

CONTRIBUTIONS TO A KNOWLEDGE OF THE THRIP- IDÆ OF IOWA.

ALICE M. BEACH.

This paper represents the results of a study of some of the Thripidæ of Iowa, and is based upon an examination of material found in the collection of the Iowa Agricultural College, some specimens kindly loaned by Miss Emma Sirrine, Messrs. F. A. Sirrine and C. W. Mally, and some in the writer's own collection. Descriptions of seven new species and three new varieties are herewith presented, including a new species of Phlœothrips described by Prof. Herbert Osborn. The descriptions are preceded by an artificial key, arranged to aid in the identification of all the described Iowa species known to the author. The table for the determination of genera is substantially that found in Comstock's Introduction to Entomology, pp. 125-127. The writer is indebted to Mr. Pergande for an outline of the characters of Euthrips, and is under special obligations to Professor Osborn for valuable aid in the prosecution of this work which has been done in the Entomological Department of the Iowa Agricultural College.

TABLE FOR DETERMINATION OF GENERA.

- A. Last abdominal segment in both sexes elongated, narrow, tubular;
both pairs of wings similar, veinless, margins equally ciliated;
maxillary palpi two-jointed; borer in female absent.....
.....Sub-Order I. Tubulifera.
- B. Contains but a single familyFam. I. Tubuliferidæ.
- C. Contains but a single genusGen. 1. Phlœothrips.
- AA. Last abdominal segment not elongated and tubular in both sexes;
both pairs of wings unlike in structure, front wings always veined;
margins unequally ciliated; maxillary palpi three-jointed; borer
in female present.....Sub-Order II. Terebrantia.
- B. Females with borer curved upwards.....Fam. II. Stenopteridæ.
- BB. Females with borer curved downwards...Fam. III. Coleoptridæ.

FAM. II. STENOPTERIDÆ.

- A. Body above netted with elevated lines.....Gen. 2. Heliothrips.
- AA. Body above smooth.
 - B. Abdomen clothed with silky hairs; apex conical, formed alike in both sexes.....Gen. 3. Sericothrips.
 - BB. Body smooth; apex of abdomen unlike in the two sexes.
 - C. Prothorax produced in front, and narrowed.....Gen. 4. Chirothrips.
 - CC. Prothorax not produced in front and narrowed.
 - D. Last segment of abdomen with a pair of spines in female; male, wingless.....Gen. 5. Limothrips.
 - DD. Last segment of abdomen unarmed.
 - E. Last two segments of antennæ shorter than the sixth segment.....Gen. 6. Thrips.
 - EE. Last two segments of the antennæ longer than the sixth segment.....Gen. 7. Belothrips.

FAM. III. COLEOPTRATIDÆ.

- A. Antennæ with nine distinct segments.....Gen. 8. Melanthrips.
- AA. Antennæ apparently five jointed, the last four segments being minute and compact
 - B. Body somewhat flattened; meso-metathorax broad; front wings without fringe on costal border, and with four distinct cross veins; males with lateral abdominal appendages.....Gen. 9. Coleothrips.
 - BB. Body cylindrical, mesothorax and metathorax constricted, wings rudimentary.....Gen. 10. Aeolothrips.

SYNOPSIS OF IOWA SPECIES.

GENUS PHLÆOTHRIPS, HAL.

- A. Proximal joint of anterior tarsi armed with a tooth on inner side ..1
- AA. Proximal joint of anterior tarsi unarmed.....2
 - 1. With postocular bristle; three bristles on each side of prothorax; antennal joints 3-6 yellow.....*verbasci*, Osb.
Without postocular bristle; a single bristle at each posterior angle of prothorax; antennal joint 3 and base of joint 4, sometimes base of joint 5, yellowish.....*nigra*, Osb.
 - 2. Black; head slightly longer than wide; tube three times as long as wide.....*caryæ*, Fitch.
Purplish-black; head one and one-half times as long as wide; tube twice as long as wide.....*mali*, Fitch.

Phlæothrips verbasci, Osb.

Description follows this paper.

Phlæothrips nigra, Osb.

Can. Ent., Vol. XV, p. 154 [1883].

Phlæothrips caryæ, Fitch.

[Third Report.] Trans. N. Y. State Agr. Soc. for 1856, Vol. XVI, p. 446.

Phlæothrips mali, Fitch.

[First Report.] Trans. N. Y. State Agr. Soc. for 1854, Vol. XIV, p. 806.

GENUS HELIOTHRIPS, HAL.

