TABLE 1

<table>
<thead>
<tr>
<th></th>
<th>Mg/g dry weight</th>
<th>Baby</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Humerus</td>
<td>Femur</td>
<td>Parietal</td>
</tr>
<tr>
<td>Calcium</td>
<td>256 ± 9</td>
<td>234 ± 6</td>
<td>175 ± 8</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>60 ± 4</td>
<td>134 ± 8</td>
<td>761 ± 11</td>
</tr>
<tr>
<td>Magnesium</td>
<td>109 ± 2</td>
<td>109 ± 2</td>
<td>64 ± 2</td>
</tr>
<tr>
<td>NPN</td>
<td>2.28 ± 0.11</td>
<td>7.46 ± 0.16</td>
<td>4.44 ± 0.13</td>
</tr>
</tbody>
</table>

TABLE II

<table>
<thead>
<tr>
<th></th>
<th>Molar ratios of the inorganic components of bones in Loris tardigradus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adult</td>
</tr>
<tr>
<td>Molar ratio</td>
<td>Humerus</td>
</tr>
<tr>
<td>Ca/Mg</td>
<td>2.25</td>
</tr>
<tr>
<td>Ca/P</td>
<td>3.01</td>
</tr>
<tr>
<td>Mg/P</td>
<td>0.13</td>
</tr>
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</table>

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April 16, 1974/November 28, 1974.

7. Denis, W., Ibid., 1922, 52, 411.

OBSERVATIONS ON THE SCALES OF THE SHORT-FINNED EEL, ANGUILLA BICOLOR
McCLELLAND AND THEIR UTILITY IN AGE DETERMINATION

It is well known that scales of fishes are of value in determining the age and growth of fishes. Several authors (Lee, 1920; Van Oostern, 1929; Walford and Mosher, 1943; Seshappa and Bhimachar, 1951; Jhingran, 1957; Seshappa, 1958 and Rao, 1961) have determined the age of various species of fishes based on the number of rings found on the scales. Pantulu (1956) has stated that scales could be used in estimating the age and not growth of the eel, Anguilla bengalensis Gray. In 1971 experimental eel culture was undertaken at the Regional Centre of Central Marine Fisheries Research Institute, Mandapam Camp, to develop a suitable method of culturing the short-finned eel, Anguilla bicolor McClelland. During the course of the experimental culture the scales of the cultured eels were studied to ascertain whether there is any correlation between the number of rings present on them and the age of eels. The results obtained in this study are reported here.

About 200 eel's of an average length of 100 mm were collected near the closed sluice gates of Sraivalkundam anicut on the river Tambraparni near Tuticorin in October 1971, transported to Mandapam Camp and reared in running water tanks. They were fed daily twice with minced clam meat and fish flesh. The water temperature in the experimental tank varied between 28° and 30° C. The size attained by the cultured eels at the end of one year exhibited a wide range of 125 mm to 500 mm and the average size was 350 mm in total length and 106 gm in weight. For the present study scales were examined from cultured eels measuring 128 mm, 153 mm, 283 mm, 363 mm, 388 mm, and 500 mm in total length. Scales were removed from the area midway between anus and tip of tail on either side of the lateral line. 10 to 20 scales were examined from each eel. In this investigation scales having maximum number of rings alone were taken into considera-
tion as they are believed to represent the correct age of eels (Gemzoe, 1904; Frost, 1945 a & b).

The scales of eels are microscopic, very thin, flat and elongate-oval in shape and are embedded in the skin at right angles to each other (Pl. 1 A). They do not overlap but are “placed in individual sacs in the dermal tissue with no connection with the epidermal coverings” (Waly, 1940). The scales are composed of concentric rows of oval, round or polygonal head-like loculi.

scales have one, two, three and four rings respectively. These results may lead to the conclusion that 283 mm, 363 mm, 388 mm, and 500 mm long eels are one, two, three and four years old respectively. It may be pointed out here that for this study scales were collected from eels reared in running water tank and though the eels ranged from 128 mm to 500 mm in total length, all of them were of the same age, as they had grown to these sizes from elvers during one year period. But their scales show varying number of rings. These observations clearly indicate that there is no relationship between the number of rings found on the scales and the age of eels. In the light of the above finding, the view so far held that the rings found on scales are annual in character and are indicative of age of fish, does not hold good for *A. bicolor*. In the present investigation the eels were reared in an environment where there were no marked changes either in the availability of food or temperature, which are normally believed to be responsible for formation of rings on scales. Therefore the causative factor for the formation of rings on scales is not clear.

