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# NUTRITIONAL INDICES AS AN INDEX TO ASSESS THE FEEDING POTENTIALS OF FOREST INSECT PESTS, *DEREODUS DENTICOLLIS* AND *MYLLOCERUS VIRIDANUS*

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**Abstract:**

Feeding preference of forest insect pests such as *Myllocerus viridanus* and *Dereodus denticollis* was studied using teak and acacia leaves in laboratory condition by analyzing the nutritional indices such as consumption index (CI), approximate digestibility (AD), efficiency of conversion of digested food (ECD) and efficiency of conversion of ingested food (ECI). The insect pests were collected from the plantations and maintained in the laboratory. Three types of experiments were conducted to understand the feeding potentials of the insects. In the first experiment, *Dereodus* sp. was fed with teak leaf for 24 and 48 hrs. In this experiment ECD and ECI were higher than the AD and CI. In the second experiment, *Myllocerus* sp. was fed with the teak leaf where the ECD and ECI were very less when compared with the results of the first experiment. The third experiment showed the efficiency of the feeding nature of the *Myllocerus* with Acaica leaf where the food ingestion and food digestion were higher than the other two experiments whereas the AD and ECI were low when compared with the first two experiments. Food preference was assessed based on the results. Probably the *Myllocerus* prefers mostly the acacia leaf than the teak leaf. The feeding potential indirectly reveals the nature of damage to the host plants. The results revealed to devise the strategy to control the plantations to avoid further damage in the form of growth and yield.

**Introduction:**

Insect-host plant interaction is a complex phenomenon which includes nutritional and non- nutritional factors. The nutritional factors play a major role in growth, survival and reproduction of insects. Besides, some species of insects prefer colors containing flavonoids in their selections of host plants. However utilization of different food plants by some phytophagous insects varies widely (Waldbaur,1968).The host plant in turn face nutritional hurdle in obtaining sufficient energy, nitrogen and other nutrition thereby the growth of the plant is affected. The insect pests case considerable loss in agriculture and forestry. Sometimes the plant itself protects by producing allelochemicals including components of secondary chemicals like amino acids, alkaloids, flavonodis, terpenoids, glycosidase, phenols, etc., which may also serve as nutrients or toxins depending on many factors like environment, its concentration and physiological state which play a pivotal role in evolution and diversification of insects. The selection or rejection of food by the insects depends upon the biochemical components. Hence an attempt has been made to study the food preference of few forest insects by analyzing the nutritional indices.

**Materials and Methods:**

Insects such as *Dereodus sp.,* (Fig. 1) and *Myllocerus sp*., (Fig.2) were collected from the nursery and maintained in the laboratory for the following experiments.

**Experiment 1:** Fresh leaves of teak were plucked from the teak garden and washed thoroughly. Water droplets were drained and kept in shade for some time to evaporate the water present on the surface of the leaves. The weight of leaf was taken and the tip of the petiole was inserted into the vial containing water and covered with cotton to avoid the drying of leaf for the next 24 hours. This set up was kept in glass jar. Well acclimatized known weight of *Dereodus sp*. was introduced in the glass jar containing the teak leaves. This set up was kept for 24 hours; then fecal matter was collected. The weight of the leaf, fecal matter and insect were noted and again the fresh leaves were kept with the jar for another 24 hours study. At the end of 48 hours, again the weight of leaf, fecal matter and insect were taken for the calculation of feeding potential. In the first experiment, a group consists of 10 insects of *Dereodus sp*., was selected. In mean time tender teak leaves were plucked from nursery and tip of the petiole was twined with cotton and then inserted in the glass jar. The selected *Dereodus* sp., was released into the jar containing teak leaves. The weight of insets and teak leaves were noted down.

**Experiment 2:** In an another experiment, the other polyphagous pest *Myllocerus sp* was collected and maintained in the laboratory at 28±2°C with 65%◦ . Fresh leaves of teak were plucked from the nursery and washed with cleaned water for the removal of dust particles. Similar to first experiment, the petiole of leaves were inserted in to the vial contained water and sealed with cotton to avoid drying of leaves. This was kept in a

glass jar. After making all the arrangements, known weight of group of insects containing 10 were released and observed feeding pattern.

