

***Tuberolachnus salignus* (Gmelin, 1790) (Hemiptera, Aphididae) on Apple (*Malus domestica* Borkh) in Kashmir, India**

Muzafar Riyaz^{1*}, Sabreena Ashraf² and Rakesh Kumar Gupta¹

¹*Division of Entomology, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu 180009, Jammu & Kashmir, India.*

²*Department of Entomology, Punjab Agricultural University, Ludhiana 141004, Punjab, India.
Email: bhatmuzaffar471@gmail.com*

ABSTRACT: This study reports the first occurrence of the invasive pest *Tuberolachnus salignus*, commonly known as the giant willow aphid, on apple (*Malus domestica* Borkh.) in Kashmir, India. Previously known to infest willows (*Salix* spp.) and poplars (*Populus* spp.), this record expands its host range to include a commercially important fruit crop. Live observations of winged adult aphids and apterae on the stems of apple trees are accompanied by detailed taxonomic descriptions, morphological features, and photographic documentation to facilitate identification. The pest's biology, distribution, and ecological adaptability are also discussed, shedding light on its potential and possible impact on apple orchards in temperate regions. Given the invasive nature of this species and its ability to exploit new hosts, the findings emphasize the need for extensive field surveys throughout the Kashmir Valley and other parts of the Northwestern Himalayas. Such surveys will help determine the pest's prevalence, host-selection behaviour, and seasonal biology in this new environment. Understanding these factors is critical to developing targeted and sustainable pest management strategies to mitigate the potential economic damage to apple cultivation. © 2025 Association for Advancement of Entomology

KEY WORDS: Apple, emerging pests, giant willow aphid, host plants, invasive pest

Tuberolachnus salignus (Gmelin), also known as the giant willow aphid, belongs to the family Aphididae in the order Hemiptera. The species is a sap-sucking invasive pest that mainly feeds on the sap from the stems and branches of willows and poplars (*Populus* spp.) (Sage and Tucker, 1997; Collins *et al.*, 2001; Sopow *et al.*, 2017); moreover, willow is considered its primary host (Blackman and Eastop, 1994). *T. salignus* is considered to have originated in Asia, but since then it has colonised practically every part of the planet where its host

species can be found. This species is now considered to be almost cosmopolitan (Blackman and Eastop, 1994), and it is ubiquitous anywhere willow grows (Charles *et al.*, 2014; Szelegiewicz, 1962). *T. salignus* can be spotted on plants during the winter (Czerniakowski, 2007; Molnár, 2003); although it is more likely to be found on host plants in the late summer or autumn months before disappearing until the following growing season across Europe. Since there are no male individuals, giant willow aphid reproduction is determined to be

* Author for correspondence

exclusively parthenogenic (Blackman and Eastop, 1994). In North America and Europe, it has been found that there is extremely little genetic variation within the species (both assumed to be part of the invasive range). In a study carried out by Aradottir *et al.* (2012), 660 samples were collected from 27 distinct populations located in five different countries. However, the authors only found 16 possible genotypes. In addition, there may be more than one genotype present in dense colonies of *T. salignus*, probably because of clustering and dispersion. In India, *T. salignus* can be found in the northwestern and eastern parts of the country. The species was first reported from Karnataka, India, on *Salix tetrasperma* (Joshi, 1980), and later in the Spiti Valley of Himachal Pradesh, India (Sharma and Thakur, 1993). Recently, it was reported on *Salix alba* and *S. tetrasperma* in the high-altitude, cold arid region of Ladakh, India (Hussain *et al.*, 2021).

Kashmir valley referred to as “*The Apple Bowl of India*,” is the primary producer of apples in the country, accounting for the majority of the country’s production. Along with the Kashmir valley, apples are cultivated in the nearby states of Himachal Pradesh and Uttarakhand as well (Riyaz *et al.*, 2018). Every year, the horticulture industry provides over Rs. 10,000 crore (7% GSDP) to the state’s revenue in Jammu and Kashmir (Govt. of Jammu and Kashmir, 2024). *T. salignus*, a recently found invasive pest from Kashmir Valley, India, is reported on apple during the course of this study.

Study site and sampling: During the insect sampling surveys in the northwestern Himalayas across both natural and agrarian ecosystems. On November 3, 2024, a single winged adult was collected and photographed in the Tehsil Herman, District Shopian, Kashmir, India (32°42’25”N 74°56’25”E) at an altitude of 2,146m with a day temperature of 14°C. Since the species was collected in an apple orchard, the majority of the vegetation around the area was fully covered with apple plantations and other fruit crops like pears, plums, and peaches. The area is mostly made up of agricultural lands with an average temperature of 13°C and 660mm of annual precipitation (Riyaz and Sivasankaran, 2022).

Identification, photography and sample deposition: Based on the morphological characteristics described in the available literature (Blackman and Eastop, 1994), the identification of the winged adult specimen was confirmed. The photographs of the live specimen on the possible new host were taken using a Redmi Note 9 Pro mobile camera (Xiaomi Communications Co., Ltd., China) with an external 25 mm macro lens attached. An Olympus BX-41 microscope was used for additional detailing of the body structures. The collected specimen is deposited in the Insect museum of Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu with voucher number SKUAST-JMU-289.

