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Observation on the Diversity of Riparian Vegetation in the Sahastradhara Stream from Doon Valley (Uttarakhand) India

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ABSTRACT

The physical and ecological health of streams is both influenced by riparian vegetation. It helps to maintain the balance of oxygen, nutrients, and sediments in the environment, as well as providing habitat and food for micro and macrofauna. The purpose of this study was to add to our understanding of the riparian vegetation of the Sahastradhara stream in Doon Valley. The studied riparian zone of the Sahastradhara stream in Dehradun comprises a total of 69 plant species belonging to 41 different families. The Asteraceae family, with 13 species, dominated the riparian vegetation, followed by Euphorbiaceae (04 species), and Solanaceae (04 Species).

Keywords: Riparian vegetation, Sahastradhara Stream, Doon Valley.

INTRODUCTION

The term riparian has its roots in Latin word ripa, meaning bank of the river (SEPA, 2009). The riparian zone is the zone of interaction between terrestrial and aquatic environments (Gregory et al., 1991). Bren (1993) detailed a riparian zone as the area which is present in close proximity to a river or stream. It is characterized as the transitional zone between land and water ecosystems that are influenced by the changes in biophysical factors, ecological processes, and the life forms present in the surrounding (National Research Council, 2002). Riparian vegetation can be defined as the assemblage of different types of plant communities present in the riparian zone. These communities of the plant are specialized and adapted to disturbances and evolved within the upland forest system (Naiman and Decamps, 1997 and Naiman et al., 1998). Riparian vegetation forms various patches of plants that differ in physiognomy, forms, and composition. This difference in patterns is due to variability in the physical and chemical conditions of the surrounding environments (Dufour and Rodriguez-González, 2019). So, it contributes to the species richness across the earth by sustaining plant species different from that of upland vegetation (Sabo et al., 2005). Naiman et al., 1998 state that the riparian forest is the vegetation that is in close contact with the rivers and streams and extends laterally to encompass the active floodplain and terraces into it.

Riparian vegetation is an essential component of the aquatic system and performs many social and ecological functions (Malanson, 1993; National Research Council, 2002). It controls the exchange of water and chemical between terrestrial and aquatic systems (Burt and Pinay, 2005). Rainwater that falls on the riparian land progresses in different ways. Some precipitation is seized by vegetation and evaporated back into the air and most of it is absorbed by the soil. Water from uplands mostly flows side wise across the riparian land to the rivers and streams. With this flowing water, there is a continuous flow of some nutrients and chemicals. Plant debris and decaying vegetation and microbes produce organic matter that contributes to the chemical quality of riparian zone and stream and river water (Dosskey et al., 2010). The plant species that are submerged in the water bodies influence the productivity of the ecosystem (Baluni and Chandola,

2019). Tree stems, plant debris, or large branches stuck in the water channel provide stability and deposition and slow the stream or river velocity, and also, provide food and habitat for micro and macro-invertebrates and fishes dwelling in the stream or river (Harmon et al., 1986). Also, stream banks lacking riparian vegetation are mostly unstable and eroded because plants provide strength to the soil through their root systems (Griffiths, 1980; Hupps and Simon, 1986, Sagir et al., 2018).

Aquatic species in the stream or river are mostly dependent on riparian vegetation for food and shelter. Leaves, twigs, small branches, and other plant materials are a good source of food for different species in water. Also, shrubs and trees along the river banks provide shade and cover to the water bodies which help in cooling their environment and protecting living organisms in it (SEPA, 2009).

Riparian vegetation is crucial in maintaining aquatic-terrestrial linkages and acts as a corridor between them. Any change in the nearby aquatic and terrestrial habitat influences the environment of riparian vegetation. Thus, it acts as a good bio-indicator by providing an early indication of any change in the environment (Decamps, 1993; Risser, 1990). Pusey and Arthington (2003) studied the effect of riparian vegetation on the ecology of water bodies. Srivastava (2007) mentioned riparian vegetation as an important functioning factor for geomorphological, physicochemical and biological aspects of the river or stream. The hydrobiology of river Alaknanda of Garhwal Himalayas was studied by Badola and Singh (1981). Joshi (1984) gave an ecological note on the riverine forest of Garhwal Himalayas. Balodi et al.(2004) detailed riparian vegetation of Eastern Nayar while Sagir and Dobriyal (2017, 2018) studied riparian vegetation of Western Nayar. Chamoli (2020) studied the weed flora of the riparian areas of the Rudraprayag district. The present study attempted to contribute to the knowledge of riparian vegetation of the Sahastradhara stream from Doon Valley.