**Experiment 3:** The experimental set up was arranged similar to the second experiment except teak leaves. Fresh Aacacia leaves taken from nursery were brought to laboratory and paced in the glass jar and released *Myllocerus* insects. The feeding pattern was observed separately for the above three experiments by taking measurement of weight of the excreta, insects leaves etc. With the collected data, nutritional indices were calculated with the procedure of Waldbauer (1962).

Figure 1: *Dereodus denticollis*

Figure 2: *Myllocerus viridanus*

**Results:**

**Nutritional indices of *Dereodus denticollis* when fed with teak leaf**: *Dereodus denticollis* indicated that the (Fig.3 and 4) feeding level of leaf varies at different intervals. The food ingestion was 0.002 mg per insect at 24 hrs and this level was increased to 0.024 mg per insect. The increasing trend observed when fed with teak leaves. Correspondingly the weight of the excreta also showed the increasing trend from 24 hrs to 48 hrs. In contrast to this result, weight of food digested was at higher level at 48 hrs and low level was observed at 24 hrs. The same trend was observed in the weight gain of the insect. This shows the statistical significance ($p<0.05$). Among the nutritional indices weight gain was very high and it was 0.0028 mg per insect. The efficiency of the conversion of digestibility was also very high. The other nutritional indices were less when compared to the approximate digestibility and efficiency of conversion of ingested food.

**Figure 3: Nutritional indices of *Dereodus* sp.fed with teak leaf**

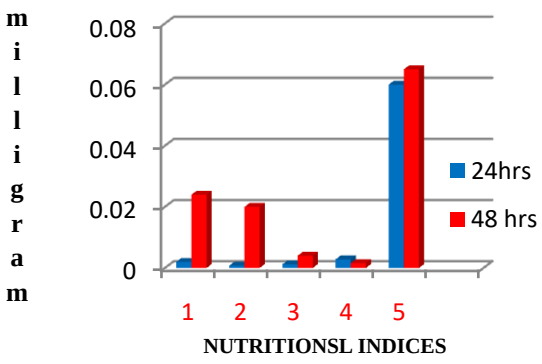
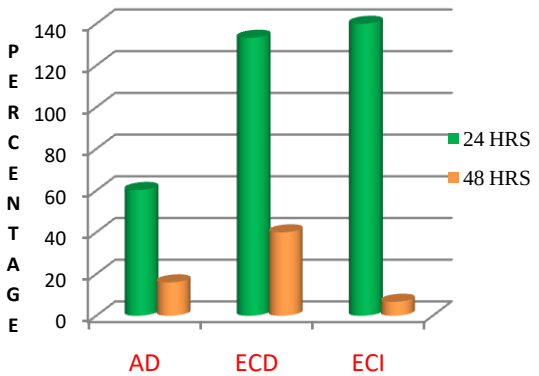



**Figure 4: Nutritional indices of *Dereodus* sp.fed with teak leaf**




1: Weight of food ingested,
2: Weight of excreta
3: Weight of food digested,
4: Weight gain, 5.consumption index.

AD: Approximate digestibility
ECD: Efficiency of conversion of digested food
ECI: Efficiency of conversion of ingested food

**Feeding potential *Myllocerus viridanus* when fed with Teak leaf:**

The *Myllocerus sp.* is a small weevil and widely distribute in all forest trees. Particularly in teak leaves the prevalence is more. The present study showed the varying quantity of leaf consumption. The weight of food ingestion was very less at 24 hrs. i.e., 0.004mg per insect. The level was increased at 48 hrs by 0.019mg per insect (fig 5 and 6). The statistical significant showed significance at $p<0.005$ level and at the same time the weight of the excreta was 0.0007mg/insect. The elimination of waste material was increased at 48 hrs. The results also indicated the increase of food digestion from 24 hrs to 48 hrs. These results also showed significance. The consumption index and approximate digestibility were also showed increasing trend from 24 to 48 hrs. The other nutritional indices such as Efficiency of conversation of food and ingestion were less at48 hrs. Though there was a reversing trend, the statistical analysis showed significance.

