aedoeagus long, slender nearly straight, about 10 times longer than wide, rather lightly chitinized but with some narrow stronger longitudinal lines, proximal end narrow and rounded, distal end truncate and slightly oblique, no cornuti, anellus s small supporting plate.
Harpes large and well developed, cucullus long, tapering, slightly curved and with tip bluntly rounded, within densely clothed with hairs, sacculus small, rectangular and at the junction with the cucullus vearing a small triangular, hirsute, heavily chitinized plate; costa heavily chitinized, hirsute except toward apex, attached to sacculus but free beyond and produced into a strong

curved, grooved arm or claw equalling or slightly exceeding the cucullus and armed with small sharp serrations on margin at apex. Vinculum broadly rectangular with basal angles roundingly produced.

This species belongs to the Tennessee list by a narrow margin. To the writers knowledge the only specimens ever taken in the state were four moths collected by him in the saddle between Blanket Mountain and Miry Ridge in the Big Smokies above Elkmont at a height of about 4000 feet on July 15, 1919. This is a northern species occurring abundantly thru New England and eastern Canada and apparently venturing this far south only in high altitudes.

Larvae of girardellus have been reared in the laboratory from eggs laid by moths sent from Nova Scotia but aside from these records nothing seems to be known of their seasonal history of habits. The larvae are large and handsomely marked with brown pinacula on a paler ground. The head is pale yellow with distinct pattern of brown or black on the face. In the laboratory the larvae fed readily on bluegrass.

CRAMBUS HEMIOCHRELLUS Zeller

Plate II.

Adult. Wing expanse 22 mm. Head and thorax pale ochraceous, palpi thickly sprinkled with gray atoms. Fore wings bright ochre-yellow between the white median vein and hind margin with dusky stripes, and usually with a clear yellow stripe along the fold, costal portion yellowish-gray, darker toward the base; median line fine, rust-brown, forming an acute angle at the end of the cell, and extending in a nearly straight line to the middle of the hind margin; cubterminal line fine, dark brown, dentate on the veins and parallel with the outer margin except at the costql end , where it curves sharply inward and terminates at the outer fourth of the costa; terminal space dusty-gray; terminal line rather indistinct, in some specimens consisting of seven very fine dark gray dotsp fringes light gray. Hind wings light gray, fringes lighter.

Genitalia. Female. Anal valve broad, nearly square in Outline, not constricted at the base, dorsal angle rounded and slightly produced. Male. All parts uniformly and moderately chitinized; body of tegumen narrow, clishtly longer than the limbs which are narrow and rounded distad; uncus slender, elongate slightly enlarged distad and ending in a small but distinct sharp hook, hirsute above; gnathos very slender, exceeding the uncus, its branches very short, naked; Harpes strongly concave at base, sacculus longer then wide, the upper distal angle rounded and covered with a group of strong sharp spines; cucullus much narrower than the sacculus, elongate, of nearly uniform width and tapering to a rounded apex, hirsute its full length; costa modified into a heavily chitinized, strong, S-shaped, naked

spine exceeding the cucullus. Aedoeagus moderately chitinized, bulbous at base and tapering to an obliquely truncate, curved tip, hollow, open at the end, with a slender, chitinous internal spine (cornutus) more than half the length of the organ extending nearly to the tip, the whole organ subtended by a weakly chitinize anellus attached about the middle.

This species is rare in Tennessee having been taken only at Chattanoog a and in small numbers. Systematically it is closely related to C. mutabilisand resembles it in the broad pectinate antennae of the male and in the brownish costal margin of the fore wing but the coloration is much richer showing considerable yellow or ochraceous in the fore wing as compared with domber browns and gray in mutabilis. The moths are smaller than those of mutabilis. Those taken at Chattanooga were captured in a dry grassy field in company with moths of C. caliginosellus which they so closely resembled in habits that their identity was jot suspected until they were studied in the laboratory.

It seems evident that there are two generations each year of this species altho it has not been sufficiently studied to make this certain.

The eggs of this species are pure white when laid and become pale salmon-yellow before hatching. The larva has a pale yellow head with a faintly darker pattern of spots and blotches. It is most definitely determined by the longitudinal reddish lines which give it a general brick-red color.

CRAMBUS LAQUEATELLUS Clemens

Plate III.

Adult. Expanse of wings 23 mm. Head luteous, thorax and palpi fuscous, the latter whitish beneath. Fore wings ochreous with two silvery-white streaks separated by a fuscous streak; the outer silvery streak margined on costa with fuscous, the inner one, which extends beyond the apical third, edged on the fold with fuscous. Beneath the fold the wing is pale yellowish with fuscous streaks along the submedian veins, apex of wing tinted with ochreous yellow, the veins streaked with silvery white, on the costa near the tip an oblique silvery streak, margined on both dides with fuscous; subterminal line slivery-white, much angulated, bending in below the apex, leaving a large whitish marginal patch streaked with dark parallel lines which end in dots before the terminal line. Fringes lustrous ochreous. Hind wings pale fuscous, fronges white.

Genitalia. Female Anal plate wider than long, somewhat constricted at base, margins serrate with tubercles terminating in long stout spines; the upper third sharply rounded and separated from the rest by a deep rounded notch, lower lobe shorter than the upper, evenly rounded above, slightly angled at lower corner.

Male. Tegumen with both body and limbs rather narrow and about equal in length, the latter slightly narrowed mesad, and rounded distad: uncus setigerous, stout, narrowing acutely distad and tipped with a short, sharp, curved tooth; gnathos naked, slender, exceeding the uncus, at tip widening and the margins upturned forming a pocket into which the tip of the uncus fits when closed. Harpes broad at base, the costa of the harpes

proper free but greatly reduced to a chitinized angular lobe extending at right angles to the base of the cucullus which is a broad rounded, lightly chitinized process, hairy within and separated from the sacculus by a narrow chitinized carina; sacculus broad and almost rectangular, slightly concave, cparingly setigerous on both margins with a portion of the inner margin thickened and inturned and terminating in a small rounded lobe. Vinculum a broad subtriangluar, weakly chitinized area supporting the sacculi. Addoeagus subconical, smaller and rounded at the base, flaring somewhat at the open end, very feebly chitinized, bearing inside about midway a small acute chitinous spine with a broad flat base, and just within the open end and projecting far beyond a huge, heavily chitinized, curved, flattened spine longitudinally carinate at the base and covered with minute acute points inclined toward the tip, this spine or cornutus equalling in length the aedoeagus proper. The anellus is a mere membrane attached to the aedoeagus ventrad.

This species occurs thruout Tennessee but os not very well known because it has but a single generation each year. The moths are present for about five weeks, from April 24 to May 31. The remainder of the year is spent as larvae in burrows among the grass roots except the few days spent in the pupa stage just prior to the appearance of the moths. It is of no economic importance, in fact we had great difficulty in rearing the larvae until we discovered that for at least the early part of its life it fed not on grasses, the usual food in this group, but on mosses of various species. This fact may

account for its peculiar distribution for the moths are to be found in certain areas every year but are absent from other nearby fields.