This genus is represented in the collections by a single species, *H. hæmorrhoidalis*, Bouché. It is probable that *H. dracænæ* Heeger also, which occurs frequently in hothouses in this country and in Europe, is found in this state. These two species may be separated as follows:

Fuscous, apex of abdomen ferruginous; antennæ and feet pale; first and second joints of the former fuscous, sixth joint black-----

----- *hæmorrhoidalis*, Bouché.
Yellowish-brown; wings white, sub-fasciate with brown... *dracænæ*, Heeger.

Heliothrips hæmorrhoidalis, Bouché.

Naturgeschichte der schädlichen und nützlichen Garten-Insekten, p. 42 [1833].

Heliothrips dracænæ, Bouché.

Sitzungsb. d. mathem.—naturw. Klasse d. Wissensch., Vol. XIV, p. 365 [1854].

GENUS SERICOTHRIPS.

One species, *Sericothrips? perplexa*, containing representatives of the male sex only, has been doubtfully referred to this genus. This species possesses well marked characters, evidently of generic importance, which do not accord with those of any genus of this family with which I am familiar. They are as follows: Head somewhat flattened or depressed and produced in front with the ocelli placed very far forward; fourth antennal joint decidedly longer than the third, apex of abdomen in male formed like that of females of this family. In Burmeister's Handbook of Entomology, Vol. 2, p. 413, the genus *Sericothrips* is characterized as having the abdomen covered with silky hairs, head hidden up to the eyes in the thoracic segment and the tip of the abdomen formed alike in both sexes. In the enumeration of species, the same authority records but a single species, hence it may prove that a more extended knowledge of allied forms will make it necessary to enlarge the limits of the genus, therefore it seems best to place this species here provisionally rather than to erect a new genus.

Sericothrips? perplexa, n. sp.

Male: Length, 1.33–1.55 mm. General color fuscous; legs and annulus on antennæ yellowish; thorax tinged with yellow-ferruginous; abdomen

except apex, varying from pale to deep fuscous; anterior wings subfuliginous, clearer at base. Form slender; bristles and spines short, inconspicuous; head, from dorsal view, subpentagonal; antennæ seven-jointed, approximate; ocelli placed very far forward toward front border of head; posterior angles of prothorax bisetose; spines on cubitus 15-16, arranged in a basal series of three or four followed by an intermediate group of nine, and this by two, more widely separated, at distal end of vein.

Head, seen from above, subpentagonal, its greatest length equal to its greatest width; sides constricted behind eyes; front margin produced, and subangulated in middle, its width almost completely occupied by the antennæ; eyes dark red-brown, of medium size, moderately granulated, pile scattered, long; posterior orbits depressed, with a row of short sparse hairs parallel to them; vertex scarcely elevated, gradually descending toward apex where it merges into the front; ocelli yellow, inner margins red; anterior ocellus on upper margin of front; lateral ocelli contiguous to upper orbits; ocellar bristles moderately long; small bristles between anterior ocellus and the eyes; occiput striate, provided with two weak bristles; front produced to base of antennæ thence receding toward clypeus, furnished with a row of four weak bristles just beneath antennæ and two similar bristles near clypeal margin. Antennæ seven-jointed, approximate, base plainly visible from above; joint 1 shortest and thickest, one-half the length of the second; joints 2-4 increase in length in the order named; joint 4 is nearly as long as joint 6, which is larger than any other joint; joint 5 is slightly longer than the second and more slender than any of the preceding; joints 6 and 7 are closely united and together pyriform in shape; the latter is nearly one-half the length of the former; the first joint is subrotund; the second, somewhat barrel-shaped; the third subfusiform; the fourth and the sixth elongate-ovate; the fifth submoniliform; the seventh lanceolate, its base narrower than the apex of the sixth; bristles and sensorial spines of joint 4 placed nearer the middle than usual.

Prothorax subquadrate, scarcely broader than head; sides very slightly constricted at anterior border; posterior angles narrowly truncate, provided with two bristles; shorter bristles or hairs are scattered over a triangular area extending backward from the front margin, and a smaller area near the posterior angles; anterior angles provided with equally small, but heavier bristles; surface apparently smooth; mesoscutum broadly convex, nearly smooth, furnished with short inconspicuous bristles each side and two submedian bristles on disc. The scutellum, obtusely ridged, feebly sculptured, provided with two short, heavy, approximate bristles on ridge near basal margin.

Abdomen slender; apex abruptly conical, resembling that of females of this family; sides distinctly sculptured; segments with a few bristles or coarse hairs laterally and on apical border of their ventral surface; caudal segments with longer and stronger radiating bristles arranged in two rings as in females.

