

AMERICAN MUSEUM *Novitates*

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, N.Y. 10024

Number 2727, pp. 1–14, figs. 1–10, tables 1, 2

May 12, 1982

Redescription of the Indo-Australian Filefish *Acreichthys radiatus* (Popta) (Monacanthidae, Tetraodontiformes)

JAMES C. TYLER¹ AND MARK D. LANGE²

ABSTRACT

Acreichthys radiatus (Popta, 1900) is redescribed in comparison to *A. tomentosus*, indicating that these two Indo-Australian species differ most obviously to the naked eye in color pattern, whereas microscopic examination shows that they also can be distinguished by the greater degree of scale spinule branching in *tomentosus*, in

the smaller size at sexual maturity in *radiatus*, in *radiatus* usually having one less anal fin ray, and in several proportional measurements. They also differ in that the smaller species, *radiatus*, is found around coral reefs, whereas the habitat of *tomentosus* is inshore on sand and grass beds.

INTRODUCTION

A small reef-dwelling species of Indo-Australian monacanthid has been difficult to identify, even though at younger stages it has a distinctive color pattern with prominent pale or chalky white vertical bars on the darker body and radiating pale lines centered on the eye.

Interest in the identity of this species that has long perplexed us was renewed recently by finding it among collections made by Vic-

tor G. Springer in the Philippines in 1978 and by the listing in Hutchins (1977) of a species under the almost forgotten name of *radiatus* Popta as a new record for Australia. By appellation alone, *Monacanthus radiatus* Popta (1900) seemed a candidate for the solution to the problem. Moreover, Hutchins (1977) placed *radiatus* in *Acreichthys* Fraser-Brunner (1941) whose few given diagnostic features applied to the unidentified specimens.

¹ Research Associate, Department of Ichthyology, American Museum of Natural History; Department of Vertebrate Zoology, Smithsonian Institution; National Science Foundation, Division of Environmental Biology.

² National Marine Fisheries Service, Southeast Fisheries Center, Miami Laboratory (present address: Rosenstiel School of Marine and Atmospheric Science, University of Miami).

Correspondence with J. Barry Hutchins indicated the likelihood of the Philippine specimens and of others previously examined by us that had been collected in Borneo by Daniel M. Cohen in 1965 and in the Moluccas by V. Springer in 1973 (all of the preceding specimens at the U.S. National Museum or the Academy of Natural Sciences of Philadelphia) being conspecific with the Australian specimens (at the Australian Museum) listed by Hutchins (1977). It also seemed probable that they were conspecific with the holotype and only previously known specimen of *radiatus* Popta (at the Rijksmuseum van Natuurlijke Historie).

Through the courtesy of M. Boeseman, the type specimen of *radiatus* has been received on loan and J. B. Hutchins has generously sent the five Queensland specimens he had on loan from the Australian Museum for comparison with the Philippine and Borneo materials. Upon hearing of this activity, Marie-Louise Bauchot (at the Museum National d'Histoire Naturelle) volunteered to send a specimen of apparently the same species that she had collected at New Caledonia in 1978. A search of the collections at the U.S. National Museum turned up three additional specimens of *radiatus* from the Philippines and Indonesia, which had been obtained in 1908 and 1909 by the exploratory research vessel *Albatross*, and had been misidentified as *Pervagor tomentosus* among a large series of *tomentosus* from various localities.

GENERIC STATUS OF *ACREICHTHYS*

Acreichthys originally was described as a subgenus of *Pervagor* by Fraser-Brunner (1941, pp. 183) with its type and only species being *tomentosus* Linnaeus. The subgenus *Pervagor* remained to contain all the other then recognizable species: *janthinosoma* Bleeker, *melanocephalus* Bleeker, *nigrolineatus* Herre, *nitens* Hollard, and *spilosoma* Lay and Bennett. *Acreichthys* was said to differ from *Pervagor* by having no groove to receive the dorsal spine when unerected (versus in *Pervagor* with a groove present), soft dorsal and anal fin origins opposite (ver-

sus anal behind soft dorsal), lateral line "obsolete" (versus discernible), scales broad (versus narrow) and dermal filaments developed (versus absent).

While all these characters at least tend to distinguish the two groups, they have usually been considered relatively trivial. Thus, *Acreichthys* has rarely if ever been recognized by subsequent workers as valid at any taxonomic level except in listings and not at all by those conversant with monacanthids. However, Hutchins (1977, pp. 12-13) recently redefined it in a key to the genera of filefishes from Australia (including nearly all the Indo-Australian genera, and several new genera and species). Hutchins recognized *Acreichthys* as a valid genus, distinguishing it more fully from *Pervagor* in having "all 4 internal teeth in upper jaw with anterior extremities notched; bristles on caudal peduncle of adult male usually in a well defined patch; 20 vertebrae" (versus in *Pervagor* "upper 2 internal teeth with anterior extremities pointed; adult male generally with all scales on side of caudal peduncle developing short bristles, decreasing in size anteriorly; 19 vertebrae").

Hutchins (1977) listed two species in *Acreichthys* (*tomentosus* and *radiatus*), the latter being a new record for Australia, but he did not describe or distinguish them. It is his plan (personal commun.) to do so later in a comprehensive general treatment of all the Indo-Pacific monacanthids, but in the interim he has generously offered to let us redescribe and diagnose the species *radiatus* in which we have had such long-term interest.

Most recently Matsuura (1979) has listed the species *hajam* Bleeker, often considered a synonym of *tomentosus* Bleeker, in the genus *Acreichthys*. Matsuura (personal commun.) tells us that *hajam* has the characteristics of *Acreichthys* as defined by Hutchins (1977) and that it is closely related to but distinct from *tomentosus*. He also tells us that it has branched spinules on the scales like *tomentosus* (in contradistinction to *radiatus*). Since *hajam* has a rather drab color pattern unlike either *radiatus* or *tomentosus*, it obviously is not as closely related to *radiatus* as to *tomentosus*. Because Mat-

