STUDIES ON SHARK LIVER OIL AND ITS RESIDUE

L. D. KAMDAR, M. K. KANDORAN & R. VENKATARAMAN,
Central Institute of Fisheries Technology Sub-station, Veraval: Gujarat State.

Seasonal variation in oil and moisture contents and vitamin A potency of oil in livers from different species of sharks landed at Veraval coast were studied. Values of moisture, protein, ash and vitamins in defatted liver residue were determined.

INTRODUCTION

The Gujarat coast extending over a distance of 1,600 km. is very rich in all varieties of Elasmobranch fishes like sharks, skates and rays. In fact, it may be said that there is an excellent virgin shark fishing ground, the potentialities of which are immense. The despised shark because of the poor quality of its flesh can be made into one of the most economically useful fish, if only suitable steps are taken to utilise all its portions properly. The liver, fin, skin, teeth and flesh are all extremely valuable products which can earn considerable foreign exchange.

In this paper attention is confined to the seasonal variation in the composition and the economic utilisation of shark liver and its residue after extraction of oil. In tropical countries shark liver is one of the main sources of Vitamin A bearing oil. The liver residue, left after the extraction of oil is, at present, being thrown away as a waste. But this residue is found to be very rich in protein and Vitamin B which are valuable for feeding poultry and cattle.

Different aspects of fish liver oil have been studied by a number of scientists in several countries. Schmidt- Nielsen *et. al* (1936) worked on livers from a number of fish species. In India, Ghosh *et al* (1933, 1934 – '35) and Pradhan, *et. al.*, (1956) and others have made deep studies on the liver oil of shark and other types of fish.

MATERIALS AND METHODS

(i) *Extraction of liver oil:*

Every month livers were procured from different sharks of known size and species. Generally livers were obtained from sharks like *Carcharias melanopterus* and *Zygaena blochii.* Each liver was measured, weighed, its colour was noted and then was minced. Sample of the minced liver was analysed to determine the moisture and oil contents. After mincing, the liver was boiled with sufficient quantity of water for about 45–60

minutes and oil was extracted as much as possible and then oil water mixture was allowed to settle for a short time and the top oil layer was removed.

Liver oil samples were preserved, Vitamin A potency of different oil samples were determined in International Units per gram by using Lovibond Tintometer (The British Drug House Pattern.) This method is based on the measurement of the unstable blue colour formed by the interaction of Vitamin A and antimony trichloride. The method used is as follows.

0.3 to 0.7 g of the shark liver oil, accurately weighed, is dissolved in chloroform to produce 10 ml. 1 ml. of this solution is further diluted to 10ml. with chloroform. 2 ml. of antimony trichloride solution in chloroform are placed in the standard Tintometer cell kept in position in the Tintometer and 0.2 ml. of the final solution of the oil in chloroform is added quickly to the cell. The blue colour developed is matched by means of the standard Tintometer glasses. The result is recorded as the number of blue units required to match the colour developed. Colour match should lie between 4.0 and 6.0 Lovibond blue units. Then the blue value per g of the oil is calculated and it is multiplied by a standard factor 2 to get the Vitamin A potency in terms of International Units per g.

(ii) *Defatting of the residue*

The residue remaining after oil extraction from liver, contained 25–35 percent (wet base) fat. This residue was dried and the remaining fat was removed by solvent (petroleum ether) extraction. The defatted residue was powdered, analysed and preserved. Data regarding moisture and oil contents in liver and Vitamin A potency of oil were collected and from these data graphs showing variations in (i) oil (ii) moisture and (iii) Vitamin A during different periods were plotted.

Results and Discussion

Oil and moisture in liver:–

As shown in Figure 1, oil content is found maximum during January and February (about 58%) then it is decreasing and falling to minimum in the month of June (22%). From July onwards it is shooting up again and reaching maximum in the month of October (55%).

Figure 2, shows variation in moisture content. From Figures 1 and 2 it is seen that moisture and oil contents are inversely proportional in shark liver as generally established in fish. The combined moisture and oil content is found to be 80 to 90 percent.

Vitamin A potency of oil:–

As given in Figure 3 there is month–wise fluctuation in Vitamin A potency. It is lowest in June (1200 I. U. /g) then it is increasing upto September (18000 I. U. / g) slightly declining in October and reaching the peak in the month of November (20,690 I.U./g). Thus there are two peaks, one in September and another in November as far as the Vitamin A content in the liver oil is concerned. Rajagopal has reported a very high potency of 1,90,400 I. U. /g for liver oil from Sind sharks belonging to Carcharias sp.

