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Keystone Bioresources of Rajasthan Desert

Rajasthan desert is among the desert of the world having rich biodiversity. Some plants and animals of this region are so interesting ecophysiologically that they act as keystone species on which many others survive and depends. The effect of keystone species is large, and disproportionately large relative to its abundance (Power *et al.*, 1996). Its role must be great in relation to its relative biomass contribution. Beech trees in a beech forest are not considered as keystone because their effect is not disproportionate to their relative abundance.

Keystone status of a species is entirely context-dependent i.e. the community importance of the same species may vary from one ecological situation to another. Menge *et al.* (1994), showed that redundant species (whose removal has negligible effect) with a low interaction strength can play a major role in a community if the keystone species (whose removal causes major changes) are removed. Mills *et al.* (1993) has used keystone species in five types viz. Predator, Prey, Mutualists, Hosts and Modifiers. Predators control the density of primary consumer and other types of ecologically significant prey species. Prey limits the density of the predator and restricts the range of parameters open to other prey. Mutualists are animals that are significant factors in the persistence of plant species otherwise known as mobile link pollinators and seed dispersers. Hosts are those plant that support pollinators and seed dispersers.

Rajasthan desert located in the North-west part of the Rajasthan state, forms an important part of great Indian Desert, known as Thar desert representing an environment with limited resources. Climate of this region is characterized by extremes of temperature, high wind velocity, low relative humidity and scanty rainfall. The soil is poor in organic matter with very low productivity. Frequent drought and subsequent famine have characterised the eco-physiological and economic dynamics of this region for centuries. Despite these inhospitable conditions, it has sustained life and remained one of the most heavily populated desert regions of the world. It is also unique in having rich biodiversity. The vegetation is xerophytic. The major trees are *Prosopis cineraria*, *Tecomella undulata*, *Acacia senegal*, *Acacia nilotica*, *Acacia jacquemontii*, *Salvadora persica*, *S. oleoides*, shrubs includes *Ziziphus nummulara*, *Capparis decidua*, *Calligonum polygonoides*, *Leptadenia pyrotechnica*, *Calotropis procera*, etc. and herbaceous are *Crotalaria burhia*, *Aerva persica*, *Lasiurus sindicus*, *Cenchrus setigerus*, etc. Common Wild life are Chinkara (*Gazella bennettii*), Neelgai (*Boselaphus tragocamelus*), Desert fox (*Vulpes vulpes pusilla*), Blackbuck (*Antelope cervicapra*), etc. It is also home of some rare animals like Great Indian Bustard (*Ardeotis nigriceps*), Indian vulture (*Gyps indicus*), Spiny tailed lizard (*Saara hardwickii*) and plants include Sua phog or Unt phog (*Ephedra foliata*), Guggal (*Commiphora wightii*), etc.

Some plants in Rajasthan desert shows profuse flowering and fruiting during early summer when the scarcity of food and fodder begins. During this unfavorable period of resource scarcity, these plants not only provide food and fodder to animals, nectar to pollinators but also protect their survival during this period. Such plants may be regarded as keystone species since they sustain the myriads of primary consumers including pollinators and dispersers. Such plant species are often termed as ecosystem engineers or ecosystem modifiers. They are also considered as Keystone species (Mclaren and Peterson, 1994). Protection of such keystone species is very necessary to support population of other species in the ecosystem that would be otherwise too small to contain viable populations (Carroll, 1992). In the present study, four plant species and one animal species have been identified as keystone species in Rajasthan desert viz. *Prosopis cineraria* (Khejri), *Capparis decidua* (Kair), *Calligonum polygonoides* (phog), *Maytenus emarginata* (Kankero) and *Scarabaeus vierreuxi* (Dung Beetle).

Besides many other ecological and physiological role in nature as keystone species, Khejri, Kair, Phog, Kankero provide food, fodder and shelter to animals and nectar to pollinators at the time of scarcity of resources. They also act as additional source of income for local people. Due to variety of land forms e.g.-deep sand or sand dune, soil with much gravel, rocky or saline soil etc., where cultivation of crops is not possible but these shrubs and trees can easily be grown in these wastelands without human caring. Desert soil is very poor in fertility especially of organic matter, in such condition Dung Beetle ensure the seed germination and growth of many plants and survival of many animal species by increasing soil fertility.

Observation

***Capparis decidua* (Forsk.) Edgew.**

Capparis decidua is an important constituent of desert ecosystem and plays a significant role in the rural economy of peoples in arid region of Rajasthan. The species can be particularly useful in arid areas as live hedge. During the hot dry period, cattle prefer to lie under them due to its cooling effect and dense shady canopy. Many rodent species dug their burrows under it and protect themselves from hot and cold waves during summer and winter season. Moreover, rodent also protects themselves from predator like cats and dogs. It also grows on those kankar lands where other shrubs and trees are totally absent. During hot summer when the land becomes barren of herbaceous species, only shrubs of this species are seen at such places it shows gregarious habit and form most protected area for many animals from predator and also from hot winds of summer. Such habit also provides breeding place for many animals.



