CHAPTER I

DISTRIBUTION OF PROXIMATE BIOCHEMICAL CONSTITUENTS AND CHOLESTEROL IN THE RED, WHITE, MUSCLES AND LIVER OF TWO SPECIES OF CAT-FISHES, WALLAGONIA ATTU (SCHN.) AND RITA RITA (HAM.)

INTRODUCTION

An account of the heterogeneity in the distribution of proximate chemical constituents (protein, fat, water, ash) and cholesterol in the red and white muscles of Wallagonia attu (Schn.) and Rita rita (Ham.), is presented in this chapter. Furthermore, data pertaining to these constituents in the liver of the fishes was also obtained to confirm the reported biochemical affinities of the red muscle with the liver and some important facts that emerged from the study have been outlined.

MATERIALS AND METHODS

Procedures for the sampling of fish and of the tissues, together with the techniques of extraction and quantitative determination of the biochemical constituents have been described earlier. Methods followed for the statistical evaluation of the data have also been referenced. Vide "PROCEDURE AND METHODOLOGY."

RESULTS AND DISCUSSION

Results of the quantitative analysis of proximate biochemical constituents and cholesterol in the red and white muscles and liver of Wallagonia attu and Rita rita have been
Fig. 5. Concentrations of protein (white bars), fat (dotted bars), water (stripped bars), ash (bars with a central row of bold spots), and cholesterol (black bars) in the white muscle, red muscle and liver of *Wallagonia attu*. Values in parentheses indicate standard error of mean.
Fig. 6. Concentrations of protein (white bars), fat (dotted bars), water (stripped bars), ash (bars with a central row of bold spots), and cholesterol (black bars) in the white muscle, red muscle and liver of *Rita rita*. Values in parentheses indicate standard error of mean.
presented in Tables I A, B and Figs. 5, 6.

PROTEIN:— Among the three tissues of *Wallagonia attu* and *Rita rita* investigated, protein concentration was found to be highest in white muscle and lowest in the liver; the red muscle occupied an intermediate position. Similar progression in protein has been reported by Braekkan (1959) for *Gadus virens*, *Hippoglossus hippoglossus*, *Lamna cornubica*, *Thunnus thynnus*, and *Mustafa* (1976) in case of *Clarias batrachus*. Higher concentration of protein in white muscle in comparison with the red has also been documented by Fujikawa & Nagamuna (1936) and Dyer et al. (1963). Alexander (1955), however, outlined his results, showing a higher protein concentration in the red muscle.

FAT:— Fat distribution in the three tissues of the two species exhibited marked heterogeneity. Liver was richest in fat in *Wallagonia attu* followed by red muscle, whereas in *Rita rita* fat content in the red muscle was higher than in the liver. White muscle contained least amount of fat in both the teleostean species. Data presented by Fujikawa and Nagamuna (1936), Alexander (1955), Braekkan (1959), George (1962), Thurstan (1962), Zama (1963), Dyer et al. (1963), George & Bokdawala (1964), Bligh & Scott (1965) and Mustafa (1976) also indicated greater fat concentration in red muscle in comparison with the white fibers. Accumulation of large
quantities of fat in the red muscle shows its resemblance with liver, a fat-rich internal organ and also emphasizes its unsuitability as a mechanical tissue. Concordant views have been expressed by a number of pioneer investigators (Braekkan, 1959; Tsuchiya & Kunii, 1960; Barets, 1961; Wittenberger, 1960; Whittenberger & Oros, 1961; Mustafa, 1976).

Braekkan (1956, 1959) viewed the close physical association of red muscle with the white as an advantage for easy and quick transfer of metabolites, chiefly energy nutrients, to the later during muscular activity, when energy requirements are high. The findings of Bilinski (1963), Bilinski & Jonas (1964) and Jonas & Bilinski (1964) revealing a greater efficiency of red muscle in oxidative degradation of fatty acids, and the physiological studies carried out by George (1962) and George & Bokdawala (1964) indicating a higher lipase activity in this tissue, make it abundantly clear that red muscle is an important seat of utilization of lipid as the main fuel.

W A T E R : Percentage of water was observed to be higher in white muscle of the two cat-fishes. Red muscle and liver showed an intermediate position in Wallagonia attu and Rita rita, respectively. Least amount of water was recorded in the liver of Wallagonia attu and red muscle of Rita rita.
A reciprocal relation between the concentration of fat and water in the three tissues of the fishes investigated was evident from the data.

ASH: The values of ash in each of the species were in order: white muscle _ red muscle _ liver. Inasmuch as a tissue requires some inorganic substances for performance of mechanical activity, greater quantities of ash in the white muscle must be expected for this kind of its role. In having lesser amount of ash, red muscle exhibited affinity with liver. Data showing comparatively larger concentration of ash in white muscle than the red has been furnished by Alexander (1955), Braekkan (1959), Dyer et al. (1963) and Mustafa (1976).

CHOLESTEROL: Of the three tissues of fishes examined, highest cholesterol concentration was recorded in the liver, intermediate in the red muscle and lowest in the white muscle. Earlier biochemical work (Igarashi et al. 1957; Mustafa, 1976) on the red and white muscles also reports higher cholesterol level in former of the two.

SUMMARY

Concentrations of various chemical constituents in red, white muscles and liver of two cat-fishes, namely, Wallagonia atta and Rita rita were investigated. White muscle was richest in protein and ash concentrations followed by red muscle. Liver
was poorest in these two constituents in the teleostean species, but appeared to be the richest source of fat in case of *Wallagonia attu* and cholesterol in both *Wallagonia attu* and *Rita rita*. Intermediate quantities of cholesterol occurred in the red muscle. Red muscle contained higher amount of fat in *Rita rita*. White muscle was found to possess least amount of fat and cholesterol. Quantitatively, water maintained an inverse relationship with fat in the three tissues of the teleosts.
Fig. 7. Concentrations of RNA (dotted bars) and DNA (striped bars) in different tissues of *Clarias batrachus*. Vertical lines indicate standard error of mean.