

SYSTEMATICS OF TWO CLOSELY RELATED SPECIES OF THE GENUS *THRIPS* (*T. FLORUM* AND *T. HAWAIIENSIS*)

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The species *T. jlorum* and *T. hawaiiensis* under the genus *Thrips* have been collected, identified and described in detail with new characters for identification along with illustrations. A key is provided for the separation of these closely related species.

Key words: thrips, *florum*, *hawaiiensis*

INTRODUCTION

Thrips hawaiiensis (Morgan) is an economically important pest species affecting various crops world wide. It is very closely related to *Thrips jlorum* Schmutz. For more than 80 years these species have been confused with one another. The identification of the nominal species *T. hawaiiensis* and *T. jlorum* poses complex taxonomic problems because of the difficulty in finding stable structure features for separating them. These are widely distributed species with little work on large populations.

The *T. hawaiiensis* complex shows striking sexual dimorphism in body colour. The females are dark brown and rarely bicoloured only in *hawaiiensis*. Although workers tried to separate these two species but the characters used were less conserved. The nominal species *hawaiiensis* (Morgan) and *florum* Schumutz were treated separately until Ananthakrishnan and Jagadish (1966) synonymized *hawaiiensis* under *florum*. However, Sakimura (1966) established *hawaiiensis* as the senior name. Nakahara (1985) distinguished *florum* and *hawaiiensis* principally on the basis of the sculpture around the anterior pair of CPS on mesonotum known in *hawaiiensis* but absent in *florum* while Palmer (1992) did not use this character for separating these species. The characters she referred to were POS 2 minute and much smaller than 1 and 3 in *florum* and POS 2 equal to 3 in *hawaiiensis*. Nakahara (1994) revised the work on *jlorum* and *hawaiiensis* and used 4 more characters for separating the *hawaiiensis* complex.

The newly discovered conserved characters (Bhatti, 1999) in the chaetotaxy of wings and pronotum have been found more ultimate in characterization of species. During the present study, these characters in samples of *Thrips florum* were found to be homogeneous (chaetotaxy of wings and pronotum).

The *Thrips hawaiiensis* complex is thus reinterpreted to include *hawaiiensis* and *florum* and the present investigation is one more step in understanding this group and underlines the need to extend the study to more populations.

MATERIALS AND METHODS

Populations of thrips were collected during 1996-1998 from various crops, vegetables and ornamental flowers by dusting them on white paper sheet. The specimens were placed in 70% alcohol containing a drop of glycerine. The slides were prepared according to Palmer et al. (1992). The thrips with their antennae, wings and legs expanded were mounted in Hoyer's medium and coverslip was placed. For identification terminology of Bhatti (1980); Palmer (1992); Palmer et al. (1992) and Bhatti (1999) was followed. Illustrations were made by projecting the specimens on 21 inch colour television through Swift camera fitted microscope M 3300-at various magnifications of 40X, 100X and 400X.

Abbreviations: Body length (BL); head length (HL); head width (HW); antecellar setae (AOS); interocellar setae (IOS); postocular setae (POS); ocellar triangle (OT); antennal segment number (An); mouth cone length (MCL); prothorax length (pro. L); prothorax width (pro. W); anteroangular setae (Aa); anteromarginal setae (Am); mid lateral setae (MI); posteroangular setae (Pa); posteromarginal setae (pm); pterothorax (Ptero.); mesothorax (Meso.); metathorax (Meta.); metanotal sculpture (MNS); median metanotal setae (MMNS); fore wing (FW); hind wing (HW); fore wing costal setae (FWCS); fore wing fore vein setae (FWFVS); fore wing lower vein setae (FWLVS); fore wing anterior fringe of hairs (FWFH ant.); fore wing posterior fringe of hairs (FWFH post.); hind wing anterior fringe of hairs (HWFH ant.); hind wing posterior fringe of hairs (HWFH post.); campaniform sensilla (CPS); scale setae (SS); tarsus (Tar.); tibia (Tib.); femur (Fem.); abdomen length (Abd.L); abdominal segment (Abd. n); ovipositor (Ovi.).

RESULTS AND DISCUSSION

The key has been constructed on the basis of new characters for identification.

Key to the closely related species of genus *Thrips*.

1. Mesonotum with anterior sculpture area; fore wings with basal discal setae shorter than apical venial setae..... *hawaiiensis* (Morgan)
2. Mesonotum without anterior sculpture area; fore

wings with basal discal setae longer than apical
veinal setae Florum Schmutz

Thrips florum Schmutz: Female (Macropterous) uniformly brown, with legs somewhat paler. Antennal segment 3 yellow. Eyes black; ocelli with reddish pigmentations. Fore wings brown somewhat paler at base.