Vitamin A potency and oil content are minimum during June but the same relationship is not found during October, as in October oil content is nearing maximum while Vitamin A potency has decreased. The higher percentage of oil content in the liver with a corresponding drop in the Vitamin A potency may be attributed to the probable dilution of Vitamin A concentration taking place in the liver.

Schmidt-Nielsen observed that the Vitamin A was diluted through an increase in both the size of liver and the oil content, or increased through reverse changes. Figures 1 and 3 show that often there is increase in Vitamin A potency with decrease in oil content and vice-versa which coincide with the results of Schmidt-Nielsen. However, no relationship between the size of the liver and vitamin A potency could be found.

There are, however, additional factors that have an influence on Vitamin A concentration in the liver oil e.g. the age of the fish and evironmental conditions such as the location of capture and seasonal differences. In sharks ratio of Vitamin A_1 to A_2 varies from 12 : 1 to 25 : 1 (Pradhan and Magar, 1956).

Defatted residue

About 35 defatted residue samples were analysed for moisture, ash and protein contents. Results are summarised as follows.

Analytical results of defatted residue:-

	Range
Moisture	: 2 — 7%
Ash	: 2 — 4%
Protein	: 65 — 85%

From the above results it is clear that defatted residue is rich in protein content.

Several defatted residue samples were analysed at Central Institute of Fisheries Technology, Ernakulam for their Vitamin content and following Vitamins were determined quantitatively.

	1	2	3	4	5	6	7
Vitamin	μg	μg	μg	μg	μg	μg	μg
Riboflavin	2.83	2.16	3.15	2.91	2.99	2.18	2.46
Niacin	22.4	20.9	19.3	24.6	18.9	19.7	20.3
Pantothenic Acid	5.63	5.94	6.02	5.13	5.08	5.98	5.92
Vitamin B_{12}	0.242	0.118	0.318	0.298	0.226	0.291	0.217

The above data show that in addition to protein the residue is rich in Vitamin B also. Hence it will be a very valuable blend for fish meal which is deficient in Vitamins.

In addition to the above work, about 12 liver residue samples were procured for analysis from shark liver oil unit at Veraval under Gujarat State Fisheries, and moisture and residual oil content in these samples were found in the range 50 to 70 percentage and 18 to 35 percentage respectively. The analysis showed that in the liver residue combined moisture and oil content was between 85 — 95 per cent.

SUMMARY

The concentration of moisture and oil in shark liver was found to be inversely proportional to each other. Maximum moisture and minimum oil content were found during the summer. Month-wise fluctuation was noted in the case of Vitamin A potency of oil. It was often observed that with increase in oil content Vitamin A potency decreased.

As defatted liver residue is rich in protein and Vitamin B contents it can be used as a valuable blend with fish meal to get it enriched with these nutrients. Thus liver residue which is being wasted at present can be profitably utilised.

