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FEEDING PREFERENCES OF ADULTS AND MANDIBULAR MORPHOLOGY IN THE DIFFERENT INSTARS OF *EYPREPOCNEMIS ALACRIS ALACRIS* (SERV.) (ORTHOPTERA: ACRIDIDAE)

THOUGH information on the host plants and nature of damage inflicted on crop plants is available for many grasshopper species, details of their food preferences are meagre for the Indian species. With a view to obtaining information on the food preferences and also on the mandibular structures in different instars, a study was undertaken on these aspects in *Eyprepocnemis alacris alacris* (Serville), commonly found on the grass *Panicum maximum* in South India.

Materials and Methods

E. a. alacris was reared in the laboratory in cages as described by Muralirangan[7]. For studying the food preference, a standard time was given for the food to be consumed, the food being in the cage for about 15 hours a day. Six plants belonging to six families were introduced into the cage and as water was always provided in the cage, the possibility of preferring plants for their water content was minimised. Mandibular structures were mounted for the study of morphological changes in different instars.

Observation and Results

E. a. alacris is a polyphagous species and its preferred food plant is *Panicum maximum*. Under laboratory conditions fresh grass was supplied every day and whenever dry grass was given, extra water was provided (Gangwere[2]). Cannibalism was noticed when the food was insufficient, the females attacking the males, much so the weaker ones, pulling off their hind legs and thereby feeding on their abdomen. The head and the thorax are usually not consumed, probably because of their chitinisation, and this is so even among the early instars, especially the first instar. Both adults and nymphs feed on their ecdysed skin. During the rearing experiments, it was observed that III, IV and V instars and adults are marginal feelers while the first and the second instars feed only in the centre of the leaves, especially at the top.

Laboratory experiments showed that out of 39 species of plants tested, belonging to 20 families, only 8 were consumed without any reluctance, while a good number of plants were just nibbled at (17 species), and still others (14 species) completely rejected (Table I). Most species of Graminae were preferred as host plants and some were consumed when no other food plant was available.

Plants belonging to Euphorbiaceae, Cucurbitaceae, Rutaceae, Asclepiadaceae, Malvaceae, Acanthaceae, Caesalpineaceae and Verbenaceae were consumed when no other food plants were available but Tiliaceae, Mimoseae, Labiatae, Compositae and Sapotaceae were completely rejected. Apocynaceae, Rubiaceae and Malvaceae include plants which may be consumed if there are no alternative plants to feed on or else they are rejected. Although the blades of grass are the normal food of the grasshoppers, the caged hoppers feed on the infloresence and the stem as well.

Observations on the nymphs of grasshoppers suggest that their food preferences are the same as those of the adults. The coarser grass species are less freely eaten by young nymphs. It was noticed that with tough grass (with silica content of 4·6%), the mortality rate was so high that a whole batch of 38–40 nymphs died within 4–5 days after hatching. When fed on the tender grass leaves of the same species (with silica content of 2%), it was found that the mortality rate was low and the nymphs fed normally on these leaves. This might also be due to the poor development of the cuticular armature of the foregut in the I and II