The moths are among the most beautiful of this group found in Tennessee. They are large and have two parallel silvery stripes on the fore wing. The eggs are white when laid but become deep salmon-red in color before hatching.

CRAMBUS LEACHELLUS Zincken

Adult. Wing expanse 21-32 mm. Palpi brown cinereous, head above bronze-brown, antennae cohreous with shining scales, thorax and patagia shining bronze, abdomen pale cinereous. Fore wings shining bronze-brown, with a broad silvery white stripe running from the base and narrowing to an acute tip almost at the subterminal line, a small fusiform silvery spot just above tip, a notch in middle of lower side of white stripe and a silvery spur running off from it, intervenular spaces toward end of wing partly sinvery, subterminal line white or silvery, shining, bordered with fuscous scales, leaving sextal margin at outer fourth, running obliquely toward end of wing and then turning at nearly a right angle and running straight to just inside the anal angle, a white spot on costa either side of subterminal line, tip of wing white with an oblique brown spot, below this the space beyond the subterminal line gray or golden with five more or less distinct black intervenular dashes; terminal line golden fuscous, fringes white at base, shading to pale fuscous outwardly, shining. Hind wings uniform pale gray, Beneath for wings pale brown, hind wings brownish

along costal margin, elsewhere as above.

Genitalia. Female. Valves rounded, the dorsal angle very slightly produced, the surface covered with minute spicules and the margin clothed with long hairs.

Male. Body of tegumen very short, scarcely half as long as the width of the limbs, limbs broad and also rather short, length about 2 1/2 times their breadth, width uniform, tips broadly rounded; uncus very long and slender, curved, its distal fourth armed above with many stout, short, retrorse spine s and a few scattered slender haird; gnathos also long and slender, somewhat esceeding the uncus, naked and smooth, tapering evenly from the base to the small rounded tip. Aedoeagus difficult to define, tip truncate, opening vertical, within for some distance from the tip the organ is studded with minute rounded papillae, at the tip moderately chitinized but becoming less so until it merges into amembranous culindrical tube which is helically coiled for 2 1/2 tumns, within this tube is a long, sharp, heavily chitinized cornutus, its length about 3 times the diameter of the tube and with its apex toward the distal opening of the organ. If this coiled tube is the penis it is parallel with the the aedoeagus and merges so imperceptibly with it that the union is not apparent. Harpes uniformly and moderately chitinized, sacculus subquadrate in outline, somewhat longer than broad, divided from the cucullus by a slight chitinous ridge which near the inner margin bears a stout blunt, slightly curved spine and also a group of hairs along inner and distal margins; cucullus large, broadly falcate, acute at tip and within densely [illegible] with long hairs; costa somewhat more heavily chitinized,

attached to margin of sacculus, free beyond and produced into a flattened acute apex which is exceeded by the cucullus, with scattered long haris along costal margin almost to tip. Vinculum more than twice as broad as long, supporting the bases of the sacculi and with a slender hastate plate mesad.

One of our most beautiful species, never common in Tennessee but more abundant some years than others. The seasonal history is not definitely known. The great mahority of the specimens in various museum collections and collected by the writer have been taken in September and October but an occasional one is taken in May indicating either that there are two possible generations annually or that some of the larvae fail to mature in the fall and carry over until the following spring. Larvae of this species have several times been taken destroying corn plants in middle Tennessee.

The larvae are large when fully grown and have clear honey-yellow heads with a faint brownish pattern of darker markings. The species has been collected at Knoxville, Nashville, Clarksville Milan and Chapel Hill in Tennessee.

CRAMBUS MUTABILIS Clemens

Plates IV, V.

Adult. Wing expanse 18-24 mm, the females averaging larger than the males. General color gray, with a dusky spot near center of fore wing, inner half of costal margin dark brown. Palpi fuscous, tips of the scales whitish, head and thorax gray-brown, male antennae broadly pectinate, female setaceous. Fore wing with costal half slaty gray, sometimes whitish toward the

center, and half with a tinge of luteous, proximal half of costa bronze-brown, a dark brown median line beginning near the middle of costal margin forms a broad angle near the end of the cell, broadens immediately below it and continues in an oblique line, gradually narrowing until it reaches the hind margin. In feebly marked specimens this median line is often obsolete except the portion below the end of the cell, which is invariably present as a more or less conspicuous dusky spot. Sebterminal line runs nearly straight across the wing, with an acute angle outward at each vein. Terminal line of suven dusky spots at the ends of the veins. Fringes gray, shining. Hind wings gras, a little paler toward base, fringes pale yellow.

Genitalia. Female. Ventral two thirds of the valve rounded and somewhat produced, the ordsal lobe smaller, rounded, both lobes hirsute. Male. Body of tegumen rather long, a little longer than the uncus, rounded above, its limbs long, narrow, turned ventrad, and narrowed at the ends; uncus nearly straight, rather narrow, with a sharp, nail-like hook at the end, hirsute above; gnathos long, slender, much exceeding the uncus, tip narrowed and turned slightly ventrad, naked. Aedoeagus straight, cylindrical, smoothly rounded cephalad, tapering somewhat from the opening to the tip which flares slightly, terminal opening oblique, with a single long, slender, heavily chitinized cornutus about half the length of the organ; anellus reduced to a mere membranous scale on ventral side. Harpes small, rather weakly chitinized; costa free but reduced to a slender shaft, spine less than half the length of the cucullus, outer margin at base hirsute; cucullus a flat, curved process with rounded tip, hirsute, the hairs on ventral half much shorter than those above.

narrowed at base and with a rounded spined lobe where it joins the sacculus. Vinculum reduced to a small scutate plate lying betweem the tips of the base of the sacculi.

Crambus mutabilis is another species common in Tennessee, occurring thrucut the state. It is of considerable economic importance. The moths prefer rich luscious bluegrass pastures and meadows and will be found most abundantly in the lower, damper portions of such fields. It is one of the larger species of the genus and can easily be distinguished by the dark brown costal margin of the wing and the broad pectinate antennae of the male. It is a somber-colored species but the brownish-gray of the wings contrasts with the whitish color of the underbody and give the appearance of a brown coat over a silvery waistcoat.

The larvae are easily distinguished by their large size, their pale yellow heads with a distinct color pattern of dark brown and by the longtiudinal whitish lines on the back and sides whence comes the name"striped webworm". The larvae are voracious feeders and are often seriously injurious to young corn following pasture of meadow. One of these larvae will wreck a young corn plant as effectively as a cutworm for which they are sometimes mistaken. Unlike the real corn webworm (Crambus caliginosellus) they feed above ground and so lay themselves open to the attacks of pafasitic enemies by which they are often killed.

There are three distinct generations in Tennessee. The [illegible] May 15, become abundant about May 20

and finally disappear about the middle of June. From July 10 to August 15 they are again abundant and again the last of August and early September a smaller generation makes its appearance. A moth of this species has been taken at Knoxville as late as October 20, far beyond the usual time limit.