MATERIAL AND METHODS

Riparian vegetation was collected from the selected areas of the Kali Gad, an upstream tributary of the Song River and popularly known as the Sahastradhara stream (Map-1). The specimens were collected and completed from September 2019 to August 2021. Plants were identified using local names consulted by the local inhabitants and then were confirmed with the help of different keys of available floras for their taxonomical specification (Gaur, 1999). The specimen's information on plants was processed, documented, and finally deposited in the Department of Zoology, SGRR University, Dehradun as reference material.

RESULT

A total of 69 species of plants belonging to 41 different families were identified from the riparian zone of Sahastradhara stream Dehradun (Table-1). Plant species collected from various spots represented various life forms i.e., herbs, shrubs, and trees. Of all the plant species most commonly noted plants were *Bidens pilosa, Ageratum conyzoides, Lantana camara, Eupatorium adenophorum, Parthenium hysterophorus, Xanthium strumarium, Artemisia vulgaris, Cyathea dealbata, Solanum nigrum and Adhatoda vasica*. Asteraceae family with 13 species formed the dominant component of the riparian vegetation followed by Euphorbiaceae with 04 species, Solanaceae with 04 Species and Amaranthaceae with 3 species respectively (Figure-1; Photo A-R).

Table-1: List of riparian vegetation of selected areas of Sahastradhara stream.

S.No.	FAMILY	BOTANICAL NAME	COMMON NAME
1.	Acanthaceae	*Adhatoda vasica*	Malabar Nut, Basinga
2.	Acanthaceae	*Strobilanthes wallichii*	Wild Petunia, Kandali
3.	Amaranthaceae	*Achyranthes aspera*	Latjiri
4.	Amaranthaceae	*Alternanthera spp.*	Stalkless Joyweed, Matsyakshi
5.	Amaranthaceae	*Pupalia lappacea*	Nagadaminee
6.	Apocynaceae	*Carissa opaca*	Cudd
7.	Asteraceae	*Gnaphalium hypoleucum*	Cudweed
8.	Asteraceae	*Parthenium hysterophorus*	Gajar ghas
9.	Asteraceae	*Ageratum conyzoides*	Chickweed, Jungli pudina
10.	Asteraceae	*Anaphalis busua*	Bugla
11.	Asteraceae	*Artemisia nilagirica*	Kunjaa
12.	Asteraceae	*Artemisia vulgaris*	Mugwort, Majtari, Charmar
13.	Asteraceae	*Bidens pilosa*	Kumur

14.	Asteraceae	*Cirsium verutum*	Kandaya
15.	Asteraceae	*Conyza aegyptiaca*	Mant
16.	Asteraceae	*Eupatorium adenophorum*	Kharna
17.	Asteraceae	*Galinsoga parviflora*	Marchya
18.	Asteraceae	*Sonchus oleraceus*	Dudiya
19.	Asteraceae	*Xanthium strumarium*	Common Cockle bar, Chota dhatura
20.	Berberidaceae	*Berberis asiatica*	Kingoorh
21.	Cactaceae	*Opuntia vulgaris*	Cactus
22.	Caesalpinaceae	*Cassia fistula*	Kirala
23.	Caesalpinaceae	*Cassia tora*	Chakunda
24.	Cannabaceae	*Cannabis sativa*	Bhang
25.	Commelinaceae	*Cyanotis cristata*	Nabhali
26.	Convolvulaceae	*Ipomoea batatas*	Shakarkand
27.	Cupressaceae	*Cupressus torulosa*	Surai
28.	Cyperaceae	*Cyperus spp.*	Saru
29.	Cyperaceae	*Cyperus rotundus*	Motha
30.	Cyatheaceae	*Cyathea dealbata*	Silver Fern, Ponga
31.	Dryopteridaceae	*Dryopteris spp.*	Wood Fern
32.	Euphorbiaceae	*Euphorbia royleana*	Sulla
33.	Euphorbiaceae	*Sapium insigne*	Khinna
34.	Euphorbiaceae	*Jatropha curcas*	Purging nut
35.	Euphorbiaceae	*Ricinus communis*	Arand
36.	Fagaceae	*Quercus leucotrichophora*	Oak
37.	Fabaceae	*Dalbergia sissoo*	Biradi
38.	Fabaceae	*Trifolium repens*	Satphal
39.	Geraniaceae	*Geranium ocellatum*	Kaphlya
40.	Geraniaceae	*Geranium nepalense*	Phori
41.	Lamiaceae	*Leucas lanata*	Guma
42.	Lauraceae	*Lindera pulcherrima*	Wild privet, Dadia, Cheri
43.	Lythraceae	*Woodfordia fruticosa*	Dhaula
44.	Malvaceae	*Malvastrum coromandelianum*	Suchi
45.	Meliaceae	*Toona ciliata*	Redcedar, Toon
46.	Menispermaceae	*Cissampelos pareira*	Velvet Leaf, Akanadi, Batindu, Pari
47.	Mimosaceae	*Acacia catechu*	Black cutch
48.	Moraceae	*Ficus religiosa*	Peepal
49.	Oleaceae	*Olea glandulifera*	Native olive
50.	Onagraceae	*Oenothera rosea*	Rose evening primrose
51.	Oxalidaceae	*Oxalis corniculata*	Amrul
52.	Phyllanthaceae	*Phyllanthus urinaria*	Sulla hajarmani
53.	Pinaceae	*Pinus roxburghii*	Chir
54.	Poaceae	*Arthraxon prionodes*	Glum
55.	Poaceae	*Saccharum spp.*	Kaans
56.	Rhamnaceae	*Ziziphus mauritiana*	Ber
57.	Rosaceae	*Rubus ellipticus*	Hinssar
58.	Rubiaceae	*Galium asperifolium*	Goosegrass

