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**TAXONOMY AND BIOLOGY OF SOME PAPUAN CULICIDAE****I. GENUS TOPOMYIA**

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**ABSTRACT**

Both sexes, larva and pupa of *Topomyia papuensis* n. sp., are described. This is the first record of the Genus *Topomyia* from the Australian region.

**INTRODUCTION**

This is intended to be the first of a series of papers on mosquitoes of the Papuan Zoogeographical Subregion. Each of the series will, as far as possible, deal with genera, subgenera or species groups, though it may prove desirable in some cases to treat single species in order to clear up nomenclatural problems.

These studies are based primarily on material collected by the author in 1958 while in receipt of a travel grant from Bishop Museum as part of the project "South Pacific insects of public health importance", supported by the National Institutes of Health, Bethesda, Md., U. S. A. (Grant E-1723). In addition, generous help with material and information has been received from other institutions and individuals and this will be acknowledged in the appropriate places.

I am indebted to the Director, Department of Public Health, Port Moresby, Dr. H. N. White, Dr. J. J. H. Szent-Ivany, and Dr. and Mrs. A. Nemes for arranging my visit to Saiho, and to native medical orderly Serere who was my guide and assistant in field work there.

In the descriptions the nomenclature of larval setae follows Belkin (1950) and of pupal setae, Belkin (1952, 1953).

**Genus *Topomyia* Leicester, 1908**

*Distinctive Characters*: Small mosquitoes; both sexes with antennae not strongly plumose; palps very short; proboscis normal; *ppn* and spiracular bristles present; postnotum bare; squama bare; distinct microtrichia on wing membrane; cell R<sub>2</sub> longer than its stem.

***Topomyia papuensis* Marks, n. sp.**

*Distinctive Characters. Adults*: Palps dark scaled; proboscis with pale scales basally; median line of silvery scales on scutum ending opposite wing root; *ppn* pale scaled; tibiae

and tarsi dark scaled; cell  $R_2$   $4\times$  length of its stem; tergites I-VII with lateral pale patches not extending dorsally.

Male terminalia: Subapical lobe of coxite with row of modified bristles; style simple; claspette absent; lobes of tergite IX not produced.

Larva: Length  $4-4\frac{1}{2}$  mm; antennal seta 1 with 2-3 branches; head seta 6 (B) with 2-5 equal branches; siphon with pecten and setae on distal  $\frac{3}{5}-\frac{2}{3}$  only; pecten a single ventral row of 6 teeth;  $3-3\frac{1}{2}$  pairs ventral and  $1\frac{1}{2}-2\frac{1}{2}$  pairs dorsal branched siphonal setae.

*Holotype* Male. Wing length 2.3 mm. Head: Integument dark; clothed with flat black scales with a broad diamond-shaped patch of flat silver scales at vertex, extending about  $\frac{1}{2}$  way to nape, and a large patch of similar scales on eye margin laterally; no pale border to eyes between patches; 2 very strong black vertical bristles and 5 ocular. Antenna about as long as proboscis; torus greyish with some fine hairs mesially; flagellar segments (Fig. 1, *a*) black, each with 6-7 long black verticillate hairs; 1st flagellar segment bears some flat black scales and tuft of 5 broadened, scale-like bristles mesially near base; corresponding 2 bristles on segment 2 slightly broadened. Clypeus dark. Palps very short, about  $\frac{1}{15}$  length of proboscis (excluding labella), and little longer than clypeus, black scaled with 1 long apical bristle. Proboscis little shorter than fore femur, slightly swollen towards apex, black scaled, with pale scaling on basal  $\frac{1}{3}$  dorsally, and discontinuous, pale-reflecting scales on basal  $\frac{2}{3}$  ventrally; 1 long bristle ventrally at base.