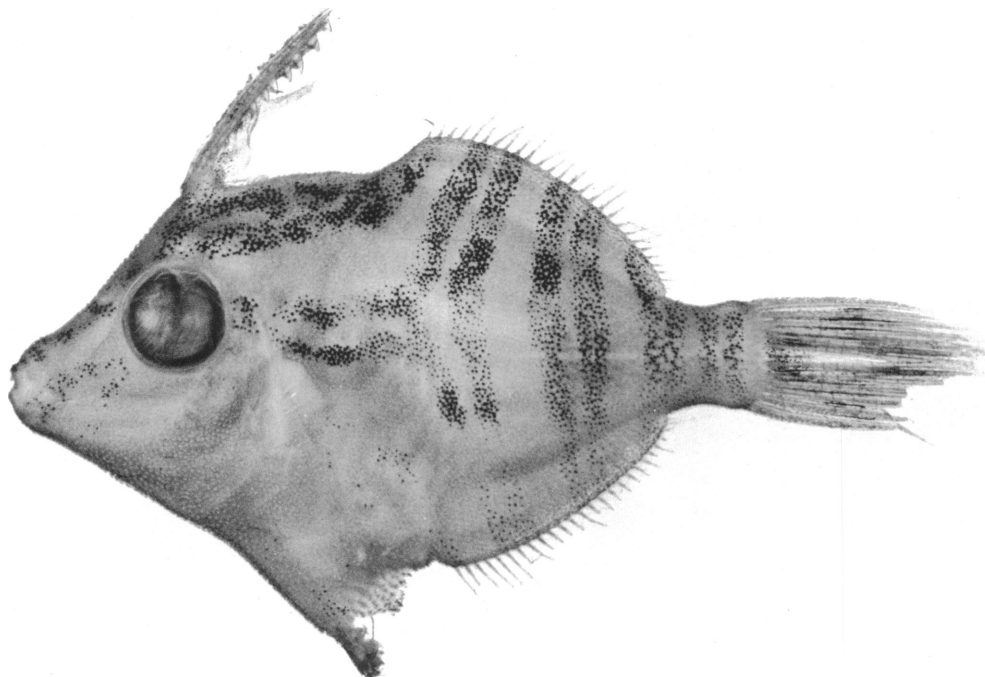


FIG. 1. *Acreichthys radiatus*, USNM 226709, 15.1 mm. s.l., Philippines (smallest specimen available, sex indeterminate).

suura is preparing a paper on the distribution and characteristics of *hajam*, we do not discuss it further here.

REDESCRIPTION OF *ACREICHTHYS RADIATUS* AND COMPARISONS WITH *ACREICHTHYS TOMENTOSUS*

Comparison of the 21 specimens of *radiatus* studied with large series of *tomentosus* (of which counts or measurements were taken on 36 specimens, with measurements concentrated on those in the ca. 15 to 50 mm. S.L. size range comparable to the specimens of *radiatus*) in the collections of the U.S. National Museum (nearly all from the Philippines but some also from Indonesia) shows *radiatus* to be most easily distinguished from *tomentosus* as follows:

(1) COLOR PATTERN: While a number of species of monacanthids have a color pattern of straight to wavy or irregular horizontal

lines or other markings, *radiatus* may be unique in the family, and clearly differs from *tomentosus*, in having about four or more pale to chalky white vertical bars on the upper half of the middle of the body, another more anterior pale bar at the front of the soft dorsal fin base which curves anteriorly to the rear of the top of the eye, and several other pale lines or bars radiating out from around the rest of the eye. The pale bands are far wider and more prominent in younger specimens than in older adults, but in the largest adults narrower versions of the main pale bands, including the four or more on the upper half of the body, are evident even in long-preserved specimens (see figs. 1-4).

By contrast, in *tomentosus* the most prominent color marking on the body is a pale or chalky white band from just behind the top of the pectoral fin base, with a ventrally curved middle region coursing posteriorly to about one-third the way back of the

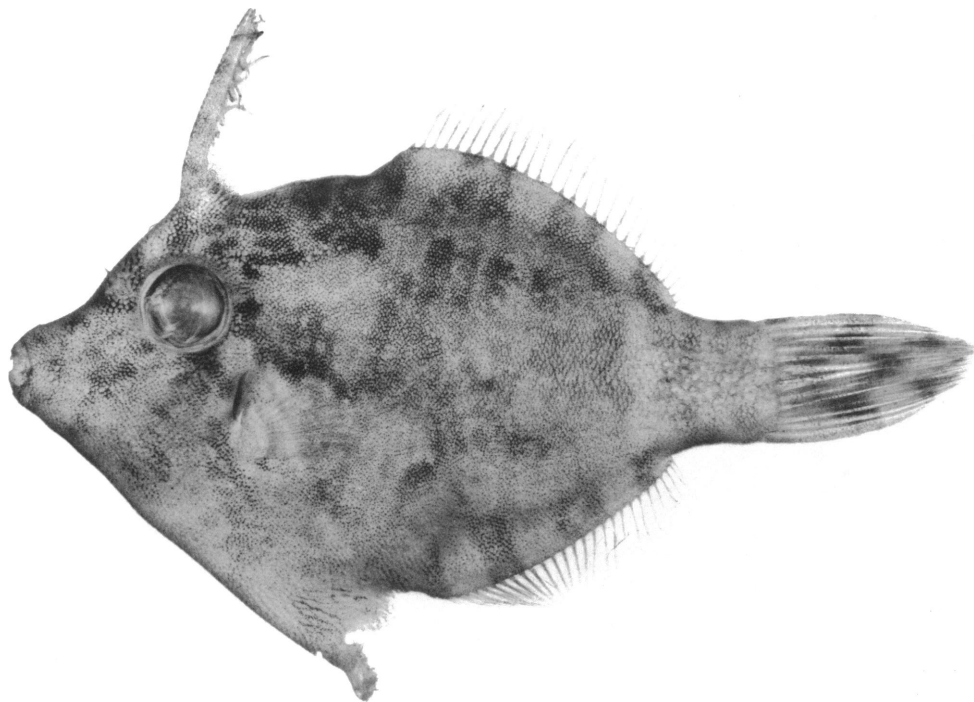


FIG. 2. *Acreichthys radiatus*, USNM 226709, 35.1 mm. s.l., Philippines (moderate size male).

level of the origin of the soft dorsal and anal fin bases, and sometimes with a much narrower pale line extending from the end of the main pale band to about one-third back along the base of the soft dorsal fin (see fig. 5). The main pale ventrally curved band, more or less horizontal on the body, is bordered both above and below by a narrower dark streak, much darker than the generally brownish (in preservative) ground color, with the upper dark bordering line tending to be slightly more complete and regular than the ventral bordering line. Another prominent color marking on most specimens of *tomentosus* is a chalky white narrow band running from the middle of the rear of the eye posteriorly and slightly dorsal to the level of about two-thirds back the distance between the spiny dorsal fin and the soft dorsal fin origin. This pale band is bordered dorsally by an irregular

dark streak. In some specimens of *tomentosus* narrow pale lines radiate out from the rest of the eye, but not as prominently as in *radiatus*. There are often irregular pale spots or lines on the lower third of the body and head of *tomentosus*, more so than in *radiatus*, and it is possible that the dermal filaments characteristic of *Acreichthys* are paler in *tomentosus* than in *radiatus*. The color pattern and its changes with increasing specimen size in *radiatus* (figs. 1–4) stand in contrast to the typical color pattern of *tomentosus* at all sizes (fig. 5), except for very young of the year early juveniles (ca. 15 mm. S.L.) of *tomentosus*, in which the pattern is not yet developed, even though the pattern is prominently developed at 15 mm. S.L. in *radiatus*.

