A DESCRIPTION OF *SARDINELLA DAYI* REGAN (PISCES: CLUPEIDAE) OF INDIAN SEAS WITH REMARKS ON ITS CLOSE SIMILARITY WITH *SARDINELLA MADERENSIS* (LOWE) AND *SARDINELLA JUSSIEUI* (VALENCIENNES)

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ABSTRACT

Since the existing descriptions of *Sardinella dayi* Regan are based on very few specimens, a detailed account of its morphometric and meristic characters on the basis of 50 specimens collected from Karwar (type locality), Vizhinjam and Tuticorin of the Indian coast, is presented. It is concluded that the material from Mauritius figured and included by Fowler (1941) under *S. dayi* is referable to *S. jussieui* (Valenciennes). Drawing attention to the close similarity between these two species and *S. maderensis*, it is recommended that future studies should assess how far the differences between these species justify distinction at species level.

INTRODUCTION

One of the species of *Sardinella* Valenciennes that has been described from very limited material is *Sardinella dayi* Regan. After its original description based on a single specimen obtained from Karwar, India (Regan 1917), contributions to its systematics have been limited to those of Fowler (1924, 1941) from Calicut (India) and Mauritius (3 + 12 specimens) and Chan (1965) from Colombo (2 specimens). A detailed description of the species is given here, based on more material, covering a greater size range and drawn from three places on the Indian coast. Some remarks are made on its close resemblance, at least on described characters, to *S. maderensis* (Lowe) from the Mediterranean and the west coast of Africa and *S. jussieui* (Valenciennes) (not *S. jussieu* (Lacepede) = *nomen dubium*, Whitehead 1967) from Mauritius.

MATERIAL AND METHODS

The study is based on 50 specimens ranging between 25 and 128 mm standard length (total length 33 to 169 mm; hereafter only standard length will

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be referred to). Of these, 19 were from Karwar (14°48' N, 74°07' E) (8 fish in 25- to 40-mm size range from the nearby Aghanashini estuary and all fish in 54- to 128-mm range from sea), 5 from Tuticorin (8°45'N, 78°11'E) and 26 from Vizhinjam (8°23'N, 76°59'E). The Vizhinjam material was first examined by the second author but was later re-examined by the first author (except for the count of lower gill rakers) in order to check possible differences in measurements and counts; no count of gill rakers on the upper arm of the first gill arch has been recorded for this material. The method of measurements and counting was essentially that used by Chan (1965) except for head length, which here represents the longest distance from the tip of snout to the end of operculum, very often diagonal, as employed by Whitehead (1965). Hence, the combined length of snout, eye diameter and postorbit would not necessarily equal head length. In Fig. 1 is shown a line drawing of the fish while Fig. 2 shows the fish of each cm group arranged serially. Table 1 gives the ranges and means of morphometric and meristic characters; the Karwar material has been split into two to enable immediate comparison of roughly similar-sized fish between the places. All the body measurements are expressed as percentages of standard length. In the description below, the overall ranges are given with the means in parenthesis.

DESCRIPTION

Sardinella dayi Regan (Fig. 1A & Fig. 2)

Sardinella dayi Regan, 1917 : 381 (type locality : Karwar, India);
Fowler, 1924 : 36 (Calicut, India);
?Fowler, 1941 : 604 (Mauritius and Calicut);
Chan, 1965 : 12 (Colombo, Sri Lanka).

Meristic counts: D iv 13-16 (18.5), mode 18; P i 12-16 (14.7), mode 15; V i 7; A ii-iii 13-20 (19.2), mode 19; C 24-30 (27.2), mode 26; scales in lateral series 35-49 (41.4), mode 40; rows of scales between dorsal and pelvic fins 11-14 (12.1), mode 12; pre-pelvic scutes 15-18 (17.0), mode 18; post-pelvic scutes 11-14 (13.1), mode 13; gill rakers, upper arm of first gill arch 28-20, lower arm 42-130.

