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Availability and Utilization Pattern of Forage Plants in relation to their Nutritive Values by Wild Elephants in South West Forests

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ABSTRACT

The study was carried out on the availability and utilization pattern of various wild plant species by migratory elephants in relation to their nutritive values. It wasobserved that migratory elephants were selective for food plants in the wilderness. Out of 52 recorded plant species, only 22 plant species were found to be utilized either fully or partially as evidenced by branch breaking, debarking, uprooting etc. Overall utilization of food plants revealed that *Diospyros melanoxylon* was utilized maximum (34.39%) followed by *Pterocarpus marsupium* (24.86%) among all the plants consumed by migratory elephants. Bark of *Buchanania lanzan* was moderately utilized (10.58%). All other recorded plants were utilized below 10 per cent. Chemical composition of some wild plants consumed by elephants revealed that crude protein content varied form 3.18 (*Shorea robusta)* to 21.25 (*P. marsupium*) g per cent. High protein content of *P. marsupium* leaves might be the reason for highest degree of utilization. Crude fibre content ranged from 20.0 (P. marsupium) to 54.0 (*D. melanoxylon*) per cent.

Keywords: Elephant, forage plant, Dry matter intake

Elephants travel a long distance during their seasonal movement for food plants. An animal's range of movement would increase with greater body size and energy requirement (McNab 1963). Some factors like availability of food, water, barriers to free movement, spatial distribution, and diversity in habitat types may influence the home range size. Though elephants have no seasonally distinct ranges, they however move widely to find food patches that are sufficiently rich with habitat resources to support them (Olivier 1978). As elephants have a digestive system which makes them particularly susceptible to toxins and tannins, they must search for plant parts which contain only small amount of such chemicals.

Since 1987 a group of elephants totaling 40-60 has been migrating from Dalma Wildlife Sanctuary (DWS) of Jharkhand state to vast areas of SWB forests during August-September and remain there for 6-7 months. The DWS is adjacent to the tri-junction of borders of Orissa, Jharkhand and West Bengal and the forest of the area is under various degrees of biotic pressure due to mining activities. This has resulted in shrinking and degradation of elephant habitat forcing elephants to move out of the traditional habitat to raid crops to meet energy requirements and seek better habitat elsewhere (Dayte & Bhagwat 1993). The elephants spend the day time in forest patches and usually enter cultivated land only after sunset and leave before sunrise. As elephants require large home ranges with plenty of forage and water and this bring them into greater contact with human settlements. Elephants consume wild plants as well as cultivated agricultural crops. Although elephant is a coarse feeder (generally) and they feed on a wide variety of plants, the migratory elephants in SWB selectively consumed some wild plant species. The factors that influence the decision to consume or reject a plant are palatability of the item, and toxic substances (Sukumar 1990) and ungulates show a positive selection of plant species and plant parts with the highest protein value (Field 1976) or minerals such as sodium (Belovsky 1981). The present study was therefore undertaken to understand the utilization pattern of various wild food plants by the Asian elephants as part of their feeding strategy in terms of nutritive values.

MATERIALS AND METHODS

The study area is located in the districts of West Midnapur, Bankura and Purulia between latitudes $22^0 25^/$ North and longitudes $86^0 30^/$ to $87^0 49^/$ East. The soil is mainly red sandy, lateritic and alluvial type with red and black soil in a few pockets (Ghosh 1992). The maximum temperature ranges between 42^0C and 46^0C during summer and in winter it varies from 8^0C to 13^0C. The monsoon period is from mid-June to end of September. The average rainfall in the study area ranges between 1180 and 1428 mm. The forest types in the studied area are tropical dry deciduous forests dominated by sal (Champion & Seth 1968). Forests are divided into four broad categories: sal coppice, open scrub, open scrub with sporadic sal and plantations (Anon. 1988). Besides migratory elephants (about 40-60) the area also supports about 35 resident elephants (Anon., 2000).