CRAMBUS PRAEFECTELLUS Zincken

Plates VI. VII

Adult. Wing expanse 18-25 mm. Head, palpi and abdomen cinereous, the abdomen lighter. Thorax and fore wings golden fuscous, the latter with a silbery white stripe bordered with a fine darker line and tapering toward each end, from base to near subterminal line, a tooth near middle of lower side, and a silvery white dasj above the tip and often fused with it, from this dash a dark shade with a light costal triangle above it, a light patch below it and crossed by the plumbeous subterminal line, runs to the apex of the wing. Costal margin wider than in leachellus, being more than one half the width of the white stripe at the middle of the costa. Subterminal space with 5 blackish intervenular dashes. Fringes white or slightlyd tinged with ochreous. Hind wings white or slightly cream-colored, fringes white. The male antennae are plainly flattened, each segment bearing a wedge-shaped process, which, in the median segments is provided with 8 to 10 sensoria. The female antennae filiform and beautifully banded with narrow alternate rings of brown and white.

Genitalia. Female. Valves two-lobed, the dorsal lobe more feebly chitinized, about one-third the width of the lower, and [illegible] the margins of both lobes

thickly set w ith stout hairs.

Male. Body of tegumen very short, about one-third the length of the limbs, which are broad, nearly straight and almost truncate at the tip; uncus broad at base but quickly narrowing, slender and of uniform width for the rest of its length, the distal third dorsad thickly set with short stout spines inclined cepahald, interspersed with a few sparse hairs; gnathos glabrous, its limbs widely separated at their tips but quickly narrowing to the slender body, which considerably exceeds the uncus. Harpes rather narrow at base, elongate and subfalcate in general shape; costa free except at base but much modified into a short chitinized process, incurved and truncate; cucullus lightly chitinized, strongly concave, widest just above the base and narrowing gradually to the rather obtusely rounded tip, very hairy within with an especially thick tuft just above the base. Cucullus not sharply separated from the sacculus which is subquadrate in general outline, with a thickened costal margin and on its disk near the ventral margin a stout, heavily chitinized finger-like spine. Vinculum much reduced to a mere band of lightly chitinized tissue connecting the bases of the harpes. Aedoeagus lightly chitinized, nearly cylindrical, rounded at the base and curved in the shape of an old-fashioned pistol; at the tip truncate and somewhat bell-shaped, the internal lining for half its length roughly tuberculate; just inside the tip is a very short, sharp, chitinized thorn-like cornutus, and about two-thirds toward the base another much larger, acute, oblique spine with a very long narrow base, its tip inclined toward the tip of the aedoeagus. Anellus a mere ventral membrane.

Crambus praefectellus occurs thruout Tennessee and has been taken at every point in the state where collecting has been done. Whilenot seriously injurious, larvae have been taken destroying corn at Knoxville and Caney Spring. The larvae feed readily on most grasses and probably also on other plants for the moths seem to prefer areas of rather open waste ground with a variety of vegetation such as occurs in old strawberry plantations, fallow fields, etc.

The larva is dull brown in color, the head pale yellow with a distinct color pattern of dark brown markings arranged much like that in Crambus mutabilis. It is easily distinguished from that of C. mutabilis by the smaller size and, by the distinct striping of the body of the latter.

The moths occur thruout the season showing no division into distinct generations. Their first recorded occurrence in Tennessee is April 3, the last October 20 and that have been taken during every intervening month.

CRAMBUS RURICOLELLUS Zeller

Adult. Wing expanse 18-20 mm. Palpi long and slender, luteous, dusted withdeep fuscous to blackish scales outwardly. Head and thorax above and patagia luteous, the latter with a few fuscous scales. Antennae whitish. Fore wings luteous, the intervenular areas covered with orange or fuscous scales or more or less diffused on costal half; a more or less distinct median line of fuscous scales arises about the middle of the costa, runs to the outer end of the cell and thence in a nearly straight line to the inner third of the hind margin, also a

similar subterminal line arises at outer third of costa, runs nearly to tip of wing and thence in a curved line to the outer third of the hind margin; a terminal line of 7 black intervenular spots. Fringes golden yellow. Hind wings whitish to pale gray, darker toward tip, pringes white. Beneath fore wings pale fuscous with 7 terminal intervenular dots, hing wings white. The color pattern varies greatly in definiteness. The species resembles vulgivagellus but is smaller and the median and subterminal lines when present are characteristic.

Genitalia. Female. Valves with margin sinuate, the lower 2/3 forming a broadly rounded lobe and the upper third more o abruptly rounded and slightly produced, the margins of both armed with long stiff hairs. Male. Body of tegumen narrow, arcuate, about as long as the linbs which are narrow, straight, abruptly rounded at apex and extend nearly to right angles to the axis of the body of the tegumen; uncus rather long, moderately stout, armed with hairs along ventral margin and a few smaller ones above toward the base and terminating in an elongated hoot or claw; gnathos long, slender, exceeding the uncus, hollow above and broadened, apex thickened and excavated forming a pocket in which the tip of the gnathos lies when closed. Addoeagus moderately chitinized, cylindrical and nearly straight, cephalic end rounded and only slightly enlarged, dorsal line nearly straight, ventral line somewhat concave, enlarging slightly and gradually toward the tip which is obliquely truncate and bears a small thorn-like tubercle just below the ventral edge of the opening, no cornuti. Harpes feebly chitinized, elongate-elliptic in general outline;

cucullus not sharply differentiated from sacculus, clothed within with fine slender hairs, broadly rounded at the tip, sacculus with a few stout hairs near ventral margin, costal margin free but reduced to a shaoply acute basal thumb-like lobe scarcely reaching the base of the cucullus and bearing a few stout hairs rising from minute tubercles near its tip.

T

This species is a very near relative of C. vulgivagellus both in its morphology and in its life history. It is somewhat smaller but scarcely to be distinguished in the field except by the more or less conspicuous median and subterminal lines in the fore wing. When at rest its wings are not so closely folded as those ov C. vulgivagellus. As with that species there is but one generation per year. In Tennessee the moths appear a few days earlier, between the 5th and 10th of September and also disappear sooner, seldom being seen after The first of October. One specimen was captured on August 19,1919 on Blanket Mountain above Elkmont at an altitude of about 4000 feet. Enough rearing work has been done with this species to ascertain that its life history is very similar to that of C. vulgivagellus, one generation each year, the larvae feeding voraciously during the spring, reaching maturity in e early summer and then lying dormant in their pupal cases thruout the summer to pupate shortly before the emergence of the moths in September. The larvae are so similat to those of C. vulgivagellus that they cannot be definitely separated. They are black-headed and have greenish-brown bodies when actively feeding.