(2) SCALE SPINULES: In all specimens of *radiatus* examined, ranging from 15.1 to 49.4

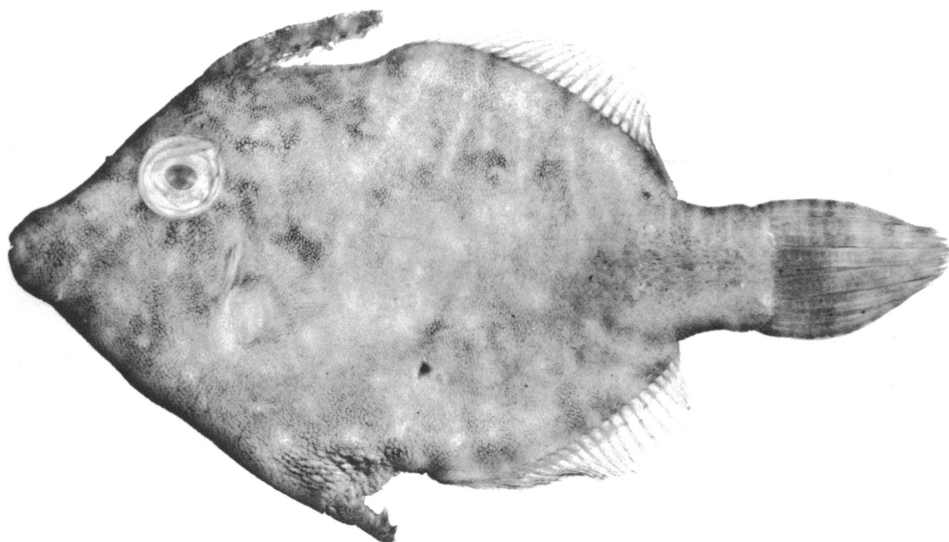


FIG. 3. *Acreichthys radiatus*, AMS IB 6156, 49.4 mm. s.l., Australia (largest specimen available, fully mature male).

mm. S.L., the great majority of the scales of the head and body have but a single upright and slightly posteriorly curved spinule on each scale plate, with the exception of the lateral line scales, which have two spinules bordering the lateral line canal pore in the center of the basal plate (see fig. 6). By contrast, in *tomentosus* at sizes between ca. 20 to 50 mm. S.L. most of the scale plates bear three upright spinules branching out from a central core, whereas in specimens larger than 50 mm. S.L. the number of spinules per scale plate continues to increase, so that an 80 mm. S.L. specimen may have seven to nine spinules branching off of a wider central core or crest, with some of the individual spinules occasionally themselves divided distally. Only in very small specimens of *tomentosus* (ca. 15 mm. S.L. and smaller) do most of the scale plates bear but a single upright spinule (see fig. 7 for spinule development at a variety of sizes in *tomentosus*).

(3) HABITAT: The collection data for nearly all the specimens of *radiatus* indicate that it lives around coral reefs, in depths ranging

from close to the surface down to about 60 feet. Most specimens have been collected by rotenoning or dynamiting coral reef habitats. In stark contrast, nearly all the specimens of *tomentosus* have been collected by seines in water shallower than 10 feet, where the bottom has been described variously as sand, seaweed, grassy sand, beach area, and muddy regions with sticks and leaves. Coral is mentioned in the collecting data for *tomentosus* only in association with other habitats such as sand or seaweed, often by relatively indiscriminate dynamite collecting. It seems obvious that *radiatus* is primarily a reef-dwelling species and *tomentosus* a more in-shore sand and sea grass bottom dweller.

(4) SIZE AND SEXUAL MATURITY: The largest specimen yet known of *radiatus* is ca. 50 mm. S.L., whereas *tomentosus* reaches sizes of over 80 mm. S.L. Males of both species develop patches of elongate bristles as they become sexually mature, with larger and more mature males having the bristles become increasingly longer and retrorse.

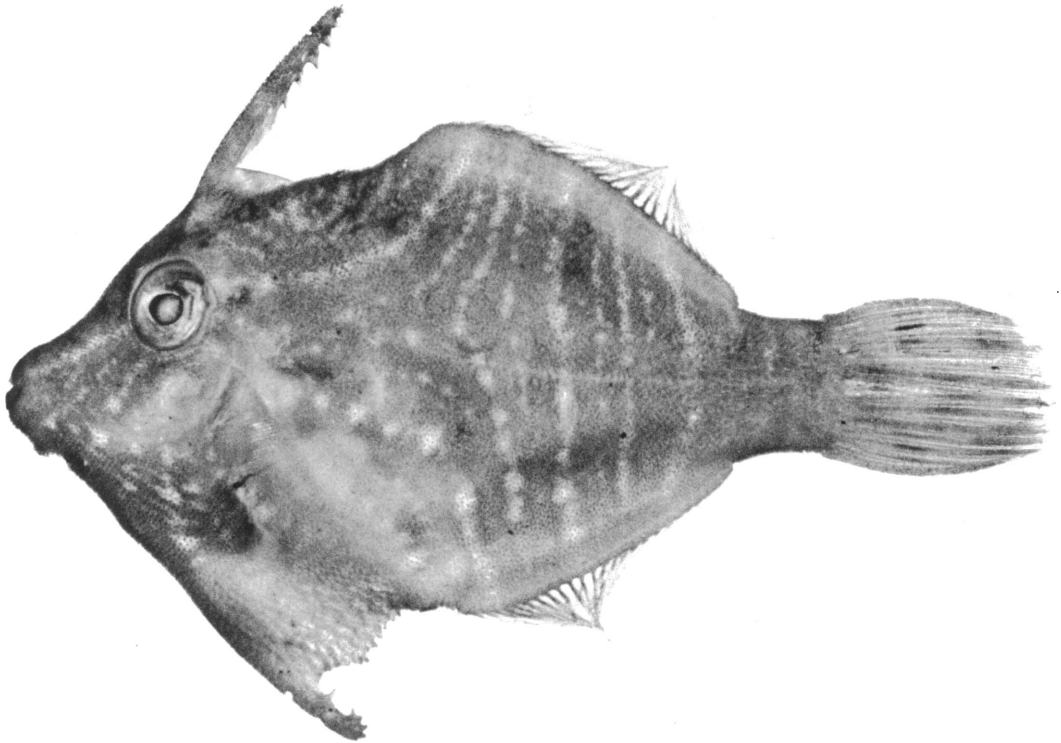


FIG. 4. *Acreichthys radiatus*, USNM 145396, 41.3 mm. S.L., Philippines (moderate size male, showing chalky white vertical bars on body and radiating lines from eye even after many years of preservation; collected in 1909).

Of the 21 specimens of *radiatus* examined, 11 have been determined to be male on the basis of a combination of having bristles of some degree of development on the caudal peduncle, gonadal shape, and gross internal tissue composition, and by elimination from other specimens having obviously developing ovaries with granular consistency or visible eggs. These 11 male *radiatus* range in size from 22.4 to 49.4 mm. S.L., and the females range from 20.7 to 33.6 mm. S.L. (the two smallest specimens, 15.1 and 17.3 mm. S.L., were immature and sex could not even be guessed at by gross examination of the small gonads). None of the females had caudal peduncle bristles of any degree of development. Among the males, bristle development was judged to be moderate, well or excellent on the basis of length of the bristles

and degree of retrorse curvature. Moderately developed straight bristles were found in specimens of 22.4, 24.7, 26.7, 27.7 and 37.3 mm. S.L.; well-developed bristles were found in specimens of 33.9, 35.1, 40.8, 41.3 and 43.9 mm. S.L., with those of the first two specimens beginning to become retrorse; excellently developed and distinctly but not greatly retrorse bristles were found in the largest specimen (49.4 mm. S.L.).