Measurements: Head length 25.7-33.8 (29.2), shorter than depth at dorsal origin. Maxilla length 10.7-15.4 (12.3), reaching to vertical from anterior margin of pupil. Eye diameter 6.8-10.3 (8.0), covered by adipose tissue with a vertical slit. Snout length 6.5-10.0 (7.9), about as long as eye. Interorbital width 6.4-11.5 (8.0), as long as eye or snout. Postorbital length 9.6-16.3 (12.1), about equal to maxilla length. Width of body at gill opening 9.3-12.1 (10.5). Minute teeth on median ridge of tongue, palatines and lower jaw. Black stellar chromotophores randomly distributed on the tongue. Two supra-maxillae, the posterior having the expanded terminal portion roughly circular with upper and

TABLE 1. *The ranges and means of various characters for* Sardinella dayi *from three different areas. Morphometric characters are expressed as percentages of standard length.*

Character	Karwar Size range: 25-65 mm No. of fish: 10		Tuticorin Size range: 42-68 mm No. of fish: 5		Karwar Size range: 71-128 mm No. of fish: 9		V'zhinjam Size range: 73-121 mm No. of fish: 26	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean
1. Head length	29.4—33.3	31.9	29.7—31.3	30.5	28.3—33.8	30.2	25.7—28.9	27.5
2. Maxilla length	11.3—15.4	13.3	10.7—13.6	12.8	11.0—14.0	12.0	10.9—13.0	12.0
3. Eye diameter	7.4—10.3	9.1	8.3— 8.8	8.5	7.0— 9.3	8.0	6.8— 8.2	7.4
4. Snout length	7.4—10.0	8.4	7.8— 9.3	8.4	6.8— 9.3	8.1	6.5— 8.6	7.6
5. Postorbital length	12.0—16.3	14.5	12.7—14.8	13.6	10.8—15.3	12.3	9.6—12.1	10.7
6. Interorbital width	8.8—11.5	9.7	8.3— 8.8	8.5	6.6— 9.2	7.7	6.4— 9.3	7.3
7. Width of body at gill opening	10.0—12.1	11.3	9.5—11.1	10.7	9.7—12.0	10.5	9.3—11.3	10.2
8. Depth at dorsal origin	32.4—38.3	35.5	35.7—39.8	37.1	33.1—39.4	36.0	30.3—36.6	33.7
9. Depth at anal origin	20.7—26.5	23.6	21.3—26.2	24.6	21.2—26.6	22.9	20.1—24.7	22.0
10. Depth of caudal peduncle	11.5—15.0	13.1	10.9—13.1	12.1	10.6—12.0	11.3	9.5—12.2	10.9
11. Predorsal distance	41.7—46.2	44.5	39.0—42.6	40.5	43.0—46.5	45.0	40.8—45.7	44.2
12. Dorsal-fin base	13.6—20.0	17.8	15.3—19.0	17.2	13.9—17.5	15.9	13.3—18.9	16.9
13. Preanal distance	75.4—80.0	77.2	75.0—76.6	75.4	77.3—80.5	79.1	74.4—81.8	77.9
14. Anal-fin base	15.2—20.0	17.2	16.1—17.9	17.0	15.5—19.6	17.0	16.9—20.0	17.8
15. Prepectoral distance	25.9—29.2	27.6	26.2—28.8	27.5	25.0—29.6	27.2	22.2—24.4	23.0
16. Pectoral-fin length	16.7—21.7	19.4	15.3—19.0	17.6	17.3—19.2	18.6	18.3—22.7	20.2
17. Prepelvic distance	51.5—53.8	53.2	50.0—52.8	51.0	50.0—53.4	52.2	50.0—56.4	52.9
18. Pelvic-fin length	10.8—15.3	13.3	10.2—11.9	10.7	10.6—12.0	11.3	10.7—13.7	12.3
19. Caudal-fin length	29.4—35.0	32.5	33.9—35.9	34.7	31.2—36.6	33.2	26.3—33.1	29.5
20. Prepelvic scutes	15—17	16.0	15—16	15.6	15—18	16.9	16—18	17.8
21. Postpelvic scutes	11—13	11.6	13—14	13.2	13—14	13.3	13—14	13.5
22. Pectoral-fin rays	13—15	14.1	15—17	16.2	14—16	14.8	13—16	14.6
23. Dorsal-fin rays	18—20	18.8	18—19	18.2	17—20	18.8	17—19	17.6
24. Anal-fin rays	17—22	18.9	18—22	20.8	18—23	19.9	15—20	18.7
25. Caudal-fin rays	28—30	28.9	26—30	28.0	26—30	28.9	24—26	25.8
26. Lower gill rakers	42—98	—	67—85	—	99—125	—	85—130	—
27. Upper gill rakers	28—52	—	44—52	—	60—80	—	—	—
28. Diagonal scale rows	11—13	12.3	11—13	12.3	11—14	12.6	11—12	11.8
29. Scales in lateral series	37—49	41.5	39—42	40.5	37—48	42.0	33—45	41.3

