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ADDITION TO THE FAUNA OF PSYLLID (HEMIPTERA: PSYLLOIDEA) IN POTHOHAR REGION OF PAKISTAN

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ABSTRACT

Psyllid fauna of Pakistan is represented by few species only. Here, a Psyllid species: *Pseudophacopteron tuberculatum* (Crawford, 1912) is recorded for the first time from Pakistan. Description of immatures and adult morphology, micrographs and biology are given to validate this new faunal record and facilitate its prompt identification. Distribution map along with notes on new distributional records of four psyllid species including *Acizzia indica* (Heslop-Harrison, 1949); *Diaphorina aegyptiaca* Puton, 1892; *Diaphorina citri* Kuwayama, 1908 and *Euphyllura pakistanica* Loginova, 1973 are provided. Ecological relationship of recorded species with ants has also been given. All collected material was identified using the most relevant and available literature.

Key words: Distribution; Immatures; New record; Pakistan

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INTRODUCTION

Members of the superfamily Psylloidea (Hemiptera: Sternorrhyncha) are phytophagous in nature with high degree of specificity toward their host plant (Hodkinson, 2009). Up till now, a total of 4000 species has been described worldwide (Ouvrard, 2020). Psyllids are economically important and thought to be responsible for sufficient economic losses (Aubert, 1987). The association between plants and psyllids initiates lerp development, gall-formation, leaf curling and plant injuries (Burckhardt, 2005). In contrast, various species of psyllid have also been described as the potential bio-control agents of mosquitoes and weeds associated with different crops (van Klinken *et al*., 2003; Donnelly, 2002).

Psyllids are the major pest problem of temperate and subtropical crops causing significant damage in economically importance crops such as Citrus, Pear, Olive, Apple, Cotton and *Pistacia* spp. (Burckhardt, 1994). However, in Pakistan *Diaphorina citri* Kuwayama, 1907 has been reported as a destructive pest in citrus growing areas of Pakistan, which cause greening disease in citrus (Khan *et al*., 2018).

Genus *Pseudophacopteron* was first erected by Enderlein in 1921 and is widely distributed in Afrotropical, Neotropical, and Oriental region with 48 described species (Ouvrard, 2020). The species of this genus are found in tropical forest ecosystem and have been considered as serious pest of economically important trees (Malenovský *et al*., 2007). Members of genus *Pseudophacopteron* can be diagnosed by the combination of following characters; forewing with high modified wing venation; vein Rs and M_{1+2} curved medially and touching together forming an X- shaped cross; vertex have ridges along median suture; antenna forming tubercles (Rendón-Mera *et al*., 2017).

Significant contribution on this genus includes; Capener (1973); Yang and Tsay (1980); Yang and Li (1983); Brown and Hodkinson (1988); Navasero (1998); Burckhardt and Van Harten (2006); Malenovský *et al*. (2007); Malenovský and Burckhardt (2009); Malenovský *et al*. (2015) and Luo *et al.* (2018). A number of species belonging to this genus have been reported from various part of the world; seven species from Brazil (Malenovský *et al*., 2015); nine from Cameron (Tamesse *et al*., 2014); one from Sri Lanka (Burckhardt *et al*., 2018); four from China (Luo *et al*., 2018) and one species from India (Burckhardt *et al*., 2018). However, little information is available on jumping plant lice of Pakistan with a most comprehensive account been a 45-year-old compilation of Mathur (1975). The nomenclature and classification used by Mathur (1975) stands outdated in modern context due to subsequent taxonomic regrouping, unrecognized synonymies and other identification confusions. Compilation of Hodkinson (1986) and Burckhardt *et al*. (2018) are much reliable to the current study. The studies were carried in Oriental Zoogeographical region and Indian subcontinent. Most of Pakistan psyllid records from Northern part of country during these studies. Prior to current study, a total of 21 species of psyllids has been recognized from Pakistan (Hodkinson, 1986; Burckhardt *et al*., 2018).

During present study we report *Pseudophacopteron tuberculatum* for the first time from Pakistan along with new distribution of some species. Moreover, distribution pattern of newly recorded species from Pothohar region of Pakistan is included (Figure 1).