Four plots measuring 1500 sq. m each were studied in four forests viz., Uthan Nayagram, Kuilibandh, Swargabati and Indkata to record pattern of different plant species consumed by elephants. Total number of each plant consumed with respect to the total number of plants present in the plots was recorded through evidences of branch breaking, main-stem breaking, stem twisting, bark peeling, uprooting and tusk markings (Ishwaran 1983). The degree of utilization was calculated based on the ratio of total individual plants consumed to total number of plants in the plot. Proximate analysis of those food plants consumed by elephants has been

done as per AOAC (1995). Sodium and potassium content of food plants were estimated using Flame Photometer (Model: Flame Photometer Burner Unit-121, Sistronics). Pressure was fixed at 0.5 kg cm^{-2} and sensitivity was medium. Copper, manganese, zinc, iron and calcium content of food plants were determined by Atomic Absorption Spectrometer (Model: Perkin Elmer A-Analyst 100).

RESULTS AND DISCUSSION

The migratory elephants consumed different plant species with varying degree of preferences. Twenty two plant species viz., Diospyros melanoxylon, Buchanania lanzan, Semecarpus anacardium, Pterocarpus marsupium, Smilax macrophylla, Ficus hispida, Acacia chundra, Aegle marmelos, Terminalia tomentosa, Shorea robusta, Lannea grandis, Butea superba, Zizyphus xylopyrus, Mucuna pruriens, Albizzia lebbeck, Trewa nudiflora, Careya arborea, Ichnocarpus frutescens, Kuttikalai (local name), Gmelina arborea, Gardenia gumifera and Terminalia belerica were consumed by the elephants as food plants. They consumed either the whole plant or its parts viz., leaf, leaf with succulent stem, bark, fruit and root. Overall utilization of food plants by migratory elephants revealed that the D. melanoxylon was utilized maximum (34.39%, n = 65) followed by P. marsupium (24.86%, n = 47) among all the recorded plants. Though the density of S. robusta was highest (1723) in the study area, elephants utilized it very poorly (0.24-0.67%). The bark of F. hispida was fully consumed wherever available. Bark of B. lanzan was moderately utilized i.e. 10.58 per cent. All other plants such as T. nudiflora, T. belerica, L. grandis and A. marmelos were utilized below 10.0 per cent. Bark of S. robusta was very poorly utilized (4.27%) in spite of their highest abundance in the forests. Out of total recorded plant species, five climber species viz., A. chundra, M. pruriens, Z. xylopyrus, B. superba and S. macrophylla were found to be consumed occasionally by elephants.

The chemical values of some wild plants indicated that crude protein content varied form 3.18 (*S. robusta*) to 21.25 (*P. marsupium*) g per cent. Leaf and entire plants were found to have higher crude protein than that in bark and roots. *Ichnocarpus frutescens* contained highest ether extract (3.64%) followed by that in *P. marsupium* (3.42%) and *T. tomentosa* (3.30%). Crude fibre content ranged from 20.0 (*P. marsupium*) to 54.0 (*D. melanoxylon*) per cent. Root of *D. melanoxylon* and bark of *Careya arborea* had higher crude fibre i.e. 54 and 51 per cent respectively. Total ash content varies from 3.25 (*T. tomentosa*) to 8.73 (*B. superba*) per cent.

NDF content ranged from 57.0 (*T. nudiflora*) to 74.0 (*G. arborea*) per cent. ADF content ranged from 24.8 (*D. melanoxylon*) to 40.0 (*G. arborea* and *L. grandis*) per cent. Lignin content of studied plants ranged from 4.0 (*S. anacardium)* to 9.1 (*G. gumifera*) per cent.