lower portions roughly equal. The cephalic sensory canal system appears as dendritic branches on all the opercular bones as well as on the suborbital series.

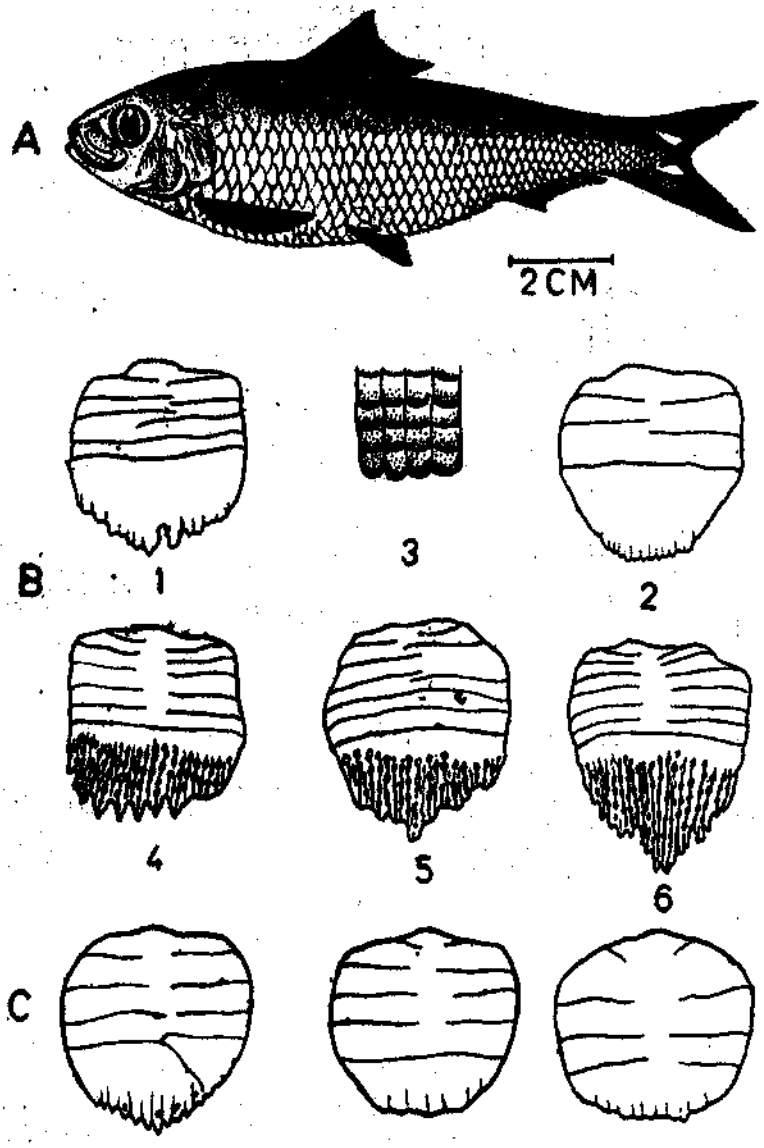

FIG. 1. A. *Sardinella dayi* Regan.
B. Body scales from *S. dayi*. 1 & 3, scales from fish below 70 mm length; 2, hind end of a scale enlarged to show the ridges; 4, a typical scale in fish above 80 mm length; 5, scale showing incidence of two uninterrupted striae; 6, scale from post-anal region showing prolongation of hind margin.
C. Body scales from Fowler's Mauritian material described as *S. dayi* (= *S. jussieui*).

Fronto-parietal region with paired cuneiform areas each having 7 to 15 striae but normally 8-10 as counted across the middle of the region.

Body moderately compressed, shape roughly oblong, normally with both the profiles evenly curved; sometimes the ventral profile may be slightly more convex. Belly moderately or sharply keeled. Depth at dorsal origin 30.3-39.8 (34.8), greater than head length. Depth at anal origin 20.1-26.6 (22.8), about

FIG. 2. A. Specimens of *Sardinella dayi* arranged serially representing each 10-mm group from 20 to 120 mm standard length. (20-, 30-, 40- & 70-mm fish from Karwar, 50- & 60-mm from Tuticorin and 90- to 120-mm from Vizhinjam)
B. Slender-bodied specimens of *S. dayi* placed on either side of a normal fish for comparison.

2|3 of that at dorsal origin. Least depth of caudal peduncle 9.5-15.0 (11.5), about 1|3 of maximum body depth and 1|2 of depth at anal origin.

Predorsal length 40.8-46.6 (44.0), origin of dorsal fin nearer to snout than to caudal base; base of dorsal fin 13.3-21.2 (16.9). Prepectoral length 22.2-29.6 (25.1); pectoral fin length 15.3-22.7 (19.5), the tip reaching vertical from dorsal origin or extending slightly beyond but failing to reach pelvic fin base by about 1-1½ eye diameters, the distance increasing with increasing length of fish. Prepelvic length 30.5-36.4 (32.6), the