Distribution and host plants: India- Karnataka (Joshi, 1980), Himachal Pradesh (Sharma and Thakur, 1993), Ladakh (Hussain *et al.*, 2021). Elsewhere- (Bochniarz, 2020). Willow is the primary host of *T. salignus*. In the study of Sopow *et al.*, (2017), the presence of this aphid was established on fifty different species and hybrids of plants, including both woody and shrub forms (Tun *et al.*, 2020). On a side note, the presence of *T. salignus* on black poplar (*Populus nigra* L.) was reported and documented (Charles *et al.*, 2014). Aphids in various stages of development were seen feeding on the *Coprosma macrocarpa* shrub in New Zealand (Sopow *et al.*, 2017). There is evidence that *T. salignus* aphids consume sap from cambium-area phloem sieve tubes that have just undergone differentiation (Mittler, 1957).

Description (adult): Adult females are either wingless or have wings. Adult gigantic willow aphids have a body length of 5.0 to 5.8 mm and are among the biggest aphids seen anywhere in the world (Fig. 1a). Adults (Apterae) without wings are a medium to dark brown colour, and they feature multiple rows of black spots. Their whole body is coated in tiny hairs, which give the abdomen a glistening golden-gray coloration. A big “thorn” or tubercle that is dark brown in colour can be seen in the middle of their back (Fig. 1b). Honeydew is secreted by a pair of siphunculi, which are big, low cones located at the rear of the abdomen. Winged adults (alates) are distinguished by the presence of two pairs of transparent wings that are held above the animal’s

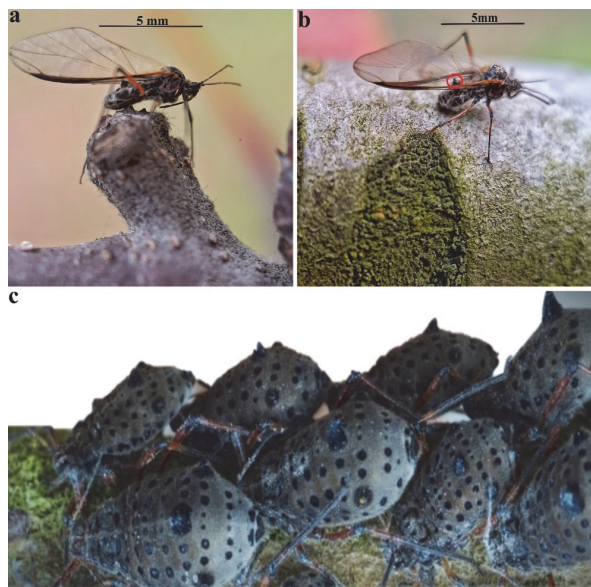


Fig. 1 a) *T. salignus* (Adult winged alate) with a body size of 5mm on a freshly pruned apple twig. b) *T. salignus* (Adult winged alate) on an apple branch with a “thorn” or tubercle on abdomen. c) Group of *T. salignus* apterae having mid-brown to dark brown with several rows of black sclerotic patches

body. The leading margin of the forewing is a shade of dark brown. With three sets of legs that are all somewhat reddish in colour and a pair of antennae that are less than half the length of the body. The underside of the head has a rostrum that is rather short and is used to hold the stylets that are used for feeding. The apterous morph of *T. salignus* is characterized by a mid- to dark-brown body adorned with multiple rows of black, sclerotic patches (Fig. 1c). The body surface is densely covered with fine, hair-like setae, imparting a greyish-golden sheen to the abdominal region. A prominent dark brown dorsal tubercle is located centrally on the thorax, anterior to the siphunculi, which are positioned on large, dark, conical bases. The antennae are relatively short, measuring less than half the length of the body. Notably, *T. salignus* is among the largest aphid species, with a body length ranging 5.0 to 5.8mm.

The possible host shift of *T. salignus* from willow to apple will likely driven by a confluence of abiotic and biotic pressures, and climate change (Liu *et al.*, 2017; Salisbury *et al.*, 2022). The widespread planting of willow windbreaks adjacent to apple orchards provides the essential ecological bridge

for dispersal. Subsequently, environmental stressors, potentially including climate-change-induced temperature shifts, drought, or overcrowding on primary willow hosts may degrade host suitability, prompting alate aphids to engage in exploratory feeding on the phylogenetically related and readily available apple trees (Skendzic *et al.*, 2021). The aphid’s known polyphagous tendency and high phenotypic plasticity, evidenced by its recorded colonization of numerous woody plants, provided the pre-adapted capability to not only probe but also successfully establish reproducing colonies on this novel, economically critical host (Salisbury *et al.*, 2022).