**Figure 5: Nutritional indices of *Myllocerus* sp. fed with teak leaf**

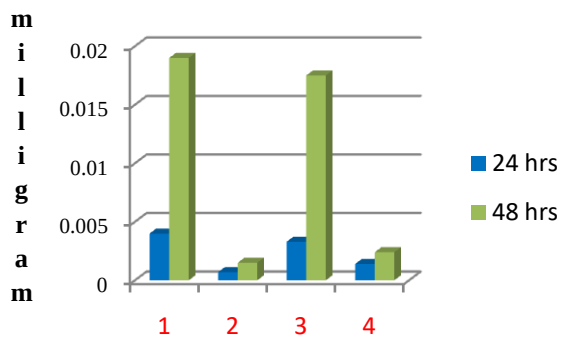
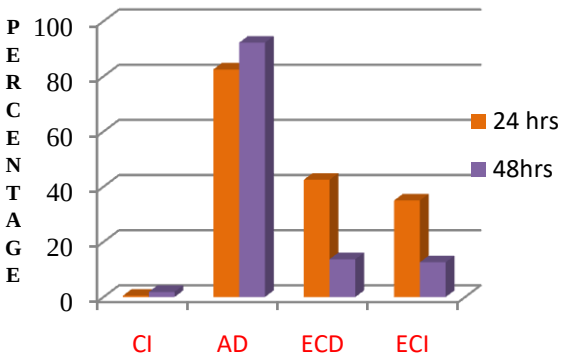



**Figure 6: Nutritional indices of *Myllocerus* sp. fed with teak leaf**




1: Weight of food ingested,
2: Weight of excreta,
3: Weight of food digested,
4: Weight gain

CI: Consumption Index
AD: Approximate digestibility
ECD: Efficiency of conversion of digested food
ECI: Efficiency of conversion of ingested food

**Feeding nature of *Myllocerus viridanus* when fed with acacia leaf:**

The feeding nature of *Myllocerus* in acacia leaf revealed high preference .From the results it was clear that the food ingestion was 0.0276mg per insect at 24 hrs (fig 7 and 8) and this level was increased to 0.0292per insect at 48hrs. Though there was an increase the statistical analysis showed insignificance. The weight of excreta was also the same level at 24 and 48 hrs. The weight gain was also high at 24hrs.The approximate digestibility was 90.2% and increased at 48 hrs. Among the three experiments, *Myllocerus* fed the acacia leaf was very high level .Similarly the weight of excreta was also high when compared to rest of the experiments. The feeding preference was more towards acacia leaf. Probably the acacia leaf is favorable to the insect when compared to teak leaf.

**Figure 7: Nutritional indices of *Myllocerus sp.* fed with Acacia leaf**

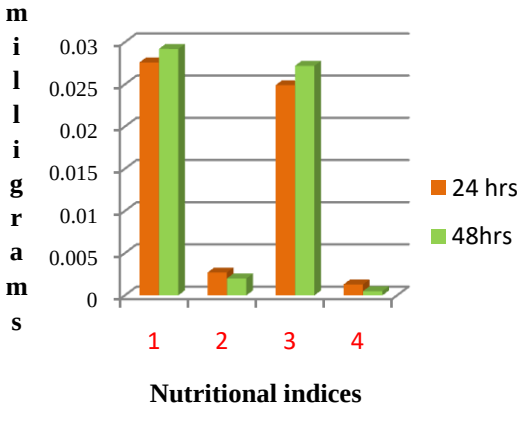
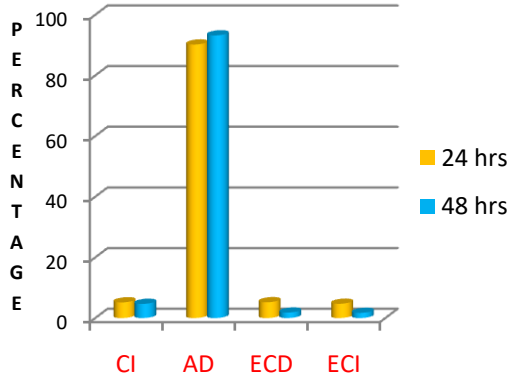



**Figure 8: Nutritional indices of *Myllocerus* sp. fed with Acacia leaf**




1: Weight of food ingested,
2: Weight of excreta,
3: Weight of food digested,
4: Weight gain

CI: Consumption Index
AD: Approximate digestibility
ECD: Efficiency of conversion of digested food
ECI: Efficiency of conversion of ingested food

**Discussion:**

Host preference is a significant feature of any organism's life history. Indeed, for some species, the host plant is not merely something fed on, it is something lived on. Preference among, and relative consumption of several forestry and agro forestry crops by insect pests, was studied under laboratory conditions. Food is one of the most important biotic ecological factors that determines the course and extent of the population development. Thus, following study gave an idea of the host range spectrum which is a vital factor in the actual assessment of the pest status. The feeding patterns of these insects vary. There are those that feed only on the epidermis and tissues, avoiding the veins, thus leaving skeletons of the leaves behind. Others feed on all leaf tissues including the veins, either beginning at the edges and working their way inwards or by creating hole on the leaf surface and enlarging them. Some of these insects may eat away entire leaves whilst others may wander from leaf to leaf, feeding only on part of the leaves.