59.	Rubiaceae	*Galium elegans*	Elegant goosegrass
60.	Rutaceae	*Murraya koenigii*	Curry tree
61.	Salicaceae	*Salix spp.*	Manjar
62.	Solanaceae	*Datura stramonium*	Kank
63.	Solanaceae	*Solanum incanum*	Banbhatuja
64.	Solanaceae	*Solanum nigrum*	Black nightshade
65.	Solanaceae	*Physalis minima*	Sunberry, Rasbhari
66.	Tiliaceae	*Corchorus aestuans*	Chonch
67.	Tiliaceae	*Grewia optiva*	Bhimal
68.	Urticaceae	*Urtica dioica*	Kandali
69.	Verbenaceae	*Lantana camara*	Big sage

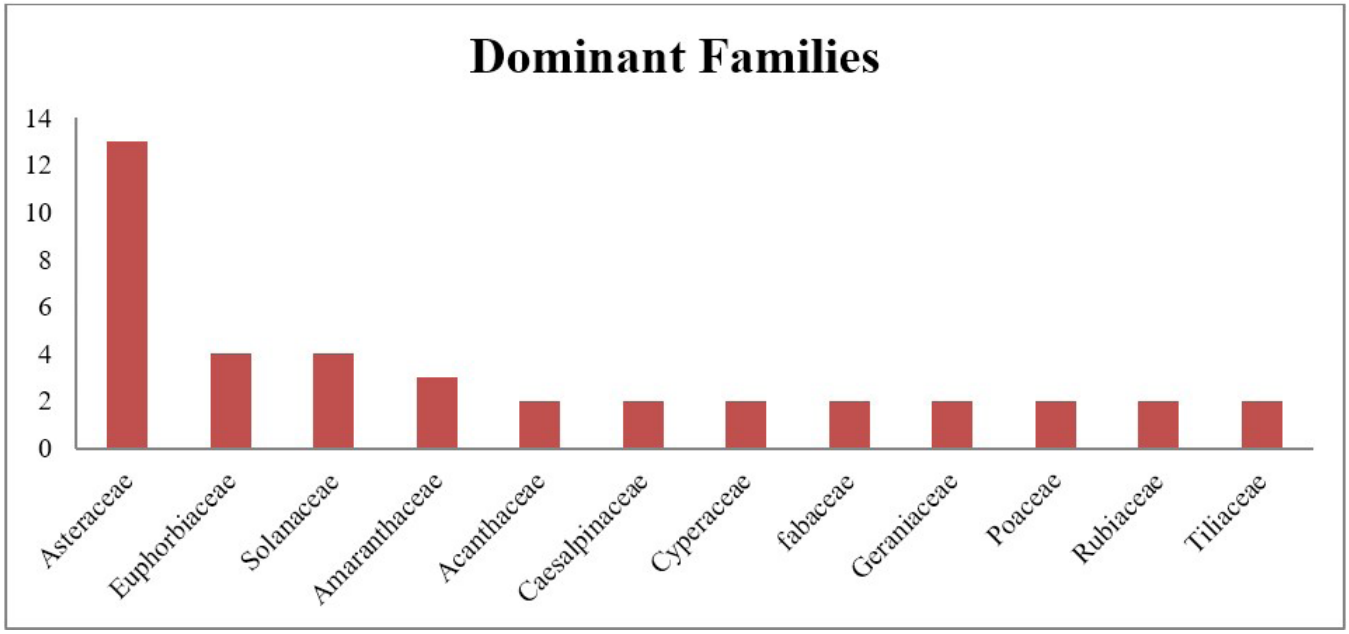
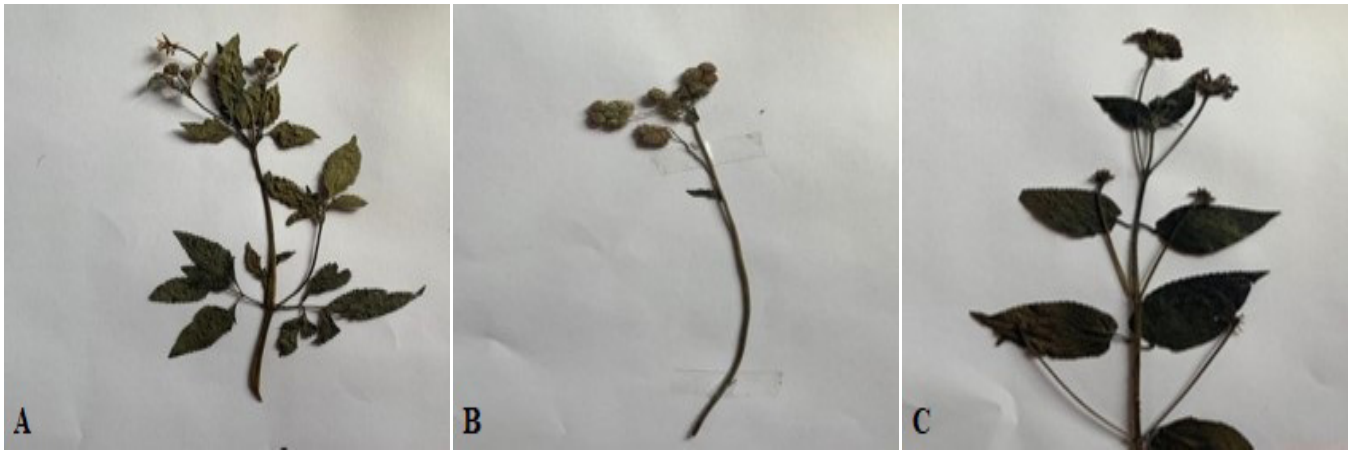