ACKNOWLEDGEMENT

The authors wish to express their sincere thanks to Dr. A. N. Bose, Director,

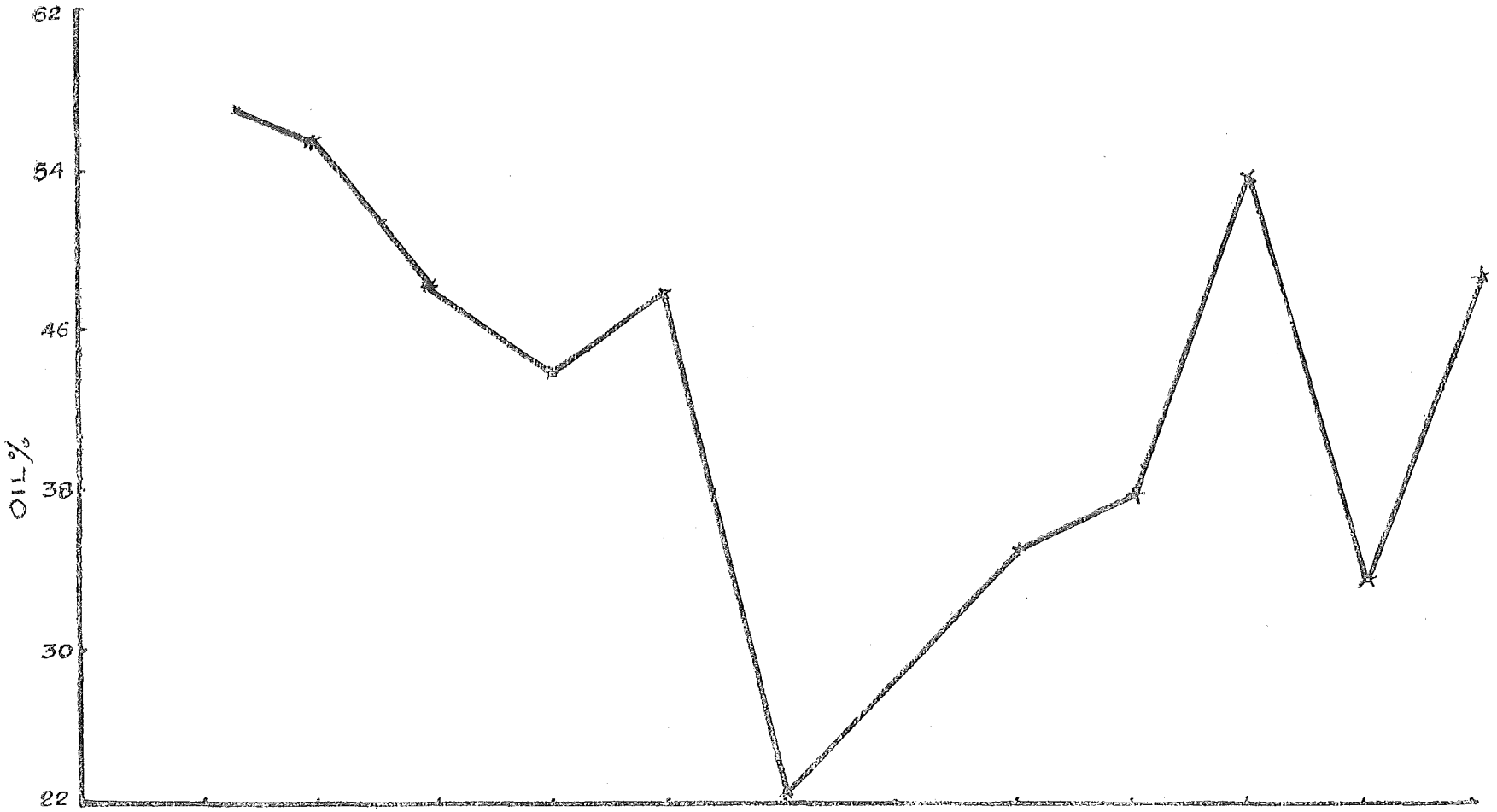
62
54
46
38
30
22
OIL %
JAN.
FEB.
MAR.
APR.
MAY.
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.

FIGURE.1.