Of the 33 specimens of *tomentosus* examined to determine sex, the two smallest, 24.1 and 24.5 mm. S.L., were indeterminate. Other specimens measuring 32.6, 32.9, 35.3, 37.9 and 40.8 mm. S.L. were of doubtful sex but probably female on the basis of lack of caudal peduncle bristles and, in some cases, hints of a granular consistency to the gonad.

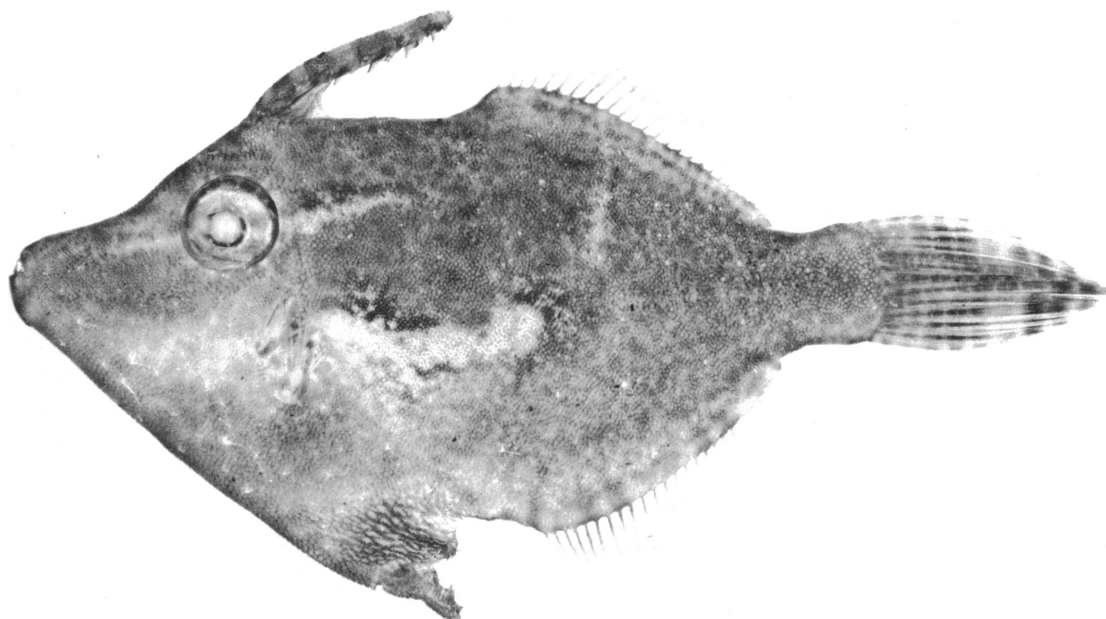


FIG. 5. *Acreichthys tomentosus*, USNM 168651, 47.2 mm. s.l., Philippines (developing female).

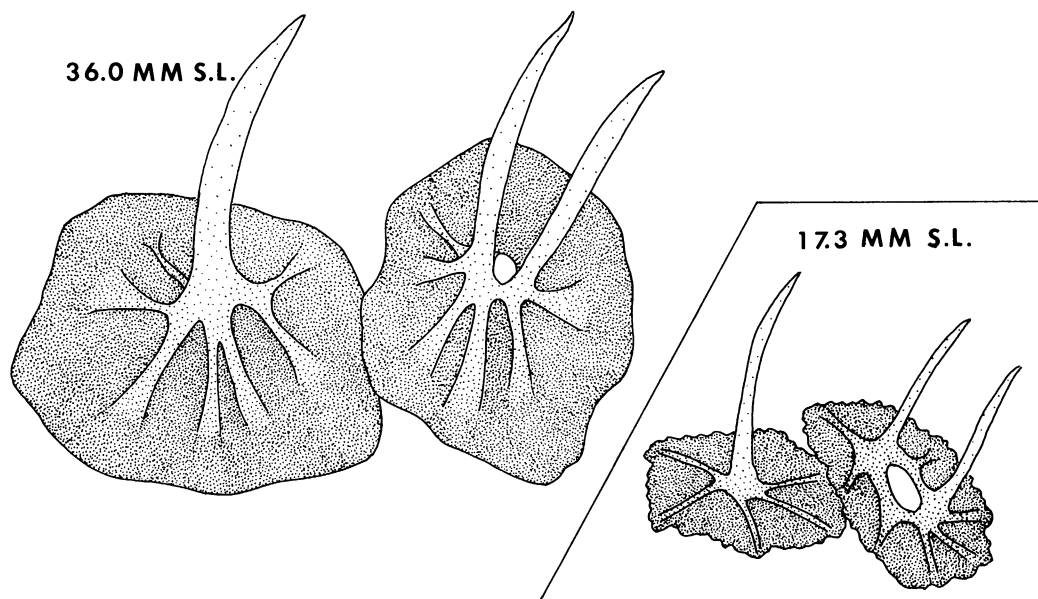


FIG. 6. *Acreichthys radiatus*, showing scale spinules at various sizes: left, USNM 226784, 36.0 mm. s.l., with a single unbranched spinule per scale plate, except for the scales of the lateral line, with two spinules surrounding the lateral line pore, this being the condition of the vast majority of scales of nearly all specimens at any size; right, inset showing similar condition in the 17.3 mm. s.l. second smallest available specimen (USNM 209968, Moluccas).