Legs slender; anterior femora scarcely expanded; posterior tibiæ spiny on inner margin and at apex; their tarsal joints with apical spines. Anterior wings lanceolate, humeral angle moderately arched; cubitus extending entire length of wing; radial vein obsolete at base and nearly obsolete at tip; costal spines, 22-24; cubital spines, 15-16, arranged in

groups, three or four at base, followed by a group of nine, and this by two more widely separated, placed at distal end; radial spines, 13; anal spines, 5; longitudinal vein of posterior wing distinct.

General color fuscous; third and fourth joints of antennæ entirely and sometimes base of fifth, legs, except more or less of dorsal surface, yellowish; thorax, especially the sutures, tinged with yellow-ferruginous; abdomen varying from fuscous to yellowish or pale fuscous; apex always dark; dorsal aspect of femora generally concolorous with head; anterior wings subfuliginous with a broad, indistinctly defined, pale sub-basal band; posterior wings subhyaline.

Described from eleven specimens taken at Ames, Iowa, on *Cyperus*, corn and in sweeping grass in August and November.

GENUS CHIROTHRIPS, HAL.

This genus is represented by a single species, *Chirothrips antennata*, Osb., which is of a brownish-black color with third joint of antennæ paler; second joint is quite characteristic, being trapezoidal with acute angle outward.

Chirothrips antennata, Osb.

Can. Ent. Vol., XV, p. 154. [1883.]

GENUS THRIPS.

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|-----|---|---|
| A. | Head of medium size; eyes moderately prominent; antennal joints 3-5 elongate..... | 1 |
| AA. | Head small; eyes very prominent; antennal joints 3-5 not elongate..... | 8 |
| 1. | Antennæ eight-jointed..... | 2 |
| | Antennæ seven-jointed..... | 7 |
| 2. | Sixth joint of antennæ annulated..... | 3 |
| | Sixth joint of antennæ not annulated..... | 6 |
| 3. | Ocelli widely separated; long bristles at all angles of prothorax; spines present at apex of all tibiæ, numerous and heavy on wings, on radial vein 12-14..... | 4 |
| | Ocelli subapproximate; single bristle of medium length at each posterior angle of prothorax, none at anterior angles; spines present at apex of posterior tibiæ only, on radial vein 2..... | 5 |
| 4. | Size medium; head, from dorsal view, rectangular; antennæ approximate..... | (<i>Euthrips</i>) <i>tritici</i> Fitch. |
| | Size large; head from above pentagonal; antennæ subapproximate..... | (<i>Euthrips</i>) <i>maidis</i> n. sp. |
| 5. | Wings more or less distinctly clouded; brown markings on thorax and band at base of abdominal segments 2-7 distinct.... | <i>variabilis</i> , n. sp. |
| | Wings nearly uniformly fuliginous; brown markings distinct on thorax; abdomen immaculate..... | var <i>a</i> . |
| | Wings and body, pale; markings, obsolete..... | var. <i>b</i> . |
| | Wings distinctly trifasciate; broad brown band on head | |

- and thorax respectively; abdominal segments 1-3 and 7-10 entirely brown ----- var. *c.*
6. Head, from dorsal view, semiovate; ocelli subapproximate, conspicuous; spines and bristles, short and few; bristles on penultimate segment of abdomen equally long ---- *striata*, Osb. Head, from dorsal view, subrectangular; ocelli remote, inconspicuous; single strong bristle at each posterior angle of prothorax; intermediate bristles on penultimate segment of abdomen, one-half as long as lateral bristles, *inæqualis*, n. sp.
7. Size medium; antennæ sub-approximate; ocelli inconspicuous; prothorax, transverse; bristles at posterior angles of medium length; spines at base of cubitus arranged in two groups ----- *tabaci*, Lind. Size large; antennæ approximate; ocelli, conspicuous; prothorax, subquadrate; bristles at posterior angles of prothorax, long; spines at base of cubitus in single group -- *lactucæ* n. sp.
8. Antennæ eight-jointed; ocelli approximate; spines and bristles, except those on abdomen, long and slender; bristle at middle of each lateral margin of prothorax, one at each anterior and two at each posterior angle ----- *pallida*, n. sp.

Thrips (Euthrips) tritici, Fitch.

[Second report.] Trans. N. Y. State Agr. Soc. for 1855, p. 536; Osborn Can. Ent., Vol. XV, p. 156 (1883).

Thrips (Euthrips) maidis n. sp.

Female. Length, 1.83-2. mm. A large species slightly variable in color, brownish-black, but sometimes paler; annulus on antennæ, extremities of femora and tibiæ, lower surface of the latter and sutures of abdomen yellowish-white; thorax, especially its sutures, tinged with yellowish-ferruginous; anterior wings dusky white; head pentagonal, front margin produced and rounded in the middle; ocelli distant, antennæ subapproximate; spines and bristles strong, blackish, arranged much as in *E. tritici*, Fitch; costal spines 25-29; cubital, 19-23; radial, 15-16; anal, 5; internal, 1.

