INTRODUCTION

The Indian armyworm, *Spodoptera mauritia* Boisduval, is a very serious pest of paddy in India. It was selected for this research project for two reasons. First, the agricultural importance of the pest necessitates the study of its life-history and behaviour which may be helpful in the control of the pest. Secondly, its morphological significance, on account of being highly evolved Lepidopterous insect (family Noctuidae), makes the study all the more essential. There is absolutely no comprehensive and consolidated work available on the morphology of a noctuid moth. Moreover, the Order Lepidoptera as a whole has received little attention for morphological studies of monographic nature. This does not mean that the morphologists have totally ignored this group of Insecta. There are some scattered works whose importance cannot be denied. Madden (1944) made an attempt to study the skeletal mechanism of *Protoparce sexta* Johan. Ehrlich (1958, 1960) has made a detailed study of the skeletal system of adult *Danaus plexippus* L., and *Eparqyreus clarus* Cramer., respectively. Ehrlich and Davidson (1961) have worked out the muscles of *Danaus plexippus* L. DuPorte (1946, 1956, 1965) and Snodgrass (1947, 1960) have included Lepidoptera in their revolutionary interpretations of the facial area of insect head. Schmitt (1938) has given a detailed account of the mechanism of feeding in Lepidoptera. Recently, Eastham and Eassa (1955) have revolutionised the study of the mechanism of ingestion by their new theory based on successful experiments on *Pieris brassicace* L. Vasudeva (1956) has studied the head
capsule of *Papilio demoleus* L. Srivastava (1957) has also published his observations on the head capsule of *Papilio demoleus* L. It is unfortunate that the two authors working on the head capsule of the same insect differ considerably. Zaka-ur-Rab (1961) has tried to clear some of the confusions created by the differing views of Vasudeva (1956) and Srivastava (1957). Further, his work (1964) on the larval head of *P. demoleus* is a useful contribution to the insect morphology. The skeleto-muscular mechanism of the thorax has been thoroughly dealt with by Weber (1924) and Maki (1938) in various representatives of the Order Lepidoptera. Nüesch (1953) and Treat (1959) have published useful observations on the thorax of *Telea polyphemus* Cr., and *Crymodes devastator* B., respectively. Srivastava (1961, 1962) has worked out the skeleto-muscular mechanism of thorax of *P. demoleus*. The external genitalia of adult Lepidoptera have drawn attention of several morphologists. Pierce (1909, 1914) has studied the male genitalia of various representatives of the family Noctuidae and Geometridae, respectively. Forbes (1939) made useful contribution to the musculature of the male genitalia. Hannemann (1954) studied the skeleto-muscular mechanism of the external male and female genitalia of *Argynnis paphia* L. Sibatani et-al (1954), Okagaki et-al (1955) and Ogata et-al (1957), combingly, have made useful observations on the skeletal conditions of the male genitalia of Lepidoptera. Snodgrass (1957) has given a revolutionised interpretation of the structure and working of the male genitalia in Lepidoptera. Bayer (1965) has thrown some light on the skeleto-muscular mechanism of the male genitalia of six species of Noctuidae.

The skeleto-muscular mechanism of adult *S. mauritia*, has been studied in considerable details. The present writer has tried to make necessary
morphological comparisons with other works on Lepidoptera. Besides, emphasis has been laid on the analogies and homologies of *S. mauritia* with important representatives of Orthopteroid, Hemipteroid and Panorpoid groups, as well as, with indispensable works on Hymenoptera. Further, the classical works of Duncan (1939), Carbonell (1947), Qadri (1948, 1949), Qadri and Aziz (1950), Bonhag (1949), Ferris (1950), Miller (1950), Alam (1951, 1953), Snodgrass (1956), Akbar (1957) and Dhillon (1966) have been of considerable help.

Various confusions in the interpretations of the skeletal system have been cleared and efforts made to give them sound morphological basis. The prevalent theory of Eastham and Eassa (1955) on the feeding mechanism has been modified on experimental grounds. Several new muscles have been added to the myology of Lepidoptera. The origin, insertion and course of a number of already described muscles have been carefully corrected. Further, the muscles have been labelled on the basis of their function in relation to the structures controlled by them. This system of interpreting muscles is copiously adopted by Alam (1951, 1953) and the present writer accepts it as a sound basis for the study of insect morphology which has been declared as a 'dynamic science' by Alam (1960). The latter in subsequent publications (1965, 1966) has further strengthened his conception of morphology as a 'dynamic science'.

All the systems of the internal anatomy of the moth have been studied. The anatomical details are supported with essential histological observations. Several new findings have been made.

The life-history of the moth has been carried out under controlled
conditions (temperature $30^\circ C \pm 1^\circ C$; R.H. $80\% \pm 5\%)$. Side by side, field observations on important aspects of its life-history have been recorded. The behaviour of the moth and of the fully grown larva have been studied with special reference to copulation, oviposition and food selection. These observations on behaviour might be of some interest to the agriculturists but certainly amount to emphasising the need of popularising insect behaviour in respect to its life-history as initiated earlier by Alam (1957, 1958) and extended by Dhillon (1966).

**MATERIAL AND TECHNIQUE**

The adults of *Spodoptera mauritia* B., were collected with the help of light traps and bred in the laboratory. Males and females were separately fixed in Picro-chlor-acetic fixative. Bouin's (alcoholic) fixative and Petrunkewitsch fixative were also tried. Picro-chlor-acetic fixative proved to be very satisfactory for anatomical and histological studies.

For the study of skeletal system, the specimens were warmed in 10% KOH. Decolorization of the material was done by exposing it to chlorine gas liberated by the action of HCl on $K_2Cr_2O_7$. Finally the specimens treated with Cl$_2$ gas were rinsed in water to remove traces of the gas and stained with acid fuchsine or Carbol-aniline; the latter stain gave comparatively better results. For obtaining transparency with muscles properly stained, the entire insect body was subjected to Alam's (1952) technique as modified by King (1960). This gave excellent results.

The material for microtomy was fixed in Picro-chlor-acetic fixative.