CRAMBUS TETERRELLUS Zincken

Plate VIII

Adult. Wing expanse 15-21 mm. Palpi and head above white, palpi beneath, thorax and abdomen pale cinereous. Fore wing cinereous with tinge of luteous more pronounced in some specimens than others, basal half darker and with numerous plumbeous of blackish scales especially in the cell and just below. Median line orange, running from just beyond the middle of the anterior margin to the tip of the cell and thence to the middle of the anal margin with an outward angle at the fold. Subterminal line orange, edged outwardly with white, running from a point midway between the median line and the tip of the wing to near the basal angle with an obtuse angle a little above the middle. Bewteen the median and subterminal lines the intervenular spaces are more or less prominently marked with orange scales and edged with black, veins lined with white. Terminal line of sever black intervenular dots, the spaces between it and the subterminal line covered with white scales tipped with black fiving this area a sale-and-pepper appearance very characteristic of this species. Fringe cinereous with golden tinge. Hindwings uniform pale cinereous with white fringes. Fore wings beneath uniformly dark cinereous with small darker terminal intervenular dots. Hind wings beneath paler than fore wings with a narrow brown marginal line. Antennae of female setaceous, of the male shorter and broadened, each segment extended laterally so as to give it the general shape of an ax head. Near the center on both the upper and lower faces of the segment is a compound sensorium consisting of one large sensorium closely surrounded by a number of others

similar in size and structure to those found on other species and elsewhere on the same sugements in teterrellus. On the more highly developed segments near the middle of the antennae the group may be composed of as many as 10 or even more of the smaller sensoria. Toward either extremity the number decreases until only two or three occur in each group. Under low magnification this compound sensorium shows merely as a distinct dark spot, and Felt has so represented it. No compound sensorium has been met with on any other species examined.

Genitalia. Female. Valve much narrower than long, narrowly rectangular with the apex only slightly produced. Male. Body of tegumen long and broad, linbs broad and short, rounded distad; uncus rather slender, setigerous above and at base and along margins, terminating in a long, strong, gently curved tooth which fails by only a little of reaching the tip of the gnatios; gnathos also rather slender, naked, t tapering evenly from the base to a narrow truncate apex. Harpes somewhat convolute at base, the free costa much shortened and truncate at tip with the angles produced into short recurved hooks; cucullus rather narrow, finger-like and densely hairy above. Sacculus not sharply differentiated but meeting the base of the cucullus with a rounded, more heavily citinized lobe bearing a grouO of short stout spines. Vinculum weakly chitinized and rather large but not sharply differentiated. Aedoeagus not heavily chitinized, slender and tapering toward each end. Cephalic end evenly rounded and produced cephalad of the dorsal opening for the penis, caudal end obliquely truncate with the opening for the egress of the penis ventrad.

From the caudal extremity arise two large glat chitinous processes curbing outward and upward in much the shape of a horseshoe and entirely unique with this species so far as we know. There are no cornuti. Anellus a definite scutate chitinous plate accurately filling the opening between the bases of the harpes and the tegumen and with an elliptic hole thru which the aedoeagus passes.

This is the most common species of this genus occurring in Tennessee. It is abundant practically thryout the summer and often comes to lighted wundows in enormous swarms. It is a rathe4 small anf very inconspicuous species but causes serious injury to pastures, meadows and other grass lands especially in dry years by eating off the bluegrass leaves as fast as they appear. Under such conditions the plants are often killed outright.

CRAMBUS TRISECTUS Walker

Adult. Wing expanse 21-35 mm; Palpi ochraceous-gray, whitish within toward the base and specked with fuscous outside; head, thorax and patagia pale ochraceous, the former whitish and the latter sometimes with a few fuscous scales. Male antennae stout, flattenedp female antennae filiform. Fore wings pale ochraceous, lighter caudad and distad, surgace scattered with dark brown to black scales except along the fold just behing which there is usually an elongated dark area extending from the base distak nearly half the length of the wing. At the end of this area, but above the fold, at the base of vein C_2

is a dark spot marking the position of the ochraceous median line which curves evenly distad and cephalad from this point until it meets the costa a little beyond the middle. About midway between this dark spot and the end of the wing is another, somewhat elongated in a direction almost parallel with the end of the wing and indicating the subterminal line which is obsolete cephalad. Terminal line indicated by two or three dark brown or black spots at the base of the fringe toward the caudal margin. Fringe fuscous, cut by three to seven white lines, continuations of the interspaces. The fore wing varies widely in the promience of the markings, in some specimens being almost uniform ochraceous, in oters with each interspace sprinkled with black scales in addition to the marking described above. Hind wings silvery white at base, shading to ochraceous or pale fuscous distad, fringes white.

Genitalia. Female. Valve sub-quadrate, a little longer than broad, somewhat constricted at base, angles rounded, the dorsal only very slightly produced. Male. Body of tegumen short, flattened above, the lings broad, acute cephalad, very lightly chitinized exdept for a narrow stronger margin, a row of coarse hairs near the center of ventral margin; uncus short, stout, and hooked at tip, concave, hirsute above; gnathos broad, short, deeply concave, only slightly exceedintg the uncus and terminating in a minute outturned tip. Aedoeagus tubular, a little enlarged cephalad, caudad turned strongly ventrad, only moderately chitinized and in a strip running spirally about the organ, distal opening oblique and lateral, one short, stout cornutus usually withdrawn to base of aedoea-

gus; anellus a lightly chitinized dumb-bell shaped plate closely subtending the aedoeagus. Harpes with costal margin free and heavily chitinized into a long, stout, sinuous arm, somewhat more sharply curved at tip, furrowed to tip on inner side; with scattered short spines for three-fourths its length; sacculus lightly and nearly uniformly chitinized, its base concave, the terminal arm or cucullus long, flat, narrow, slightly exceeding the free costa and rounded at the tip, dansely hairy with a brush of especially long hairs about the middle of the outer margin; at the base of the gree portion of the sacculus and somewhat between it and the free costa is the short, stout, curved heavily chitinized spine-like clasp arising from a chitinous ridge which extends to the outward margin at the base of the free costa and there ends in a chitinous shoulder bearing a tuft of slender hairs. Vinculum not conspicuous, reduced to a thickened basla margin and a small triangular plate between the bases of the sacculi. The left harpe is usually a little larger and longer than the other and the tip of the left free costa is more decidedly curved.

Th

This is a northern and western species and has been collected only twice in Tennessee, both times by the writer. At Clarks- a few specimens were taken and at Kingston only one. These points represent the extreme southern limits of this species east of the Mississippi River

In the north this species is of considerable economic importance and causes serious injury to grass lands and also to corn planted following grass or sod. The eggs when laid are

white but quickly become dull-orange in color and remain thus until they darken preparatory to hatching.

The larvae are leather-brown and their heads are dark brownish-yellow, marked with blackish blotches made up of close groups of round black spots.

