Determination of whitefly (Hemiptera: Aleyrodidae) species from South Kyrgyzstan

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Abstract: This study has been conducted in the South Kyrgyzstan in 2015-2016 for determining whitefly species on vegetable and field crops. Main vegetable crops are tomato, melon, cucumber, pepper and squash and field crops are cotton, tobacco, sunflower and other annual crops with weeds that found in this cultivated plants were sampled during this study. According to sampling results, *Aleyrodes proletella* (L.) (*Lactuca serriola, Brassica oleracea*); *Bemisia tabaci* (Gennadius) (*Cucumis melo*, *Nicotiana tabacum*, *Gossypium hirsutum*, *Solanum lycopersicum*, *Helianthus annuus*) and *Trialeurodes vaporariorum* Westwood (*Solanum lycopersicum*, *Helianthus annuus*, *Cucurbita pepo*, *Cucumis sativus*) were found on vegetable and field crops areas. These three species are the first record for Kyrgyzstan's insect fauna.

Keywords: whiteflies, Aleyrodidae, first record, Kyrgyzstan;

Түштүк Кыргызстанда таралган ак канаттардын (Hemiptera: Aleyrodidae) түрлөрүн аныктоо

Аннотация: Бул жумуш Түштүк Кыргызстандагы ар түрдүү өсүмдүк кожоюндардан алынган ак канаттардын түрлөрүн аныктоо максатында жасалган. Пахта, тамеки, томат, коон, күнкарама жана ашкабак өсүмдүктөрүнөн үлгүлөр алынып, изилдөөнүн жыйынтыгында *Aleyrodes proletella* (L.) (*Lactuca serriola, Brassica oleracea*); *Bemisia tabaci* (Gennadius) (*Cucumis melo*, *Nicotiana tabacum*, *Gossypium hirsutum*, *Solanum lycopersicum*, *Helianthus annuus*) жана *Trialeurodes vaporariorum* Westwood (*Solanum lycopersicum*, *Helianthus annuus*, *Cucurbita pepo*, *Cucumis sativus*) түрлөру аныкталды. Аныкталган бул үч ак канат түрү Кыргызстан үчүн биринчи жолу катталууда жана түрлөрдүн аныкталуусу морфологиялык өзгөчөлүктөрүнө таянып жасалды.

Ачкыч сөздөр: ак канаттар,Aleyrodidae, биринчи каттоо, Кыргызстан

INTRODUCTION

The family Aleyrodidae comprises 1556 species from 161 genera in over the world (1).All whitefly species are small, highly prolific, phytophagous, and some are vectors of plant viruses (2,3, 12). Some species such as *Trialeurodes vaporariorum* Westwood and *Bemisia tabaci* (Gennadius) are the most economically important pests for agricultural crops (4,10,12,13). For above mentioned reasons, Aleyrodidae family's fauna, systematic, biology, ecology have been well studied in developed countries.

Russian entomologist Prof. Danzig (5) identified only one species called *Bemisia mesasiatica* from Kyrgyz Soviet Socialist Republic during his survey in 1966. After his journey, no more works have been conducted from Kyrgyzstan on the Aleyrodidae family and it is still poorly understood. Nevertheless, different scientists from Central Asia, noted that whiteflies occur and damage vegetable plants in open field and greenhouses for many years (16, 17, 18, 19). But, any of them not defined the species by using morphological characters.

This study has been conducted for determining whitefly species in the south region of Kyrgyz Republic in 2015-2016. We hope this work will be basic material to identify and to continue research's on whitefly species in Kyrgyzstan.

MATERIALS AND METHODS

Whitefly samples were collected in an open field from different host plants in south region of Kyrgyzstan during a summer, 2015. All leaves that whitefly puparia attached were put into the paper bag and data recorded outside of the bag than put in the ice-box for laboratory studies. In the laboratory, all sample photos have been taken and saved in the Eppendorf tube with 70 % ethanol till preparation. Whitefly slide mounting preparations have been done following modified technique of Bink (1979) and Kosztarab and Kozar (1988), identification of samples done by using Danzig (1969), Bink-Moenen (1991), Martin (1999), Martin et al. (2000) and Ulusoy (2001) identification keys. Synonyms of species copied from Mound and Halsey (1978) and Jesudasan and David (1991) and world distribution and host plants of species taken from Evans (2008). Drawings of Aleyrodids done from puparia mounted slides by using Olympus U-Da drawing tube and camera Lucida. Rapido pencils were used for drawings and they were corrected by Photoshop Element 7 Programmed.