The consumption of food provides the energy and nutrients (including water) necessary to carry out the remainder of an insect's (or other animal's) life activities: growth and development, storage of metabolic reserves, movement, defense, and eventual reproduction (Slansky and Rodiquez, 1985)). Feeding is thus, one of the most fundamental behaviors; its widespread ramifications provide the underlying framework for the adaptive strategies of consumers and its broad consequences for consumer fitness have likely lead to its evolution as a highly regulated behaviour. The rate of feeding is a key component of an insect's foraging strategy; and it is the large part determines the quantity of food consumed and the net nutrient gain from feeding. In addition, the quality of an insect's food can affect its feeding rate and therefore the quantity eaten subjects to risk of survival. It is therefore obviously important to understand the factors affecting feeding and the extent to which insects can regulate their food consumption. The insect's nutritional needs may differ depending on age, sex and previous diet.

The result indicates the food preference of the insects which vary widely. Among the leaf feeding sp., the digestibility and efficiency of conversion vary widely with the species of food plant. The weight of the food ingestion is very low in the case of *Dereodus* on teak leaves at 24 hr. but at 48 hr the results shown that ingestion was higher than the first day ingestion and correspondingly the CI is increased at 48 hr. However the ECD and ECI have shown to be higher at 24hr than the 48hr. The preferred food plant may contain all nutrients in right concentration. The weight gain indicates more on 24hr rather than 48hr. Though the indices show the various levels, the CI explains the higher value at 48 hr than the 24 hr. The weight at 48 hr shows lesser value and it may be due the fact that the higher level of excretion may be the reason and ingested food will be excreted immediately. The digestion and absorption of nutrient component of the food is reduced by the presence of fiber (Mattson and Scriber 1987). Scriber and Slansky (1981) in a review indicated that the efficiency with which ingested food is converted to body matter (ECI) which may increase, decrease or show little change depending on the digestibility of food, its nutritional values and the level of nutrient intake. Consumption of food had highly significant positive correlation with faecal matter excretion, assimilation, tissue growth, consumption rate, growth rate, efficiency of conversion of ingested food and efficiency of conversion of digested food but it showed a significant negative correlation with consumption index and approximate digestibility. Reddy and Alfred (1979) reported positive and significant correlation between the food ingested and the food egestion; food metabolism and food assimilation. It was found that the increased intake of food enhanced the egestion and metabolism and the increase in assimilation increased the conversion and oxidation and the increase in food intake increased the assimilation and conversion into body substance of the larvae. Singh *et al.* (1975) found a positive correlation between the food consumption and assimilation and tissue growth in adult *Poecilocerus pictus.*

The *Myllocerous* sp. feeds teak leaves very less at 24 hrs. than the observation made at 48 hr. The food ingestion is slightly higher when compared to the food ingestion of *Dereodus* sp. Correspondingly the food digestion is also increased. The major determinants of the quality of feed are generally nitrogen, water, allelochemicals contents and various physical attributes such as toughness and pubescence (Slansky and Scriber, 1981). However weight gain and excretion of waste materials have been shown to reduce at 24h when compared to *Dereodus* sp., probably the high concentration of phenol and carbohydrate may reduce the food consumption. Though the ingested food was less at 24 hrs, the ECD, AD and ECI were high where as at 48 hrs the same parameters such as CI, ECD, and ECI were less at 48 hrs. Probably the insect at initial stage consumed at high level and subsequently it may be reduced. The low level of feeding may be due to the fact that the secondary metabolites available in the plant maybe a factor to fulfill the feeding desire which block the bioavailability of nutrients (Broadway and Duffey, 1986). The chemical constituents present in the plant may be a phagostimulant or deterrent which plays an important role in the consumption and digestion of food and these properties may alter the feeding rate and weight gain. The *Myllocerus* sp. when compared to *Dereodus* sp. the consumption was little higher. Though the ingestion was higher, the weight gain showed less than the *Dereodus* sp. Harborne (1982) reported that the availability of common flavonoid, glycosides including rutin, quecitrin and isoquecitrin are known to act as toxins to a number of insects. Probably the secondary metabolites may alter the food consumption among the insects.