CRAMBUS VULGIVAGELLUS Clemens

Plate IX

Adult. Wing expanse 22-25 mm. Palpi long and conspicuous, luteous, the scales ontside and toward the tip strongly marked with deep fuscous to black, head, dorsom of thorax and abdomen luteous, the scales on the patagia partially fuscous, antennae covered with luteous scales on inside, naked and fuscous outwardly. Fore wings luteous or with a slight orange tinge especially along costal margin, various marked with fuscous scales ranging from a few pale fuscous scales outlining the cell to a dense pattern in which each intervenular space is deep fuscous leaving the veins and disk of the cell luteous. At the distal margin each intervenular space ends in a distinct black spot, 7 in all. Fringes long and conspicuously golden. Hind wings pale gras, fringes white. Beneath fore wings slightly fuscous with terminal linex of seven small black dots opposite those above, hind wings paler.

Genitalia. Female. Valve short, broader than long the margin sinuate, broadly rounded below and somewhat produced above, armed with a marginal row of stout bristles. Male. Body of tegumen moderately long, xxxxxxx slightly shorter than limbs, arcuate above, the laimbs narrow and slightly sinuate, rounded

distad, naked; uncus straight and fairly stout, with one median and two lateral carinae above, fringed with numerous reflexed bristles both above and along margins, slightly hooked at extreme tip; gnathos rather small and slender, exceeding the uncus and at the tip enlarged and excavated above to form a cup into which the tip of the uncus fits when closed. Aedoeagu s moderately but uniformly chitinized, rather short and stout, cylindrical, the proximal end roundly produced beyond the dorsal opening thry which the penis enters, just before the distal end slightly constricted and then enlarged especially ventrad and terminating in a globular extremity obliquely truncated and with the opening at an angle of about 45° with the main axis, a small broad chitinous tooth just outside the ventral margin of the opening; anellus merely a weakly chitinized supporting scale. Harpes weakly chitinized; cucullus elongate triangular in outline, the tip rounded and slightly constricted, heavily clothed within with slender pale hairs; sacculus not sharply differentiated but nearly naked and weakly chitinized especially on disk; costa free but reduced to an angular lobe extending from the base about 2/5 the length of the organ and bearing several stout bristles along its margin. Vinculum broadly V-shaped, the arms subtending the sacculi, the basla angle rounded and with a small suctate plate a little more heavily chitinized than the rest of the sclerite.

Crambus vulgivagellus is a species with wide distribution over the eastern United States and Canada. The larvae have been known to cause serious and widespread injury to pasture and meadow lands. There is but one generation each year. In Tennessee the moths appear jurst about September 15, quickly become abundant and then gradually disappear. The last worn specimens can usually be found about the last of October or early November. The eggs are dropped by the moths in grassy places, hatch in about 10 days and the young larvae begin at once to feed. When sold weather oertakes them they go into hibernation to resume again in the spring. They become fully grown about June 1 and then sonctruct their pupal cells in which they lie quietly all summer, pupating about 10 days before the emergence of the moths in September. The larvae are leather-brown in color with shining black heads.

Plate I.



FIG. 3.—Seedling corn plant showing silken nest of webworm attached to stem at right just below surface of soil.



FIG. 2.—Corn plant showing injuries inflicted by a webworm.

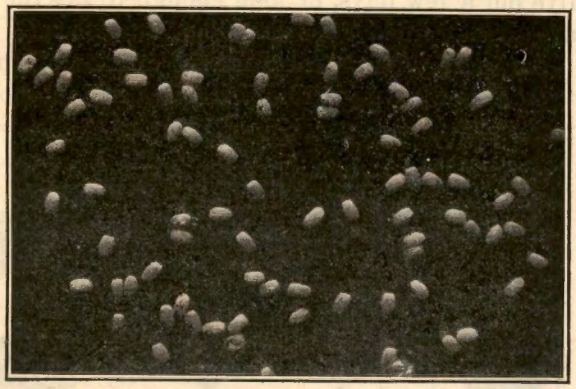
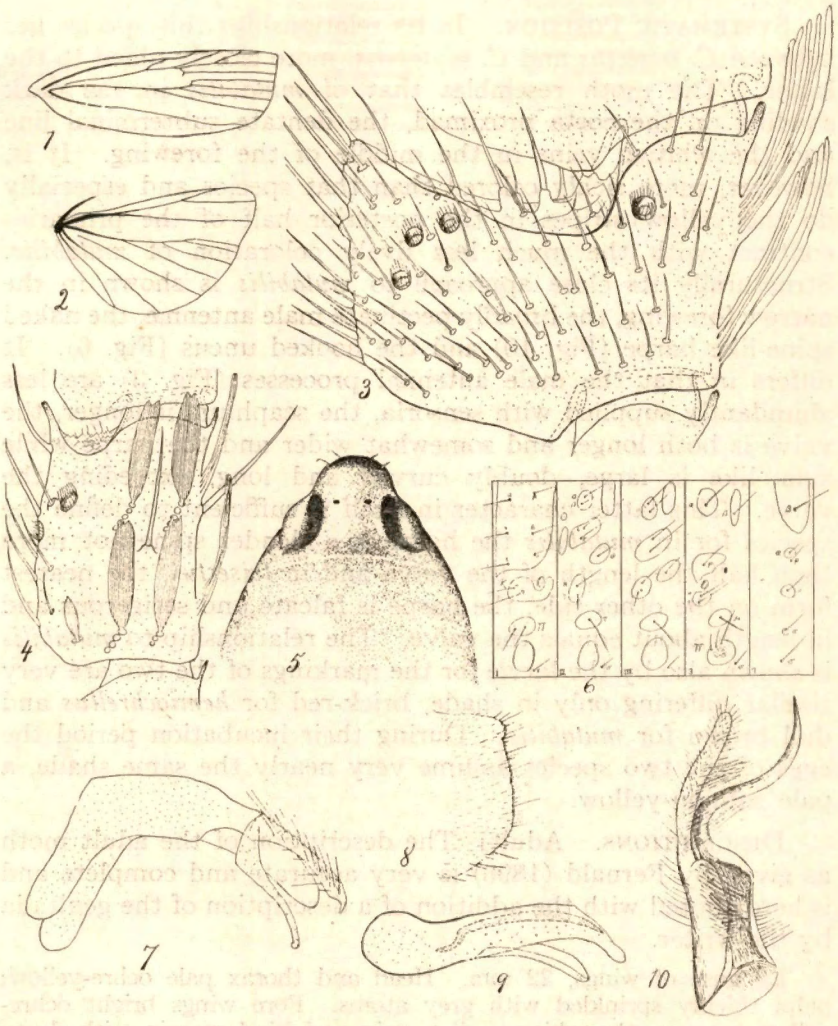


FIG. 4.—Eggs of a webworm moth. Much enlarged.



FIG. 1.—Approximate injurious distribution of webworms in the United States.