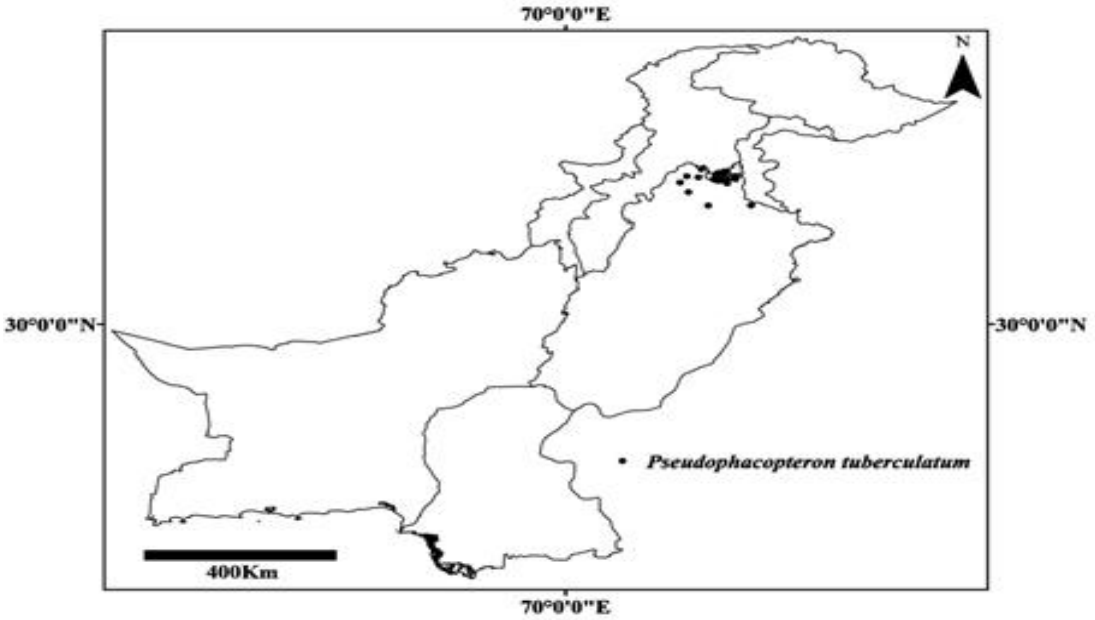

Figure. 1. Distribution pattern of *Pseudophacopteron tuberculatum* (Crawford, 1912) in Pakistan

MATERIALS AND METHODS

Study area: Pothohar

Pothohar spread an area of 22254km^2 with 350–575-meter elevation. The area is covered by Jhelum River, Indus River, Kala Chitta Range, Salt range and Margalla Hills.

Collection and Preservation: For collection of psyllids, different filed surveys were conducted in various localities of Pothohar region (Islamabad, Rawalpindi, Attock, Jhelum, and Chakwal) of Pothohar region of Pakistan during the years, 2018-2019. Standard collection procedures were followed. Specimens of adult psyllid were collected by sweep net from respective host plant. Field data of collected specimens was also recorded. Moreover, ants associated with psyllids species were also collected. Affected leaves of *Alstonia scholaris* L. were collected, then shifted to laboratory and kept at ambient temperature. Nymphs remained inside the galls but adult psyllid emerged from enclosed galls after 2-3 days, which were preserved in 75% ethanol. Microscopic slides were prepared for nymphal stages and each body parts of both sexes followed Hodkinson and White (1979). The material was put into 10% KOH, then boiled in water bath for 10-15 minutes. After boiling distil water was used to wash, then this material was passed into different concentration of ethyl alcohol. Cleared and dissect the material in a drop of clove oil with help of two entomological needles. This cleared material was mounted using Canada balsam.

Identification: Identification procedure was performed using the most relevant and available literature Mathur (1975) and Luo *et al*. (2018) with the help of NOIF XSZ 107 BN microscope. Similarly collected ants were also identified by following Bingham (1903). Morphological terminologies for description of adult and nymphal stages were followed Luo *et al*. (2018). All specimens are housed in the department of Entomology, PMAS Arid Agriculture University, Rawalpindi.

Measurements: Ocular micrometer was used to measure various body parts. All measurements are in millimeter (mm). Following abbreviation have been used in description and morphometric of immature and adult.

BL: Body length; total length of body from head to genital plate.

AL: Antennal length; total length of antennae from basal segment to apical segment.

HW: Head width in frontal view.

WL: Length of fore wing.

WW: Width of fore wing.

wL: Length of hind wing.

wW: Width of hind wing.

MPL: Length of male proctiger.

PL: Length of paramere.