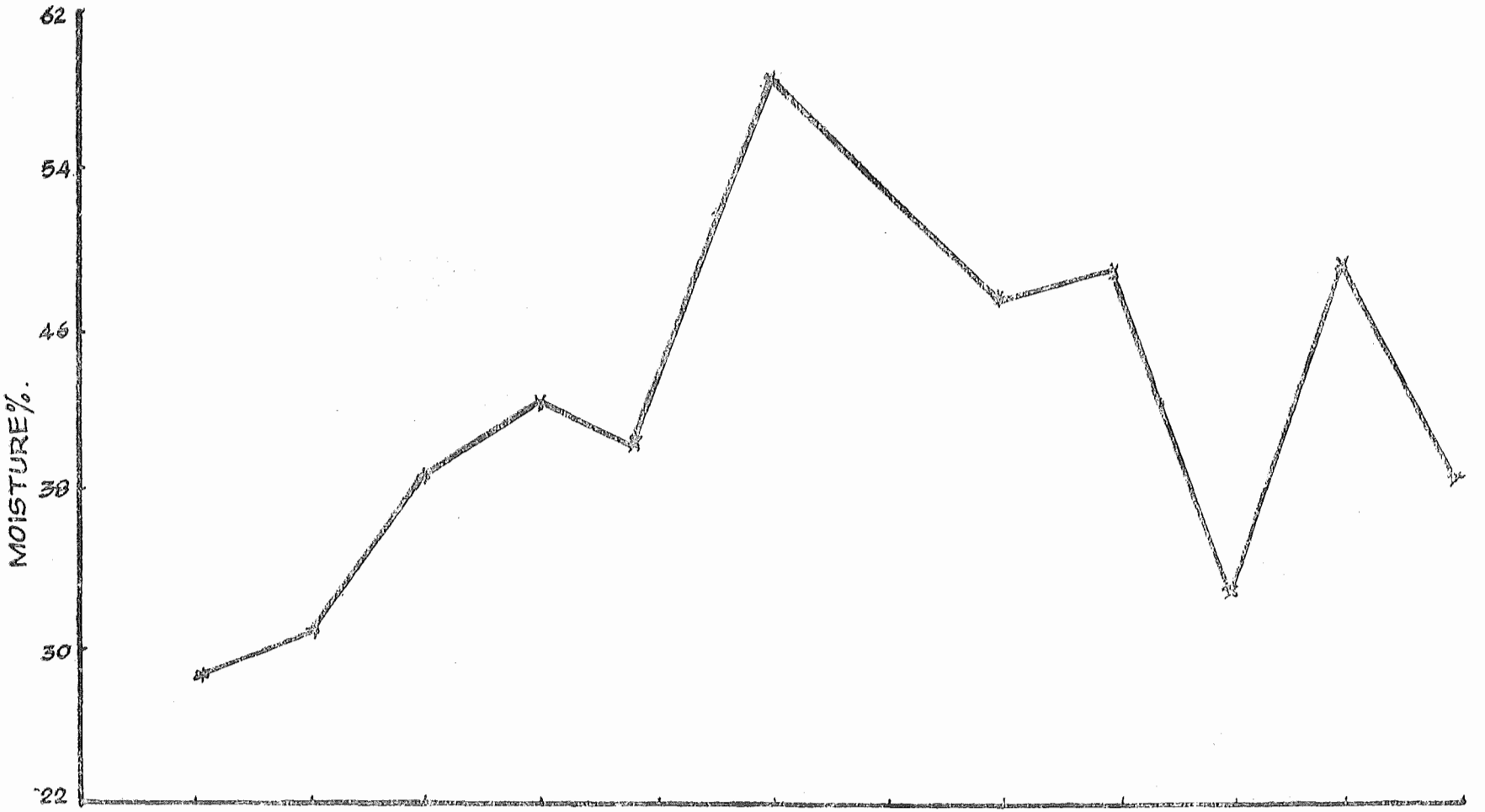
62
54
46
38
30
22
MOISTURE%.
JAN.
FEB.
MAR.
APR.
MAY
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.

FIGURE. 2.