Thorax: Integument dark. Scutum clothed with rather large narrow curved black scales and with a median silver stripe, formed of a double row of very large flat metallic scales, extending to level of wing base. Scutum partly denuded, but with strong bristle on fossa above scutal angle, another anteriorly, bases of 1 dorsocentral and 2 prescutellar bristles on each side, and numerous black supraalar bristles. Scutellum flat scaled, midlobe with large silver scales basally, black scales apically; lateral lobes black scaled; 4 long black bristles on midlobe, 3 on lateral lobes. Postnotum brown. *Apn* lobes almost meet in midline anteriorly, clothed with flat silver scales, and with numerous stout bristles; *ppn* with flat silver scales on upper half; propleuron with patch of silver scales; flat silvery white scales on post- and sub-spiracular and prealar areas, almost entirely clothing *stp* except on lower anterior margin, and on anterior half of *msp*; paratergite bare; 1 stout black *ppn* bristle, 1 propleural, 1 black spiracular, no postspiracular; 1 bristle low down on *stp*; 5 small pale upper and no lower *msp* bristles.

Legs: Coxae clothed with flat pale scales and with some bristles, including a strong black bristle on midcoxa; trochanters pale scaled; femora dark scaled with pale reflecting scales posteroventrally, tibiae and tarsi dark scaled, claws of all legs (unmounted) equal, apparently simple; fore pair largest, hind smallest. (In a mount of claws of a paratype (Fig. 1, *b-d*) the fore claws bear 4 and the mid and hind each 1 fine bristle-like tooth).

Wings: Black scaled. Plume scales slender with square tips; alula with 2 fine fringe scales; cell  $R_2$   $3.4-4.4\times$  length of its stem; cell  $M_1$   $0.8\times$  length of its stem, its base well distal to that of cell  $R_2$ ; r-m its own length distal to base of  $M_{3+4}$ ; An ends just beyond m-cu,  $Cu_1$  fork. Halteres large, about  $\frac{1}{6}$  length of wing; knob elongate and almost half total length, dark scaled, scales extending almost to base of stem (which is pale).

Abdomen: Tergites I-VII dark scaled dorsally, and with pale scales on lateral margin, fairly straight on I-III, on IV-VII broad at base, narrow at apex; most sternites obscur-

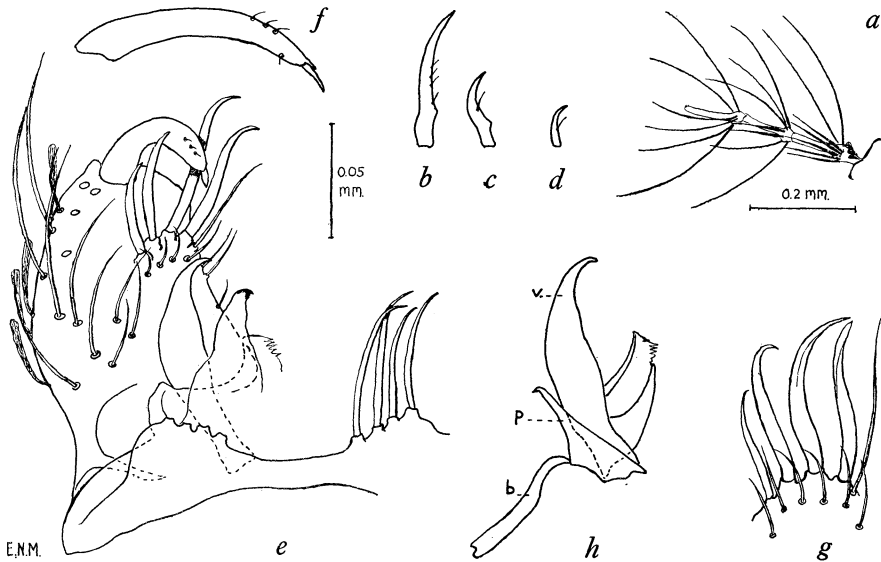


Fig. 1. *Topomyia papuensis* n. sp. ♂ a, base of flagellum of right antenna, mesial view; b-d, tarsal claws; b, fore; c, mid; d, hind; e-h, terminalia; e, left half, tergal view; f, style, lateral view; g, subapical lobe of left coxite, mesial view; h, aedeagus, right half, sternal view; b, basal apodeme; p, paramere; v, ventral arm of phallosome; a, e, h from holotype, b, c, d, f, g from paratype, b-h to the same magnification.

ed or denuded; tergite and sternite VIII dark scaled.