Head: Small, cheeks arcuate. IOS outside the OT; AOS minute; POS 1 and 3 longer than the remaining (Fig. 1a). Antennae 7-segmented, ~ and 4 with forked sense cones, with 6 and 7 rows of microtrichae. Head with parallel transverse striae.

Thorax: Pronotum with none of the discal setae especially developed except the sublateral which is somewhat prominent (Fig. 2a); lateromarginal setae similar to discal setae, Pm 1 slightly longer than Pm 2 and 3. Pronotum with transverse striae occupied by unsculptured 8 spots (Fig. 2a). Pa outer 85:85 µm while Pa inner 91.42 µm. Mesonotum anteriorly with unsculptured area around CPS (Fig. 3a). Metanotal sculpture longitudinal striated with MMNS anterior, longer than lateral; CPS present (Fig. 3a). Fore wings with basal discal setae of clavus longer than apical veinal setae, the latter shorter than subapical veinal; base with seta 4 of radius longer than the remaining (Fig. 4a); FWCS 28, FWFVS 7+3 and FWLVS 12.

Abdomen: Abdominal sterna 3-7 with 12 accessory setae arranged in line medially; Pm setae slightly longer than accessory setae. T₈ with comb complete and of broad based microtrichia (Fig. 5a), T₇ with ctenidia containing dotted microtrichia (Fig. 5b); T₇ with major seta equal to those on T₁₀ the latter not completely split and more or less pointed.

Bhatti (1999) used the characters of pronotum and wings and found more accurate for separating *Thrips florum* from *T. hawaiiensis*. These characters have been used in the present studies and found suitable, moreover the microtrichae on ctenidia in tergum 8 have been observed for the first time and found to be in the form of dots. This character has not been reported either by Bhatti or by Palmer. While comparing this character with that, in *T. hawaiiensis*, it has been observed that microtrichae are more prominent on ctenidia of tergum 8. All other characters are largely similar to the published description of Palmer (1992) of this species, except for the following differences:

All legs pale yellow; abdominal sternite 2 with 4 setae, tergite 2 with 3 lateromarginal setae.

Measurement (µm): 1: B.L. (1308.00); H.L. (145.70); H.W. (202.84); A.n. L. (28.57; 39.99; 65.71; 59.99; 45.71; 62.85; 18.57); Pro. L. (179.99); Pro. W. (245.70); Pa L. (85.71); Ptero. L. (303.30); Meso. W. (303.30); Meta. W. (262.86); MMNS.L. (62.85); FWL. (667.26); HWL. (566.16); FWFH ant.# (16); FWFH post. # (63); FWCS# (28); Fw.FVS# 910); (7+3); FWLVS# (12);

	Pro	Meso	Meta
Tar.L.	71.42	79.99	88.56
Tib.L.	159.99	128.56	199.99
FemL.	165.70	128.56	165.70
Abd. L. (707.70); Abd. W. 5th (303.30); Ovi. L. (232.53); Abd. 9 & 10th L. (121.32).			

Material Examined: Faisalabad 1~, 15-IX-1996 on cotton (*Gossypium hirsutum*) and recorded for the first time from Pakistan.

Thrips hawaiiensis (Morgan): Female body colour dark brown. Head and thorax dark orange brown. Eyes black; ocelli blood-red. Antennae uniformly dark, except paler 3rd segment. Pterothorax dark reddish-brown. Legs light brownish, with distal ends of tibiae and tarsi paler. Fore wings dark throughout or becoming slightly paler at base. Abdomen entirely dark brown.

Head: Broader than long, with distinct transverse striae; cheeks with prominent crenulations, arched inward, forming a slight constriction behind eyes; ocelli equidistant from each other; postocular 1st and 2nd pair prominent, inserted behind each hind ocellus (Fig. 1b). Antennae 7-segmented, segments 3, 4 and 6 equal, the latter not distinctly thinner than 3, without specially developed long setae, style 1-segmented, 3 and 4 well-developed with forked sense cones; Mouth cone long, reaching base of prosternum. Thorax: Prothorax distinctly broader than long, its general chaetotaxy strong, with two pairs of strongly developed, long setae at each posterior angle, 3 pairs of posteromarginals, the inner pair being the largest, disc with numerous setae; 3 pairs of setae fairly developed i.e. 2 pairs of anterosubmarginal setae and 1 pair of sublateral seta (Fig. 2b); lateromargin with stouter and longer setae. Pterothorax 1.33 times longer than prothorax, mesescutum transversely striated with sculptured area around CPS, with one pair of median setae; metascutum sculptured, anteriorly made up of transverse lines, and just beyond this with a few reticulations, 2 pairs of metascutal setae inserted marginally, inner pair about twice as long as the outer; CPS present (Fig. 3b). Legs similar, provided with bristles, hind tibiae with one pair of stout spurs at apex. Fore wings broad, with well-developed setae, 29 FWCS, 10-11 FWFVS (8 basal, one middle and 2 distal), 15 FWLVS setae, fringe cilia wavy; scale with 4 anteromarginal setae, basal discal setae shorter than the apicalveinal setae (Fig. 4b), while apical veinal seta longer than the subapical seta; seta # 4 of radius from base equal to seta # 5 on fore wing (Fig. 4b).