This paper documents a new and significant concern for this vital industry: the first confirmed presence of the giant willow aphid, *T. salignus* on apple trees in the region. Previously considered a specialist on willow, this field observation confirms a critical host shift by *T. salignus* onto a major commercial crop. This finding represents a potentially serious escalation of the pest pressure facing Kashmiri orchards. Regardless of the cause, the establishment of *T. salignus* on apple signals a new and emerging threat to apple production.

The findings underscore the critical and immediate need for systematic monitoring, in-depth research into its impact on apple yield and health, and the rapid development of integrated management strategies to protect the economic security of the Kashmir Valley.

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REFERENCES

- Aradottir G. I., Hanley S.J., Collins C.M., Dawson K.J., Karp A., Leather S.R., Shield I.F. and Harrington R (2012) Population genetics of *Tuberolachnus salignus*, an obligate parthenogenetic aphid. *Agricultural and Forest Entomology* 14(2): 197–205. doi: 10.1111/j.1461-9563.2011.00559.x

- Blackman R.L. and Eastop V.F. (1994) Aphids on the world's trees: An identification and information guide. CAB International, UK.
- Bochniarz A. (2020) Giant willow aphid (*Tuberolachnus salignus* Gmelin, 1790): A literature review. Polish Journal of Agronomy 30(43): 113–124. doi: 10.26114/pja.iung.449.2020.43.11
- Charles J.G., Nef L., Allegro G., Collins C., Delplanque A., Gimenez R. and Augustin S. (2014) Insect and other pests of poplars and willows. In Poplars and willows: Trees for society and the environment. Rome: Food and Agriculture Organization/CAB International. pp 459–526. doi: 10.1079/9781780641089.0459
- Czerniakowski Z.W. (2007) Bugs (Homoptera) on short-rotation coppice plantations. Progress in Plant Protection 47(4): 330–333.
- Government of Jammu & Kashmir (2025) Economic Survey 2024–2025, Directorate of Economics and Statistics, Srinagar. 85pp.
- Hussain B., War A.R., Singh S. and Ahmad S. (2021) First record of an invasive pest, giant willow aphid, *Tuberolachnus salignus* (Gmelin) (Homoptera: Aphididae), on *Salix alba* in the cold arid region of Ladakh, India. Entomological News 129(5): 538–545. doi: 10.3157/021.129.0508
- Josh, S. (1980) Aphids (Homoptera: Aphididae) and their hosts from Karnataka, India. Biosystematica 2(1): 19–32.
- Mittler T.E. (1957) Studies on the feeding and nutrition of *Tuberolachnus salignus* (Gmelin) (Homoptera, Aphididae): I. The uptake of phloem sap. Journal of Experimental Biology 34(3): 334–341.
- Molnár N. (2003) Population dynamics features of willow-feeding aphids. Acta Phytopathologica et Entomologica Hungarica 38(1–2): 125–135.
- Riyaz M., Mathew P., Paulraj G. and Ignacimuthu S. (2017) Entomophily of apple ecosystem in Kashmir valley, India: A review. International Journal of Scientific Research in Biological Sciences 5(5): 146–154.
- Riyaz M. and Sivasankaran K. (2022) First record of *Xanthia (Cirrhia) icteritia* (Hufnagel, 1766) (Noctuidae: Xyleninae) from India. Journal of Threatened Taxa 14(8): 21745–21748. doi: 10.11609/jott.7846.14.8.21745-21748
- Sage R.B. and Tucker K. (1997) Invertebrates in the canopy of willow and poplar short rotation coppices. In Biomass and energy crops. Cirencester, Royal College of Agriculture, UK. pp105–112.
- Salisbury A., Mansfield L., Edwards G. and Aradottir G.I. (2022) Quince (*Cydonia oblonga* Mill), an unusual host for the giant willow aphid *Tuberolachnus salignus* Gmelin (Homoptera: Aphididae). British Journal of Entomology and Natural History 35(4): 416–418.
- Skendzic S., Zovko M., Ivković I. P., Lešić V. and Lemić D. (2021) The impact of climate change on agricultural insect pests. Insects 12(5): 440. doi: 10.3390/insects12050440.
- Sharma G.C. and Thakur J.R. (1993) Biology of giant willow aphid, *Tuberolachnus salignus* (Gmelin) (Homoptera: Aphididae) in the cold arid zone of HP. Indian Forester 199(8): 648–653.
- Sopow S.L., Jones T., McIvor I., McLean J.A. and Pawson S.M. (2017) Potential impacts of *Tuberolachnus salignus* (giant willow aphid) in New Zealand and options for control. Agricultural and Forest Entomology 19(3): 225–234. doi: 10.1111/afe.12211.
- Szelegiewicz H. (1962) Materiały do poznania mszyc (Homoptera, Aphididae): 1. Podrodzina Lachninae. Fragmenta faunistica 10(6): 63–96.
- Tun K.M., Minor M., Jones T. and McCormick A.C. (2020) Volatile profiling of fifteen willow species and hybrids and their responses to giant willow aphid infestation. Agronomy 10(9): 1404. doi: 10.3390/agronomy10091404