Species identified by one of us, Prof. Dr. M. Rifat ULUSOY and permanent slides saved at Kyrgyzstan – Turkey Manas University, Faculty of Agriculture, Entomology laboratory.

RESULTS AND DISCUSSIONS

***Aleyrodes proletella* (Linneaus, 1758) Latreille, 1801**

Synonyms:*Phalaena (Tinea) proletella* Linnaeus, 1758; *Aleyrodes proletella* (L.) Latreille, 1801;*Coccus preanthis* Schrank, 1801; *Aleyrodes chelidonii* Latreille, 1807; *Aleyrodes brassicae* Walker, 1852; *Aleyrodes euphorbiae* Low, 1867; *Aleyrodes youngi*Hempel, 1901.;*Aleyrodes prenanthis*(Schrank,1801), Cockerell, 1902.

Diagnosis: Pupae oval and flattened shape with no ridges, vasiform orifice circle, thoracic tracheal fold and caudal furrow not defined. All dorsal setae and caudal setae are short.

Material examined:3 pupae, Khaydarkan, Batken, 10.08.2015, *Lactuca serriola* L. (Asteraceae); 8 pupae, Khaydarkan, Batken, 19.08.2015, *Brassica oleracea* Capitata (Brassicaceae); 2 pupae, Suzak, Djalal-Abad, 21.08.2015, *B. oleracea*;

Host plants: Asteraceae: *Cichorium intybus*, *Cichorum juncea*, *Chondrilla juncea*, *Emilia sonchifolia*, *Lactuca indica*, *Lactuca serriola*,*Mycelis muralis*, *Sonchus arvensis*, *Sonchus oleraceus*, *Sonchus*

oleraceus;Brassicaceae: *Brassica oleracea*, *Raphanus raphanistram*, *Rorippa indica*; Campanulaceae:*Campanula grandis*, *Campanula persicifolia*;Euphorbiaceae:*Euphorbia esula*; Oxalidaceae:*Oxalis* sp.;Papaveraceae:*Chelidonium majus*; Ranunculaceae:*Celadine* sp.;Rutaceae:*Citrus*sp. (Evans, 2008).

World distribution:Worldwide. Nearctic region: USA; Neotropical region: Bermuda, Brazil, Mexico, Puerto Rico, Virgin Islands; Palearctic region: Austria; Azores, Belgium, Canary Islands, Czech Republic, Egypt, England, Finland, France, Germany, Hungary, Iran, Italy, Poland, Portugal, Russia, Spain, Sweden, Switzerland, Yugoslavia, Hong Kong; Afrotropical: Angola; Canary Island, Kenya, Mozambique, Sierra Leon, Zimbabwe; Pacific Islands: New Zealand. (Mound and Halsey, 1978; Martin *et al.,* 2000; Evans, 2008).