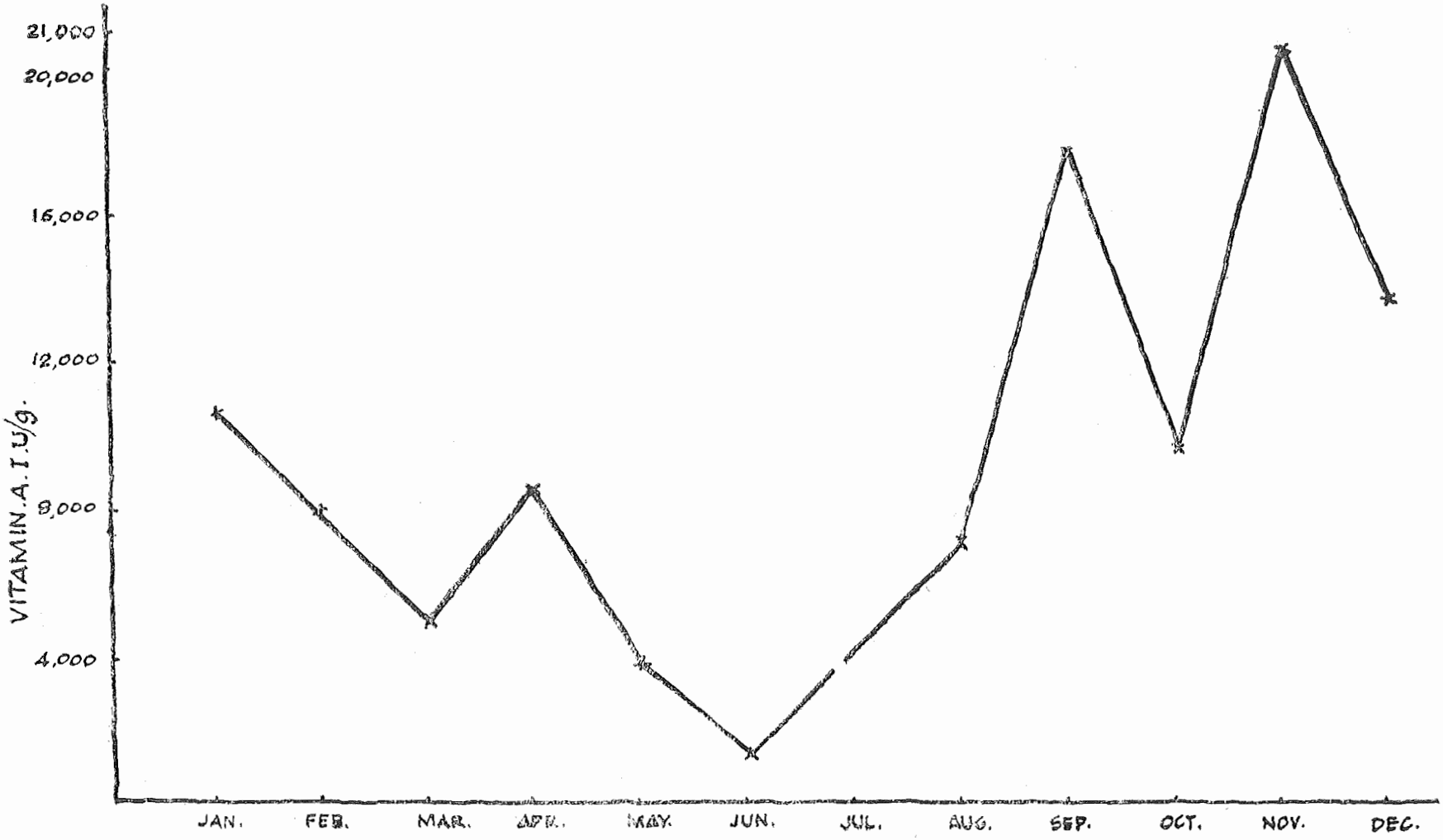
21,000
20,000
16,000
12,000
8,000
4,000
VITAMIN A. I.U/g.
JAN.
FEB.
MAR.
APR.
MAY.
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.

FIGURE 3.

Central Institute of Fisheries Technology, Ernakulam for his keen guidance and encouragement.

REFERENCES

A. O. A. C., 1960 Methods of Analysis.

Ghosh, A. R., Chakravarty, P. N., and Guha, B. C., 1963. *Indian J. Med. Res.* **21**, 441–446.

Ghosh, A. R., Chakravarty, P. N. and GUHA B. C., 1934–35. *Indian J. Med. Res.*, **22**, 521.

Higashi, H., 1940 a. *Bull of Agricultural & Chemical Society,* Japan **16,** 169–170.

Higashi, H., 1940 b. *Journal of Agriculural & Chemical Society,* Japan **16**, 179–80.

Higashi, H, Hirao, S., Shimizu, K., Yamada, J. and Kikuchi, R., 1953 b. *Bull. Jap. Soc. Sci. Fish* **18**, 8, 349–352.

Maqsood, A. C., Abdul Haq., S., and Mohdihassan, S., 1958. *Pakistan Sci. Ind. Research* **1**, i, 70–73.

Pradhan, S. K., & Magar, N. G. 1956. *Indian J. Med. Res;* **44**, 11–20.

Pradhan, S. K., Marathe, V. G. and Arsiwala, S. M., 1956. *J. Sci. Ind. Res.* **15 C**, 218–220.

Rajagopal, K; 1942. *Current science* **11**, 22. 2.

Rajagopal, K. 1941, *Indian J. Med. Res.* **29**, 575.

Schmidt–Nielsen, S., Astad, A., Flood, A., Setene, J, and Sorensen, N. A. 1936. *Kgl. Norske Videnskab. Selskabs Forh-Skifter* 1935 No. 40, 77 Pp.

The Tintometer Ltd., Salisbury, England–The Lovibond Tintometer (The British Drug Houses Pattern)–No. L–51 A.