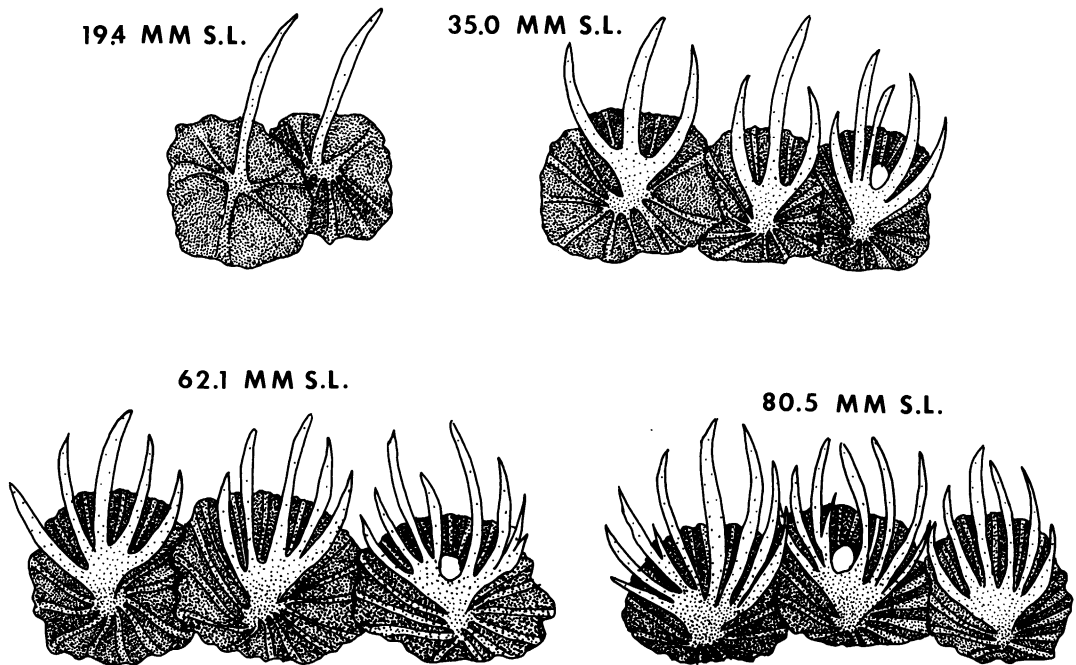


FIG. 7. *Acreichthys tomentosus*, showing scale spinules at various sizes and the increasing spinule branching with increasing size: 19.4 mm. s.l. (USNM 169039, Philippines), 35.0 mm. s.l. (USNM 169038, Philippines), 62.1 mm. s.l. (USNM 168679, Philippines), 80.5 mm. s.l. (USNM 145415, Moluccas).

There were 11 unquestionable females ranging in size from 37.5 to 80.1 mm. S.L., with specimens up to *ca.* 45 mm. S.L. considered as just beginning to develop eggs, specimens of *ca.* 45 to 65 mm. S.L. having moderately developed eggs (with the exception of a 47.2 mm. S.L. specimen that was still relatively less mature), and the largest specimen examined, 80.1 mm. S.L., being fully ripe. As in *radiatus*, none of these females had any degree of bristle development.

There were 15 definitely male specimens as judged on the basis of bristle development and/or gonadal condition, ranging from 31.9 to 70.3 mm. S.L. In addition to the three categories used above in defining bristle development in *radiatus*, a category of lesser degree of development is necessary in the *tomentosus* specimens, that of just beginning to develop bristles that are only slightly longer than those surrounding them on the caudal peduncle: these latter specimens were of

29.2, 31.9, 34.0, 37.0, 38.8, and 39.4 mm. S.L. At comparable sizes in *radiatus* the bristles are already moderately developed. In *tomentosus* the bristles are moderately developed and straight in specimens of 37.8, 40.8, 41.7, 46.4, 52.6, and 59.4 mm. S.L. At comparable sizes in *radiatus* the bristles are already well developed, and by *ca.* 40 mm. S.L. beginning to become retrorse. In *tomentosus* the bristles are well developed and beginning to become retrorse in specimens of 50.0 and 70.3 mm. S.L., while the largest known specimen of *radiatus*, 49.4 mm. S.L., already has the bristles excellently developed and distinctly retrorse.

The best developed and most retrorse bristles found in a specimen of *tomentosus* examined for this work were in a 55.4 mm. S.L. individual whose testes were exceptionally well developed and fully ripe, probably on the verge of spawning. Thus, there is some variability in the specimen size of maximum

TABLE 1
Meristics

<i>radiatus</i>	Averages for 20 (usually) specimens (15.1–49.4 mm. S.L.) ^a		
	Range	Average	N
Dorsal rays	26–29	27.9	20
Anal rays	25–27	25.9	20
Pectoral rays†	10–11	10.9	40
Caudal rays	12–12	12.0	20
Vertebrae	20 (7 + 13)	20.0	4

^a 15 specimens listed for measurements in table 2 plus two cleared and stained specimens: USNM 226784, 1, 36.0 mm. S.L.; USNM 209968, 1, 17.3 mm. S.L.; and three more recently discovered USNM specimens collected by the *Albatross* and used for counts but not for measurements. † Both sides counted; excluding uppermost rudimentary ray.

<i>tomentosus</i>	Averages for 30 (usually) specimens (24.5–80.5 mm. S.L.)		
	Range	Average	N
Dorsal rays	27–30	28.4	30
Anal rays	26–29	26.9	29 ^b
Pectoral rays	9–12	11.0	60
Caudal rays	12–12	12.0	30
Vertebrae	19–21 (10 at 7 + 13) (1 at 7 + 12) (1 at 7 + 14)	20.0	12

^b One specimen with abnormally developed posterior portion of anal fin with weak, slender more numerous rays, for a total count of 33 ignored here.

bristle development and it may be somewhat dependent on attainment of maximum gonadal development.

It is clear that *radiatus* reaches sexual maturity and increased bristle development in males at a smaller size than in *tomentosus*, and it appears likely that the reef-dwelling *radiatus* is a smaller species than is the more inshore sand and grass bed dwelling *tomentosus*.

(5) MERISTICS: As seen in table 1, the meristics of the two species differ mainly in that *radiatus* usually has one less anal fin ray (25.9 average for 20 specimens) than does *tomentosus* (26.9 average for 29 specimens).

TABLE 2
Measurements

<i>radiatus</i>	Averages for 15 (usually) specimens (15.1–49.4 mm. S.L. ^a ; average size 28.6 mm. S.L.)		
	Range in percentage S.L.	Average	N
Head	30.7–35.1	33.0	15
Snout	15.9–20.5	18.8	15
Eye	10.7–13.4	12.1	15
Snout to spiny dorsal	29.5–34.5	31.6	15
Snout to pelvic terminus	61.9–67.9	64.7	15
First dorsal spine	23.7–32.5	28.7	15
Gill slit	5.1–7.0	5.8	15
Pectoral fin	11.1–14.7	13.1	15
Interdorsal space	24.3–32.4	28.9	15
Body depth	53.1–61.6	57.5	15
Soft dorsal base	37.5–42.0	39.7	15
Soft dorsal height	8.7–12.4	10.9	13
Anal base	33.0–37.7	35.4	15
Anal height	8.5–12.0	10.4	12
Caudal peduncle length	9.9–14.6	12.6	15
Caudal peduncle depth	12.6–16.1	14.6	15
Caudal fin length	25.3–34.4	31.5	15
Body width	14.0–16.8	15.9	15
Interorbital width	9.7–12.4	11.0	15
Pelvic structure length	7.3–10.5	9.0	15

^a RMNH 6826, 1, 20.7 mm. S.L. (holotype); USNM acc. no. 333189, SP78-10, 2, 25.7–30.9 mm. S.L.; USNM acc. no. 333189, SP78-27, 1, 20.9 mm. S.L.; USNM 226709, 3, 15.1–35.1 mm. S.L.; ANSP 124326, 1, 24.7 mm. S.L.; ANSP 123649, 1, 22.4 mm. S.L.; AMS I 19448-014, 1, 37.3 mm. S.L.; AMS IB 6156, 1, 49.4 mm. S.L.; AMS IB 6157, 4, 24.2–33.6 mm. S.L.