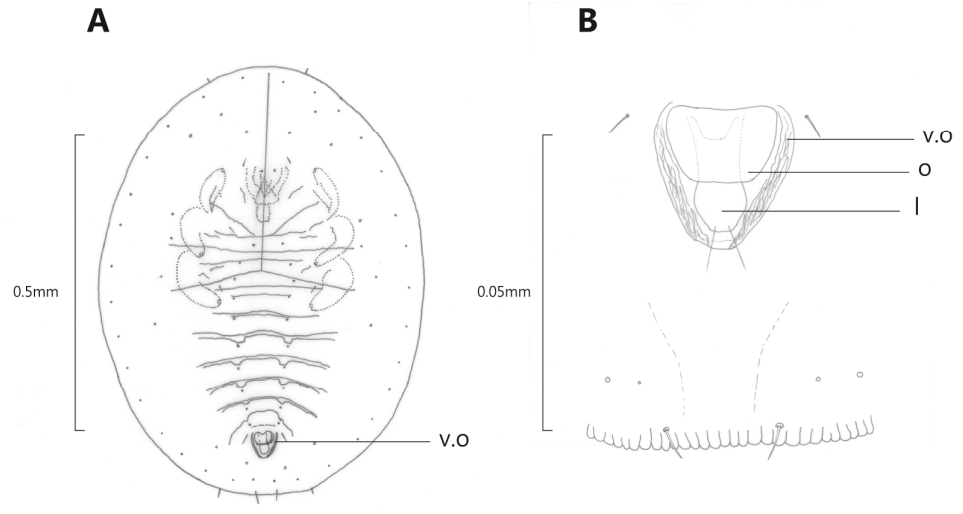

Figure-1. *Aleyrodes proletella*; A. puparium, B. vasiform orifice; v.o-vasiform orifice, o-operculum, l-lingula

***Bemisia tabaci* (Gennadius, 1889) Takahashi, 1936**

Synonyms: *Aleurodes tabaci* Gennadius, 1889; *Aleurodes inconspicua* Quaintance, 1900; *Bemisia emiliae* Corbett, 1926; *Bemisia signata* Bondar, 1928; *Bemisia bahiana*Bondar, 1928; *Bemisia costa-limai* Bondar, 1928; *Bemisia gossypiperda* Misra and Singh, 1929; *Bemisia achyranthes* Singh, 1931; *Bemisia hibisci* Takahashi, 1933; *Bemisia gossypiperda* var *mosaicivectura*Ghesquiere, 1934; *Bemisialongispina* Priesner & Hosny, 1934; *Bemisia goldingi*Corbett, 1935; *Bemisia nigeriensis* Corbett, 1935;*Bemisia rhodesiansis* Corbett, 1936; *Bemisia tabaci* (Gennadius) Takahashi, 1936;*Bemisia manihotis* Frappa, 1938; *Bemisia vayssierei* Frappa, 1939;*Bemisia lonicerae* Takahashi, 1957; *Bemisia minima* Danzig, 1964; *Bemisia miniscula* Danzig, 1964;*Cortesiana restonicae* Goux, 1988;*Bemisia argentifolii* Bellows and Perring, 1994.

Diagnosis: Pupae oval shape, symmetrically narrow to the side abdomen, light yellowish color with red eyes. Dorsal setae well developed. Vasiform orifice elongate triangular, caudal furrow well defined by a pair of ridges. Thoracic tracheal openings with subtle combs. Caudal setae long and stout, longer than vasiform orifice.

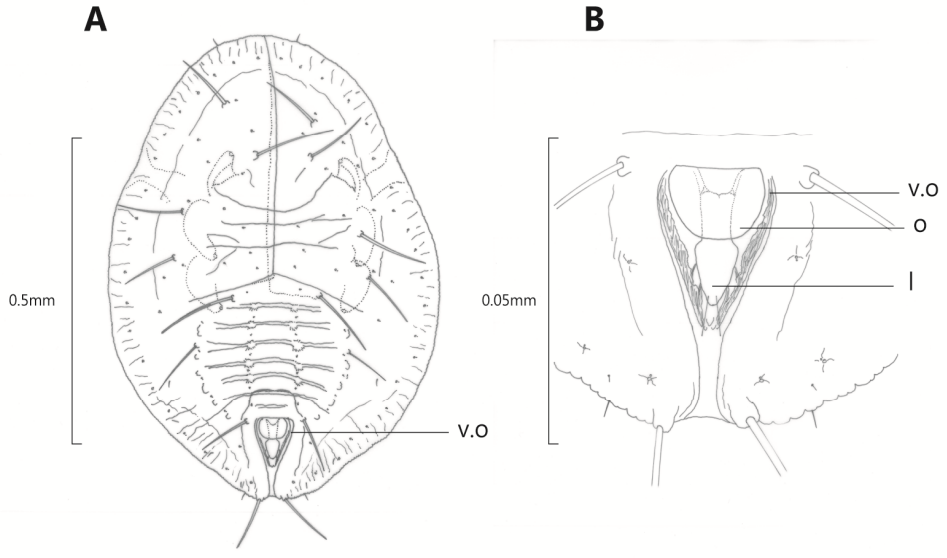

Figure-2.*Bemisia tabaci*; A. puparium, B. vasiform orifice; v.o-vasiform orifice, o-operculum, l-lingula