Capparis decidue : in flowering stage and supporting a climber – *Cocculus pendulus*



Scarabaeus viette : rolling dung ball



Prosopis Cineraria : in harvested pearl millet crop field with nest of weaving bird



Calligonum polygonoides : in flowering stage



Maytenus emarginata : habit, supporting climbers- *Ephedra foliata* and *Cocculus pendulus*

***Calligonum polygonoides* Linn.**

Calligonum polygonoides locally known as Phog, Phogala or Phogaro, is a slow growing almost leafless, highly branched, glabrous, perennial shrub, 6-8 ft. in height (Bhandari, 1990). Sometimes it attains a height of 12-15 ft. It grows well in absence of any type of vegetation and is dominant biomass producer of the sandy areas in desert (Khan, 1997). *Calligonum polygonoides* is very good sand binder, prevent soil erosion thus help in controlling desertification. They are also used as live hedge, wind breaks and create favorable micro-climate for crop. Its branches are very much liked by camel and goat. It is the most important source of food for sustenance during famines (Bhandari, 1990 ; Kumar *et al.*, 2005; Goyal and Sharma, 2008). Flower buds locally known as *lasson*, is used for making *Raita* by mixing them in whey. Also give cooling effect to the body and cure sun stroke (Singh *et al.*, 1996). The aqueous paste of Phog is used as antidote against the heavy dose of Opium and poisonous effect of *Calotropis procera*. Its dried branches and roots are used as fuels in Charcoal making. Mechanical farming, sand mining and excessive cutting of branches for fuel are some of the reason of its rarity.

***Maytenus emarginata* (Willd.) Ding Hou**

Maytenus emarginata locally known as Kankero is an evergreen tree of Thar Desert. It is a small tree attaining a height of 3-5m. This multipurpose tree species mostly used as live hedge. It is drought hardy species and can grow very well in village common lands, orans, sand dunes and along road sides. It is used in traditional agro forestry system in arid regions of Thar Desert since ancient time. Besides having fodder value, it provides browse at the time of scarcity such as drought. Dense canopy of this tree provide shade to many animals and idle nesting habitat for birds. During the hot summer periods when other plants dry up, the Chinkara readjust their feeding habit and feed on the green leaves of *Maytenus emarginata* (Bohera *et al.*, 1992). It provide ideal place for growth of other climber plants like *Ephedra foliata* and *Cocculus species*. The dense canopy of this tree generates the cooling effect.

***Prosopis cineraria* (Linn.) Druce**

Prosopis cineraria is a life supporting multipurpose keystone tree species of Thar desert. It has become part of social and cultural life. It is valued in desert region due to its soil binding capacity, deep tap root system, positive allelopathic effect, soil fertility improvement and yield augmentation of under storey crops. It is a drought resistant tree, and can withstand extremes of temperature up to 48°C and less than 100 mm of rainfall. Khejri wood is useful for house construction and for making carts and agricultural implements.

Fruiting in *Prosopis cineraria* occur during summer season (April- June) and the protein rich new leaf formation occur during the end of summer (June- August). The tree is also known as "Kalaptaru" due to its phenophase suitability and popular utilization pattern (Krishnan and Jindal, 2015). It is a nitrogen fixing tree, thus improves the fertility and physical characteristic of the soil. The tree useful for birds and animals. Pods of this plant are eaten by birds. It is suitable tree species for nesting habitat for wide variety of bird's species including

critically endangered vultures (Hall and Hamilton, 2014). Many Honeybee species obtain nectar from its flowers, make their beehive on this tree and produce the best quality honey. During the summer period, animals rest under the shade of this tree due to its cooling effect.

***Scarabaeus viette* (Dung Beetle, Gubrela)**

Scarabaeus viette lives in varied habitat including desert, farmland, forest and grassland. They eat the dung of herbivores and omnivores. Some dung beetle also feed on mushroom and decaying leaves and fruits. By using their sensitive sense of smell these beetles search for dung. After capturing the dung, it rolls by following a straight line. They can roll up to ten times their body weight. The dung ball is buried inside the soft soil either for food storage or for making brooding ball.

Dung beetle plays remarkable role as keystone species in agriculture for nutrient recycling. They also protect livestock by cleaning the dung, which otherwise may provide habitat for pests. The bury dung material breaks down rapidly making nutrients easily available for growth of plants. These dung beetles disperse the seeds along with the dung of fruit eating animals and allowing new plants to flourish at distance. In addition, by burying and feeding on dung, the beetles kill the parasites of vertebrates contained in the dung and keep their population healthy. These dung beetle exist at very low density in ecosystem and constitute only fraction of the biomass, but plays a crucial role in the community (Klein, 1989). Thus, it acts as keystone species.

Within biological community some species may determine the persistence of many species in the community. The keystone species affect the organization of community to far greater degree than one would predict. Keystone species may hinge upon highly specialized relation with other species. *Capparis decidua*, *Calligonum polygonoides*, *Prosopis cineraria* and *Maytenus emarginata* are important tree and shrubs of Rajasthan desert. All the four species provide fruits during early summer when the scarcity of food and fodder begins. *Prosopis cineraria* is a nitrogen fixer. *Maytenus emarginata* is the most preferred supporting tree for the growth of *Ephedra foliata* and *Cocculus species*. Owing to frequent drought and famine in desert area rearing of livestock is the main subsidiary activity of the people. The desert soil is very poor in nutrients particularly of organic matter. In such conditions, Dung Beetle plays a very important role in increasing fertility of desert soil, ensures the seed dispersal and germination and survivals of many plant and animal species. By considering these characteristic features, these species may be considered as keystone species in Rajasthan desert.

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