Male terminalia (Fig. 1 e-h, described from holotype and one paratype): Coxite about  $1\frac{1}{2} \times$  as long as broad with moderately long setae, and with dark scales laterally and sternally. Subapical lobe bearing a row of 4 long stout flattened curved setae, and 1 long slender seta, with a row of short setae proximal to them. No basal lobe nor claspette. Style  $\frac{2}{3}$  length of coxite, stout, slightly tapering, with 3-4 fine setae near apex; appendage terminal, about  $\frac{1}{6}$  length of style, stout and bluntly pointed. Paraprocts with 2-3 small teeth apically. Phallosome complex, with a large ventral arm (V) with curved pointed tip, which extends almost to subapical lobe of coxite. Dorsal to ventral arm a shorter pointed median element and dorsal to median element a plate sclerotized on its outer margin and with fimbriated membranous inner margin. Lobes of tergite IX distinct and well separated, bearing a row of 3-4 stout setae. Sternite IX roughly semicircular, without setae.

2 paratype males show following differences: Wing length 2.4 mm. Proboscis pale scaled on basal  $\frac{1}{4}$ - $\frac{1}{3}$  above, basal  $\frac{1}{2}$ - $\frac{2}{3}$  beneath; 2 long hairs ventrally near its base. 4 very strong black dorsocentral bristles and 3 prescutellar on each side; 1-2 spiracular and 3-4 upper *msp* bristles. 3-4 fine scales on alula; cell  $R_2$   $4.6$ - $4.9 \times$  length of its stem; cell  $M_1$   $0.9$ - $1.1 \times$  length of its stem. Lateral pale markings on tergites IV-VII irregular but narrowest apically; sternites pale scaled.

*Allotype Female*: Differs from males as follows: Wing length 2.6 mm; median silver patch on head appears smaller; antenna similar to male, but lacks specialized bristles on flagellar segments 1 and 2; proboscis with pale basal ring  $\frac{1}{8}$  its length; black scales at