DAL: Aedeagus length (distil segment length).

FPL: Length of female proctiger.

FSPL: Female subgenital plate length.

MSPL: Male subgenital plate length.

OL: Ovipositor length

Illustrations: Images of adult, their body parts and each nymphal stage were prepared with the help of Amscope 18-megapixel camera attached with same microscope. Prepared images were cleaned in Adobe Photoshop CS6 software as per requirements. Distribution pattern of newly recorded species is provided.

RESULTS

***Pseudophacopteron tuberculatum* (Crawford, 1912)**

Figures 2-3: *Pauropsylla tuberculata* Crawford, 1912. For complete taxonomic history see Luo *et al.* (2018)

Description (Adult)

Morphometric n=3 (Adult): BL: 1.32-1.87; AL: 0.5-0.61; HW: 0.59-0.64; WL: 1.29-1.42; WW: 0.75-0.95; wL: 1.23-1.27; wW: 0.60-0.63; MPL: 0.16-0.21; PL: 0.14-0.15; DAL: 0.07-0.1; FPL: 0.20-0.31; FSPL: 0.16-0.25; MSPL: 0.12-0.17; OL: 0.1-0.21.

Coloration: Adult (Figure 2 C-F). Body blackish generally, posterior margin yellow, dark red-brownish at anterior margin; antennae yellowish, apical segment IX and X black; legs more or less light in color, femur brownish, darker at hind dorsum.

Structure. Body smaller in length, about 1.32-1.53 mm for male while 1.82-2.10 in female. Head smooth and shorter, almost equal in width as thorax, with fine and sparse pubescent throughout; vertex downwardly rounded (Figure 2 A), about 1/2X as broader as longer, emarginated posteriorly, ocellar part less prominent, posterior ocelli placed at perceptible distant from eyes, anteriorly placed ocelli seen from dorsum of head, without median suture, placed just close to clypeus; genal process absent (Figure 2 A), eyes prominent, more or less triangular, in profile clypeus large and easily visible.

Antennae long and ten segmented (Figure 2 B), about 0.50-0.60 mm in length (Excluding apical setae), near to anterior ocelli, longer as width of head, apical setae distinctly longer, about the ½ of total length of antennae, segment III longest, segment IV and V almost equal in length.

Thorax with fine but sparse pubescent, strongly arched (Figure 2 C), with rugulose surface allover; pronotum shorter than rest of body, narrow, raised upward, lateral margin broad, with 2 foveae laterally (Figure 2 D); prescutum convex medially, about ½ X as broad as longer, anterior and posterior margins narrow; scutum smaller than prescutum, convex, about 2.5 times broader as longer, lateral margin angulate; scutellum having strong epiphysis dorsally.

Legs with small, white hairs generally; thick, somewhat long setae present at hind tibiae, meracanthus minute but slandered (Figure 2 E).

Fore wing hyaline smaller, almost 1.32-1.42 mm longer while 0.75-0.92 mm wider, transparent, almost square, shorter in length than width, vein R longer distinctly, vein Rs angular, finely arched and closed to vein M_{1+2}, radius somewhat longer than cubital petiole (Figure 2G), minute setae present on veins throughout. Hind wing whitish (Figure 2 H).

Abdomen with sparse pubescent; tergite 3rd and 4th produced posteriorly.

Male terminalia in profile, longer about 0.15 mm, similar to pear anteriorly, having thick and sparse setae (Figure 2 I); proctiger somewhat larger than paramere (Figure 2 I), almost 0.18-0.19 mm in length; paramere shorter, about 0.14-0.15 mm in length, downwardly sloped; hypandrium with thick and minute setae present on small tubercle; aedeagus smaller, terminal face with 0.08-0.09 mm longer, thick and oval shaped spoon like tip (Figure 2 I); subgenital plate slightly shorter than female's subgenital plate, about 0.12-0.13 mm in length.

Female terminalia in profile shorter, pubescent, having long hairs throughout, lateral and dorsal plates are not equal in length, also having slopped caudad (Figure 2 J); proctiger acute apically, larger than male's proctiger apparently, about 0.23 mm in length; subgenital plate somewhat larger in female, about 0.18 mm in length; ovipositor 0.5X shorter than proctiger.

