

First Record, Distribution and Morphology of Psyllid, *Trioza fletcheri* minor Crawford, 1912 From Punjab Province of Pakistan

Imran Bodlah,* Muhammad Adnan Bodlah, Muhammad Naeem, Tasleem Akhter, Muhammad Farooq Nasir and Muhammad Tariq Chaudhry

Department of Entomology, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan

Abstract.- *Trioza fletcheri* minor Crawford, 1912 is recorded for the first time from various districts of Punjab Province of Pakistan. A taxonomic note along with distribution range in Punjab is presented. Morphology of *Trioza fletcheri* minor (adult as well as various nymphal instars) along with seasonal occurrence has been described. It is illustrated using micrographs and line drawings.

Key words: *Trioza fletcheri*, Psyllid, sap sucking insects.

INTRODUCTION

Psyllids belong to order Hemiptera and comprise a group of about 3000 species (Hodkinson, 2009) along with 6 families (Burckhardt, 2009). They are phytophagous sap-sucking insects, majority are narrowly host-specific and predominantly associated with perennial dicotyledonous angiosperms (Hodkinson, 2009). Economically these are considered as pest on one side both directly by sap sucking resulting in galling, leaf curling and sooty mould development and indirectly by acting as vector of virus like diseases (Aubert, 1987). On the other side they have been proved as bio-control agents e.g. tested as bio-control agent of mosquitoes (mosquito psyllids) in Australia (van Klinken *et al.*, 2003; Donnelly, 2002).

Genus *Trioza* Forster, 1848 (Triozidae: Hemiptera) is a morphologically very diverse genus of psyllids worldwide in distribution (Hodkinson, 1986). This genus is characterized dorsally by head and thorax glabrous or with few scattered hairs; genal cones not clavate in dorsal view, broadest at base; forewing without colour pattern, costal margin convex in apical third (Hodkinson and White, 1979). A number of species belonging to this genus have been recorded from various parts of the world like 52 species from Oriental region (Hodkinson, 1986), 5 from Taiwan (Kuwayama,

1931), 13 from Serbia (Jerinić-Prodanović, 2010), 20 from Britain (Hodkinson and White, 1979), 56 from Neotropical region (Hodkinson and White, 1981), 27 from new world (Crawford, 1914), 49 from afro-tropical region (Hollis, 1984) and 17 from Australia (Percy *et al.*, 2006). In neighbors, Raman *et al.* (1997) reported that *Trioza fletcheri* minor, induces leaf galls on at least five species of *Terminalia* in the Indian subcontinent. No work has been done on this genus in Pakistan. Hence various surveys were conducted during 2009-2010 for the determination of biodiversity of psyllids in Punjab.

MATERIALS AND METHODS

Leaves bearing galls were collected from *Terminalis arjuna* during 2009-2010 from various districts of Punjab Province. They were put in plastic bags and placed in laboratory at ambient temperature for the emergence of adult psyllids. An optimum humidity level of 65-75 percent was maintained in the laboratory for the emergence of various nymphal instars from the leaves. Upon the emergence of adults after 2-3 days, adults were placed dry and a few in 75% ethyl alcohol in small glass vials. Adults were also collected by net sweeping of the plants from various districts of Punjab. Three methods for mounting and storing of the psyllids were followed *viz.* dry collection, spirit collection and slide mounted collection. Dry specimens were mounted on cardboard points using water soluble glue. Psyllids for dissection were placed in 15% potassium hydroxide for 24 h, washed twice for 30 min in distilled water,

* Corresponding author: imranbodlah@gmail.com
0030-9923/2012/0005-1361 \$ 8.00/0
Copyright 2012 Zoological Society of Pakistan

dehydrated by passing through a series of 30%, 50%, 70%, 90%, 100% alcohol (20 min in each) and cleared in clove oil. Specimens were then dissected in a drop of clove oil on a microscope slide and mounted in Canada balsam. For dissection, standard procedure of Hodkinson and White (1979) was followed. Galls were dissected under microscope and various nymphal instars were obtained. Adults and nymphs were identified under Nikon™ microscope and coloured photographs were snapped. Line drawings were also prepared. Measurements were taken with the help of stage and ocular micrometer. Morphological terminology follows mostly Hollis (1984) and Ossiannilsson (1992).

RESULTS AND DISCUSSION

Trioza fletcheri minor Crawford 1912

Crawford, D. L. 1912. *Rec. Indian Mus.* 7(5): 434-435. Pl. xxx, Fig. R. (*Terminalia arjuna*; Pusa. Bihar)

Ramakrishna Ayyar, T.V. 1924. *Rec. Indian Mus.* 26(6): 624.