pelvic fin origin below first 1|3-1|2 of dorsal fin base, either midway between or slightly nearer to caudal base than to tip of snout and slightly nearer to anal origin than to pectoral base; pelvic fin length 10.7-15.3 (12.2), about as long as maxilla or postorbital length; axillary scale present at base. Preanal length 74.4-81.8 (77.8). The distance between anal and caudal base and that between anal and pelvic bases is almost equal in the smaller fish but in larger fish the latter is slightly longer, so that the anal origin is nearer to caudal base than to pelvic base by about 1|3-2|3 eye diameter. Anal fin base 15.2-20.0 (17.4), roughly equal to dorsal base, with last two rays enlarged. Distance between dorsal and anal origin about twice that between pectoral base and dorsal origin. Caudal fin length 26.3-36.6 (31.2), roughly as long as head length or slightly longer; the lower lobe is almost always the longer of the two. Alar scales present.

Gill rakers: Pseudobranch present, exposed, as long as eye diameter in larger specimens and up to 1½ eye diameters in smaller fish; the lower border arched and ridged distinctly or moderately, pale yellow in colour (in small fish) or black (in larger fish) but no distinct groove below the ridge. The number of gill rakers in the upper and lower arms of first branchial arch increases progressively as may be seen from Table 2 which shows the range and mean for each 10 mm group from different localities. The relation between fish length and number of lower gill rakers, shown in Fig. 3, is found best expressed by the exponential equation, $Y = 5.2130\ X^{0.6579}$ ($r = 0.949$), where Y is the number of gill rakers and X, standard length in mm. The epibranchial gill rakers of larger specimens curve slightly upwards and may or may not overlap the ceratobranchial gill rakers. The length of longest gill raker may vary from 3|5 to 1 eye diameter, and 1|5-2|5 longer than the corresponding gill filaments.