Mineral contents of some selected wild plants indicdated that sodium content of *T. tomentosa* bark was much higher (2.57 mg g $^{-1)}$ as compared to other plants. The lowest sodium content was found in the bark of *S. robusta* (0.78 mg g $^{-1}$). Potassium content ranged from 18.76 mg g $^{-1}$ (*S. robusta*) to 154.83 mg g $^{-1}$ (*Gardenia gummifera*). Except *S. robusta*, barks contained higher amount of potassium in other plants. Calcium content in bark ranged from 7.34 mg g $^{-1}$ in *Careya arborea* to 32.50 mg g $^{-1}$ in *T. tomentosa*. However, *A. marmelos* contained lowest amount of calcium (0.40 mg g $^{-1}$). Iron contents ranged from 0.16 to 3.18 mg g $^{-1}$ in studied plants. However, the iron content was much higher in roots of *D. melanoxylon* (3.18 mg g $^{-1}$) and *S. anacardium* (2.38 mg g $^{-1}$) than the other parts of various plants analyzed. Copper content varied from 0.03 (*B. lanzan*) to 1.42 mg g $^{-1}$ (*S. robusta*). Roots of *S. anacardium* were found to have highest amount of manganese (0.77 mg g $^{-1}$) followed by that in *T. nudiflora* bark (0.59 mg g $^{-1}$). Lowest manganese content was found in the fruits of *A. marmelos* (0.02 mg g $^{-1}$). Zinc content ranged from 0.01 mg g $^{-1}$ to 3.36 mg g $^{-1}$.

Utilization pattern of wild plant species by migratory elephants in South West Bengal forest revealed that out of 52 plant species recorded in the studied area, elephants were selective in taking 22 food plants. Few plant species consumed by the migratory elephants in the wilderness is due to their dependency on cultivated crops which have

higher palatability and nutritive value than wild plants. Two plant species *D. melanoxylon* and *P. marsupium* were highly preferred by elephants as food. Though heavy debarking of *Pterocarpus* spp in rain forest of Malayasia was reported (Olivier 1978), yet Dalma elephants showed strong preference for leaves of *P. marsupium*. As *P .marsupium*, *D. melanoxylon* and *B. lanzan* are utilized more by elephants these plants therefore should be protected by dissuading people from cutting.

High protein content of *P. marsupium* leaves (21.25 g per cent) is probable reason for its highest degree of utilization. This can be supported by the fact that ungulates can select food of desired nutritive value by applying their nutritional wisdom (Field 1976). Debarking of many food plants by elephants has been observed in various parts of tropics (Olivier 1978). Feeding on bark may help maintain an optimum fibre: protein ratio to ensure proper digestion of protein (Laws *et al*., 1975), or supply minerals such as manganese, boron, copper, iron and calcium (Bax and Sheldrick 1963). Bark of some plants has been observed high mineral contents viz. iron, copper and manganese in the present study. The present finding is corroborated with Dougall *et al* (1964). In the present investigation *B. latifolia* bark with high calcium content (22.72 mg g $^{-1}$) was consumed at moderate level (10.58%). However, some plant species with high calcium content viz., *T. nudiflora* (25.66 mg g $^{-1}$) and *T. tomentosa* (32.50 mg g $^{-1}$) were found to be

utilized very poorly (0.52%). The present findings do not agree with the earlier study (Laws *et al.,* 1975) where it was found a positive correlation between degree of debarking by elephants and calcium content of plant species. The reason might be that these plant species may contain higher amount of toxic alkaloid leading to their poor utilization or the Ca requirement of the animal is met through feeding of agricultural crops. As elephants are known to be prone to sodium deficiency (Benedict 1936; Olivier 1978), they visit salt-lick to consume certain soils rich in minerals (Sukumar 1985). In the present investigation elephants consumed some plant species having higher sodium and other mineral contents. The role to trace elements viz. zinc, manganese, copper and iron in elephant nutrition has not been properly elucidated (Sukumar 1985). However, the analyzed plant samples found to contain comparatively high level of trace elements was possibly due to the soil composition of South Bengal. Though some factors such as food-dispersal pattern, nutritive value and toxicity are important in influencing selection of food plants by elephants (Olivier 1978), it is unlikely that any single factor would explain the elephant's preferences (Ishwaran 1983).

The present investigation therefore safely concludes that preferences for some plant species with high nutritive values probably influence the decisions to consume as conveyed to the mega- herbivore through its senses. However, the foraging strategy i.e. preferring the nutritively richer agricultural crops over the natural fodder by migratory elephants play most important role in selection of wild food plants in south West Bengal.

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