TABLE I

Food preferences of Eyprepocnemis alacris alacris

Sl. No.	Plant	Family	Eaten without reluctance	nibbled	not eaten
1.	*Panicum maximum*	Gramineae	+	–	–
2.	*Bambusa arundinacea*	,,	+	–	–
3.	*Panicum colonum*	,,	–	+	–
4.	*Phoenix sylvestris*	Palmae	+	–	–
5.	*Jatropha glandulifera*	Euphrobiaceae	+	–	–
6.	*Acalypha wilkesiana*	,,	–	+	–
7.	*A. indica*	,,	–	+	–
8.	*Casuarina equisetifolia*	Casuarinaceae	+	–	–
9.	*Thevetia neriifolia*	Apocynaceae	+	–	–
10.	*Vinca rosea*	,,	–	+	–
11.	*Allamanda cathartica*	,,	–	–	+
12.	*Ficus bengalensis*	Urticaceae	+	–	–
13.	*Coccinia indica*	Subfam. Moreae Cucurbitaceae	+	–	–
14.	*Mukia scabrella*	,,	–	+	–
15.	*Murraya exotica*	Rutaceae	–	+	–
16.	*Calotropis gigantea*	Asclepiadaceae	–	+	–
17.	*Mussaenda frondosa*	Rubiaceae	–	+	–
18.	*Morinda tinctoria*	,,	–	+	–
19.	*Ixora coccinea*	,,	–	–	+
20.	*Sida cordifolia*	Malvaceae	–	+	–
21.	*Abutilon hirtum* (inflores.)	,,	–	+	–
21 A.	*Abutilon hirtum* (Leaves)	,,	–	–	+
22.	*Eranthemum atropurpureum*	Acanthaceae	–	+	–
23.	*Thunbergia erecta*	,,	–	+	–
24.	*Desmodium grandiflora*	Leguminosae Subfam. Papilionaceae	–	+	–
25.	*Abrus precatorious*	,,	–	–	+
26.	*Pongamia glabra*	,,	–	–	+
27.	*Porana malabarica*	Subfam. Mimoseae	–	–	+
28.	*Pithecolobium dulce*	,,	–	–	+
29.	*Stachytarpheta indica*	Verbenaceae	–	+	–
30.	*Achyranthes aspera*	Amaranthaceae	–	+	–
31.	*Corchorus acuitangulus*	Tiliaceae	–	+	–
32.	*Anisomeles malabarica*	Labiatae	–	–	+
33.	*Anisomeles malabarica*	,,	–	–	+
34.	*Ocimum sanctum*	,,	–	–	+
35.	*Vernonia cinerea*	Compositae	–	–	+
36.	*Wrightia tinctoria*	,,	–	–	+
37.	*Eucalyptus* sp.	Myrtaceae	–	–	+
38.	*Mimusops elengi*	Sapotaceae	–	–	+

instar nymphs; this assumption is supported by the fact that the coarser food is eaten from the III instar nymph onwards (Muralirangan and Ananthakrishnan[8]).

Mandibular Structure in the Adult and Instars (Fig. 1)

The basic structure of the insect mandible has already been described by Snodgrass[5]. Isely[4] broadly classified the acridid mandibles into three types, on the basis of the nature of the leaves they ate, broad-leaved plant feeder, grass feeder and mixed plant feeder types, while Williams[6] classified the mandibles only into herbivorous type and graminivorous type. Chapman[1] agrees with Isely's classification, while Gangwere[3] classifies the acridid mandibles into two types in which he includes the herbivorous type mandibles of Williams as a sub-type under the graminivorous type. The mandibles of *E. a. alacris* conform to the mixed plant feeder of Isely and herbivorous type of Williams.

of the herbivorous type, the mandible of *E. a. alacris* show long left incisors with ridges and furrows in the molar region. The incisors are long and sharp in the