Scales: The median predorsal scales are arranged in a double row. Body scales firmly adherent except in small juveniles up to 40 mm. The striae pattern of the covered region, as well as the degree of perforation and erosion of the exposed part, differ according to size. In Fig. 1B are shown some of the different types encountered. In smaller fish (up to 70-mm length), the striae-pattern is not fully developed and there are 1-3 uninterrupted vertical striae preceded by 1-3 interrupted ones, overlapping occasionally. The scales are not perforated. The exposed portion has ridges while the edges may or may not be regularly

TABLE 2. *The number of gill rakers on lower and upper arms of the first gill arch on the left side in* S. dayi *of different places for various size groups.*

Size group (mm)	Gill rakers on lower arm							Gill rakers on upper arm				
	Karwar		Tuticorin		Vizhinjam		Overall mean	Karwar		Tuticorin		Overall mean
	Range	Mean	Range	Mean	Range	Mean		Range	Mean	Range	Mean	
20	42-46	43.7	—	—	—	—	43.7	28-30	29.3	—	—	29.3
30	45-58	49.8	—	—	—	—	49.8	31-44	35.8	—	—	35.8
40	60	60.0	67	67.0	—	—	63.5	42	42.0	44	44.0	45.0
50	—	—	71-81	76.0	—	—	76.0	—	—	47-48	47.5	47.5
60	88-98	91.0	78-85	81.5	—	—	86.3	52	52.0	47-52	49.5	50.8
70	99-110	105.7	—	—	88-99	91.2	96.6	60-65	62.0	—	—	62.0
80	123	123.0	—	—	89-96	93.7	97.9	80	80.0	—	—	80.0
90	—	—	—	—	88-125	101.0	101.0	—	—	—	—	—
100	—	—	—	—	103-120	108.8	108.8	—	—	—	—	—
110	106-116	111.0	—	—	104-130	119.3	116.5	56-72	64.0	—	—	64.0
120	113-125	118.0	—	—	104	104	114.5	70-75	72.3	—	—	72.3

wavy. The perforations develop after 70 mm length, the number increasing with the length. The edges then are eroded to different degrees and are increasingly fimbriated. In the post-anal scales the posterior margin is produced. The typical pattern for the covered portion is one continuous stria preceded by 3-4 discontinuous ones in the 70-80 mm length group and 5-8 in larger fishes. In regions II and III (Chan 1965), the incidence of 2 uninterrupted striae is not uncommon as also the overlapping of one or more of the interrupted ones. Thus, the scale pattern is not such a stable feature as believed by Chan (1965). Fowler (1924, 1941) has also reported 2 parallel and widely spaced vertical striae on the scales of this species.

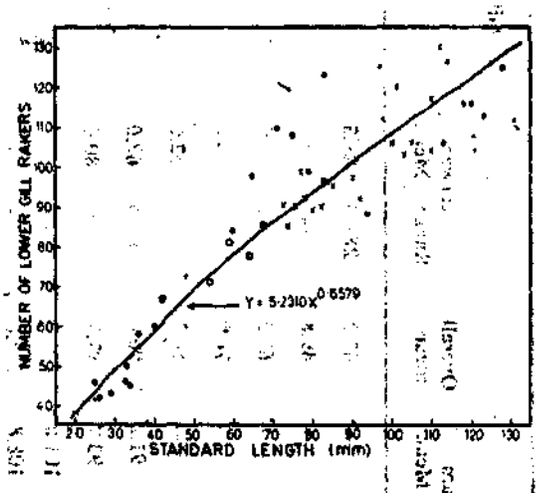

FIG. 3. The relation between body length and number of lower gill rakers in *S. dayi*. Dots represent data from Karwar, the circled dots those from Tuticorin and the crosses, those from Vizhinjam.