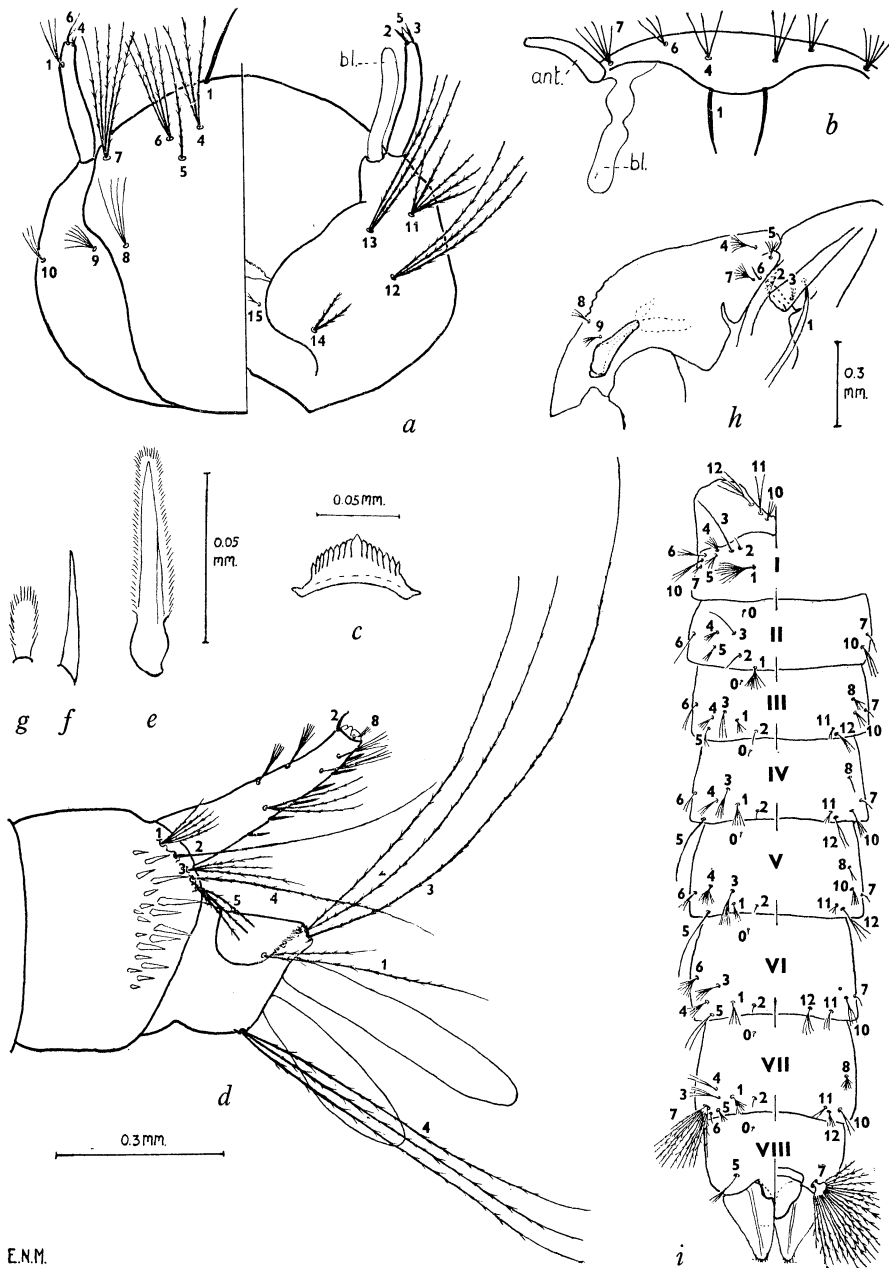


Fig. 2. *Topomyia papuensis* n. sp. a-g, larva. a, head (to same magnification as d); bl, bladder-like organ as it appears on slide mount; b, from sketch of front of head of living larva lying on its back; ant, antenna, bl, bladder-like organ; c, mentum; d, terminal segments; e, largest comb tooth; f, pecten tooth; g, scale from apex of saddle; h, i, pupa; h, cephalothorax; i, metanotum and abdomen.

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apex of mid lobe of scutellum extend forward partly dividing silver scaled basal area; *apn* lobes meet in midline; 1-2 *ppn* bristles; claws (unmounted) equal, apparently simple, fore pair largest, mid and hind apparently same size. *r-m* twice its own length distal to base of  $M_{3+4}$ ; haltere 1/8 length of wing. Lateral pale markings on tergites forming almost straight margin on I-III, and large basal patches extending 2/3 length on IV-VI and reaching almost to apex on VII; tergite and sternite VIII dark scaled with numerous dark bristles. (left legs broken from specimen; two mounted on slide with pupal skin, but lack distal tarsal segments.)

*Larva* (Fig. 2, *a-g*).

Length 4.0-4.6 mm; small whitish larva with numerous stellate setae. On underside of head, arising just mesial to base of antenna is a transparent bladder-like organ. In life this is a little longer than antenna and directed ventrally and posteriorly, proximal spherical portion appears possibly tracheated, but no structure shows in distal cylindrical portion. In preserved and mounted specimens organ is somewhat shrunken and of uniform thickness; probably a cephalic gill. [Organs of this type have been described in *Aedomyia* by Hopkins (1936) and in certain species of *Aedes* and *Culex* by Lewis (1949).]

Head 3/4-5/6 as long as broad. Antenna 1/3 length of head, 5 × as long as broad, slightly tapering, without spicules; seta 1 arising at 5/6 length, 2-3 branched, simple; setae 2-6 arising close together at apex. Head seta 1 about 2/3 length of antenna, stout, pointed, simple or slightly frayed along its mesial edge. Base of 7 slightly in front of base of antenna; 6 anterior to 7 and halfway between it and mid line, 5 in line with 7 and mesial to 6; 4 anterior and mesial to 6; 4-7 frayed and approximately equal in length to antenna; 4 with 3-4 branches; 5 single; 6 with 2-4 branches; 7 with 4-6 branches; 8, 9 and 10 simple; 8 with 2-4 branches, 9 with 5-8 branches; 10 with 2-4 branches; 11-14 frayed; 11 with 4-6 branches, short, stout, stellate; 12 and 13 about 1½ × length of antenna, 13 anterior and stouter; 12 with 2-3 branches; 13 with 3 branches; 14 stout, 2-3 branched; 15 very fine, simple, 3-4 branched. Some setae of mouth brushes pectinate. Mentum with a broad median tooth and 7-9 lateral teeth.