The phenomenon of damaging the host plant may be sever or less sever based on the secondary chemicals. The degree of digestibility and utilization are well related to the water content and its associated influence in terms of host preference at 48hr. All parameters have increased except ECD and ECI. Among two species *Myllocerous* sp. preferred more teak leaves than the *Dereodus* sp., The index of weight gain shows increasing trend. When the *Myllocerous* is fed with Acacia leaves, the indices levels have been increased at 24 hr when compared to the same sp., in teak leaves. The utilization of different food plants by the same phytophagus sp., varies widely. The indices showed slightly increased except weight gain and ECD and ECI. The tannins are known to inhibit digestion and growth rate . The higher food intake may be due to the increased amount of secondary substances as feeding stimulants in insects has been widely studied by Dethier (1972). Pallavi *et al.*, (2014) reported that their results indicated that both weevils were from the family, Curculionidae and were abundant in monsoon season from July to October and they were moderate from February to June and

was low from the November to January. *Myllocerus discolor* and *viridanus* were found throughout the year feeding Mulberry leaves.

The *M. subfaciatus*, *M. discolar* and *M. viridanus* were found on mulberry ecosystem of Kolhapur district throughout the year. However, *M. discolor* and *M. viridanus* were abundant from July to October. The present study will be helpful for designing the control strategies of weevils on Mulberry. The role of weevils in agro ecosystem has been determined up to certain extent but predatory, nutritional and medical roles have not widely attempted. Hence, there is need to undertake research on above aspects for utilization of diversity and sustainable development of the region. Most of the weevils recorded were abundant in monsoon season when there was sufficient and diverse food in the form of flora. However, *Myllocerus discolar*, *Cosmopolites sordidus*, *Odoiporus longicollis*, *Viridanus* and *M. subfaciatus* were found throughout the year feeding on their respective host plants. Most of the weevils were collected from tender parts of the crop. *Myllocerus* in the present study, consumed 0.0276 mg per insect and it showed high level when compared to other studies. A significant other factors have also observed in the present work. Among the three experiments, *Myllocerus* preferred Acacia leaf than the teak leaf.

The preference of host plant by phytophagous insects is mainly involved in nutritional and non-nutritional factors of host and sometimes the feeding nature may change due to dietary composition and nutritional requirements.

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**References:**

1. Broadway R M & Duffey S S, *J.Insect .Physiol*., 32 (1986) 827.
2. Dethier V G, *Chemical ecology* (Academic Press, , New York) 1972
3. Harborne J B, *Introduction to ecological biochemistry* (.Academic Press, London) 1982
4. Mattson W J & Scriber J M, *Nutritional ecology of insects, mites, spiders and related invertebrates* (John Wiley & Sons, Inc., New York) 1987
5. Pallavi, V. Khairmode and T.V. Sathe, 2014. Seasonal abundance of weevils *Myllocerus* spp. on mulberry in Kolhapur region, International Journal of Science and Technology, Vol. 3, No 1, 203 – 207
6. Reddy, M. V. and J. R. B. Alfred, 1979. Utilization of castor (*Ricinus communis* Linn.) leaves by last instar larvae of the silk moth *Philosami aricini* Hutt.
(Lepidoptera: Saturniidae). *Ind. Biologist*.11: 36-40
7. Scriber, J. M. and Slansky, F. Jr. E.C.1981. The nutritional ecology of immature insects. *Ann. Rev. of Entomol.*, 26: 183-211.
8. Slansky, E. C. F. Jr. and J.M. Scriber. 1985. Food consumption and utilization. In*:*
Kerkut, G. A. and Gillbert, II (Eds.). Comprehensive Insect Physiology, Biochemistry and Pharmacology, Pergamon, Oxford. 87-163.
9. Singh, J.S., Singhal, R.N. and L.K. Vats. 1975. Food consumption, partitioning and ecological efficiencies in adult *Poecilocerus pictus* Dabr. (Orthoptera:Acrididae). *Tropical Ecology*.16: 171-181
10. Waldbauer G P, Adv. Insect Physiol., 5 (1968) 229.