Head, from dorsal view, pentagonal, scarcely broader than long; its sides parallel; anterior border produced and rounded in the middle; occiput less than one-half the length of the head measured on a median line, plainly striated; genæ uniformly full; eyes rather large, coarsely granulated, feebly pilose; orbits yellow, encircled with a few short hairs; ocelli, pale yellow, margined with red crescents, widely separated and arranged in a broad triangle with its lateral angles contiguous to superior orbits; vertex broad, gently convex between lateral margins; produced cephalad and provided with a transverse row of four short hairs near its anterior margin; the front wide with medial, longitudinal elevation; antennal sockets occupying less than its entire width, making antennæ subapproximate, more widely separated than in *E. tritici*, Fitch; antennal joints 3 and 4, occasionally base of 5, white, the rest, black; joint 1 globose, more than one-half as long as joint 2; the latter subglobose, somewhat contracted toward base, both joints more robust than those following: joints 3-5 elongate, submoniliform, decreasing in size in the

order named; the third nearly as long as the sixth; apical joints subequal, minute; all joints thinly covered with microscopic hairs; bristles or stiff hairs on basal and intermediate joints which on distal joints are replaced by slender hairs; sensorial spines on the third, fourth and sixth joints, distinct; clypeal, subantennal and postocular bristles present, the last less conspicuous than in *tritici*; mouth parts distinctly asymmetrical; each joint of maxillary palpi cylindrical, narrower than the preceding; first and third subequal in length, and second shorter than either.

Prothorax about one and one-half times as broad and equally as long as preceding segment; anterior angles rectangular, posterior rounded, sides slightly converging cephalad; disc striate and sparsely hairy; front and hind borders more deeply striate or rugose, bristly; the most conspicuous bristles are arranged as follows: One long bristle at each anterior and two at each posterior angle; two shorter bristles on anterior margin, two on posterior margin and one on disc near each posterior angle.

Meso-metathorax, subquadrate; mesoscutum more finely striate than prothorax, with small bristles, one at each lateral angle, two near and two on posterior margin; scutellum as long as mesoscutum, narrow, not strongly carinate; base transversely striate, sides longitudinally rugose; basal bristles as in *tritici*.

Abdomen broad, ovate, basal segments and sides sculptured, bristles similar to those of *tritici*.

Legs, with numerous short bristles; all tibiae and joints of posterior tarsi with terminal spines; anterior femora incrassate, their tibiae stout.

Wings rather broad; humeral arch not prominent; surface minutely pilose; veins distinct, uniformly and heavily spinose; anterior and posterior basal cross veins present; cubitus inserted in marginal at tip of wing; radius obsolete at proximal end, but perceptible before it unites with the posterior basal cross vein; costal spines longer than those on the other veins, numbering from twenty-five to twenty-nine; cubital, from nineteen to twenty-three; radial, from fifteen to sixteen; anal, five, gradually increasing in size from one to five; internal, one; posterior wings hyaline; longitudinal vein indistinct, except at base.

This form approaches closely the dark colored specimens of *tritici*, from which it may be separated by its larger size, the annulus on the antennae, and especially by the shape of the head, which is pentagonal instead of rectangular, and the less approximate antennae.

Described from twenty-nine specimens taken at Ames, Iowa, in July, August, September and January.

Thrips variabilis n. sp.

Head transverse Antennae eight-jointed, distant; ocelli approximate. Each posterior angle of prothorax provided with a single medium sized bristle; bristles on penultimate segment of abdomen not strongly radiating, not extending backward beyond the base of the succeeding row; radial vein bispinose, obsolete; legs slender.

Female. Length from .84-1.23 mm. Head one-half as long as broad; viewed from above, subrectangular; anterior margin straight; occiput short, transversely convex and striate; distinct oblique depression behind each eye; genae moderately full; vertex abruptly ascending, tumid

across whole anterior border; ocellar area small, elevated; ocelli approximate, inner margins heavy, conspicuous; ocellar bristles not more than one-half the length of the head; eyes large, prominent, feebly pilose. Antennæ eight-jointed, distant, moderately bristly; basal joint short, thick, hidden from dorsal view by vertex; the following joint longer, more robust, globose; joints 3-6 elongate; joint 3 the longest, subfusiform; joint 4 a little shorter than joint 3, elongate-modioliform; joint 5 obovate, intermediate in length between 2 and 4; the remaining joints sessile, together elongate-conical; joint 6 equal to joint 4 but a little stouter; joints 7 and 8 minute, together one-half as long as preceding, line of separation between them oblique; sensorial spines on joint 6 originate beyond middle; four short bristles in transverse row on front above antennæ, and one behind each eye; mouth parts nearly symmetrical.