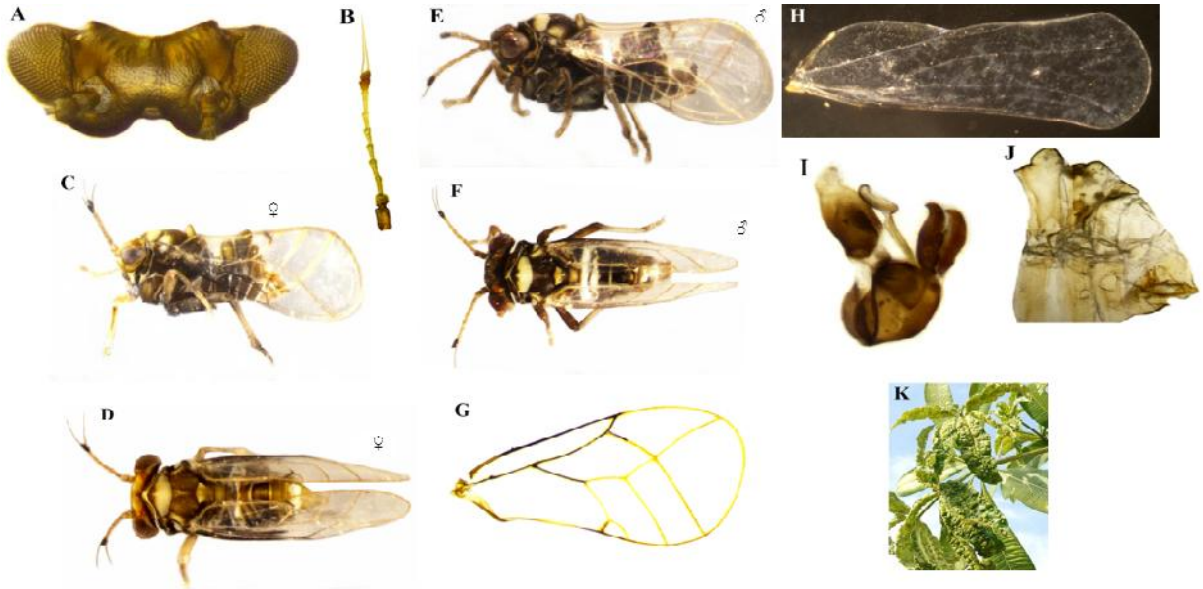

Figure. 2. *Pseudophacopteron tuberculatum* (Crawford, 1912) (A-K). (A) Head in frontal view (B) Antenna (C-D) Adult (Female) (E-F) Adult (Male) (G) Fore wing (H) Hind wing (I) Male terminalia in profile (J) Female terminalia in profile (K) Infested leaves of *Alstonia scholaris*

First instar: Much smaller and elongated, without wing-pad projection (Figure 3 A). Head margin with few setae; antennae smaller with reduced segments. Total Body length about 0.42-0.45 mm. Antennae shorter, about 0.04-0.05 mm apparently.

Second instar: Body shorter, having lanceolate setae throughout; posterior margin with long and 3-4 setae of various size; body 0.48-0.52 mm in length and almost 0.30-0.33 mm in width; antennae shorter, about 0.08-1.05 mm longer, apical face downwardly curved; wing pad slightly produced (Figure 3 B), about 0.27-0.28 mm in length.

Third instar: Shorter than fourth instar larvae, antennae shorter and more imbricated (Figure 3 C), about 0.20-0.35 mm in length; body 0.77-0.0.85 mm longer whilst 0.50-0.71 mm wider.

Fourth instar: More resembles with fifth instar larvae, but clearly differentiated in body size, about 1.08-1.10 mm longer and 0.5-0.6 mm wider; wing-pads shorter than fifth instar larvae, almost 0.45-0.48 mm in length; total antennal length 0.42-0.44 mm. Meta legs with two long setae apically (Figure 3 D). Minute and thick setae present at margins of wing-pad and abdomen (Figure 3 D).

Fifth instar: Body 1.29-1.34 mm in length; clearly distinguished from fourth instar larvae in certain characters; antennae thick and longer, about 0.5-0.72 mm in length; wing-pads strong and larger (Figure 3 E), about 0.55-0.72 mm in length; body 1.296-1.34 mm longer whilst 0.264-0.320 mm wider.