Colour: In fresh condition, the upper portion (slightly less than 1/3 of body depth at dorsal) is bluish grey with golden and green reflections while the sides are silvery white. The fish is very slimy. In formalin-preserved material, the back is dusky brown while the sides are yellow. Sometimes, especially in younger fish up to 80 mm lengths, there are 4-8 dark vertical streaks along the lower margin of the coloured upper portion (Fig. 2). The top of the head and tips of upper and lower jaws are stippled dark. The dorsal fin has dark tips with the bases of the unbranched rays black. The caudal edges and tips are dusky brown, other fins hyaline.

Local names: In Tamil, *Choodai* is a common name referring to *S. fimbriata*, *S. albella* and *S. dayi*. Similarly in Malayalam, the name *Chalamathi* is used in southern parts of Kerala while in the Malabar region the term *Parandha mathi* is applied. Fowler (1924) refers to the species as *Thollayanmathi* from the same

region. At Karwar (North Kanara), although all the available sardine species other than *S. longiceps* are commonly known as *paidi* (Konkani language), fishermen distinguish *S. albella* and *S. dayi* respectively as *Kolendasadi* and *Thalehesadi* (Kannada language).

Distinguishing character: Superficially it is rather difficult to distinguish between *S. albella* and *S. dayi*. The slightly longer head and deeper body in *S. dayi* may not be of much help in fishes from an area like Vizhinjam where these two characters may tend to approach those of *S. albella*. For the present, the only distinguishing feature is the distinct difference in the lower gill raker count. While in *S. albella* the number of gill raker is independent of the length of fish and has a shorter range of 53 to 68 in fish of 87-116 mm size range (= *S. bulan* of Antony Raja and Hiyama, 1969), in *S. dayi* the gill-raker count increases with the size of fish and would number about 90 to 130 in fish of similar size range.

Aberration: Two unusually slender-bodied specimens, measuring 123 and 125 mm, were caught at Karwar. They are shown in Fig. 1 together with a normal specimen. In percentages of standard length, depth at dorsal is 29.3 and 29.6 (slightly greater than head length), depth at anal, 17.9 and 18.4 and least depth of caudal peduncle, 9.7 and 9.6. In all other respects they agree well with the Karwar specimens of similar size, except that the perforation on the scales are less numerous.

Variation: Comparing the two sets of data on the Karwar specimens (Table 1), it appears that the following characters may exhibit allometry with standard length: maxilla length, eye diameter, snout length, postorbital length, interorbital width, width of body at gill opening, least depth of caudal peduncle, dorsal fin base and pelvic fin length. Between the small fish of Karwar and Tuticorin, majority of the characters (18 out of 29) show differences in the mean values. A comparison of the mean values between Karwar and Vizhinjam specimens of roughly similar size range shows that in the latter, the head length as well as all the parts of head are smaller (except maxilla, which is comparable), the prepectoral length shorter, the body less deep and the caudal shorter with fewer rays; also, there is one more pre-pelvic scute but one less dorsal and anal ray. Although the gill-raker count increases with size (Table 2), a comparatively greater number of rakers occurred in Karwar specimens in three out of four comparable size groups. However, how far the above mentioned differences are significant and truly reflect geographical variations can only be ascertained from a biometrical study.

Table 3 gives a comparison of past and present records of a few morphometric and meristic characters. Because of greater sample-size covering a wider size range, the range of values obtained during present study are wider and hence past records are well-contained (except for the lower limit for head length as recorded by Fowler 1941).