Thorax: Prothoracic seta 1 small, 3-5 branched, frayed, stellate; 2 slightly longer, single, frayed; 3 twice length of 1, stout, 3-4 branched, sparsely frayed; 14 moderately long, 3-5 branched, frayed, stellate.

Abdomen: Seta 6 on segments I-VI and seta 7 on I and II, long, frayed. Seta 6 on I and II 3-4 branched, on III-VI single; seta 7 on I and II single. Segment VIII: Lateral comb a patch of about 20-30 teeth in 2-3 rows; these appear as pointed spines but under high magnification are seen to have a membranous fringed flange, rounded at apex; those in posterior row are about twice as long as in preceding row and again smaller teeth anterior to latter; setae 1-5 frayed, arising quite close together, bases of 1 and 2 apparently raised and joined, those of 4 and 5 likewise; seta 1 with 3-6 branches; setae 2 and 4 single and longest of group; seta 3 with 2-3 branches; seta 5 with 3-4 branches, stout, stellate. Siphon tapering, slightly curved forward; index 4.0-4.5; basal portion without pecten or setae; distal 3/5-2/3 bears pecten consisting of a single ventral row of 6 simple pointed spines, and 6-7 ventral setae (arranged in pairs), and 3-5 dorsal setae (arranged in pairs). Proximal pair of ventral setae are stouter, 3-4 branched; remainder 4-6 branched. Dorsal setae have a flattened stem, dividing at about 1/3 length into 4-6 fine

branches; seta 2 stout, with its pointed tip curved forward, seta 8 with 3–5 branches. Anal segment: Saddle covering dorsal  $2/5$  of segment, clothed with fine spicules and with a row of about 8–10 fringed scales at apex. Setae long, frayed; 1 with 2–3 branches; 2 with 2 branches; 3 single; 4 (ventral brush) of two 3–4 branched setae; anal papillae sausage shaped, unequal, the upper pair  $3\times$  as long as saddle, lower pair  $2/3$  length of upper.

Described from 4 morphotype larvae and 1 larval skin associated with paratype male.

*Pupa* (Fig. 2, *h, i*). Integument and setae very pale and in life pupa is white until almost mature adult gives it a darker appearance. Branching of setae is often at  $1/3$ – $1/2$  length.

Cephalothorax: Trumpet evenly pigmented, about  $3\frac{1}{2}\times$  as long as greatest width, with thick walls and oblique opening; ratio of meatus to whole 1: 1.36–1.54, apical notch not apparent. Seta 1 long, strong, 2–3 branched; seta 2 with 3–5 branches; seta 3 with 2–3 branches; setae 4 and 5 with 4–7 branches; seta 6 single, simple or 2–4 branched at tip; seta 7 with 5–10 branches; seta 8 with 1–4 branches; seta 9 with 3–5 branches; seta 10 with 2–4 branches; seta 11 with 2–3 branches; seta 12 with 3–6 branches.