Material Examined: Islamabad (Daman-e-Koh) (33°44'29.57"N'73° 3'19.04"E), 2-vii-2018, 12♂ and 09♀; Rawalpindi (PMAS Arid Agriculture University Rawalpindi) (33°38'52.16"N' 73° 4'46.62"E), 23-vii-2018, 21♂ and 15♀; Kahuta (33°35'20.90"N'73°23'49.39"E), 28-vii-2018, 17♂ and 11♀; Islamabad (Sihala) (33°33'7.99"N'73°12'18.62"E), 28-vii-2018, 07♂ and 10♀; Rawalpindi (33°34'56.84"N'72°58'9.48"E) , 25-ix-2018, 04♂ and 03♀; Islamabad (Rose and Jasmine Garden) (33°35'15.81"N'73°5'7.51"E), 07-vii-2018, 04♂ and 07♀; Islamabad (Faisal Mosque) (33°43'37.77"N'73°2'18.44"E), 12-vii-2018, 12♂ and 09♀; Rawalpindi (Morgah Biodiversity Park) (33°32'46.06"N'73°4'35.31"E), 11-vii-2018, 21♂ and 15♀; Kahuta (33°35'21.16"N'73°24'36.94"E), 15-vii-18, 17♂ and 11♀; Islamabad (Pakistan Agricultural Research Council) (33°43'12.96"N'73°5'43.51"E), 17-vii-2018, 07♂ and 10♀; Islamabad (Village Malpur) (33°43'30.94"N' 73°9'6.25"E), 25-vii-2018, 16♂ and 20♀; Rawalpindi (Ayub National Park) (33°34'19.15"N'73° 4'59.05"E), 5-viii-2018, 16♂ and 20♀; Rawalpindi (33°33'55.56"N'73°0'57.03"E), 13-viii-2018, 10♂ and 07♀; Rawalpindi (Morgah Biodiversity Park) (33°32'46.06"N'73°4'35.31"E), 19-viii-2018, 13♂ and 21♀; Taxila (33°50.040"N' 72°43.509"E) 3-iv-2018, 04♂ and 07♀; Chakian (33°34.247 "N' 73°14.983"E) 5-v-2018, 4♂ and 7♀; Taxila (33°50.040"N'72°43.504"E) 6-v-2018, 08♂ and 12♀; Rawalpindi (PMAS-AAUR) (33°37.364"N' 73°05.425"E) 19-vii-2018, 09♂ and 08♀; Khaur (Attock) (33°16.00"N' 72°27.806"E) 12-vii-2018, 11♂ and 06♀; Chakwal (32°56'4.08"N' 72°51'40.89"E) 11-x-2018, 08♂ and 07♀; Jhelum (32°56'32.85"N' 73°43'32.70"E) 11-ix-2018, 04♂ and 07♀; Mankiala (Rawalpindi) (33°28.795"N'73°14.552"E) 19-x-2018, 20♂ and 43♀; Shahpur (Attock) (33°30.252"N'72°17.823"E) 21-x-2018; Rawalpindi, 22-viii-2018, 31♂ and 22♀; Rawalpindi (Nawaz Sharif Park) (33°38'57.86"N'73°4'32.64"E), 26-viii-2018, 04♂ and 09♀; Rawalpindi (PMAS AAUR) (33°38'52.16"N'73°4'46.62"E), 04-ix-2018, 09♂ and 05♀; Islamabad (Shahdara Valley) (33°46'38.54"N'73°10'11.00"E), 20-ix-2018, 22♂ and 19♀; Islamabad (F-9 Park) (33°42'6.47"N' 73°1'24.96"E), 25-ix-2018, 04♂ and 03♀; Islamabad (Kachnar Park) (33°40'9.46"N' 73°4'57.55"E), 27-ix-2018, 4♂ and 7; ♀Islamabad (E-7 park) (33°43'39.21"N' 73°3'2.23"E), 12-vii-2019, 12♂ and 09♀; Rawalpindi (Morgah Biodiversity Park) (33°32'46.06"N' 73° 4'35.31"E), 21-vii-2018, 21♂ and 15♀; Kahuta (33°35'21.16"N'73°24'36.94"E), 22-vii-2019, 17♂ and 11♀; Islamabad (Lake view park) (33°42'55.59"N'73°7'45.66"E), 24-vii-2019, 07♂ and 10♀; Islamabad (Village Malpur) (33°43'30.94"N' 73°9'6.25"E), 25-viii-2019, 16♂ and 20♀; Rawalpindi (33°38'57.86"N' 73°4'32.64"E), 09-viii-2019, 10♂ and 07♀; Rawalpindi (Morgah Biodiversity Park), 11-viii-2019, 13♂ and 21♀; Rawalpindi (33°38'52.16"N' 73° 4'46.62"E), 13-viii-2019, 31♂ and 22♀; Rawalpindi (Nawaz Sharif Park) (33°38'57.86"N'73°4'32.64"E), 16-viii-19, 04♂ and 09♀; Rawalpindi (PMAS AAUR) (33°38'52.16"N' 73°4'46.62"E), 04-ix-2019, 09♂ and 05♀; Islamabad (Bhara Kahu) (33°44'37.47"N' 73°10'38.02"E), 02-ix-2019, 22♂ and 19♀; Islamabad (F-9 Park) (33°42'12.74"N' 73°0'35.45"E), 09-ix-2018, 04 and 03♀; Islamabad (Shakarparian) (33°41'25.05"N' 73°4'22.63"E), 13-ix-2019, 4♂ and 7♀; Rawalpindi, 09-viii-19, 10♂ and 07♀; Rawalpindi (Morgah Biodiversity Park) (33°32'46.06"N' 73° 4'35.31"E), 10-viii-2019, 13♂ and 21♀; Rawalpindi, 13-viii-2019, 31♂ and 22♀; Rawalpindi (Chattar park) (33°46'43.35"N' 73°14'30.48"E), 15-viii-19, 04♂ and 09♀; Islamabad (Sohan) (33°39'36.80"N' 73°5'45.53"E), 03-ix-2019, 9♂ and 05♀; Islamabad (Bani Gala) (33°42'46.20"N' 73°9'34.00"E), 06-ix-2019, 22♂ and 19♀; Islamabad (National Agricultural Research Centre) (33°40'1.92"N' 73°7'22.32"E), 01-ix-2019, 04♂ and 03♀; Islamabad (H-9 Sector) (33°40'20.87"N'73°3'18.05"E) 11-ix-2019, 04♂ and 07♀; Sahng (Gujar Khan) (33°39.910"N' 73°24.205"E) 15-iii-2019, 14♂ and 17♀; Attock (33°39.616"N' 72°25.871"E) 15-iv-2019, 8♂ and 11♀; Attock (33°38.029"N' 72°39.759"E) 1-v-19, 04♂ and 07♀; Attock (33°38.006"N'72°39.542"E) 1-v-2019, 21♂ and 17♀; Rawalpindi (PMAS AAUR) (33°38'52.16"N' 73°4'46.62"E), 25-v-2019, 09♂ and 05♀; Kahuta (33°38.105"N'73°29.494"E) 20-vii-2019, 04♂ and 07♀; Jhelum (32°56'29.94"N' 73°43'1.79"E) 2-vii-2019, 08♂