Mathur, R, N. 1935. *Indian Forest Rec.* 1(2): 64-65 (Biology; New Forest).

Beeson, C. F. C. 1941. *Forest insects*, p. 781.

Saksena, R. D. 1944. *ft. R. Asiat. Soc. Beng.* 10:123.

Mani, M. S. 1948. *ft. R. Asiat. Soc. (Sci.)* 14(2): 80, 112.

Mani, M. S. 1959. *Agra. Univ. f. Res. (Sci.)* 8(2): 170-171, 174-173.

Taxonomic note

Body light yellowish-brown, ranging from 1.75-1.81mm. Head narrower than vertex; 2.45 times wider than longer and sparsely pubescent (Fig.1A). Antennae 0.55-0.58mm, longer than width of head, ten-segmented, antennal scape 1.5 times the length (Fig. 1C). Vertex slightly broader than long, with a deep fovea posterior to center and a prominent, longitudinal sulcate impression on each side of median line, ocellar and lateral regions near the eyes swollen, gradually rounded anteriorly, posterior margin slightly emarginated, anterior margin invaginated at point of excision; anterior ocellus visible in front; genal cones small, about one-fifth as long as vertex, much below the level of vertex. Ocelli 0.22mm separated; about one time longer than wider. Eyes dorso-laterally 1.61 times longer than wider.

Thorax arched, sparsely pubescent, finely

rugulose; prothorax convex, roof-shaped, descending, with two foveal impression on each lateral side; prescutum broader than long, broadest posterior to center, narrower anteriorly, angulate laterally and on posterior margin; scutum much broader than long, slightly shorter than prescutum, weakly depressed dorso-medianally, angulate laterally, posterior margin weakly invaginated along scutellum; scutellum trapezoid, broad anteriorly and narrow posteriorly, about twice as broad as long. Legs slender, pubescent and armed with minute points. Forewings small hyaline, 2.7 times longer than wider, subacute at apex, veins R, M, Cu arising from the same point, basal vein longer than Cu, radius short, shorter than cubitus, marginal cells subequal, first marginal longer and broader than second, M₁₊₂ meeting just before apex; veins armed with microscopic setae (Fig. 2A).

Abdomen broad, 1.47 times longer than thorax, sparsely pubescent and also beset with minute points, pubescence longer on sternites. Male genital segment smaller than abdomen (Fig. 2D). Anal valve somewhat as long as forceps, broad basally, sub-triangular in profile, anterior margin almost straight, lateral lobes bent inwards, upper surface armed with minute points and the apical region and lateral lobes with simple setae, marginal setae somewhat. Female genital segments smaller than abdomen, both plates sub equal, broad basally and gradually narrowed apically, armed with minute points and also beset with simple setae of varying length, setae longer in middle; dorsal plate longer than ventral, gradually sloping from base to apex, subacute at apex, apical region armed with peg-like setae; circum-anal pore ring composed of a double row of pores; ovipositor acutely pointed (Fig. 2E).

Measurements

Antennal length 0.55mm; scape length and width: 0.07 and 0.04mm; pedicel length and width: 0.04 and 0.04mm; Width of vertex between eyes: 0.28-0.29 mm; Head width and length: 0.54 and 0.22mm; Ocellar length and width: 0.04 and 0.03mm; dorsolateral length and width: 0.21 and 0.13mm; pronotal width: 0.33mm; thorax length: 0.62mm; wing length and width: 0.79 and 0.29; abdomen: 1.08mm.

