

lininæ. It is widely distributed in India specially in the tracts of sugarcane-growing provinces. The genus was originally created by Howard³ in 1898. He described the species *Azotus marchali*, reared from two specimens *Diaspis ostreaformis* on pea and another from *Aspidotus merii*.

The percentage of parasitisation was studied for two consecutive fortnights.

TABLE I

Data of Life-History of the Chalcid Parasite
Azotus delhiensis

Period	Number of pupæ examined	Number of parasitised pupæ	Percentage of parasitisation	Name of the parasite
15-1-1944 to 29-1-1944	100	24	24	<i>Azotus delhiensis</i> Lal
29-1-1944 to 5-2-1944	100	26	26	do
Total	200	50	50	

Average per cent. parasitisation -- 25

The table shows that the average percentage of parasitisation for *Azotus delhiensis* is about 25 per cent. The parasitisation is greater in December and January and decreases in February and March when it is practically nil. Laboratory studies have shown that the life-cycle at 58° F. is 13 days on the average. The maximum life-cycle is 16 days and the minimum is 11 days.

The parasite appears in the last week of November in large numbers and oviposits in the first week of December. Oviposition takes place for about 30". The first generation adults liberated on a fresh batch of white-fly pupæ under laboratory conditions approximating to those in the field. They were fed on dilute sugar solution, and after copulation were liberated on white-fly pupæ. The first adult emerged in 3 weeks, the second, third and fourth generations successively in about two weeks. Adults of the fourth generation went into hibernation. In the field there was so much of overspreading and overlapping of generations that it was impossible to determine the number of generations undergone. From the observations it seems that the first generation adults took longer to appear.

Experiments on the longevity of the adult *Azotus delhiensis* were carried out both with food and without food. Under laboratory conditions the average length of the life of the adult female is 3¼ days and that of the male is 2¾ days without food; and with food it is 3¾ days for the female and 3¾ days for the male. The maximum longevity for the males is 4 days and for the females is 5 days and minimum for the former is 1 day and for the female is 2 days without food. The maximum longevity with food for the males is 5 days and that for the females is 6 days. It appears that the females are sturdier than the males and can resist the drought much longer. Record

of emergence indicates a proportion of 1 male to 4 females. The parasite emerges through a circular hole cut dorsally in the integument of the host near the anterior end.

The parasite displays super-parasitism, and 3 to 5 pupæ of the parasite have been observed in a single pupa of the white-fly. Each emergent adult parasite cuts a separate circular hole in the dorsum of the white-fly pupa.

The egg, larvæ, pupæ and the adults of the above parasite have been studied and will be described at a later date.

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ON THE FOOD OF THE 'BEKTI', *LATES CALCARIFER* (BLOCH), IN THE COLD SEASON

MOCKEERJEE, Ganguy and Majumdar¹ made a note of the food of 20 specimens of *Lates calcarifer* (Bloch), of about 8.5 inches average length, examined on two days in December 1945. Hardly any additional detailed observation on the food or feeding habits of this brackish-water perch of economic importance is on record. A detailed investigation on the food and feeding habits of this fish which is on hand has brought out the following salient features with reference to the cold season from October 1947 to February 1948.

Systematic analyses of the gut contents of 313 specimens of *L. calcarifer* ranging from 10 inches to 25 inches, collected from the estuarine regions of Bengal and Orissa were carried out. The details of the gut contents and their proportions are given below:—

(1) *Teleosts* (65.34). These consist mainly of Mulletts such as *Mugil parva* and *Mugil* sp.; Siluroids such as *Mystus gulio*, and *Mystus* sp.; Clupeid fishes such as *Engraulis graji*, *E. parava*, *Stolephorus indicus*, *Dorosoma nasus*, *Dorosoma* sp., and *Coilia* sp.; *Lates calcarifer*; *Anabas testudineus*; *Sciænooides microdon* (?); *Eleotris fusca* (?); *Datnioides polata*; *Triacanthus* sp.; *Sillago* sp.; *Leiognathus* sp.; *Gerres* sp.; *Barbus* sp.; *Ophicephalus* sp.; *Cynoglossus* sp.; *Hemirhamphus* sp.; gobies, eels and digested remains. (2) *Decapod crustacea*: (a) *Anomura* (23.71 per cent.), consisting of *Palæmon carcinus*, *P. idæ* (?), and *Palæmon* sp.; *Penæus indicus*, *P. carinatus*, *P. semisulcatus* and *Penæus* sp.; *Metapenæus monoceros*, *M. brevicornis*, *M. lysianassa*, *M. dobsoni* (?), and *Metapenæus* sp. (b) *Brachyura* (2.23 per cent.), comprising of Portunid and Grapsid crabs belonging to the genera *Scylla*, *Charybdis*, *Varuna*, and *Sesarma*.