Prothorax broader than long; anterior angles prominent, rectangular; posterior angles broadly rounded and furnished with a single bristle; surface plainly and uniformly marked with transverse striæ, with a few short slender bristles on front margin and more on disc. Mesoscutum is quite convex from base to apex, marked with fine transverse striæ, and provided with four short bristles on disc. Scutellum with triangular area at base striate as in mesoscutum, furnished with four basal bristles.

Abdomen broad, ovate; sides, under high power, appear thickly set with minute appressed hairs; a pair of bristles occurs on disc of each segment from the second to the seventh; they are approximate on the second and gradually become more widely separated on the succeeding segments; lateral bristles few and short; apical border at sides and on ventral surface of segments bordered with minute ciliæ interspersed with coarse hairs or bristles; caudal spines rather light; those on penultimate segment directed backward and extending only to base of following segment; terminal spines a little longer than the preceding, radiating at sides.

Legs very slender, somewhat bristly; tarsi elongate; anterior femora not dilated; apex of intermediate and posterior tibiæ and of posterior tarsal joints terminating in short spines; inner margin of posterior tibiæ feebly spinose.

Wings; veins heavy; in anterior pair radius and cross veins obsolete; costal spines number 22-30; cubital, 20-26, arranged in two series; radial, 2; anal, 4; one near base of anal cell; longitudinal vein of posterior wing very heavy for two-thirds of the length.

Male. Length, 78-86 mm. Resembles the female very closely. Differs in being of smaller size, in having from 23-25 costal spines, 20-21 cubital: the remaining spines on the wing as in female. The apex of the abdomen is more blunt; the anal segment is cleft on either side, the lateral lobes terminate in two spines; the middle lobe is prolonged considerably beyond the lateral lobes, making apex more pointed than apex of male of *T. tritici*. The spines on preanal segment are similar to those in female.

This species presents considerable variation in color. The extreme forms are quite distinct and might almost be considered separate species were it not that in addition to the similarity in structure there is the occurrence of a series of intergradient forms.

Var. *a*. Female: General color yellowish-white, meso-metathorax pale yellow, basal joints of antennæ concolorous with head, joint 3 and base of joint 4 dusky; the remainder of the antennæ and spot at distal end of tarsi, brownish-black; eyes dark red-brown; ocelli nearly colorless; inner margins red; anterior wings indistinctly clouded with fuliginous at base, distal portion clearer; brown markings as follows: A clearly defined saddle-shaped patch on posterior portion of prothorax, concave along its front border, nearly interrupted by a wedge-shaped incision extending forward from posterior border; anterior border of mesonotum; scutellum except median stripe; bands at base of abdominal segments two to seven, dilated at sides, and narrower and fainter along intervening space; patch on upper side of all the femora, darkest on posterior pair.

One specimen, taken on clover August 14, 1893, and one on hackberry, October 6, 1893, Ames, Iowa.

Another specimen taken on hackberry, October 6, 1893, at Ames, Iowa, corresponds with the description of variety *a* except that the thorax is a deeper yellow.

Another specimen taken on elm, August 21, 1894, is more uniformly yellow, the anterior wings more uniformly dusky, bands at base of abdominal segments narrower and other markings fainter.

A fourth specimen that may be placed in this group resembles the first, but it is of a deeper yellow color; the markings on the prothorax are prolonged farther backward, and the wings are more uniformly fuliginous. Ames, Iowa, Oct. 8, 1893.

Var. *b*. Male and female: Body pale yellowish, immaculate; apical joints of antennæ black, remainder pale; wings and fringes tinged with yellowish.

Hawthorn and hackberry, Ames, Iowa, October 6, 1893.

Var. *c*. Male and female: Wings nearly uniformly fuliginous; last three joints antennæ, distal half of joints 4 and 5 black, sometimes intermediate joints altogether dusky; brown markings very distinct, confined to two large spots on thorax and scutellum respectively, the latter oblong and approximating posteriorly; abdomen immaculate.

Hawthorn and hackberry, October 6, 1893, Ames, Iowa.

Var. *d*. Male and female: This variety is characterized by having the wings fuliginous, trifasciate with white bands, and in being more heavily marked with brown; the markings on the thorax and bands at base of first, second and third (sometimes of second and third only), and seventh and eighth segments of the abdomen are extended until they coalesce and form broad bands; the dorsal surface of the head is brown; sometimes all of the caudal segments are brown; the legs are white, with brown streaks on dorsal surface of femora, and frequently on tibiæ also; antennæ as in preceding variety.