There is a marginal trend for *radiatus* to have a slightly lesser (by 0.5) average number of dorsal fin rays than does *tomentosus*, but this will be substantiated only when far larger numbers of specimens of *radiatus* are available for study.

(6) MEASUREMENTS: Table 2 provides measurements in percentage of S.L. for 15 (usually) specimens of *radiatus* in terms of range and average values for specimens of 15.1 to 49.4 mm. S.L., with an average length of 28.6 mm. S.L. In *tomentosus* the shape and proportions do not seem to differ significantly from those of *radiatus* in side

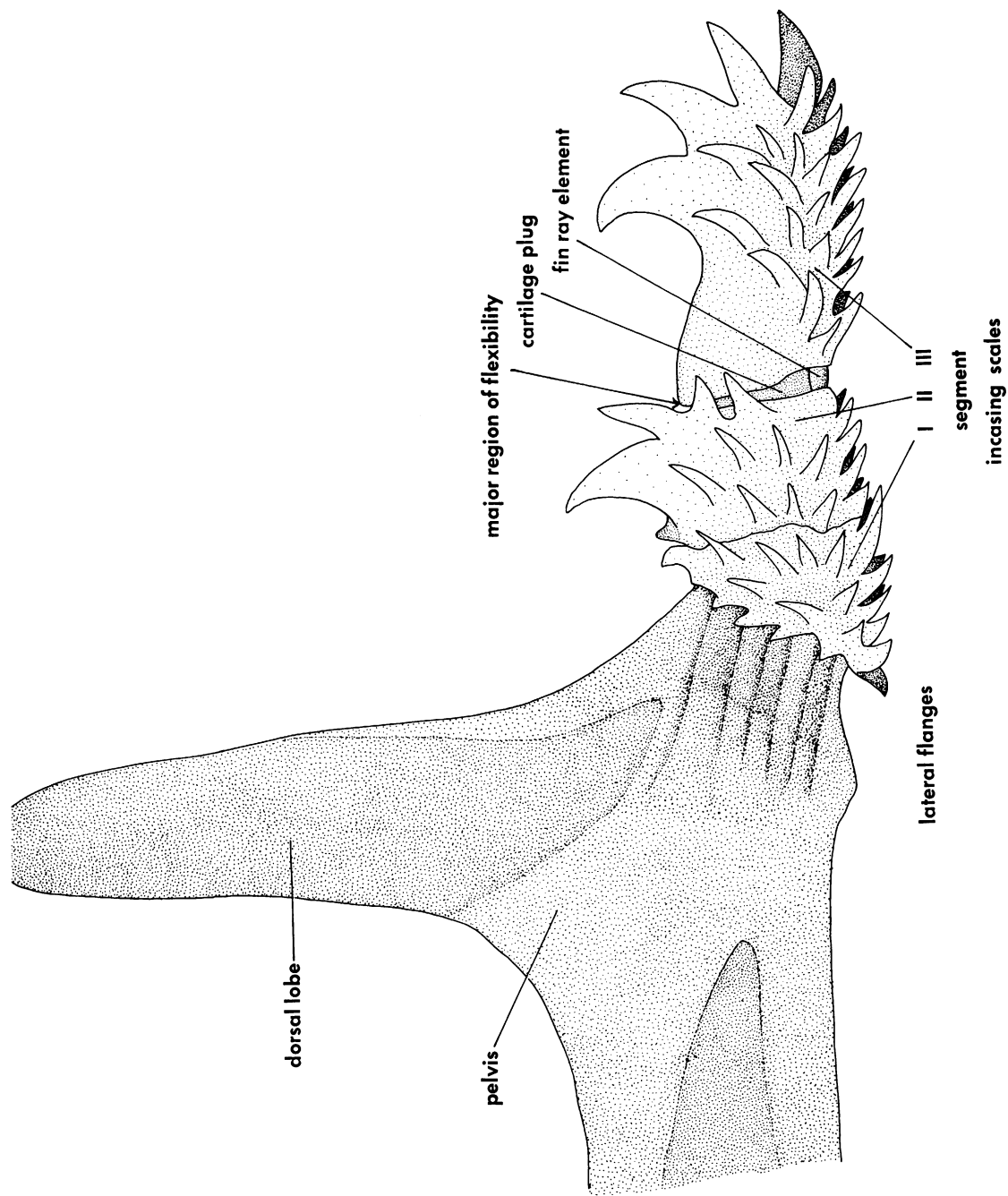


FIG. 8. *Acreichthys radiatus*, USNM 226784, 36.0 mm. s.l., Philippines, lateral view of end of pelvis and of incising scales surrounding the rudimentary fin ray element.

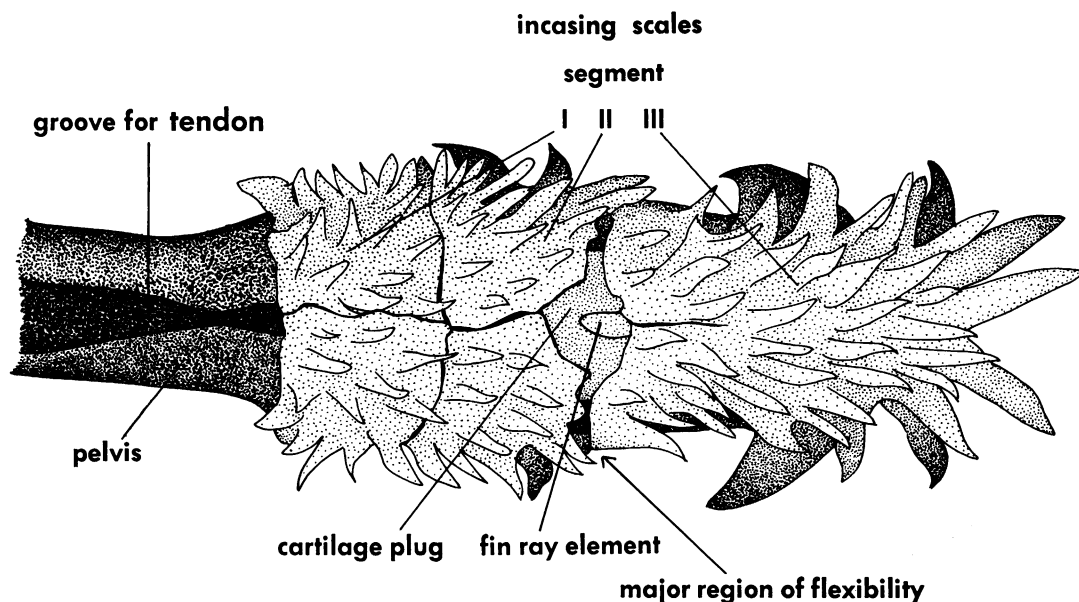


FIG. 9. *Acreichthys radiatus*, same specimen as in figure 8, ventral view of end of pelvis and of incasing scales surrounding the rudimentary fin ray element.

