



Figure 1. Channel cross-sections generated at different steps of the tool. *a*, Cross-section profile generated after import of data; *b*, With water stage after first click; *c*, Water inundated shown by shaded region; *d*, Final display with values of water discharge and average depth.

sustenance of river ecology) at any given cross-section, the ChanGe tool can be used to estimate the amount of discharge to be released from upstream⁶. Water resource management for irrigation canals or agricultural practice will be another potential sector where this tool can be utilized. Lastly, the estimation of flood inundation due to high magnitude floods can also be estimated with this tool.

We have presented a simple tool, ChanGe to estimate the discharge for any desired stage using the cross-section data from any natural river. Additionally, the tool provides channel geometry parameters such as hydraulic radius, average flow velocity and average depth. Results from a hypothetical cross-section show the usefulness of the MATLAB based tool in flood hydrology analysis. Moreover, the simple workflow approach with an intuitive graphical interface will help researchers to estimate hydrological and

hydraulic parameters with ease. Although there are many sophisticated toolboxes available^{11,12}, ChanGe will provide simplistic means to the researchers and planners. Future work seeks to incorporate discharge-dependent roughness coefficient which will minimize the error in discharge estimation. Quantification of this error will be helpful for designing hydropower stations, irrigation and other management practices^{1,2,6}. It is also noted that the flow-velocity is variable across the channel and with the depth¹¹. Therefore, another future development could be the incorporation of variable flow velocity along the river cross-section as well as the depth-dependent distribution of flow velocity with physics-based laws.

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Invasive hawthorn spider mite, *Amphitetranychus viennensis* (Zacher) (Acari: Tetranychidae) from India

The spider mites (Acari: Tetranychidae) are the most economically important group of mites which cause considerable loss of yield on different crops^{1–3}. Till date, 1321 valid spider mite species are

known on 3917 species of plants with 16,221 host records³. The Indian spider mites fauna is also rich with 122 species and nearly 10% of total species of the world. Among these, more than 12 spe-

cies are reported as most economically important on different agro-horticultural crops^{3,4}. Hawthorn spider mite, *Amphitetranychus viennensis* (Zacher, 1920)⁵ (family

Tetranychidae), is one of the important pests of fruit crops and ornamental plants in European countries⁶⁻¹¹. It is distributed in over 39 countries, including the Oriental (3) and Palearctic (36) biogeographical regions. It has been reported on 70 different host plants belonging to 14 families, of which the family Rosaceae recorded the maximum number of mites. It is commonly present on apple, pear, plum, cherry, black cherry, blueberry and other pome fruits³. This mite has been notified as a quarantine pest on seedlings of *Malus domestica* under SPS committee of WTO regarding plant quarantine (Regulation of import to India) (Third Amendment) Order 2018, against apple seedlings which are to be imported from Austria, Germany and Ukraine¹². So hawthorn spider mite may become a serious pest on apple and other pome fruits in India. The present study aims at reporting *A. viennensis* as an introduced pest species from India.

Small branches along with leaves were collected from the Indian persimmon, *Diaspyros kaki* Thunb., and examined under 10× hand lens for mites. Twigs along with the mites were transferred to a zip-lock bag for further examination in the laboratory with proper collection data. The mites were directly mounted in Hoyer's medium. All the mounted specimens were identified based on available keys^{13,14}.

Materials examined – Three females; ex. Persimmon, *Diaspyros kaki* Thunb.; collc. Jayaram C.S.; Sarsai, Kullu District, Himachal Pradesh (32°08'14"N 77°10'32"E) (1696 m amsl); October 2017. This mite occurred on the under surface of the leaves.

A. viennensis is commonly found on plants belonging to the family Rosaceae^{11,15-18} and other families like Apocynaceae, Betulaceae, Caprifoliaceae, Asteraceae, Fagaceae, Grossulariaceae, Hydrangeaceae, Malvaceae, Moraceae, Oleaceae, Salicaceae, Sapindaceae and Ulmaceae. It was recently reported with molecular confirmation from two countries, viz. Serbia-Montenegro¹¹ and the Republic of Korea¹⁹. Mohyuddin²⁰ reported the same species under *Tetrany-*

chus viennensis on apple in Pakistan, while Wang and Cui²¹ reported it on a plant species belonging to family Rosaceae in China. Although it was reported during 1990s in Pakistan and China, it has been recorded from India after 27 years. It is presently found associated with *D. kaki* (family Ebenaceae), which is considered as a new host. So it is suspected that this mite might have gained entry into India from an unidentified source and in future it might become a serious pest on apple and other pome/stone fruits grown in Himachal Pradesh, Jammu and Kashmir, Uttarakhand and Ladakh.

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