On smartweed, June 16, 1893, and on cucumber, July 28, 1893, Ames, Iowa.

By the shape of the head and by the antennal characters this species is allied to *T. tritici*, but it may readily be distinguished from it by the smaller and more approximate ocelli, the absence of large conspicuous bristles on the thorax, the difference in the number of spines on the wing, and the more slender legs.

Thrips (Euthrips) striata, Osb.

Can. Ent., Vol. XV, p. 155.

Thrips inequalis, n. sp.

Female: Length, 88 mm.; yellow; style and distal portion of antennal joints, 3-6, black; joint 6 distinctly annulated toward apex; posterior angles of prothorax with a single bristle; lateral bristles on dorsum of penultimate segment of abdomen twice as long as intermediate pair.

Head, broader than long, contracted at posterior border, occiput forming not more than one-half of its dorsal surface; genæ uniformly full; eyes of medium size, moderately prominent, distinctly pilose; vertex uniformly tumid at anterior margin, becoming transversely convex and descending toward posterior margin; ocelli subapproximate; front, above insertion of antennæ, longitudinally elevated along median line.

Antennæ subapproximate; the two basal joints stout, subequal; the second barrel-shaped, more than one-half as long as succeeding; joints 3-6 subequal in length and less elongate than in *T. tritici*; joints 3 and 4, thick, irregularly turbinate, gibbous below insertion of sensorial spines; joint 5, smaller and more regular in shape; the remaining joints form an elongate oval; joint 6 has a distinct articulation on distal half, similar to the annulation on the sixth antennal joint of *T. striata*, Osb.; this may be an indistinct annulation, in which case the antennæ would be properly considered nine-jointed, three of the joints forming the style; the ultimate joint is nearly cylindrical and longer than the penultimate, which is of the same length as that portion of the joint 6 between the annulation and the apex; the joints are furnished with a few medium-sized bristles or stiff hairs, which become finer toward the distal end of the antennæ; sensorial spines as in *T. tritici*.

The prothorax is one and one-half times as long as the head, equally as broad at anterior border and about one-third broader at posterior border. The disc is convex, rather indistinctly striate and sparsely set with stiff, blackish hairs or bristles, which are almost entirely wanting on median portion, and most numerous near lateral and posterior borders. Posterior angles with a single long bristle.

The disc of the mesoscutum is convex, finely striate, elevated at posterior border, provided with a single short bristle near each lateral angle, two on disc and two on posterior margin. The scutellum is trapezoidal, gently sloping from the very small elevated area near base toward posterior and lateral margins; on the basal margin are two widely separated and two short approximate bristles.

The abdomen is ovate, resembling that of *T. tritici*, Fitch, in an arrangement of bristles, except that the median pair on penultimate segment is but one-half as long as those on either side.

Legs, especially femora and tibiae, thinly covered with short, coarse hairs which are replaced by bristles at apex of anterior and intermediate tarsal joints; inner margin of posterior tibiae feebly spinose; its apex and apex of its tarsal joints terminating in spines; anterior femora moderately dilated.

Anterior wings nearly attain tip of abdomen: veins heavy; inner marginal vein very distinct; costal fringe rather heavy; costal vein bears from 24-28 spines; radius, 18-19, those on basal half of vein separated into two groups of four each, the intervals between the rest growing wider toward the distal end of the vein; cubitus, 10-11; anal, 5; anal cell, 1.

Color yellow, deeply tinged with orange on thorax and abdomen, faintly dusky along median line of thorax and abdomen; head and two basal joints of antennae, whitish; proximal portion of joints 3-6, dusky; remainder of antennae and spot near apex of tarsi, black; eyes, red-brown; ocelli, pale yellow; inner margins, orange-red; spines and bristles blackish; anterior wings and fringes tinged with dusky yellow.

Described from a single specimen taken with *T. tritici* on aster at Ames, Iowa, September 16, 1893.

Thrips tabaci, Lind.

Schädlichsten Insekten des Tabak in Bessar. Abien., pp. 62-63. (1888.)

Thrips lactuce, n. sp.

Female: Length, 1.40 mm. General color pale yellow, with two broad diverging stripes on middle of thorax, a narrow band at base and one or more spots at sides of abdominal segments brown. Form elongate; anterior border of head convex. Antennae seven-jointed, proximal joints pale, remaining joints black. Wings variable in size. Ocelli conspicuous, placed close together near posterior margin of vertex. Spines and bristles stout, on thorax, arranged much as in *T. tritici*; the cubital spines are grouped into two series, a basal group of seven, followed by three, more widely separated, on distal portion of vein.