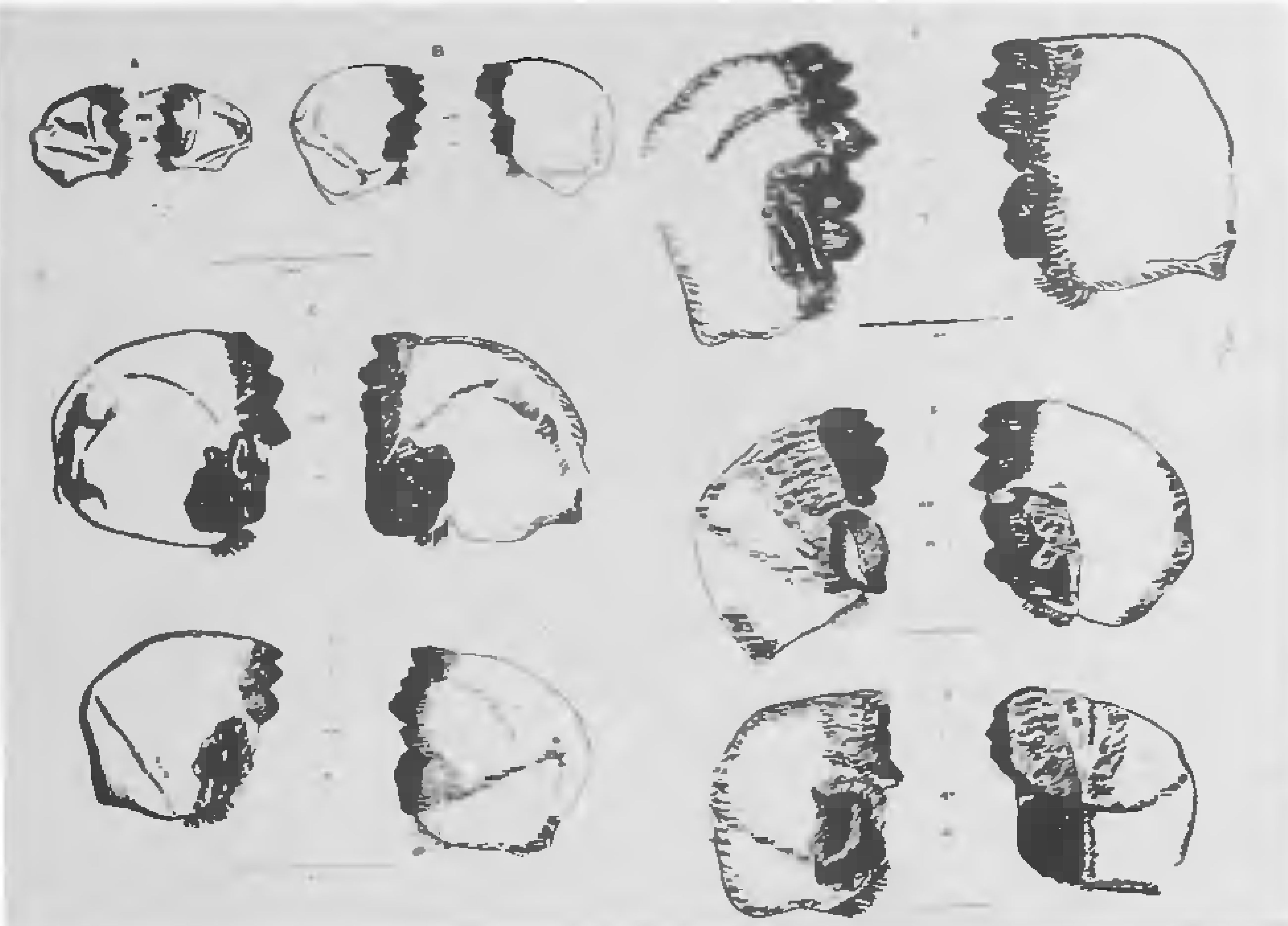

FIG. 1. Mandibular structure in adult and instars of *Eyprepocnemis alacris alacris*. A–E, Instar I to Instar V; F–G, Adult); I, Incisors. Mm. Medium molars; M, Molars.

The incisors and the molar areas are well differentiated in the mandibles of *E. a. alacris*, the incisors being 4 on the left and on the right. The median molar-region is not well differentiated in the left mandible but well marked in the right. In addition, the right mandible overlaps the left mandible. The teeth and the ridges of the right mandible exactly fit into those of the left. In fact when the crop contents were examined, large fragments of leaves were present, suggesting that the molars were not used well during the process of grinding. The incisor cusps arise at the same level as that of the molar cusps. The mandibular structure of *E. a. alacris* was found to agree with that of the mandibles of *Chorthippus bicolor* (Charpentier) and *C. parallelus* Charpentier (Williams[6]).

In the first instar of *E. a. alacris* the incisors are long, sharp and better differentiated than the molars. The molars of this instar give the appearance of the incisors and they do not exhibit any grinding surfaces. It may be because of the absence of this grinding surface in the first and the second instars, that the nymphs are not able to utilise the tough grass leaves of *Panicum maximum* which have higher percentage of silica. If the same instars are fed with young leaves of the same plant, they survive and develop well (*loc. cit.*). The molar area develops after the III instar and in the adult it becomes highly chitinised. As is typical first two nymphal stages, and then gradually become flat. When they become old, the well defined cusps of the mandibles become worn down (possibly affecting the feeding ability of the grasshopper) (Chapman[1]) so that it may become very smooth. This wearing away is possibly due to the friction with silica content of the grasses on which they feed.

Discussion and Conclusions

In the studies on the food preferences of *E. a. alacris*, of the 38 species of plants tested, only 8 were found to be preferred, while a majority of them are nibbled at and others are rejected altogether. Among Graminae, most are preferred, while some are consumed when no other food plants are available. Plants belonging to Tiliaceae, Mimoseae, Labiatae, Compositae and Sapotaceae were completely rejected. It may thus be concluded that *E. a. alacris* prefers only a small number of plants but nibbles at a good number and when nothing is available, it feeds on these plants but the quantity of food eaten is very little.