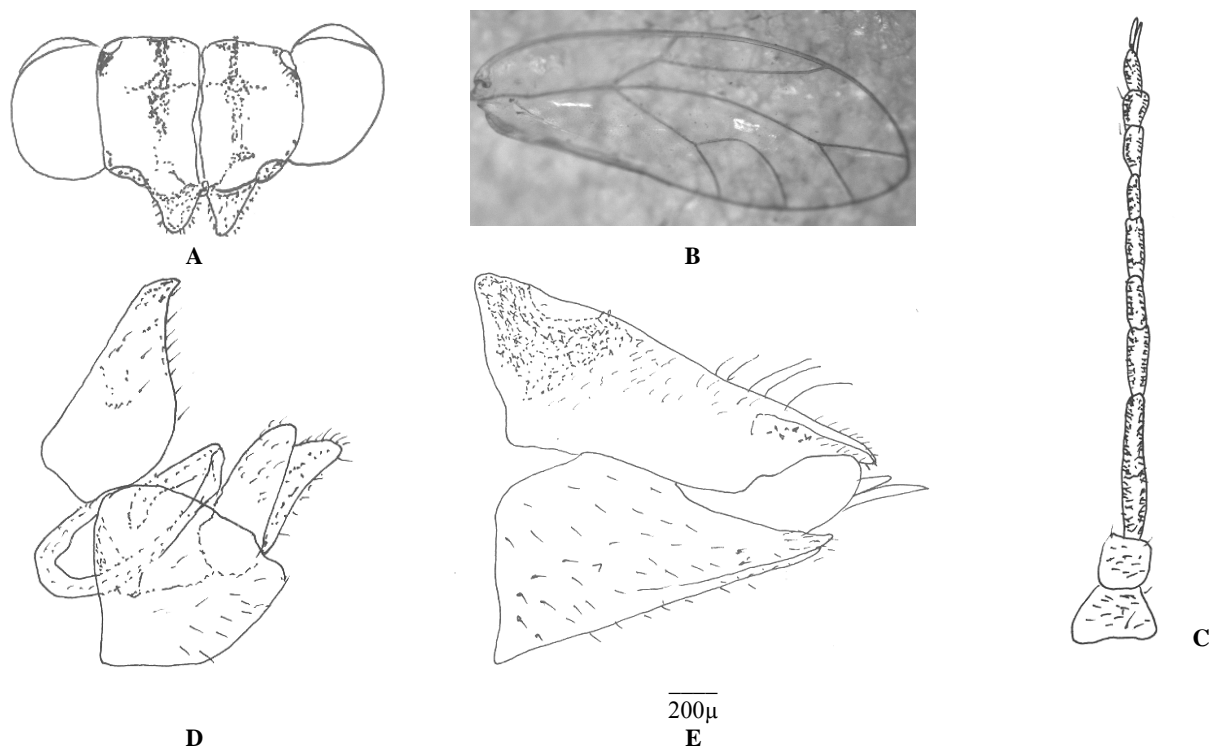


Fig. 1. External morphology of *Trioza fletcheri* minor, A, frontal view of head; B, forwing; C, antennae; D, lateral view of male genitalia; E, lateral view of female genitalia.

Host plant

Terminalis arjuna

Material examined

Rawalpindi, 18-vii-09, 12♀ and 8♂; Attock, 28-viii-09, 5♀ and 2♂; Jhelum, 28-vi-2010, 9♀ and 12♂; D.G. Khan, 1-ix-2010, 14♀ and 18♂; Muzafar garh, 17-vi-09, 14♀ and 5♂; Lahore, 12-iv-09, 25♀ and 12♂; Faisalabad, 19-vi-09, 15♀ and 8♂; Khanewal, 24-vi-10, 5♀ and 8♂; Sahiwal, 18-ix-09, 10♀ and 8♂; Multan, 18-vii-09, 9♀ and 5♂; Bahawalpure, 21-vi-10, 16♀ and 8♂; Bahawalnager, 17-viii-10, 19♀ and 12♂; Gujranwala, 2-ix-09, 15♀ and 9♂; Layyah, 27-vii-09, 19♀ and 12♂; Mianwali, 1-vii-2010, 9♀ and 2♂; Islamabad, 21-vi-09, 27♀ and 18♂.

Nymphal stages (Fig. 2A-E)

Fifth stage: Body oval, 1.6 mm (on slide). Antennae ventral, about 0.27 mm long, apparently ten-segmented, bearing four sensorial, four apical segments imbricate and darker, terminal

segments with two minute apical spines. Legs small, sparsely bearing small, simple setae, femora not reaching margin of body; trochanters weakly represented; tibio-tarsal articulation distinct; each tarsus with long golf-club seta; claws absent, pulvillus in the form of a circular pad.

Fourth stage. Body 0.83mm-0.85mm. Resembling the fifth stage, except in being smaller in size; antennae apparently seven-segmented, bearing three sensorial; tibio-tarsal articulation absent.

Third stage. Length 0.55mm. Resembling the above stage, antennae apparently five segmented bearing two sensoria; wing pads smaller.

Second stage. Resembles the above stage with minor size difference.

First stage. Length 0.22mm. Antennae apparently three segmented, bearing one sensorium, apical setae very long; dorsum for the most part sclerotic; having few marginal setae; wing-pads knob-like, bearing one or two seta-setae; abdominal segments distinct.