Head scarcely broader than long; outline seen from above semioval; occiput, feebly striate, one-half the length of the head, with shallow, longitudinal furrow each side behind the eye; genae, broad, full, prolonged posteriorly; vertex elevated, convex between the eyes, ascending and expanding towards apex, front margin arcuate; ocelli conspicuous, remote from anterior border of vertex, inner margins heavy, contiguous in front; ocellar area elevated; ocellar bristles of medium size; eyes, moderate, pilose; a row of bristles on front, beneath insertion of antennae, is partially visible from above; a few microscopic bristles around orbits; antennal sockets prominent, easily seen from above; antennae approximate, seven-jointed; the intermediate joints elongate; joint 1 is one-half the length of joint 2, equal to or longer than joint 7, semiglobose; joints 2-5 are subequal in length; joint 2 is cupshaped, a little shorter but much stouter than any of the three immediately following; joints 3-5 are moniliform;

pedicel of 3 is short; joints 6 and 7 together form an elongate oval; the latter is acuminate at apex two-fifths the length of the former and terminates in two or three long slender hairs; surface of all the joints set with minute appressed hairs and furnished with a few bristles which are arranged in a preapical ring on joints 2-5, and on remaining segments are replaced by slender hairs; sensorial spines on joints 3, 4 and 6, distinct.

The prothorax is subquadrate, a little longer and wider than preceding segment; posterior angles nearly rectangular; posterior border margined; surface nearly smooth and, with the exception of two discal areas, covered with coarse, stiff hairs which are largest near lateral and posterior borders; two short bristles at each anterior angle and four longer ones near front border; two large, strong, subequal bristles at each posterior angle, two of moderate length on hind border, and a similar one on disc near each posterior angle.

The surface of the mesoscutum is apparently smooth, its posterior discal portion only moderately elevated, provided with two small bristles; two similar bristles occur on the posterior border, and one at each lateral angle. The metanotum is very short. The scutellum is obtusely carinated, its surface longitudinally striate, provided with two approximate submarginal bristles on anterior portion of disc, and two, more widely separated, on basal margin.

Abdomen is quite uniform in width, convex above, striate at base and at sides; base slender; apex short, conical; segments constricted, bearing a few stiff hairs on dorsal and ventral surfaces and a few bristles at sides; both hairs and bristles become stronger on anal segments, where the latter are arranged in two rings.

Legs, especially posterior pair, slender; anterior femora but slightly expanded; hind tibiæ spiny on inner margin, terminating in three strong spines, joints of their tarsi also furnished with apical spines; entire surface bristly, especially at apex of intermediate and anterior tibiæ.

Wings varying in size from rudimentary to fully developed; the anterior pair slightly dusky, posterior pair hyaline; in fully developed wing the cilia on costal border of each pair is short and sparse, on posterior border longer but not very heavy; venation of anterior wings rather weak; anterior and posterior basal cross veins present, but not distinct; costal vein furnished with 18-21 spines; cubitus, 10; radius, 10-11; anal, 5; anal cell, 1; spines on cubitus are arranged in a basal group of seven, followed by three more widely separated on distal end of vein; longitudinal vein of posterior wings incrassate at base, not quite attaining tip of wing.

Color usually pale yellow, deeper on thorax and legs, the latter frequently dusky; head and proximal joints of antennæ white, intermediate joints brownish-black at base, the rest of the antennæ deep black; occiput often tinged with yellow, sometimes dusky; eyes dark red-drown; ocelli yellow, inner margins brick-red; prothorax at margins, disc of mesonotum, pleuræ, except upper portion of mesopleuræ in front, narrow medium stripe on scutellum, pale; two spots or patches on prothorax, sometimes diffuse and coalescing sometimes nearly or quite obsolete, two broad, approximate stripes on scutellum, diverging slightly and extending outward and backward in a broken and interrupted line to lateral margin, upper portion of mesopleuræ in front, brown; abdomen somewhat dusky, more or less pale

at sides and toward apex; narrow basal band on segments 2-7, expanding laterally and broken up into spots, one of which is more conspicuous than the others, brown.

Femora and tibiae dusky or brownish on upper surface, pale on lower surface and at base, the latter also pale at tip; anterior wings dusky yellowish; spines brown.

By its seven-jointed antennae. *T. lactucae* is allied to *T. tabaci*, Lind., but it is more heavily marked with brown; the color of the intermediate joints of the antennae is darker; the antennae and the ocelli more approximate; the ocelli more conspicuous and farther removed from the anterior margin of the vertex; the prothoracic bristles larger and less uniformly distributed, being entirely absent from two discal areas; those at posterior angles, longer; proximal spines on cubitus arranged in a single group.

Described from numerous specimens taken on wild lettuce in October, November and March, at Ames, Iowa.