Material examined:7 pupae, Jeke-Miste, Batken, 13.08.2015, *Gossypium hirsutum* L.(Malvaceae); 2 pupae, Too-Moyun, Batken, 13.08.2015, *Solanum lycopersicum* L.(Solanaceae); 3 pupae, Too-Moyun, Batken, 13.08.2015, *G. hirsutum*;2 pupae, Ak-Shar, Batken, 13.08.2015, *G. hirsutum*;5 pupae, Lenin, Batken, 13.08.2015, *Cucumis melo*

L.(Cucurbitaceae); 3 pupae, Ak-Shar, Batken, 13.08.2015, *C. melo*; 2 pupae, Lenin, Batken, 13.08.2015, *G. hirsutum*; 7 pupae, Yntymak, Batken, 13.08.2015, *Nicotiana tabacum* L.(Solanaceae); 4 pupae, Too-Moyun, Batken, 13.08.2015, *C. melo*; 2 pupae, Eski-Nookat, Osh, 19.08.2015, *G. hirsutum*; 4 pupae, Suzak, Jalalabad, 19.08.2015, *G. hirsutum*; 1 pupae, Turkobod, Jalalabad, 19.08.2015, *G. hirsutum*; 2 pupae, Suzak, Jalalabad, 19.08.2015, *S. lycopersicum*; 5 pupae, Yusupova, Osh, 19.08.2015, *S. lycopersicum*; 2 pupae, Aravan, Osh, 19.08.2015, *G. hirsutum*; 3 pupae, Aravan, Osh, 20.08.2015, *Helianthus annuus* L.(Asteraceae)

Host plants:Over 600 host plants in many different families (Mound & Halsey, 1978; Martin et al., 2000; Oliviera et al.,2001).

World distribution: Worldwide. Neotropical region: Brazil; Palearctic region: Egypt, France, Iran, Israel, Greece, Malta, Turkey, Italy, Sicilia, Spain, China, Korea; Afrotropical region: Kameron, Chad, Congo, Guinea, Kenia, Madagascar, Nigeria, Niger, South Africa, Sudan, Uganda; Oriental region: India, Pakistan; Australasian region: Australia, New Guinea, Indonesia (Mound and Halsey, 1978; Martin *et al.,* 2000; Evans, 2008).

***Trialeurodes vaporariorum* Westwood, 1856**

Synonyms: *Aleurodes vaporariorum* Westwood,1856; *Asterochiton lecanioides* Maskell, 1879;*Asterochiton papillifer* Maskell, 1890; *Aleurodes nicotiana* Maskell, 1895;*Aleyrodes glacialis* Bemis, 1904; *Aleyrodes sonchi* Kotinsky, 1907;*Asterochiton vaporariorum* Quaintance & Baker, 1914; *Asterochiton sonchi* (Kotinsky); Quaintance & Baker, 1914; *Trialeurodes sonchi* (Kotinsky); Quaintance & Baker, 1914.*Trialeurodes vaporariorum* (Westwood); Quaintance & Baker, 1915;*Trialeurodes mossopi*Corbett, 1935; *Trialeurodes sesbania* Corbett, 1936;

Diagnosis: Pupae oval shape, with long dorsal setae and single submarginal row of papillae, lateral margin with relatively broad crenulations. Eighth abdominal setae located anterior to widest part of operculum. Caudal setae long.