Abdomen: Abdomen long, gradually broadening from base to 5th segment, thereafter narrowing towards posterior end, with well-developed lateral setae, segment 2 with a basal dark line, 3-7 with a dark transverse line slightly posterior to anterior margin; tergum B with a complete comb, short

and irregular at posterior margin (Fig. 6a); sterna 3-7 with accessory setae (Fig. 6b), arranged in a row running across middle, 2 with only 2 setae. Ovipositor well-developed. According to Bhatti (1980), the ovipositor in this species does not project distally beyond the end of abdomen and the antennal segments 5-6 are of dark brown colour; The specimens from the Punjab conform to Bhatti's definition except that some females have their ovipositor projecting beyond the end of abdomen. It may be concluded that the character of ovipositor is variable and only the colour of the antennal segments seems to be more reliable. Recently new characters (Bhatti, 1999) for classifying confused species of *Thrips* (*hawaiiensis* and *florum*) have been used. He has found that the pronotal anterosubmarginal and sublateral, basal discal and apical veinal setae of scale and fore wing seta 4 and 5 of radius can be best used in separating these two species.

The females collected are largely in agreement with the published descriptions (Palmer, 1992; Saeed and Yousuf, 1994; Bhatti, 1999) but differ from the descriptions of this species given by Ananthakrishnan and Sen (1980; Sen et al. (1988) in the following characters:

Antennal segments 4-5 brown; fore wing bases paler with lower vein setae 15.

Measurements (J.Lm) 11 : B.L. (1569.75 ± 9.91); H.L. (160.35 ± 0.58); H.W. (223.19 ± 0.53); IOS.L. (43.34 ± 0.39); POS1.L. (32.04 ± 0.54); POS2.L. (12.10 ± 0.55); POS3.L. (17.81 ± 0.80); POS4.L. (11.84 ± 0.51); POS5.L. (20.29 ± 0.32); AOS.L. (18.00 ± 0.52); ALL. (35.13 ± 0.62); A2.L. (43.24 ± 0.40); A3.L. (66.08 ± 0.32); A4.L. (66.08 ± 0.32); A5.L. (55.09 ± 0.68); A6.L. (66.12 ± 0.44); A7.L. (20.13 ± 0.10); M.C.L. (138.05 ± 0.75); Pro.L. (171.94 ± 0.46); Pro. W. (257.96 ± 0.61); Ptero. L. (324.04 ± 0.43); Meso. W. (313.89 ± 0.36); Meta. W. (304.35 ± 0.71); MMNS.L. (77.87 ± 0.75); FWL. (789.19 ± 0.54); HWL. (708.20 ± 0.47); FWFH ant. # (32); FWFH post. # (80); HWFH ant. # (23); HWFH post. # (54); FWcS # (29); FWFVS # (8+1+2); FWLVS # (15);

	Pro	Meso	Meta
Tar. L.	92.04 ± 0.47	86.93 ± 1.55	100.10 ± 0.09
Tib. L.	163.25 ± 0.30	149.30 ± 0.44	226.29 ± 0.41
Fein. L.	192.20 ± 0.52	160.16 ± 0.39	215.17 ± 0.63
Abd. L.	(890.32 ± 0.47)		(149.26 ± 0.48)
Abd. W.	$5th (3f3.85 \pm 0.47)$		$Ovi. L. (292.32 \pm 0.61)$

Material Examined: Qadirpur 50~ 05-VI-1997; Adilpur 38~, 06-VI-1997; Tando Ghulam Ali 18~, 10-VI-1997; Islamabad 22~, 14-I-1996.

Habitat: Rose (*Rosa indica*); Chrysanthemum (*Chrysanthemum mortfolium*); Mango (*Mangifera indica*); Jaman (*Sysygitin cumini*); Maize (*Zea mays*); Carrot (*Daucus carota*); Petunia (*Petunia hybrida*); Water-melon (*Citrullus vulgaris*); Onion (*Allium cepa*); Jasmine (*Jasminum sambac*).

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