and 07♀; Chakwal (32°56'4.08"N'72°51'40.89"E) 1-viii-2019, 04♂ and 03♀.

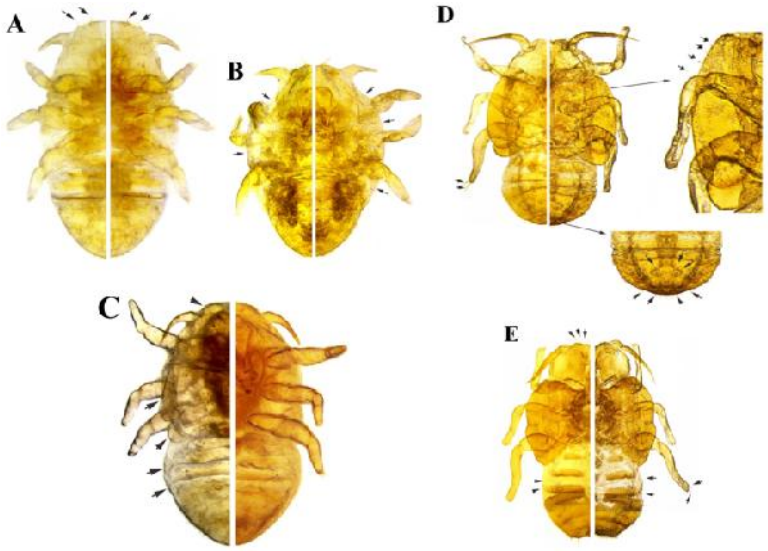

Figure. 3. Immatures, *Pseudophacopteron tuberculatum* (Crawford, 1912) (A-E) Right= Ventral aspect; Left= Dorsal aspect (A) First instar (B) Second instar (C) Third instar (D) Fourth instar (E) Fifth instar

Distribution: India, Malaya, (Mathur, 1975); Bangladesh, China, Indonesia, Laos, Malaysia, Myanmyr, Papua New Guinea, Philippines, Thailand, Vietnam (Percy *et al*., 2016; Luo *et al*., 2018); Pakistan (Present study)

Host plant: *Alstonia scholaris* (Apocynaceae).