Based on length frequency data and scale readings Pantulu (1956) has estimated age of *Anguilla bengalensis*. According to him the respective average length of I to V year old eels, as estimated from length frequency are 210 mm, 265 mm, 331 mm, 441 mm and 507 mm and as calculated from scale readings are 183.5 mm, 249.5 mm, 340 mm, 447 mm and 516.6 mm. Since there is a close agreement in the estimates of age calculated by the two methods, he stated that scales could be utilized for estimating the age of *A. bengalensis*.

The present experimental culture of *A. bicolor*, an allied species of *A. bengalensis*, has clearly shown that there is a wide range in the length of eels of same age and that there is no relationship between the number of rings present on the scales and age of eels. Bertin (1956) has also stated that measurement of length or weight cannot be used to determine the age and growth of an eel, as it would risk an error of one to five years either way. Therefore it may be stated that in the case of eels any estimate of age arrived at by length frequency method and scale readings is likely to be erroneous. The only reliable method of determining the age of eels is by making direct observations on the rate of growth through rearing.

Central Marine Fisheries Research Institute, Cochin-18, July 17, 1974.

COMMON ANTIGENS IN HOST-PARASITE RELATIONSHIP*

It has been shown in mammalian systems, that antigenic closeness between a host and a parasite, leads to a stable host-parasite relationship (host ‘tolerance’) while antigenic disparity leads to host resistance to the parasite (host ‘intolerance’). Although the plant does not produce an immune system similar to that in animals, the concept that common antigens between host and parasite might have a role in disease development found some support in plant pathology as well. The present investigation is an attempt to see if this concept is applicable in vascular wilt of cotton.

Experiments were designed to look for possible common antigens between two species of cotton, *Gossypium arboreum* L. and *G. hirsutum* L. and a virulent Indian strain of *Fusarium vasinfectum* Atk. Earlier work has shown that this strain is highly pathogenic to *G. arboresum* but not to *G. hirsutum* although it infects and colonizes both to varying degrees. In order to exclude errors owing to non-specific reactions in the final results, the following fungi and plants were included for reference; *Fusarium solani* (Mart.) App. et Wr., *F. culmorum* (W.G. Sm.) Sacc. and *Pyricularia oryzae* Cav. none of which are known parasites of cotton, and *Abelmoschus esculentus* (L.) Moench. and *Phaseolus mungo* L. plants that are not known to be infected by *F. vasinfectum*.

The extraction of the fungal antigens was as described in an earlier paper. For host antigens the initial steps of extraction were the same as outlined by DeVay and co-workers. The material was extracted under liquid nitrogen using polyvinyl pyrrolidone and sodium ascorbate with a pestle and mortar. Further homogenization was done in a VirTis homogeniser. The extractant used was phosphate-buffered saline at pH 7.2. The antigens were purified further by the same procedure as for fungi. The antigens mixed with Freund's complete adjuvant were administered intramuscularly in a course of six injections to white rabbits (each weighing approximately 1.5 kg). Antisera were collected on 23rd day by bleeding the ear veins and stored at 0°C with merthiolate as preservative. The antisera against the two species of cotton were tested by the agar-gel double diffusion method with their antigens in homologous and heterologous reactions. The antigens of *A. esculentus* and *P. mungo* were also allowed to react with the two antisera. *A. arboreum* formed three lines of precipitation in homologous reactions and two in heterologous reaction with *G. hirsutum* while the latter showed two antigens in homologous as well as heterologous reactions. *A. esculentus*, which belongs to the same family as cotton, shared an antigen with both the species of cotton. *P. mungo* produced no precipitation with either species of cotton.

Using the same technique, the antisera and antisera of the two species of cotton were tested against the antigens and antisera, respectively, of all the test fungi. The antisera of the two species of cotton on reacting with the antigens of *F. vasinfectum*, or the antisera of the latter on reacting with the antigens of the former two, formed a single precipitin band indicating the presence of a common antigen (Fig. 1). However, such a result

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*Fig. 1. Antigen of *G. arboreum* in the central well (K7) reacting with homologous antiserum (K7) and with heterologous antisera of *G. hirsutum* (mu), *Fusarium vasinfectum* (fv), *F. culmorum* (fc), *F. solani* (fs) and *Pyricularia oryzae* (po).*