Figure-1: Dominant families of the riparian zone of the Sahastradhara stream

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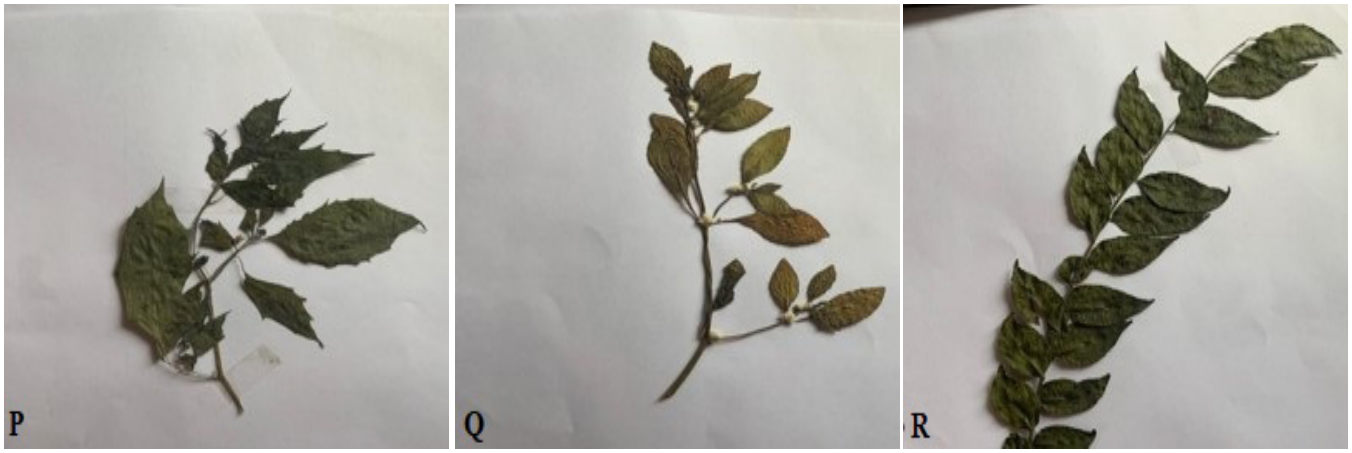
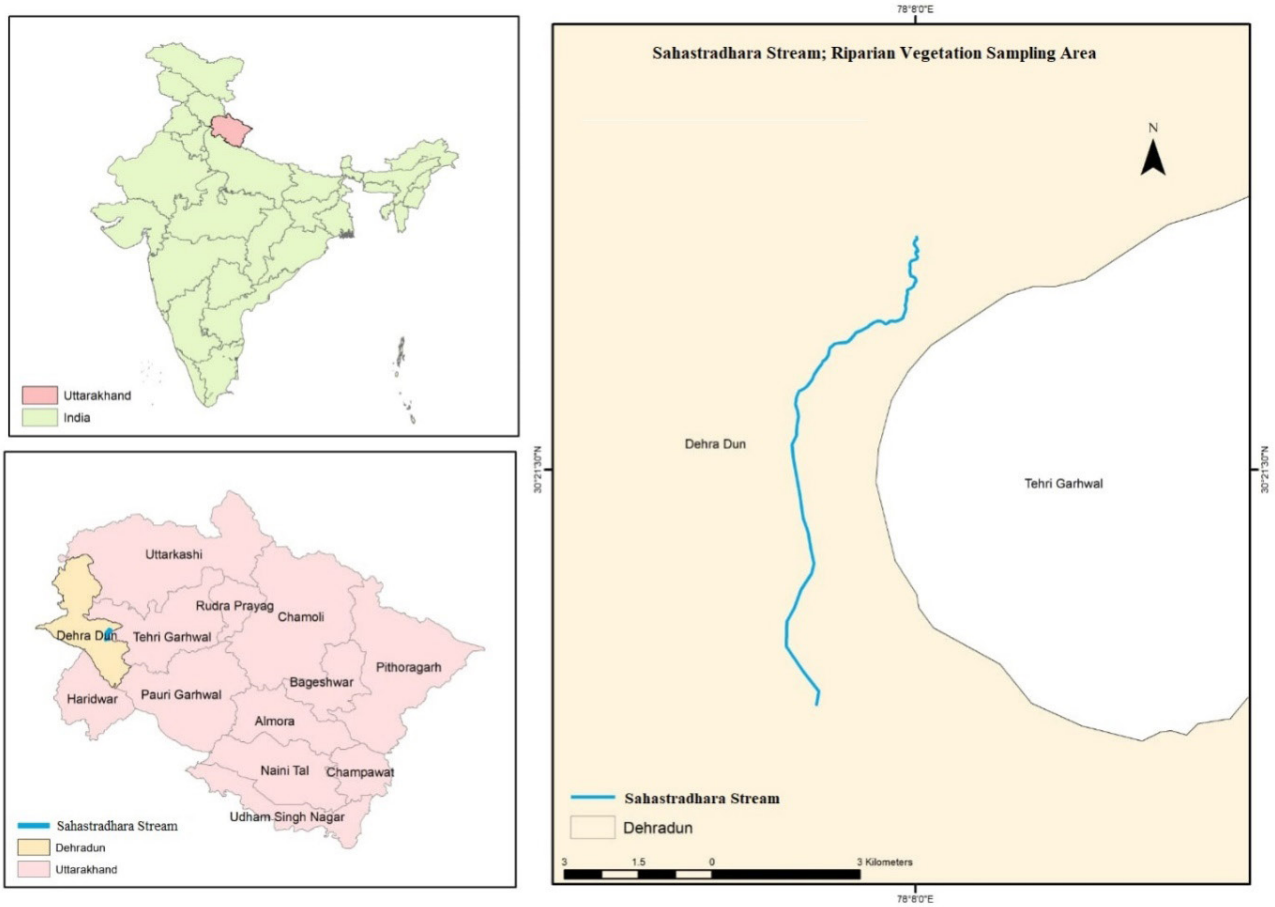