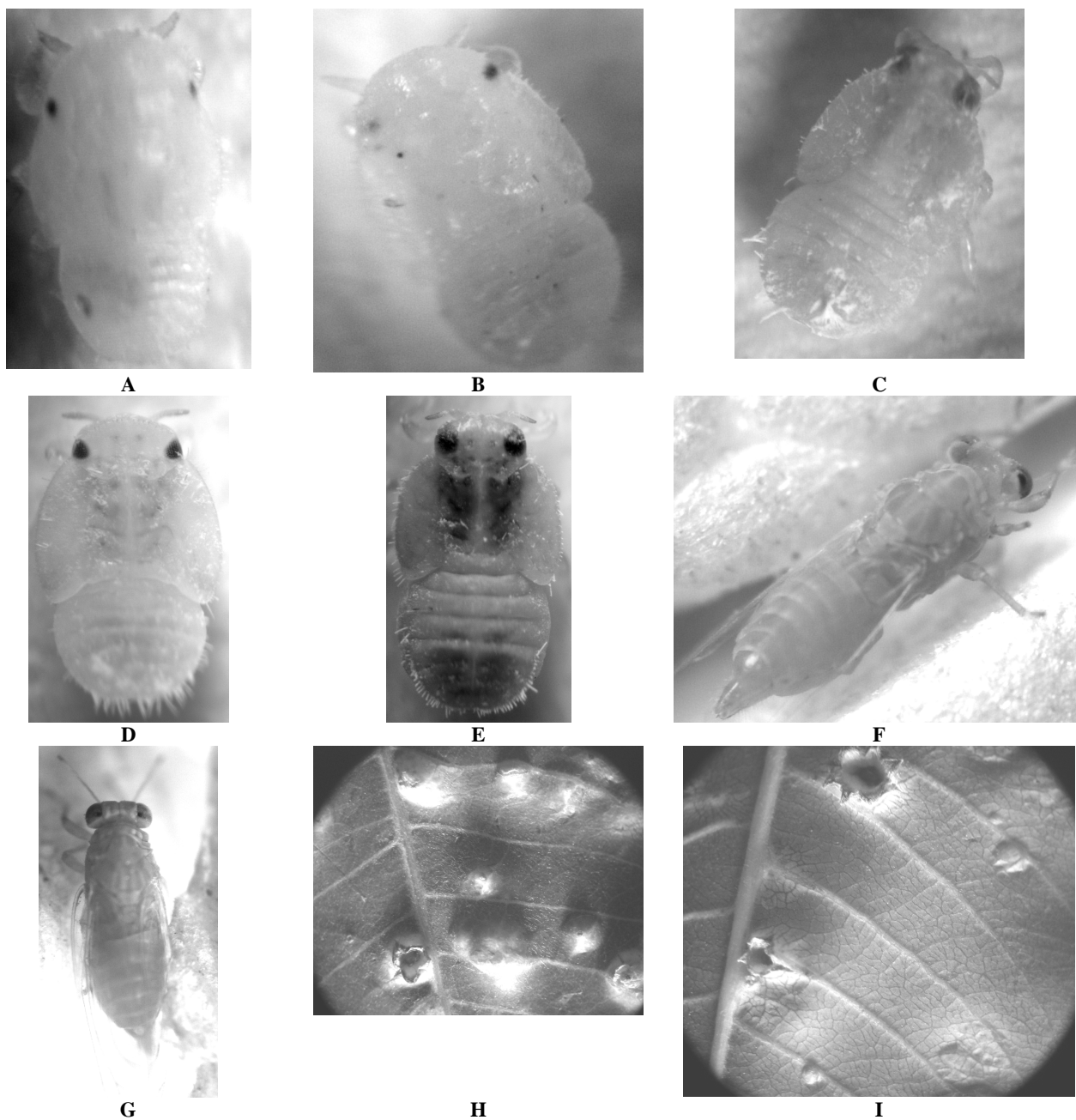


Fig. 2. Various life stages of *Trioza fletcheri* minor and leaf galls; A, 1st instar; B, 2nd instar; C, 3rd instar; D, 4th instar; E, 5th instar; F, green adult; G, dark colored adult; H, brown galls on the leaf; I, green galls on the leaf.

General discussion

The specimens collected from Pakistan were compared with the description given by Mathur (1975) and found to be similar. Male and female of this species can be differentiated by the differences in genitalia (Fig. 1D,E). Various

characters of male and female adults like coloration at emergence and at maturation agrees with the observation of Raman *et al.* (1997). Host plant in Pakistan for this psyllid is *Terminalis arjuna* while in India it has been reported from *T. arjuna* and *T. tomensota*. Morphology of galls at

early stages and on later stages agreed with the results of Raman *et al.* (1997).