Material examined: 2 pupae, Karavan, Batken, 13.08.2015, *Solanum lycopersicum* L.(Solanaceae); 6 pupae, Khaydarkan, Batken, 13.08.2016, *Cucurbita pepo* L.(Cucurbitaceae); 3 pupae, Kadamjay, Batken, 13.08.2015, *S. lycopersicum*; 4 pupae, Otuz-Adyr, Osh, 19.08.2015, *S. lycopersicum*; 1 pupae, Too-Moyun, Batken, 19.08.2015, *C.pepo*; 4 pupae, Otuz-Adyr, Osh, 19.08.2015, *C. pepo*; 4 pupae, Aravan, Osh, 20.08.2015, *Helianthus annuus* L.(Asteraceae); 2 pupae, Kok-Jelek, Osh, 20.08.2015, *Cucumis sativus* L.(Cucurbitaceae);

Host plants: Polyphagous. Asclepiadaceae: *Gonolobus* sp.; Asteraceae: *Ageratum* sp., *Helianthus annuum*, *Lactuca serriola*, *Sonchus oleraceus*, *Xanthium occidentale*; Cucurbitaceae: *Citrullus colocynthis*, *Cucumis sativus*, *Sechium edule*; Euphorbiaceae: *Euphorbia geniculata*, *Manihot esculenta*; Fabaceae: *Phaseolus vulgaris*; Malvaceae: *Hibiscus trionum*; Solanaceae: *Lycopersicon esculentum*, *Nicotiana glauca*, *Salpichroa rhomboidea*, *Solanum melongena* (Mound & Halsey, 1978; Evans, 2008).

World distribution: Nearctic region: Canada, USA; Neotropical region: Argentina, Bermuda, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guadeloupe , Guatemala, Honduras, Jamaica, Mexico, Peru, Puerto Rico, Venezuela; Palearctic region: Azores, Austria, Belgium, Bulgaria, Canary Islands , Denmark, France, Germany, Greece, Hungary, Iran, Ireland, Italy, Israel, Jordan, Netherlands, Norway, Poland, Portugal, Spain, Turkey, United Kingdom, Hong Kong, Japan, Korea; Afrotropical: Ethiopia, Kenya, South Africa, Zimbabwe; Oriental region: Bangladesh, India, Philippines, Reunion, Sri Lanka; Australasian region: Australia, Indonesia, New Guinea; Pacific Islands: New Zealand; Hawaii (Mound and Halsey, 1978; Martin *et al.,* 2000; Evans, 2008).

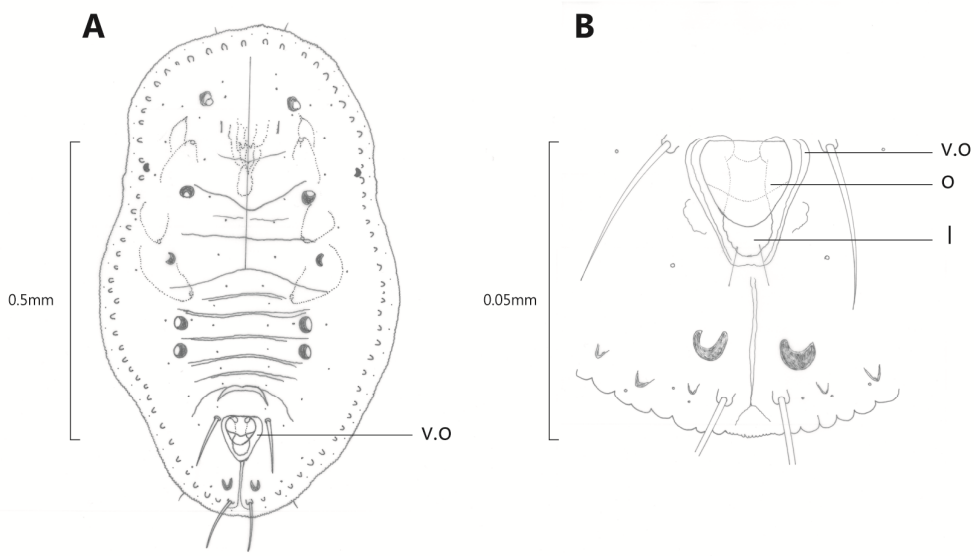

Figure-3.*Trialeurodes vaporariorum*; A. puparium, B. vasiform orifice; v.o-vasiform orifice, o-operculum, l-lingula

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REFERENCES

1. **Martin, J. H. & , L. A. Mound,** (2007). An annotated check list of the world's whiteflies (Insecta: Hemiptera: Aleyrodidae). Zootaxa, 1492: 1-84.