Biology: High infestations of *Pseudophacopteron tuberculatum* induce enclosed conical or barrel-shaped galls on leaf blade. However, most of the galls were observed along mid-rib of leaf. Population start to appear in August and damage become high during September-mid of October. Our observations on the biology of this species were found to be similar to Mathur (1935); Mani (1948); Mani (1964) and Yang and Li (1983).

***Acizzia indica* (Heslop-Harrison, 1949)**

Note on distribution and Ecology: Mathur (1975) reported this species from Northern Pakistan. However, exact locality was not provided. Here we added new distribution and ecological data for the first time from Rawalpindi and Islamabad.

New Distribution: Rawalpindi and Islamabad (Present Study)

Host Plant: *Albezia procera* (Fabaceae).

Ecology. During collection of this species, two species of ants namely, *Lepisiota* sp. and *Camponotus compressus* were found to be associated with *A. indica*. Present study revealed that secretion of honeydew from immatures of psyllid results in attraction of these ants for foraging on sugary material.

***Diaphorina aegyptiaca* Puton, 1892**

Note on distribution and Ecology: This species was previously reported from Northern Pakistan (Mathur, 1973 and Burckhardt, 1986) but nothing much has been provided about the exact occurrence point. Herein we added new distribution and ecology of this species from Pothohar region of Pakistan.

New distribution: Chakwal, Kallar Kahar, Talagang (Present study)

Host plant: *Cordia myxa* (Boraginaceae).

Ecology: During our survey, we have noted two different species of ants e.g. *Tapinoma melanocephalum* and *Camponotus compressus* were foraging on honey dew. Present study provides the new association between psyllid and ants for the first time from Pothohar, Punjab, Pakistan.

***Diaphorina citri* Kuwayama, 1908**

Note on distribution and Ecology: Widely distributed species from various part of the world. This species has also been reported from different localities of Pakistan (Mathur, 1975; CABI, 2017). Here we added its new distribution from various localities of Pothohar region of Pakistan.

New distribution: Rawalpindi, Jhelum, Chakwal and Attock (Present study)

Host plant: *Citrus* spp.

Ecology: The ecological observation of this serious pest includes the trophic association with ants from Pothohar. During present study three species of ants *Meranoplus bicolor*, *Camponotus compressus* and *Crematogaster biroi* were found to be associated with *D. citri* for taking honey dew as a food source.

***Euphyllura pakistanica* Loginova, 1973**

Note on distribution and Ecology: Mathur (1975) originally described this species from Pakistan. Herein we added new exact localities of this important pest from different areas of Pothohar along with some observation of ecology.

New distribution: Rawalpindi, Attock, Kahuta, Panj Peer, Ahmad Abad, Chakwal, Kalar Kahar, Talagang, Choa Saidan Shah, Islamabad (Present study)

Host plant: *Olea europaea* (Oleaceae).

Ecology: During feeding of immatures and adult psyllid, workers of four different ant species were foraging on honeydew. Foraging ant's species were identified as *Monomorium sagei*, *Crematogaster biroi*, *Lepisiota frauenfeldi* and *Lepisiota* sp. Our study provides new trophic association between this psyllid species and foraging ant.

***Camponotus compressus* (Fabricius, 1787)**

Diagnostic characters: Head in full face view longer than wide, with broad posterior margin. Clypeus with distinct medial carinae. Mandibles slightly punctured and dentate at inner margin. Antennal carinae distinct; scape extending beyond the posterior margin of head. Mesosoma forming single convexity. Gaster with very fine circular striations, minute sparse hairs and yellowish bands in profile.

***Crematogaster biroi* Mayr, 1897**

Diagnostic characters: Head subquadratic, weakly sculptured, reticulates laterally. Vertex transverse, mandibles smooth, armed with 4 teeth. Clypeus convex and well produced. Scape extending at posterolateral corner of head, club 2 jointed, apical segments twice than penultimate. Eyes paced above the middle of head. Mesosoma shorter, more punctured, pronotal feebly ridges dorsally, promesonotum forming a rectangular shape, irregular striae, weakly reticulate, metanotum densely punctate, slightly concave and bispinous. Post petiole globose and tubercle at apex. Gaster elongated and massive.