A. Bidens Pilosa , B. Ageratum conyzoides, C. Lantana camara, D. Eupatorium adenophorum, E. Parthenium hysterophorus, F. Xanthium strumarium, G. Artemisia vulgaris, H. Solanum nigrum, I. Cyathea dealbata, J. Adhatoda vasica, K. Strobilanthes wallichii, L. Lindera pulcherrima, M. Dalbergia sissoo, N. Dryopteris spp., O. Cissampelos pareira, P. Physalis minima, Q. Alternanthera spp., R. Murraya koenigii



DISCUSSION

Sahastradhara stream has rich areas of riparian vegetation with a variety of plant forms. Riparian vegetation is very significant in regulating the environmental processes along the river as it performs multiple functions that are advantageous for both terrestrial and aquatic fauna of the Sahastradhara stream. It regulates the intensity of light reaching the area and maintains the temperature of the surroundings by shading and covering. Shading keeps the temperature of both land and stream water from rising

too high, protecting micro invertebrates, fish, and animals from the harmful effects of high temperatures.

Riparian vegetation has a strong relationship with the biotic community dwelling in the water as mentioned by Hynes (1975). A rich aquatic biota of the Sahastradhara stream indicated the regular abundant availability of food and nutrients. Vegetation along the river is a good source of nourishment for micro and macro-organisms. It contributes detritus and nutrients to the aquatic fauna and helps in holding soil, thus avoiding its erosion and consecutively improving the quality of the stream (Sagir and Dobriyal, 2018). Leaves, branches, and woody debris of plants provide feeding reserves, breeding spots, and hiding places for a wide range of fauna (Shilla and Shilla, 2012; Zanetti et al., 2016). Water Mites prefer to remain in the dark and cervices of logs and stones for hiding and breeding. Also, larvae of water mites feed on the leaves, twigs, and other plant parts which were best provided by vegetation along the Sahastradhara stream.

Riparian vegetation also regulates the flow of water and nutrients from the land to the stream by acting as a corridor and maintaining the biodiversity of the River (Naiman et al., 1993). The plant species present in the area are beneficial for the local people for fulfilling their basic needs of fodder for cattle, traditional medicine, fruits and wood. Sahastradhara stream is an important source of water for domestic and agricultural purposes. Agricultural-derived contaminants and other domestic effluents directly or indirectly flow into the river. Riparian vegetation acts as a great buffering system. It is believed to reduce the flow of the contaminants direct into the river by modifying, diluting, or downgrading its chemical composition (Osborne, 1993). Thus, there are fewer to no disturbances for the aquatic water mites to survive.

The study has shown of constant relation between abiotic and biotic constituents sustaining life in the Sahastradhara stream. The aquatic fauna, especially water mites are very much dependent on riparian vegetation. Their food and feeding habits, shelter and protection from predators and breeding sites are more or less satisfied by the plant communities or their parts besides the river.

Hence, Riparian vegetation provides river bank stability, decomposition, shade, food, nutrients, organic matter, detritus, protection, breeding spots, hiding places, wood, fodder, traditional medicine, and a buffering system which indicates a good and healthy environment for the neighboring ecosystems. It is also indicative of good water quality and conditions for the survival of micro and macro-organisms in the river or stream. Any loss to the vegetation can cause deprivation of these natural rewards. Shyam (2008) linked the importance of riparian vegetation to anthropogenic requirements during his study on the river Ganga. Srivastava (2007) has suggested that riparians affect the geomorphology and physical chemistry of the river system.

According to Baluni and Chandola (2019), the riparian vegetation in the Kyunja stream was observed as rich and conducive to biological productivity. Authors observed rich epilithic periphyton and detritus standing stock along with macrozoobenthos. Periphyton diversity and distribution concerning stream physicochemical parameters have a huge impact on the occurrence of several mites (Bahuguna et al., 2019, 2020; Pesic et al., 2019a,b; 2020a,b; Negi et al., 2021), macrozoobenthos (Kumar and Dobriyal, 1999; Rautela et al., 2006; Bahuguna and Dobriyal, 2018; Mamgain et al., 2021) and drifting behaviour of invertebrates (Bahuguna et al., 2019, 2020; Bahuguna and Dobriyal, 2020; Negi et al., 2021) and on fish diversity (Bahuguna et al., 2010; Bahuguna and Joshi, 2012; Bahuguna 2020, 2021; Rayal et al., 2021a,b). Sagir and Dobriyal (2017, 2018) have worked on the riparian vegetation of Western Nayar and reported that they form detritus and hence positively affect the production of macrozoobenthos and fishes.

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