T. lactucae bears some resemblance to *T. tritici* in size and general color, from which it may be easily separated by the fewer antennal joints, less rectangular head, less widely separated ocelli, absence of long bristles at anterior angles of prothorax, less numerous cubital spines and their arrangement in groups, absence of spines at apex of intermediate and anterior tibiae and inner margin of posterior tibiae.

From *T. striata* it may be known by the difference in number of antennal joints, absence of annulation on sixth joint, presence of longer and more numerous spines and bristles.

Thrips pallida n. sp.

Female: Length 1.12 mm. Color varying from white to pale yellow. Antennae, beyond basal joints, more or less dusky. Head small, eyes large. Anterior wings partially trifasciate. Bristles on anterior portion of body long and slender. Prothorax characterized by the presence of a long bristle on the middle of each lateral margin in addition to those at anterior and posterior angles.

Head small, about as long as broad. Occiput very short, not more than one-third the length of the head. Eyes dark red-brown, very large and prominent, sparsely and feebly pilose. Vertex narrow, elevated, transversely convex, ascending toward the anterior margin, the latter arcuate. Ocelli in middle of vertex, nearly colorless, their inner margins white, contiguous anteriorly. Ocellar bristles as long as the head. Front prominent, bearing a row of recurved bristles above insertion of antennae. Mouth parts short, nearly symmetrical.

Antennae approximate; the two basal joints the stoutest; joint 1 semi-globose, one-half the length of joint 2; the latter is stouter than the former, barrel-shaped, equal in length to joint 5, and a little shorter than joints 3 or 4; these are robust, subequal in length and broadly obovate, the pedicel of joint 3 is short and slender; joint 5 is oval and less robust than the two immediately preceding; the remaining joints are sessile, together form

an elongate oval; joint 6 is longer than any other joint; joints 7 and 8 are short and of equal length, base of former narrower than apex of 6; apex of 8 is lanceolate. Bristles and hairs are of equal size, and arranged much as in *T. tritici*. The long sensorial spine on outer side of joint 6 originates below the middle of the joint.

The prothorax is convex; its sides converge cephalad; its surface is nearly smooth, with a double median transverse groove or double impressed line and a few short and several long slender bristles, the latter arranged as follows: one at each anterior angle, two on intervening space of anterior border, one at middle of each side, one near and two at each posterior angle. The mesoscutum is longitudinally convex, its surface nearly smooth, furnished with two lateral bristles directed inward, and two smaller ones on disc and on posterior border, respectively. The scutellum is subrectangular, obtusely carinated, descending toward the apex; on basal margin provided with two distinct bristles which extend nearly to apex.

The abdomen is slender at base, ovate, with few conspicuous bristles; those at apex of ultimate segment much shorter and weaker than those on preceding segment.

Legs are moderately stout, bristly; anterior femora incrassate, their tibiae stout; spines present at apex of posterior tibial and tarsal joints, on inner margin of tibiae replaced by bristles.

The anterior wings are whitish, slender, rather thin, subfasciate with three dusky spots; the first near base of anal area, the other two dividing the remainder of the wing into three subequal parts; sometimes a faint spot may be detected near apex of wing; these spots are variable in distinctness and may be obsolete; ciliae of inner margin, light; of outer margin, sparse and scarcely longer than the spines with which they are interspersed. Radial vein is obsolete between base of wing and posterior basal cross vein, consequently it appears to originate in the cubitus. Both radius and cubitus terminate abruptly before attaining marginal vein. Cross veins connecting costal and cubital veins are obsolete. The costal vein bears from 15-20 spines; the cubital, 10; radial, 5; anal, 4, and posterior marginal vein 1, placed opposite the posterior basal cross vein. The posterior wings are hyaline; proximal end of longitudinal vein incrassate.

Male. Length .97 mm. Smaller than the female, but very similar in distinctive characters. Apex of abdomen is bluntly conical, less truncate than in male of *T. tritici*, partially trilobate, the lateral lobes are very narrow, shorter than the middle lobe, and terminate in a single long bristle. Penultimate segment terminates in a row of short sparse bristles, on dorsum, and single long spine on each side.

Described from ten females and seven males. Taken on bean and elm at Ames, Iowa; on blackberry at Belle Plaine, Iowa, and on hop at Barraboo, Wis.

Thrips pallida is a well marked species and is readily separated from the other species included in this paper by the small head, the presence of a bristle on middle of lateral margin of prothorax, the feeble armature of inner margin of posterior tibiae and the number of spines on the front wings.



Beach, Alice M. T. 1897. "Contributions to a knowledge of the Thripidae of Iowa." *The Proceedings of the Iowa Academy of Science* 3, 214–227.

<https://doi.org/10.5962/bhl.part.14877>.

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