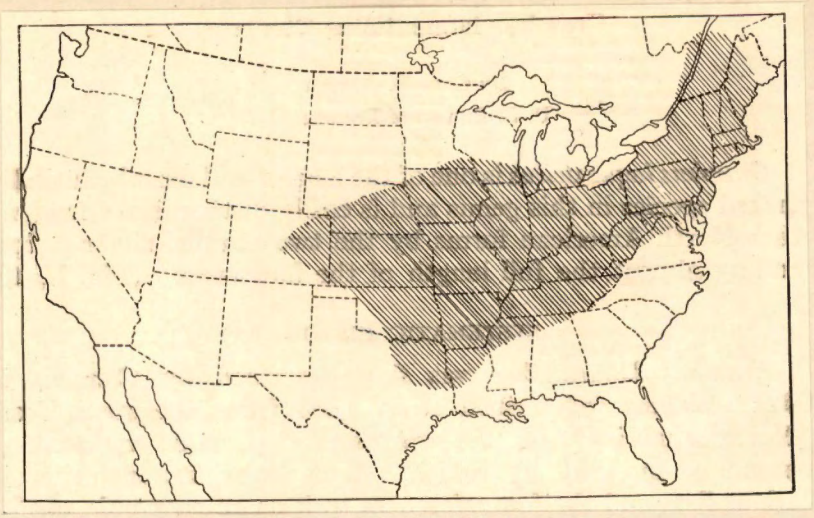
Plate II.



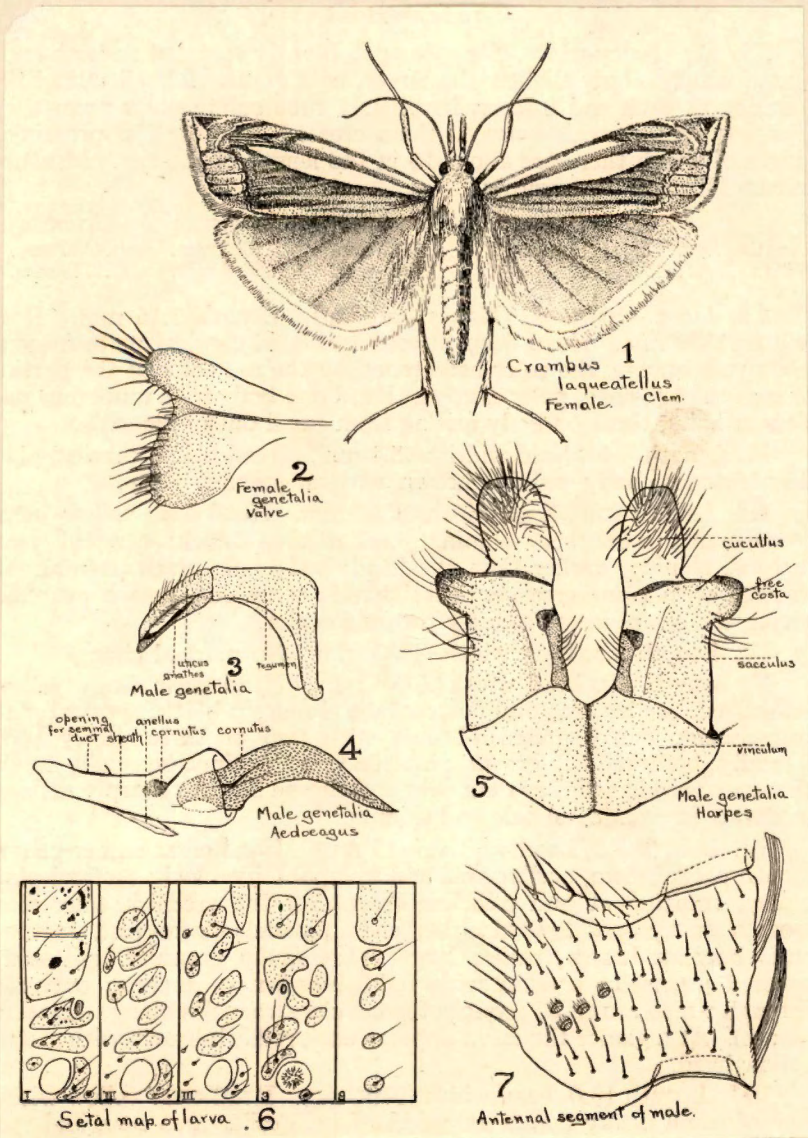
EXPLANATION OF FIGURES.

Fig. 1. Venation of fore wing.
Fig. 2. Venation of hind wing.
Fig. 3. Antenna, male, 25th segment.
Fig. 4. Antenna, female, 25th segment.
Fig. 5. Tip of pupa, dorsal view.
Fig. 6. Setal map showing arrangement of pinacula and setae on three thoracic segments and the 3rd and 9th abdominal.
Fig. 7. Male genitalia, scaphium, uncus and lower limb.
Fig. 8. Female genitalia, edge of anal plate.
Fig. 9. Male genitalia, penis.
Fig. 10. Male genitalia, clasp showing harpe and valve.

Plate III.