2. **Byrne, D.N., Bellows, T.S., Parrella, MP.,** (1990): Whiteflies in agricultural systems, pp. 227-261 In D. Gerling [ed.], Whiteflies: Their Bionomics, Pest Status and Management. Intercept LTD, United Kingdom, 348 pp.
3. **Suh, S., G. & S. Hodges,** (2008). Key to the Korean species of whiteflies (Hemiptera: Aleyrodidae). J Asia Pac Entomo. 11:123-131
4. **Hodges G.S, & Evans G.A.,** (2005): An identification guide to the whiteflies (Hemiptera: Aleyrodidae) of the southeastern United States. Florida Entomologist 88: 518 – 534.
5. **Dantsig, Ye. M.,** (1969). On The Whiteflies (Homoptera:Aleyrodidae) of Soviet Central Asia and Kazakhstan. Entomological Review. 48: 552-559
6. **Evans, G. A.** (2008). The whiteflies (Hemiptera: Aleyrodidae) of the world and their host plants and natural enemies.Available from: http://www.sel.barc.usda.gov/whitefl y/wfframe.htm
7. **Mound, L. A., & S. H. Halsey,** (1978). Whitefly of the World. A systematic catalogue of the Aleyrodidae (Homoptera) with host plant and natural enemy data. British Museum and John Willy and Sons, Chichester-Newyork-Brisbonbe-Toronto, 340pp.
8. **Martin J. H.** (1987). An identification guide to common whitefly pest species of the world (Homoptera, Aleyrodidae). Tropical Pest Management. 33, 298 –322.
9. **Martin J. H.** (1999). The whitefly fauna of Australia (Sternorrhyncha: Aleyrodidae). A taxonomic account and identification guide. Technical paper, Division of Entomology, Common Wealth Scientific and Industrial Research Organisation, Canberra, 38: 1-197.
10. **Martin, J. H., D. Mifsud, & C. Rapisarda,** (2000). The whiteflies (Hemiptera: Aleyrodidae) of Europe and the Mediterranean Basin. Bulletin Entomological Research. 90: 407-448.
11. **Oliviera M.R.V., Henneberry T.J., & Anderson P.,** (2001). History, current status, and collaborative research projects for Bemisia tabaci. Crop. Prot. 20: 709-723
12. **Ulusoy, M. R.,** (2001). Türkiye Beyazsinek Faunası. Baki Kitabevi, Adana, 99 s.
13. **Gill, R.,** (2012). A pleminary report on the World species of *Bemisia* Quaintance and Baker and its congeners (Hemiptera: Aleyrodidae) with a comparative analysis of morphological variation and its role in the recognition of cpecies. Insecta Mundi 0219: 1-99
14. **Bink, F. A.,** (1979). Methods for mounting Aleyrodidae specimens. Entomologische Berichten Amsterdam, 39: 158-160.
15. **Bink-Moenen, R. M., & D. Gerling,** (1990). Aleyrodidae of Israel. Bollettino Del Laboratorio Di Entomologia Agraria Filippo Silvestri, 47: 3-49
16. **Эшматов С.Т., Кадыров А.К.** (1991) Белокрылки и борьбы с ними. // Защита растений. №2. - С.23-24.
17. **Карамхудоева М. Н.,** (2016). Экология белокрылок (Homoptera, Aleyrodınea) западного мира и научные основы меры борьбы с ними. Диссертация. Душанбе-2016.
18. **Мярцева С.Н., Смирнова Ж.В., Мухиев Р.Х.** (1998). Белокрылки (Homoptera, Aleyrodoidea) и их естественные враги в Туркменистане. Академия наук Туркменистана. Монография Ашгабат, – 300 с.
19. **Алимухамедов С.Н., Ходжаев Ш.Т., Эшматов О.Т., Хошимов Х., Хакимов М., Кадыров А** (1990). Рекомендации по борьбе с белокрылкой в условиях Узбекистана. – Ташкент, - 8 с.