by side visual inspection of specimens of comparable size. As a check on this, measurements of a few standard features were taken on 19 specimens of *tomentosus* within the size range of the specimens examined of *radiatus*, although the average size of the measured specimens of *tomentosus* (24.1 to 50.0 mm. S.L., average 37.6 mm. S.L.) is 9 mm. longer than those of *radiatus*. In *tomentosus* the length of the head ranges from 31.4 to 36.4 percent S.L., averaging 34.5 percent S.L. (versus 33.1 % S.L. average in *radiatus*). In *tomentosus* the length of the snout ranges from 18.7 to 22.3 percent S.L., averaging 21.0 percent S.L. (versus 18.8% S.L. average in *radiatus*). In *tomentosus* the diameter of the eye ranges from 9.7 to 12.2 percent S.L., averaging 11.1 percent S.L. (versus 12.0% S.L. average in *radiatus*). In *tomentosus* the depth of the body between the origins of the soft dorsal and anal fins ranges from 45.3 to 53.4 percent S.L., averaging 49.8 percent S.L. (versus 57.5% S.L. average in *radiatus*). In *tomentosus* the length of the pelvic apparatus as measured

from the anterior edge of the first segment of incasing scales to the end of the last segment ranges from 9.4 to 11.4 percent S.L., averaging 10.3 percent S.L. (versus 9.0% S.L. average in *radiatus*).

Some of these differences in the average values for these five features seem insignificant and accountable to individual variation in a limited sample size and especially to the 9 mm. larger average specimen size of *tomentosus* versus *radiatus*.

A *t* test, however, indicates that the differences in head length and snout length are not significant at the .05 percentage level. By contrast, differences in eye diameter, body depth and pelvic apparatus length are significant at the .001 percent level.

OSTEOLOGICAL NOTES

In the classification of any monacanthid fish, it is critically important to know the detailed structure of the highly modified pelvic fin apparatus, including the specialized incasing scales which mostly obscure its inti-

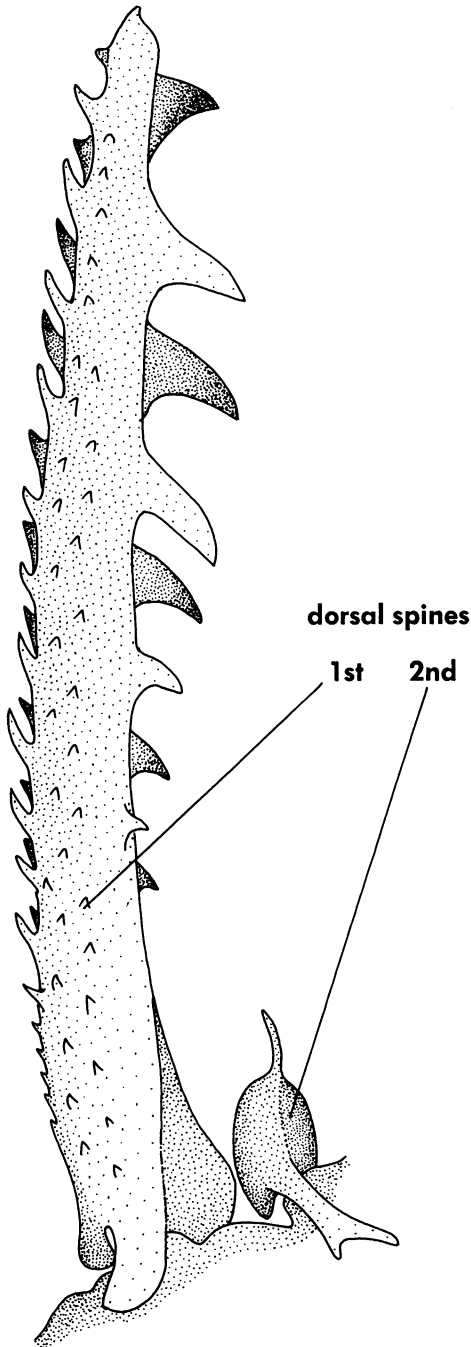


FIG. 10. *Acreichthys radiatus*, USNM 209968, 17.3 mm. s.l., Moluccas, lateral view of dorsal fin spines: number of barbs, especially posterolaterally, increases with increasing specimen size.

mate details: Tyler (1962, 1980); Hutchins (1977); and Matsuura (1979). Therefore, a lateral view of the posterior end of the pelvis (fig. 8) and a ventral view of this region and its incasing scales (fig. 9) are given here, along with an illustration (fig. 10) of the spiny dorsal fin, whose barbs of the first spine and degree of development of the second spine are also often of generic significance.

CONCLUSIONS

Acreichthys radiatus (Popta, 1900) is a valid species differing from its closest relative, *A. tomentosus* (Linnaeus, 1758) in color pattern, scale spinules, size, several morphometric features and in habitat.

MATERIAL EXAMINED

ABBREVIATIONS: United States National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM); Academy of Natural Sciences of Philadelphia (ANSP); Rijksmuseum van Natuurlijke Historie, Leiden (RMNH); Australian Museum, Sydney (AMS); Museum National d'Histoire Naturelle, Paris (MNHN).

Acreichthys radiatus

PHILIPPINES. USNM acc. no. 333189 SP78-10, 2, 25.7–30.9 mm. S.L., Oriental Negros, just off Bonbonon Point at southern tip of island, coral reefs 200 m. offshore, rotenone at 19 m., 13 May 1978, V. G. Springer et al. USNM acc. no. 333189 SP78-27, 1, 20.9 mm. S.L., Palawan Province, Cuyo Island off west side of Cocoro Island, coral reefs 300 m. offshore, rotenone at 17–22 m., 26 May 1978, V. G. Springer et al. USNM 226784, 1, 36.0 mm. S.L., Oriental Negros, off southeast end of island, west side of Apo Island about .3 km. north of south end of latter, 60 m. off rocky shore, rotenone at 0–6 m., 6 June 1978, V. G. Springer et al. (cleared and stained). USNM 226709, 3, 15.1–35.1 mm. S.L., Balicasag Island, coral reefs at west side of drop-off, 45 m. offshore, rotenone at 12–19 m., 10 June 1978, V. G. Springer et al. USNM 14513, 1, 43.9 mm. S.L., Dalaganem Island east of Palawan, Wreck Bay, rock, sand and coral, dynamite at 12–18 feet, 8 April 1909, *Albatross* Linen Tag (L.T.) 10845. USNM 145396, 1, 41.3 mm. S.L., Jolo Island,

Tutu Bay, coral and sand, dynamite at 10–20 feet, 19 September 1909, *Albatross* L.T. 22162. USNM 145411, 1, 40.8 mm. S.L., Luzon, Balicuatro Island, Biri Channel, marginal reef, dynamite at 12–24 feet, 1 June 1909, *Albatross* L.T. 16365.