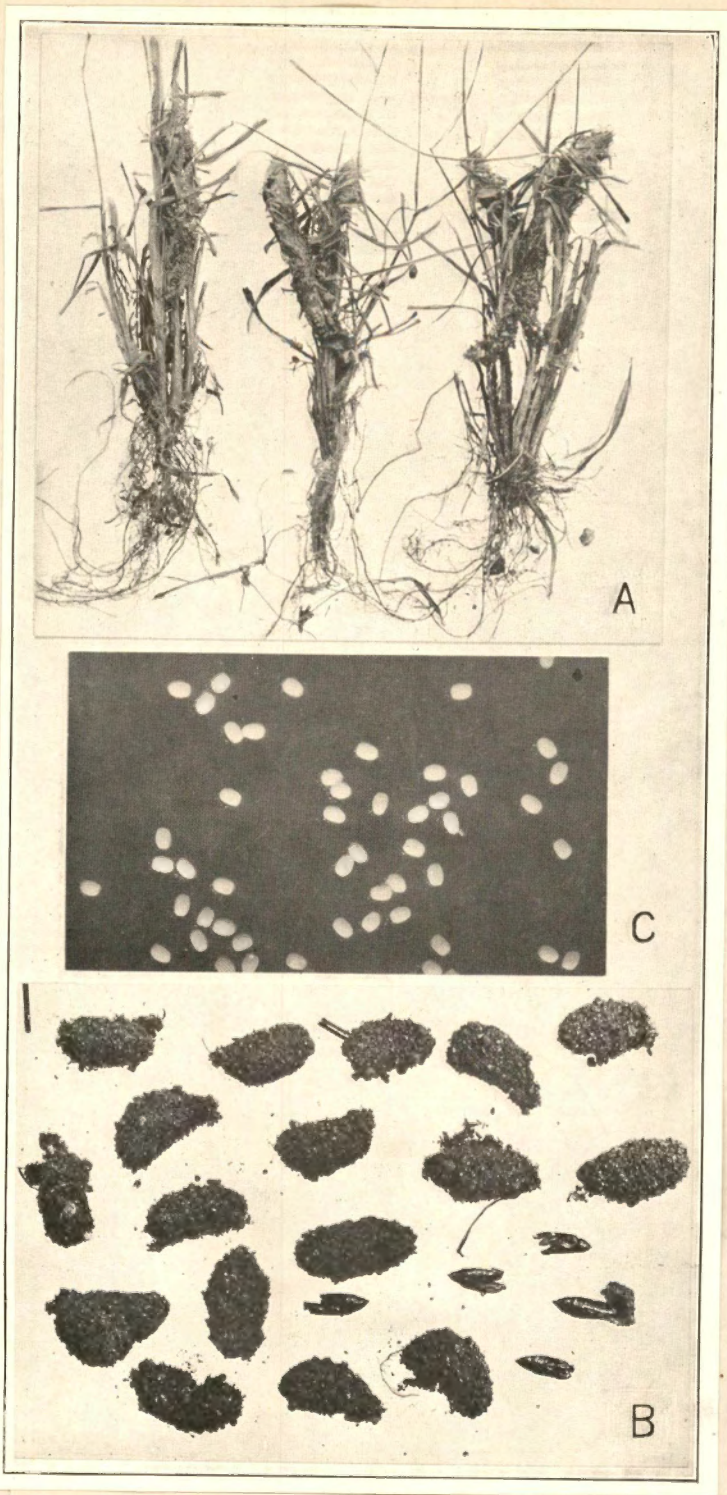


Map of the United States showing the known distribution of Crambus laqueatellus.



CRAMBUS LAQUEATELLUS

Plate IV.



Crambus mutabilis:

A.—Winter cases of larvæ on blue-grass plants.
B.—Pupal shells and cocoons.
C.—Eggs. Greatly enlarged.

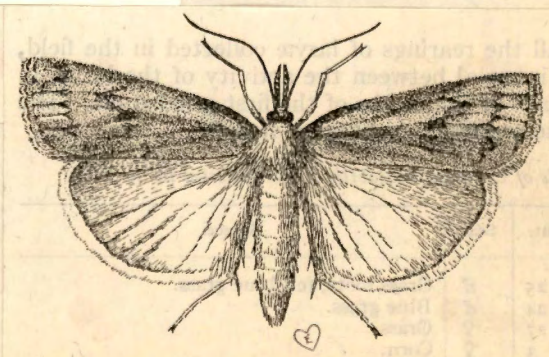
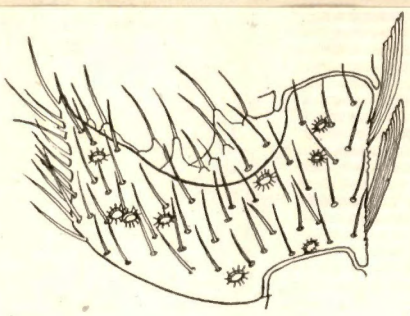
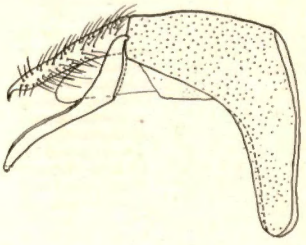


FIG. 2.—*Crambus mutabilis:* Adult female. About three times natural size.

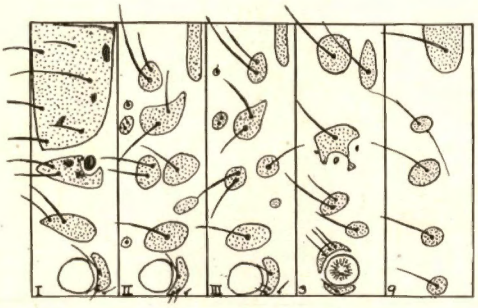
Plate V.



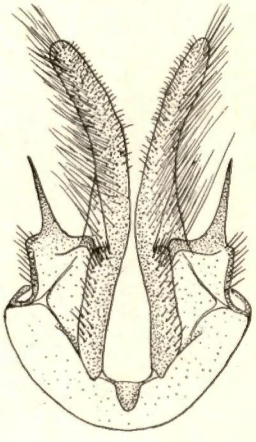
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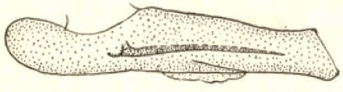
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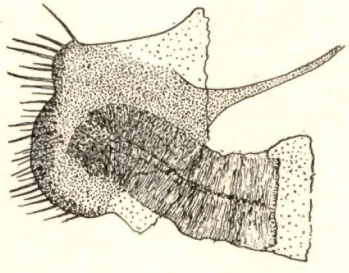
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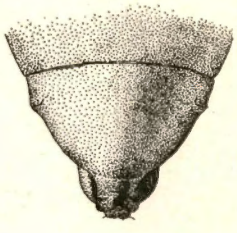
D



E



F



G

Crambus mutabilis:

A.—Male antennal segment (twenty-fifth), greatly enlarged.
B.—Setal map of three thoracic and third and ninth abdominal segments of larva.
C.—Male genitalia: Tegumen and uncus.
D.—Male genitalia: Harpes.
E.—Male genitalia: Aedoeagus.
F.—Female genitalia: Valve.
G.—Tip of pupa, dorsal view.

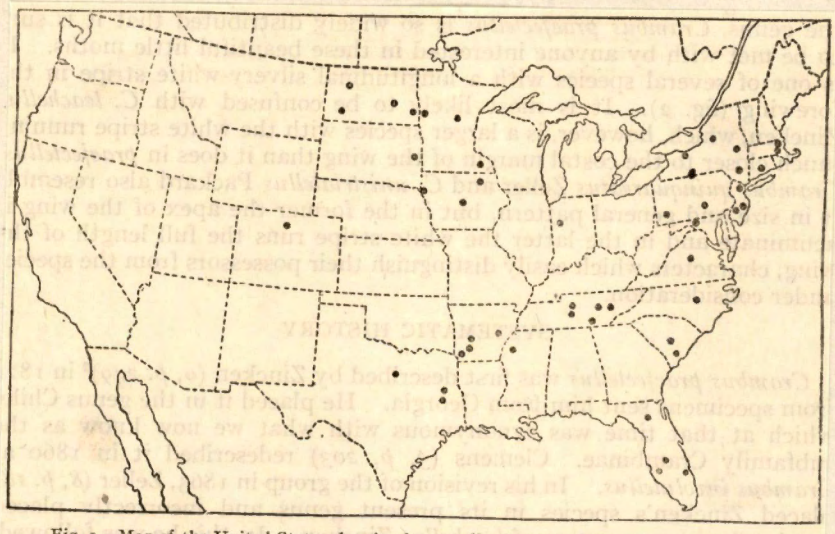


Fig. 1.—Map of the United States showing known distribution of *Crambus praefectellus*.