Observations on the food preferences of the nymphs show that unlike the adults, the early instars were unable to feed on the coarser grass species with high silica content, because of the poor development of the foregut armature, in addition to the poorly differentiated molar region of the mandible, thus indicating a correlation between the nature of the food with the degree of specialisation of the structure of the foregut armature and mandibles of the III and subsequent instars (Muralirangan and Ananthakrishnan[8]).

Cannibalism was observed both in the adult as well as in the early instars. This behaviour was linked with the shortage of water and the lack of sufficient food or the innate craving for animal food as stated by earlier workers (Gangwere[2]) but the present study indicates that even when sufficient food and water were provided, cannibalistic behaviour was evident.

As regards the mandibular changes, the grinding surface of the molars develops only after III instar onwards, which explains the inability of the first two instars to feed on the older leaves of *Panicum maximum*. When the insect becomes old, the molars become smooth, possibly due to the high silica content of the grasses on which they feed.

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DEVELOPMENTAL BEHAVIOUR OF *DIACRISIA OBLIQUA* (WALKER) (LEPIDOPTERA: ARCTIIDAE) ON SOME COMMON WEEDS

THE hairy caterpillar, *Diacrisia obliqua* (Walker) is a polyphagous pest of several cultivated crops in India and neighbouring countries. A detailed information is available on its growth and development on several cultivated crops (Djou[2]; Pandey *et al.*[5]; Kabir and Khan[4], and Deshmukh *et al.*[1]. The developmental pattern of *D. obliqua* on few common weeds is presented in this note.

Materials and Methods

Development of *D. obliqua* was studied on 8 plant species, *viz.*, *Chenopodium album* L. *Ageratum conyzoides* L., *Blumea glomerata* DC., *Cirsium arvense* (L.) Scop. *Argemone mexicana* L., *Mentha viridis* L, *Brassica rugosa* (Roxb.) and *Glycine max* (L.) Merrill belonging to 6 different families. First five are common weeds of Tarai. Eggs of *D. obliqua* were obtained from a pair collected from the light source. Newly hatched larvae (0–12 h old) were transferred to various test plants in groups of 10 in plastic petri dish. Each replication had 10 larvae and each treatment was replicated five times. After one week larvae were separated and kept individually in petri dishes. Fresh food was supplied at 24 h interval. In order to avoid drying of leaves a wet piece of cotton was placed at the tip of petiole or midrib Experiment was conducted at 27·5 ± 1° C, 65–70% r.h. and 12 h photophase and 12 h scotophase. Observations were recorded on larval survival, per cent pupation, adult formation, larval and pupal duration, pupal weight and sex ratio. Sexing was done by following the method of Rathore and Verma[8]. Various growth indices were also computed to evaluate the suitability of plant species. Data were subjected to statistical analysis in a completely randomized design Due to lack of sufficient information part of the analysis of the data on *A. mexicana* was deleted.

Results and Discussion

Perusal of Table I reveals that significantly higher larval survival was recorded on *G. max* and *C. arvense* and significantly lower on *A. mexicana* followed by *B. rugosa*. No survival was recorded on *A. conyzoides*. Poor feeding was observed on this plant and larvae survived from 17 to 25 days but did not develop beyond 2nd–3rd instar. This indicates, perhaps, the presence of deterrent in leaves which did not permit required consumption of food material and ultimately death occurred or it might be due to the presence of toxic chemicals which inhibited the growth and development of larvae. On *A. mexicana*, only 1 larva survived. The survival on *G. max* was not as high as reported by Deshmukh *et al.*[1] because some larvae died due to disease in the later stage of development. Larval period also varied significantly from 19·9 to 32·1 days; the longer being on *B. rugosa* followed by *B. glomerata* and *C. arvense*. There was no significant difference in larval duration on *C. album*, *M. viridis* and *G. max* The data obtained in the present investigation are in accordance with that of Deshmukh *et al.*[1]. Prepupal and pupal period varied from 1·5 to 1·8 days and from 8·8 to 9·6 days respectively on various plant species but did not differ significantly. Per cent pupation differed greatly and followed the same trend as per cent larval survival. Significantly heavier pupae were obtained when larvae fed on *C. album* followed