INDONESIA. USNM 209968, 1, 17.3 mm. S.L., Moluccas, Saparua, two coral reef collections mixed, one from an isolated coral head at 9 m. and the other from a patch reef at 4 m., rotenone at 4–9 m., 18 January 1973, V. G. Springer and M. Gomon (cleared and stained). ANSP 124326, 1, 24.7 mm. S.L., Borneo, off eastern end of island, Darvel Bay, Pulau Gaya, inside lagoon, band of coral 15–20 m. wide and 0–3 m. deep, rotenone at 0–3 m., 1 February 1965, D. M. Cohen and W. Davis (Te Vega Exped. Cr. 6, stn. 213). ANSP 123649, 1, 22.4 mm. S.L., Borneo, off eastern end of island, Darvel Bay, Pulau Bohidulong, next to Pulau Gaya, coral reef in 0–3 m., rotenone at 0–3 m., 2 February 1965, D. M. Cohen (Te Vega Exped. Cr. 6, no stn. no.). RMNH 6826, 1, 20.7 mm. S.L. (holotype), East Indies, P. Bleeker.

QUEENSLAND. AMS IB 6156, 1, 49.4 mm. S.L., Gillett Cay, Swain Reefs, October 1962, Australian Mus. Swain Reefs Exped. AMS IB 6157, 4, 24.2–33.6 mm. S.L., same date as preceding. AMS I 19448-014, 1, 37.3 mm. S.L., Lizard Island, Casuarina Beach, reef in front of research station, spear and handnet, 0–4 m., November 1975, R. Kuiter and R. Kuronuma.

NEW CALEDONIA. MNHN 1980-786, 1, 28.5 mm. S.L., east coast of New Caledonia near Kinde Reef, rotenone at 12 m.

Acreichthys tomentosus

PHILIPPINES. USNM 168651, 15 (out of 29), 24.1–63.0 mm. S.L., Luzon, Port San Vicente, mud, sand, sticks and leaves, seine at 5 feet, 18 November 1908, *Albatross*. USNM 168679, 13, 24.5–70.3 mm. S.L., Luzon, Varadero Bay beach, grassy sand, seine at 8 feet, 23 July 1908, *Albatross*. USNM 145404, 1, 40.8 mm. S.L., Luzon, Jamelo Cove beach, sand, seine at 10 feet, 13 July 1908, *Albatross*. USNM 145405, 1, 37.5 mm. S.L., Leyte, Dumurug Point, Cataingan Bay beach, seine (no other habitat data other than "beach"), no depth recorded, 18 April 1908, *Albatross* L.T. 19850. USNM 145409, 1, 37.9 mm. S.L., Mindanao, Inamucan Bay, sand, seine at 3 feet, 9 August 1909, *Albatross* L.T. 19578. USNM 169038, 1, 35.0 mm. S.L., Linapacan Strait, Linapacan Island, Malcochin Harbor, sand, seaweed and coral, seine at 3 feet, 18 De-

cember 1908, *Albatross* L.T. 20153. USNM 169039, 43, ca. 13.5–20.5 mm. S.L., Jolo Island, Teomabal Island, no habitat data, no collecting data, but perhaps dip nets at surface in early evening over ca. 60 feet bottom depth, *Albatross* D.5561 (examined mainly for scale structure).

INDONESIA. USNM 145414, 2, 52.6–80.1 mm. S.L., Borneo, Danawan and Si Amil Islands, sand and coral, dynamite, 3–20 feet, *Albatross* L.T. 21103–04. USNM 145415, 2, 69.5–80.5 mm. S.L., Moluccas, Amboina market, 7 December 1909, no other data, *Albatross* L.T. 22380–81.

ACKNOWLEDGMENTS

We appreciate the opportunity to thank Dr. James E. Bohlke of the Academy of Natural Sciences of Philadelphia for his long cooperation with this study begun in his Department of Ichthyology; and also to thank Dr. William Smith-Vaniz for the loan of specimens subsequently. Drs. Daniel M. Cohen and Bruce B. Collette provided research space at the National Systematics Laboratory of the National Marine Fisheries Service, where the crisp radiographs graciously were taken by Ms. Ruth E. Gibbons. Dr. Victor G. Springer and his colleagues at the U.S. National Museum also provided research space as well as the use of specimens. Ms. Susan J. Jewett of the U.S. National Museum produced the exceptionally clear and detailed photographs of monacanthids given here, including those of specimens as small as 15.1 mm. S.L., a rare accomplishment. Both she and Ms. Janet R. Gomon helped with specimen collection and catalogue data.

Mr. J. Barry Hutchins of the Western Australian Museum most generously sent us all the specimens of *Acreichthys radiatus* that he had on loan from Dr. John R. Paxton of the Australian Museum, and endorsed this effort to clarify the status of *A. tomentosus* and *radiatus*, prior to what will be his more definitive treatment of this genus and its species in relation to those of other genera of monacanthids of the Indo-Pacific. Additional materials for this study graciously were lent by Dr. Marie-Louise Bauchot of the Museum National d'Histoire Naturelle,

who collected the rare *A. radiatus* at New Caledonia, and the staffs of the U.S. National Museum and the Academy of Natural Sciences of Philadelphia for those specimens collected by Dr. D. Cohen in Indonesia and Dr. V. Springer (et al.) in both the Philippines and Indonesia.

Dr. C. Lavett Smith of the American Museum of Natural History volunteered his time in working out the “*t*” tests for significance of proportional differences between the two species (several of which surprised us), while Dr. John L. Brooks of the National Science Foundation permitted the senior author to take time off from administrative duties to help complete the manuscript at the U.S. National Museum.

LITERATURE CITED

- Fraser-Brunner, A.
 1941. Notes on the plectognath fishes.—VI. A synopsis of the genera of the family Aluteridae, with descriptions of seven new species. *Ann. Mag. Nat. Hist.*, ser. 11, vol. 8, pp. 176–199.
- Hutchins, J. B.
 1977. Descriptions of three new genera and eight new species of monacanthid fishes from Australia. *Rec. Western Australian Mus.*, vol. 5, no. 1, pp. 3–58.
- Linnaeus, C.
 1758. *Systema naturae*. Ed. 10, tomus 1, 823 pp. Holmiae.
- Matsuura, K.
 1979. Phylogeny of the Superfamily Balistoidea (Pisces: Tetraodontiformes). *Mem. Faculty Fish. Hokkaido Univ.*, vol. 26, nos. 1/2, pp. 49–169.
- Popta, C. M. L.
 1900. On a small *Monacanthus*. *Notes Leyden Mus.*, vol. 22, pp. 126–128.
- Tyler, J. C.
 1962. The pelvis and pelvic fin of plectognath fishes; a study in reduction. *Proc. Acad. Nat. Sci. Philadelphia*, vol. 114, pp. 207–250.
 1980. Osteology, phylogeny, and higher classification of the fishes of the Order Plectognathi (Tetraodontiformes). U.S. Dept. Commerce, Natl. Ocean. Atmos. Admin., Natl. Marine Fish. Serv., NOAA Tech. Rep., NMFS Circ. 424, 422 pp.