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RESEARCH ARTICLE

Trapa natans L. (WATER CHESTNUT) IN HIMALAYAN WETLAND DEORIA TAL, INDIA.

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Abstract

The Himalayas are the rich source of tangible and intangible goods and services. The Himalayan lakes and wetlands possess rich and diverse biodiversity. The present study was conducted to find the impacts of *Trapa natans* (water chestnut) on Himalayan wetland Deoria Tal from April 2014- March 2016 spreading in the epilimnetic zone of the wetland. The beautiful wetland is a tourist spot and is famous for its landscape and panoramic view of the nearby snowy mountain peaks that are reflected in the water, which are the main attraction for the tourists round the year. Water chestnut hinders the picturesque beauty as well as the path of aquatic fauna. Keeping in view the effects of water chestnut on the wetland, few objectives and control measures have been suggested for its eradication so that conservation and management should be done.

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Introduction:-

Deoria Tal is a beautiful wetland located at an altitude of 2,445 m above m.s.l. between latitude 30°31'44" N and longitude 79°07'48" E to South-East of Ukhimath in the Rudraprayag district of Garhwal Himalaya, India with an area of 25,703.06 m², covering total circumference of 759.62 m (Fig 1). The wetland is 12 kilometers from Ukhimath through village *Sari*. From *Sari*, there is a trek route of 3 km towards the wetland. It has so many mythical stories connected with the epic "*Mahabharata*". Local people believe it pure and sacred as *devas* (Hindu Gods) bathe in the water so the name given "*Devaria/ Devariya/ Deoria*" and celebrate the festival "*Krishna Janamashtami*" on 15th September every year in which a huge crowd gathers near the wetland and do *Nagaraja* (God of Snakes) *puja* (Sharma et al, 2018).

The wetland is facing a serious problem of weed *Trapa natans* from the last few years. **This weed is commonly known as water chestnut/ horned water chestnut/ water caltrop/ water nut/ bull nut that dominate shallow lakes, ponds and river margins** (Pemberton, 1995) and is an invasive annual macrophyte that grows mainly in parts of southern Europe, Africa, Asia and spread worldwide. It has been grown in Europe and used as food by ancient Europeans (Bhatwal et al., 2012). Historically, the herb was used as an ornamental herb. Every year, tourists visit the place and attracted towards the scenic beauty and landscape (Fig 2). Wetlands help in maintaining the natural cycles and ecological diversity so the present study is focused to provide very first report on the impact of the weed on the wetland. Tantara and Rafiq, 2013 discussed the effect of nutrient concentration on biochemical characteristics of *Trapa natans* in Mansbal lake, Kashmir. Adkar et. al., 2014 discussed nutritional and

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pharmacological aspects of *Trapa bispinosa*. Few Gani et. al., 2010 examined Physico-chemical, morphological and pasting properties of starches from water Chestnuts from three Lakes of Kashmir, India. Few research articles have been published on the water quality and microbiological diversity of Deoria Tal (Sharma et. al., 2018; Chaudhary et. al., 2018). **It has become important to control or keep a check on the weed *Trapa natans* so that the beauty, as well as the water quality will remain in the actual state.**