The psyllid appear during the month of June on the fresh growth of the *Terminalis arjuna*. Their population remains from June to mid September in various districts of Punjab. During mid July various parasitoids (unknown) and hyper parasitoids (unknown) appear and control their population. In mid September, population of psyllid and parasitoids reduces and in October both hibernate. Normal field sex ratio of the psyllid is 1:1 which on later stages due to hyperparasitism is female biased. Adult psyllids initially are green but on later stages during August become darker in coloration (Fig. 2F,G). This psyllid induces leaf galls in *Terminalis arjuna*. Various nymphal instars live in the gall, which gets larger in size with the subsequent developing instars. Galls initially are greenish but later on get brownish in coloration (Fig. 2H, I).

There is still a need of research project on the determination of parasitoids (unknown) and hyper parasitoids (unknown) of this psyllid which will help to manage this pest in future.

REFERENCES

- AUBERT, B., 1987. *Trioza erythrae* Del Guercio and *Diaphorina citri* Kuwayama (Homoptera: Psylloidea), the two vectors of Citrus Greening Disease: Biological aspects and possible control. *Fruits*, **42**: 149-162.
- BURCKHARDT, D., 2009. *Fauna Europaea: Psylloidea*. *Fauna Europaea version 2.1*, <http://www.faunaeur.org>
- CRAWFORD, D. L., 1914. A monograph of the jumping plant-lice or Psyllidae of the New World. *Bull. U.S. nat. Mus.*, **85**:1-182.
- DONNELLY, G.P., 2002. The host range and biology of the mesquite psyllid *Heteropsylla texana*. *BioControl*, **47**: 363-371.
- HODKINSON, I. D. AND WHITE, I. M., 1979. Homoptera: Psylloidea. In: *Handbook for the identification of British Insects*, vol. **2**, pp. 1-98.
- HODKINSON, I.D. AND WHITE, I. M., 1981. The Neotropical Psylloidea (Homoptera: Insecta): an annotated check list. *J. nat. Hist.*, **15**, 491-523.
- HOLLIS, D., 1984. Afrotropical jumping plant lice of the family Triozidae (Homoptera: Psylloidea). *Bull. Br. Mus. nat. Hist (Ent)*, **49**: 1-102.
- HODKINSON, D., 1986. The psyllids (Homoptera: Psylloidea) of the Oriental zoogeographical region: an annotated check-list. *J. nat. Hist.*, **20**: 299-357
- HODKINSON, I.D., 2009. Life cycle variation and adaptation in jumping plant lice (Insecta: Hemiptera: Psylloidea): a global synthesis. *J. nat. Hist.*, **43**: 65-179.
- JERINIĆ-PRODANOVIĆ, D., 2010. Checklist of jumping plant-lice (Hemiptera: Psylloidea) in Serbia. *Acta Ent. serb.*, **15**: 29-59.
- KUWAYAMA, S., 1931. A revision of the Psyllidae of Taiwan. *Ins. Mats.*, **5**: 117-132.
- MATHUR, R.N., 1975. *Psyllidae of the Indian Sub-continent*. The Indian Council of Agricultural Research, New Delhi, India. 429pp.
- OSSIANNILSSON, F., 1992. The Psylloidea (Homoptera) of Fennoscandia and Denmark. *Fauna Ent. Scand.*, **26**, 346.
- PERCY, D.M., TAYLOR, G.S. AND KENNEDY, M., 2006. Psyllid communication: acoustic diversity, mate recognition and phylogenetic signal. *Inver. Syst.*, **20**: 431-445.
- RAMAN, A., SINGH, R.N. AND MARYANSKA-NADACHOWSKA, A., 1997. Biology and karyology of a cecidogenous psyllid, *Trioza fletcheri* minor (Homoptera: Psylloidea) and morphogenesis of galls on the leaves of *Terminalia tomentosa* and *T. arjuna* (Combretaceae). *Ins. Mats. N.S.*, **53**: 117-134.
- VAN KLINKEN, R.D., FICHERA, G. AND CORDO, H., 2003. Targeting biological control across diverse landscapes: the release, establishment, and early success of two insects on mesquite (*Prosopis* spp.) insects [sic] in Australian rangelands. *BioControl*, **26**: 8-20.

(Received 30 July 2012, revised 27 August 2012)