***Lepisiota* sp.**

Diagnostic characters: Body length 2.0-3.5 mm. Head little longer, smooth and shining with small decumbent whitish hairs. Eyes rounded, larger, placed at middle of head. Vertex smooth, shining, weakly reticulate near ocelli. Mesothorax, narrow, rounded at posterio-dorsum corner of prothorax. Gaster smooth, little longer, with standing pilosity at apex of abdominal tergites. Body smooth allover.

***Lepisiota fraenfeldi* (Mayer, 1855)**

Diagnostic characters: Head somewhat shining, opaque and rugulose, rectangular, longer than wide, a little convex in middle. Eyes moderately large truncate laterally and present above the middle of head. Antennae long with 11-segmented, scape clearly extending beyond the top of head. Clypeus broad and carinate. Mandibles small with apical tooth. Pronotum broader than mesonotum, with pair of setae in profile; mesonotum compressed and narrow, meso-metanotum suture distinct, metanotum with two pointed teeth dorsally. Petiole longer than broad. Gaster opaque, gibbous having circular anal aperture and few erect hairs apically.

***Meranoplus bicolor* (Guérin-Méneville, 1844)**

Diagnostic characters: Head square in full face view, as broad as long, opaque, with finely reticulations and rugussions, broader posteriorly. Eyes truncate laterally, usually longer in length than width, placed above the middle of head. Scape of antennae hardly reaching beyond the top of head. Clypeus rounded posteriorly. Mandibles small and dentate at inner margin. Mesosoma sculptured; pronotum spinous, metanotum with two short propodeal spines. Petiole longer in length than width. Gaster smooth, coardate. Whole insect covered with long whitish pilosity.

***Monomorium sagei* (Forel, 1902)**

Diagnostic characters: Head in full face view, transparent, rectangular, smooth, striated near the base of antennae and remarkably larger in length. Antennae with distinct club of flagellum. Eyes very small, as broad as long, present below the middle of head. Clypeus smooth, usually bicarinate. Mandibles short, with apical tooth. Pronotum smooth, meso-metanotum suture distinct, metanotum rugulose laterally. Post petiole broader than petiole. Gaster smooth with blackish tinge posteriorly.

***Tapinoma melanocephalum* (Fabricius, 1793)**

Diagnostic character: Head in frontal view, longer than wide, with minute pilosity. Scape of antennae hardly reaching beyond the top of head. Clypeus oval and smooth at inner margin. Mandibles small with acute teeth. Eyes little longer than broad. Mesosoma short, smooth, with small pilosity but without erect hairs. Petiole short. Gaster larger in length than wide in profile.

DISCUSSION

Alstonia scholaris is widely used in agroforestry for timber and planted as an ornamental plant in Asia. Serious infestation of *P. tuberculatum* leads to produced enclosed conical and barrel shaped galls on leaf blade. Major damage is attributed to immatures, which induce from localized necrosis and the formation of galls to malformation of the meristematic tissue (Hodkinson, 1974). In Pothohar, symptoms of *P. tuberculatum* start to appear during Summer-Autumn with closed and barrel shaped galls on leaves. Immatures of psyllid species remains inside the galls until their maturity. However, adult aggregate on leaf margin and can easily be collected through net sweeping on plant canopy. In case of severe infestation of *P. tuberculatum* the appearance and productiveness of *A. scholaris* can highly affect by feeding, galls and abundant amount of honey dew. In Pakistan, *A. scholaris* has drawn increasing attention by Plant Protection department but nothing much has been

published due to lack of experts in country. This study provides a synthesis of regional taxonomical work and will provide a baseline for further future studies regarding its management. In present study we have noted the trophic association of various ants with four different species of psyllid includes *Acizzia indica* (Heslop-Harrison, 1949); *Diaphorina aegyptiaca* Puton, 1892; *Diaphorina citri* Kuwayama, 1908 and *Euphyllura pakistanica* Loginova, 1973. Mutualistic associated ants were foraging on honey dew secreted by psyllid species. In addition to trophic association, more sampling of psyllid fauna along with ecological observation are needed for better understanding of this association pattern.

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