TABLE 3. *Comparison from the past and present records of a few morphometric and meristic characters in* Sardinella dayi. *Parts of head are expressed in relation to head length and other morphometric characters in relation to body length.*

Character	Regan, 1917	Fowler 1924 & 1941	Chan, 1965	Present study
Head	3.80	3.00-4.20	3.63-3.73	3.0-3.9
Maxillary	below anterior 1/3 of eye	2.13-2.33	2.26-2.44	2.1-2.9
Eye	3.67	3.75-4.00	3.50-3.51	3.3-4.1
Snout	3.67	3.75-4.00	3.71-3.80	3.3-4.3
Depth	2.75	2.67-3.00	2.78-2.85	2.5-3.3
Predorsal	nearly midway	—	2.11-2.28	2.1-2.6
Preanal	—	—	1.28-1.30	1.2-1.3
Prepectoral	—	—	3.76-3.88	3.4-4.5
Prepelvic	below middle of dorsal	—	1.85-1.86	1.8-2.0
Dorsal rays	18	16-17	18-19	17-20
Anal rays	19	20	19	15-23
Pectoral rays	—	—	15-16	13-17
Prepelvic scutes	19	16-17	17-18	15-18
Postpelvic scutes	13	12-14	13-14	11-14
Lateral scales	44	38-42	41-42	35-49
Longitudinal rows of scales	12	12-13	12	11-14
Gill rakers on the lower arm	130	90-96	88-103	42-130
Gill rakers on the upper arm	—	56-68	54-65	28-80

DISCUSSION

The record of such a short head length as 4.20 in length for *S. dayi* by Fowler (1941), well beyond the present and other past records, was at first a little intriguing but a study of the recent literature appears to lead to an interesting possibility. The figure drawn by Fowler (1941) is based on Mauritian material and it does show that the head is short, about 23% in standard length. The only allied Indian Ocean form having a comparable head length and a corresponding high gill-raker count is *Sardinella jussieui* (Valenciennes). Inasmuch as the body depth in Fowler's figure — about 31% — is also comparable to other Mauritian material of *S. jussieui* reported by Whitehead (1967), namely

29.8 to 33.5%, it raises the doubt that Fowler's material from the same place was truly *S. jussieui*. This is further supported by the evidence on the scales. Whitehead (1967) showed that the 'key' character distinguishing *S. jussieui* from *S. dayi* is the absence of perforations on the scales. Sending a sample of scales taken from between the base of the dorsal fin and the midline of one of Fowler's Mauritian specimens, Dr Cohen reported that the body scales appear fimbriate but not perforated (personal communication). Three of such scales are figured herein (Fig. 1C). Dr Cohen also reported that there are no dark vertical streaks on the sides of the body as mentioned by Fowler (1941). Although, it may not be a stable and characteristic feature, since the presence of such streaks is borne out from the present study, it is possible that Fowler (1941), while carrying over much of the description of *S. dayi* as recorded for the Indian specimens (Fowler 1924) to the Mauritian material also, has included this feature too.

For the present, *S. maderensis* is the recognised species of a rather variable *maderensis-eba-granigera-cameronensis* group (Ben-Tuvia 1960) and Whitehead (1967) considers *S. dayi* as a member of this group. Hence, for comparison, some of the characters of *S. maderensis*, *S. jussieui* and *S. dayi* are listed in Table 4. It is seen that there is considerable overlap in all the characters and that *S. jussieui* distinguishes itself from the other two species in the nonperforated-scale character. Since the recorded size of *S. maderensis* is much larger than that of *S. dayi* and in view of allometry between number of gill rakers and fish length, the higher extreme in the gill-raker count for *S. maderensis* is only to be expected. Whitehead (1967) mentioned that, with the exception of *S. maderensis*, all the species of *Sardinella* that can be grouped under the subgenus *Clupeonia*, are characterised by the absence of ventral ridge in pseudobranch. However, the present study shows that in the case of *S. dayi* also the pseudobranch has a ventral ridge. In Fowler's specimens from Mauritius, considered here as *S. jussieui*, the lower border of the pseudobranch is reported fleshy which could be described as ridge-like (Cohen, personal communication). Thus, the only diagnostic feature between *S. jussieui* and *S. dayi* or *S. maderensis* appears to be the presence or absence of perforations on the scales. Since it is seen that the perforations appear in the Indian forms of *S. dayi* after attainment of about 70-mm length, it is possible that in *S. jussieui* the perforations have failed to develop in the larger fish also. It would be of interest to know when the perforations develop in the case of *S. maderensis*.