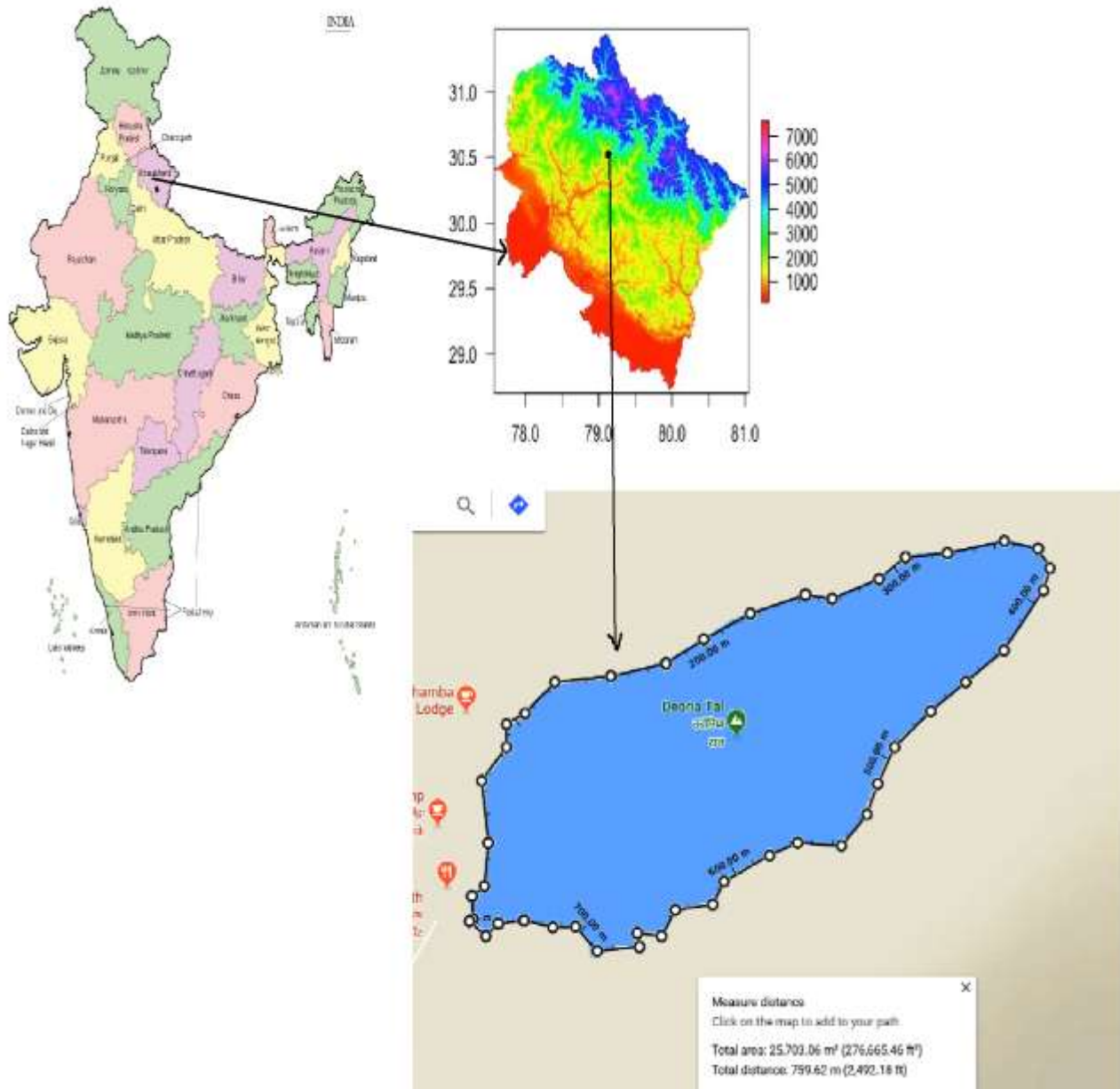


Figure 1:- Map of the Wetland Deoria Tal, India (Source: Google Earth)



Figure 2:- Magnificent view of the wetland Deoria Tal

Description of the plant:-

Trapa natans L. (Family: *Trapaceae*) is an annual, broadleaved and herbaceous freshwater macrophytic weed having slender roots that grows from the bottom with annual reproductive cycles. The persistent seeds usually germinate in the spring season. This macrophyte has a floating canopy of leaves with a submerged stem (Hummel and Kiviat, 2004). The leaves petiole float on the surface of the water. The stems have many branched roots. The plant has single white and small flowers that grow in the center of the rosette. Each rosette can produce hard, nut-like and sharp spiny fruits in July. *T. natans* grows best in shallow and nutrient-rich water bodies with a pH range of 6.7-8.2 and calcium carbonate alkalinity of 12-128 mg/l (Charles, 2006) When the fruit with older leaves is released from the parent plant, the central terminal meristem produces new leaves in the rosette (Groth et al, 1996). The plant spread in the shallow water bodies at a very fast rate, deteriorating the health of the aquatic ecosystem.

Plant Physiology Timeline

- **Mid-May:** central rosettes emerge from the water
- **Mid-June:** secondary rosettes emerge, central rosettes forming flowers
- **Early July:** secondary rosettes flowering, mature seeds already viable on central rosettes
- **Late July:** hundreds of viable seeds present on each plant

Source: Maryland Department of Natural Resources Management Strategies for Water Chestnut (*Trapa natans*): A Historical Perspective

Impact of *Trapa natans* on wetland:-

Wetland Deoria Tal is blessed with a beautiful panoramic view. The reflecting images of the nearby mountain peaks like Chaukhamba, Nilkantha, Kalanag and Bandarpunch can be seen in the crystal clear water of the wetland (Fig 2). *T. natans* not only forms the nuisance mat over the surface of the water, but block the reflection of the snowy peaks and vegetation. **These mats affect aquatic ecosystems by obstructing the path of the aquatic fauna.** The spiny nuts can create injuries to people and cattle walking along the shore of the wetland. The mats of *T. natans* can affect the productivity cycles of the wetland as well as the water quality by decreasing the dissolved oxygen because of the decomposition of the plant in the water. The growing population can also affect the light penetration path of the phytoplankton. In Hudson's river study, 0.5% light could reach underneath beds of *T. natans* (Caraco and Cole, 2002). Hummel and Kiviat, 2004 also reported intercept 95% of light.



Figure 3:- *Trapa natans* (Water chestnut) mat affecting the wetland Deoria Tal

Conservation and management:-

Keeping in view the significant role of wetlands, it is important to take the initiatives for better conservation of the Himalayan wetland Deoria Tal and find suitable measures for its management.

The complete eradication of *T. natans* is not possible because of its fast growing nature. The process requires expensive control efforts. Few following measures have been suggested for the removal of species from the wetland.

Harvesting-

Hand harvesting is a good option to remove the small plants (Naylor, 2003). All plants can be removed to minimize the expanding population of **T. natans** (Swearingen et al, 2010). The harvested fragments of weed should be disposed off at a place far from the wetland. Harvesting should be done before the abscission and maturation of seeds (Methe et al, 1993). As the seeds remain present for many years, sequential harvesting should be done for complete and effective eradication (Naylor, 2003; Hunt and Marangelo, 2009).

Biological:-

The leaf beetle **Galerucella birmanica** has remarkable negative impacts on **T. natans** populations and is used as pest in China (Ding et al, 2006).

Chemical

Herbicides containing 2,4-D are effective in controlling **T. natans** and provide best results in early summer. 2, 4-D. Herbicides containing triclopyr are also effective but their use may harm other plants. The growth can also be repressed by light attenuating dyes before the plant germination.

Conclusion:-

T. natans, an indigenous weed is posing a threat to the Himalayan wetland Deoria Tal. Few measures have been suggested for the eradication of the weed. The forest department and the local agencies should come up with the best solution measures for its conservation and management. As this plant has some medicinal properties too, the awareness campaigns should be organized for the local people to make them aware of the use as well as effects.

Conflict of interest:-

There is no conflict of interest regarding the publication of this paper.

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