(3) *Minor crustacea*: (a) *Isopoda* (0.41%), Isopods (parasitic forms) presumably taken in along with the host. (b) *Stomatopoda* (0.4 per cent.), *Squilla* sp. (c) *Miscellaneous crustacean remains* (12.15 per cent.) (4) *Molluscan shells on coconut tree roots* (0.01 per cent.). (5) *Insecta* (0.36 per cent.): Insects, young stages of dragon fly and unidentified insect remains. (6) *Vegetable Matter* (0.64 per cent.) These consist of water weeds, bits of grass, cladodes of casuarina and occasionally leaves of land flora. (7) *Digested Matter* (3.9 per cent.): Animal matter digested and mixed with mucus, and (8) *Mud and Sand Grains* (0.85 per cent.): Fine mud mixed with mucus and particles of sand grains.

In four instances the stomach was found to have been pierced by the pectoral spines of the cat fish *Mystus gulio*.

Seasonal observations are continued with a view to making a detailed, comparative study of the food and feeding habits of the fish in the different seasons and stages of growth.

Observations so far carried out show that *Lates calcarifer* feeds actively in the cold season. It is a column feeder, preying mainly on Teleosteans and Decapod crustaceans. Mud and sand in the guts of a few specimens examined were obviously brought in by the mullets which were consumed. The fragments of vegetable matter included in the diet are probably accidental. The 'Bekti' takes a considerable toll of valuable food fishes, like mullets, clupeids, cat fishes and prawns, but the large variety of specimens consumed show that as long as adequate animal food is provided in the environment, 'Bekti' may not destroy the major food fishes exclusively. By providing sufficient quantities of forage fish it should, therefore, be possible to maintain Bekti farms successfully.

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 Central Inland Fisheries
 Research Station, Calcutta. P. M. G. MENON.
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THE ROLE OF MAWA, AN INDIGENOUS MILK PRODUCT, IN THE NUTRITION AND EPIDEMIOLOGY

MAWA, a crudely manufactured form of condensed milk, is a widely consumed nutritious diet; although the milk is concentrated enough to facilitate transportation, this product still has enough moisture to favour the growth of micro-organisms of which the moulds give visible growth on its surface within about six days of storage at room temperature. It was of considerable practical interest to determine if mawa plays any part in the dissemination of the intestinal pathogenic bacteria.

The chemical composition of several samples (collected on different occasions) revealed that, on an average, mawa contains 10.81 per cent. moisture, 26.71 per cent. proteins, 29.67 per cent. fat, 19.98 per cent. lactose, 3.81 per cent. ash, 1.46 per cent. calcium, 0.66 per cent. phosphorus and trace of iron. The above composition suggests the possibility of mawa serving

as an excellent material for the nutrition of both man and micro-organisms.

Bacteriological studies conducted on mawa with *E. typhosa*, *S. schottmuelleri*, *E. coli communis*, *S. dysenteriae* (Shiga), *S. paradysenteriae* (Flexner), and *V. cholerae* have yielded remarkably clear-cut results on repeated experimentations. Mawa was used in the state obtained and in a slightly more moist state and was experimented upon in both its native (non-sterilized) and steam-sterilized states. Incubation was done both at the room (28°-29° C.) and the body (37° C.) temperatures. The results obtained clearly show that growth of all the tested species does take place and that the survival period may vary from 14 to 34 days depending upon the species, the moisture and sterility status of mawa and also on the incubation temperature. A detailed report on this work will be published elsewhere.

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ACCLIMATISATION OF THE MILLIONS *LEBISTES RETICULATUS* (PETERS) IN MADRAS*

It is widely believed that the Millions, *Lebistes reticulatus* (Peters), are incapable of withstanding the climatic conditions in the hotter tracts of this country.¹ The species is now considered as not being found in India,² but only in Ceylon where it is used for larvicidal purposes.³ It was, however, found thriving in the tanks of the Rameswaram temple situated in Ramnad district in February 1946 during an investigation of the distribution and local densities of the larvicidal fishes indigenous to the provincial waters. It is possible that it has been introduced from Ceylon, but exact details are not available.

In October 1946 a consignment of about 1,000 fish was taken to Madras with a casualty of only 9 en route, and stocked in a concrete garden cistern, in which they bred for the first time in December 1946 and several times thereafter. The stock was then distributed to other waters in the City and to departmental farms and certain private waters in the districts of Tanjore, Cuddappah, Kurnool, Malabar and Salem, where they soon got acclimatised and multiplied. Through gradual adaptation the fish has also been acclimatised to brackish waters. The maximum size to which the fish has grown is 1.5 inches in the case of the female and 1 inch in the male. The two sexes occur in equal proportions. The females are dull grey in colour; and the males are iridescent. Details of sexual dimorphism concerning colour, pattern, body form and size, and of the factors influencing sex recognition in the species have already been recorded by Breder and Coates.⁴

Lebistes reticulatus is a surface feeder, and moves about in small groups of 10 to 15. Its food in Madras provincial waters was found to be the following:—