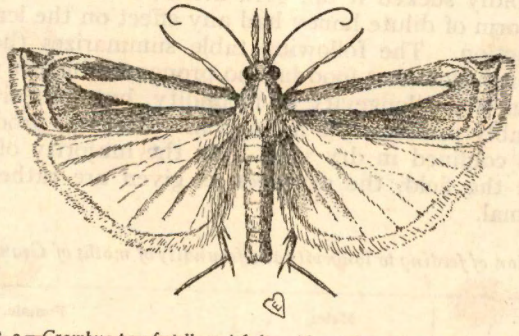
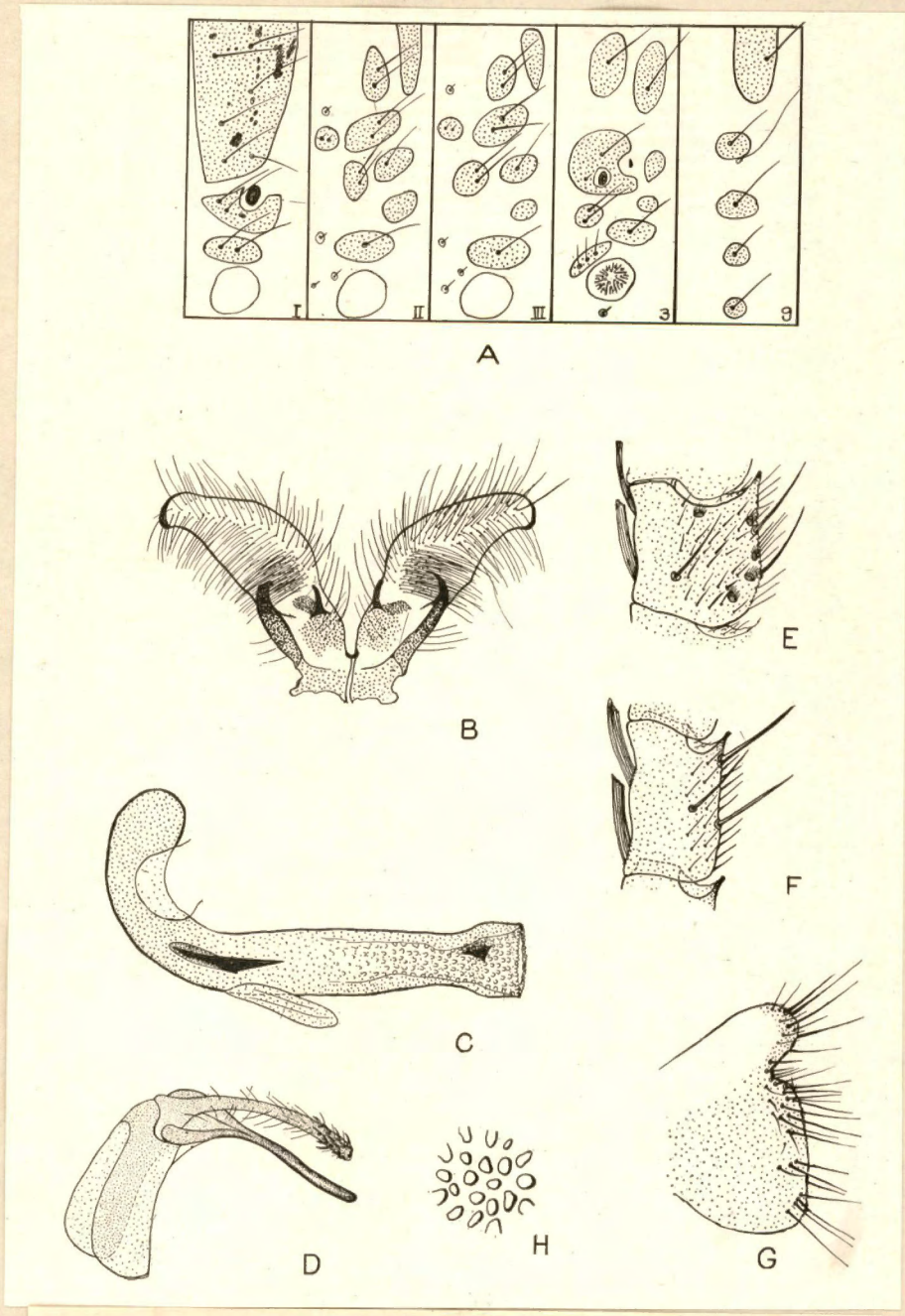


FIG. 2.—*Crambus praefectellus:* Adult. About three times natural size.

Plate VII.



Crambus praefectellus:

A.—Setal map of larva showing arrangement of pinacula and setæ on the three thoracic and third and ninth abdominal segments.
B.—Male genitalia: Harpes.
C.—Male genitalia: Aedoeagus.
D.—Male genitalia: Tegumen and uncus.
E.—Male antennal segment (twenty-fifth). Greatly enlarged.
F.—Female antennal segment (twenty-fifth). Greatly enlarged.
G.—Female genitalia: Valve.
H.—Polar area of egg. Greatly enlarged.

Plate VIII.



FIG. 11.—Adult of blue-grass webworm. About three times natural size.

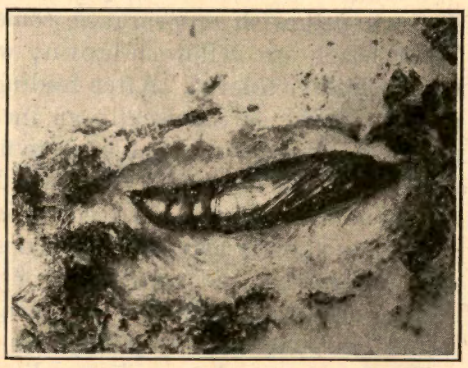


FIG. 7.—Pupa of the bluegrass webworm. About three and a half times natural size.

CRAMBUS TETERRELLUS Zincken

Plate IX.

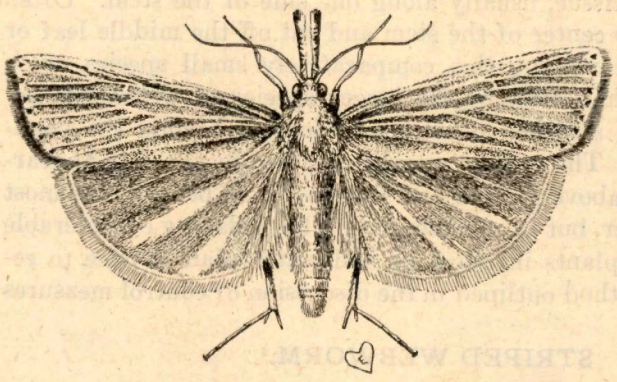


FIG. 8.—Adult of the black-headed sod webworm. About three times natural size.

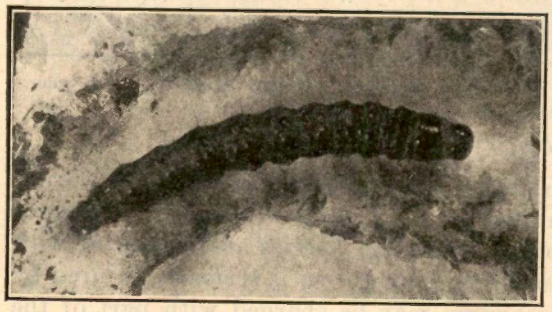


FIG. 5.—Caterpillar of the black-headed sod webworm. About three and a half times natural size.

CRAMBUS VULGIVAGELLUS Clemens