Recently, Whitehead (1973) has placed with doubt *S. dayi* of Fowler (1941) under *S. jussieui* and *S. samarensis* of Roxas (1934) under *S. dayi*. While the present work confirms the former doubt, the description of Roxas (1934) on *S. samarensis* appears to satisfy that of *S. maderensis* more than that of *S. dayi* especially the body depth (3.5-3.7), the number of longitudinal rows of scales (9-11) and the number of postpectoral scutes (14-15). On the other hand, although Roxas (1934) has reported the scales as regular, entire and non-

TABLE 4. *Comparison between* S. maderensis, S. jussieui *and* S. dayi. (*Morphometric measurements are in percentages of standard length. Proportional measurements given by Ben-Tuvia* (1960) *and in some past records on* S. dayi *are converted into percentages*)

Character	*S. maderensis* (Ben-Tuvia, 1960) Size = 60 mm and above	*S. jussieui* (Whitehead, 1967) Size = Holotype, 140 mm. Two more fish of 121 & 122 mm are involved in the ranges given	*S. dayi* (Past and present records, omitting Fowler, 1941) Size = 60 mm and above
Head length	22.2—29.4	24.6—25.3	25.7—33.8
Body depth	24.4—34.5	29.8—33.5	30.3—39.4
Predorsal length	40.0—47.6	45.2	39.7—47.4
Prepelvic length	45.5—55.5	52.3	50.0—56.4
Preanal length	66.6—90.9	78.3	74.4—81.8
Dorsal-fin rays	17—21	19	16—20
Pectoral-fin rays	14—17	16	13—16
Anal-fin rays	17—22	21	15—23
Prepelvic scutes	18—20	17—18	15—19
Postpelvic scutes	13—15	13	12—14
Lower gill rakers	70—166	84—98	78—130
Scales	Fimbriated and perforated	Not fimbriated or perforated; fimbriated in Fowler's material	Fimbriated and perforated in fish above 70 mm
Pseudobranch	Ventral ridge present with a groove below (Whitehead, 1967)	No mention of ventral ridge by Whitehead; ventral ridge present with a depression below in Fowler's specimens (Cohen, p.c.)	Ventral ridge present with no distinct groove

fenestrate, which thus should appear similar to those of *S. jussieui*, his illustration shows that the scales have a few perforations with the hind margin of the scales irregularly wavy. This perhaps may indicate that in the scale type the species may be closer to *S. jussieui*. The systematics diversity of the tropical clupeoids, in general, and of *Sardinella*, in particular, is such that a true solution could emerge only from a comprehensive investigation of the *maderensis-jussieui-dayi-samarensis* complex.

Although there is a distinct areal difference between the reported distribution of *S. maderensis, S. dayi, S. jussieui* and *S. samarensis,* in view of the fact that species like *S. aurita* could have a discontinuous distribution without suffering nomenclatural splitting, it is recommended that future studies should attempt to assess how far the differences between the above four species justify distinction at species level. Until then, they may have to remain undisturbed with their present identity.

ACKNOWLEDGEMENT

One of us (BTAR) thanks Mr P. J. P. Whitehead, Zoology Department of the British Museum (Natural History), London, for his kind perusal of the manuscript, valuable corrections and comments. He is also grateful to Dr Daniel M. Cohen, Laboratory Director, Systematics Laboratory, U.S. National Museum, Washington, for the information on Fowler's specimens and for kindly sending a sample of scales from that material. We are much obliged to our colleagues, Mr D. B. James for the Tuticorin material, Mr K. Y. Telang for the estuarine fish, Mr G. M. Kulkarni for the slender-bodied specimens and Mr K. L. K. Kesavan for drawing the figures.

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