Abdomen: Segment I: Seta 1 moderately developed with 6–19 branches; seta 2 with 1–3 branches; seta 3 with 1–2 branches; seta 4 with 7–10 branches; seta 5 with 2–6 branches; seta 6 with 2–4 branches; seta 7 with 1–4 branches; seta 10 with 3–4 branches. Segment II: Seta 1 with 6–11 branches; seta 2 single or bifid or trifid at tip; seta 3 single or bifid; seta 4 with 3–6 branches; seta 5 with 2–6 branches; seta 6 single; seta 7 single or bifid; seta 10 with 2–6 branches. Segment III: Seta 1 with 4–6 branches; seta 2 single; seta 3 with 3–8 branches; seta 4 with 4–6 branches; seta 5 with 2–4 branches; seta 6 with 2–3 branches; seta 7 with 1–2 branches; seta 8 with 4–5 branches; seta 10 with 1 to 3 branches; seta 11 with 2–4 branches; seta 12 with 2–5 branches. Segment IV: Seta 1 with 3–7 branches; seta 2 single; seta 3 with 2–6 branches; seta 4 with 2–5 branches; seta 5 single or bifid; seta 6 with 1–4 branches; seta 7 with 1–2 branches; seta 8 with 1–3 branches; seta 10 with 1–4 branches; seta 11 with 1–2 branches; seta 12 with 1–4 branches. Segment V: Seta 1 with 2–7 branches; seta 2 single; seta 3 with 2–10 branches (relative positions of setae 1 and 3 variable; seta 1 may be almost level with, and mesial to 3, directly posterior to 3, or posterior and well lateral to 3); seta 4 with 6–13 branches; seta 5 single; seta 6 with 2–3 branches; seta 7 single; seta 8 with 1–4 branches; seta 10 with 3–7 branches; seta 11 with 2–3 branches; seta 12 with 1–3 branches. Segment VI: Seta 1 with 3–7 branches; seta 2 single; seta 3 with 3–9 branches; seta 4 with 3–7 branches; seta 5 with 2–4 branches; seta 6 with 5–13 branches; seta 7 with 1–3 branches; seta 8 absent, but represented on one side of one specimen by a setal ring; seta 10 with 2–4 branches; seta 11 with 1–4 branches; seta 12 with 2–4 branches. Segment VII: Seta 1 with 3–7 branches; seta 2 single; seta 3 with 2–5 branches; seta 4 with 2–7 branches; seta 5 with 2–5 branches; seta 6 with 1–2 branches; seta 7 with 11–13 branches, plumose; seta 8 with 6–13 branches; setae 10 and 11 with 1–4 branches; seta 12 with 2–5 branches. Segment VIII: Seta 5 with 2–4 branches; seta 7 with 17–25 branches, plumose, about  $1.3\times$  as long as paddle. Paddles tapering to blunt apex, without marginal fringe or apical setae, but with about 8 elongate fine spicules at apex; breadth index 1.4–1.6; midrib broad and well developed.

Described from 4 pupal skins individually correlated with type, allotype and 2 paratypes.

DISTRIBUTION: New Guinea (Papua).

Holotype ♂ (P. 1749, with linked pupal skin), allotype ♀ (P. 1833, with linked pupal skin; linked larval skin apparently lost); two ♂ paratypes (P. 1734, with linked larval and pupal skins; P. 1755 with linked pupal skin) and 4 morphotype larvae, Saiho (8° 50'S, 148° 05'E), Northern District, Papua, 16 Apr. 1958, E. N. Marks, from axils of crinum-like plant. (The actual site was named Koipa, 4-5 miles from Saiho on the Popondetta road.) Holotype, allotype and 2 morphotype larvae in University of Queensland collection; paratype P. 1734 in Bishop Museum (Honolulu); paratype P. 1755 and 1 morphotype larva in British Museum (Natural History); 1 morphotype larva in collection of Malaria Section, Department of Public Health, Port Moresby.

*Biology*: Larvae were collected from axils of a crinum-like plant (local native name "Sinda") growing in deep shade in secondary rain forest, at about 270 m altitude. The axils held up to about 20 cc of clean fresh water with a fair amount of debris at the bottom; water temperature was 78° F. The pupal period occupied 4 days (approximately 100 hrs. for one specimen). Associated species were *Aedes kochi* (Dönitz) and *Aedes wallacei* Edwards.

*Discussion*: Stone *et al.* (1959) list 21 species in the genus *Topomyia*, the distribution of which ranges from the southern tip of India east to Philippines and Celebes and from Yunnan south to Java, with the greatest number of species (12) recorded from Malaya. The genus has not hitherto been recorded from the Australian region, and adds another to the known Malayan elements in the Papuan insect fauna. *T. papuensis* has been compared with descriptions of adults of all the species listed by Stone *et al.* (1. c.), except *T. houghtoni* Feng, and the 7 larvae of these that have been described; the distinctive characters listed will separate it from them. On the basis of the terminalia it appears closest to *T. decorabilis* Leicester (known from Malaya and Borneo), both species having a simple style, a row of modified bristles on the subapical lobe, and no claspette, the larva of *T. decorabilis* is undescribed.

The genera *Topomyia* and *Malaya* Leicester are closely related and the adult of *T. papuensis* bears a general resemblance to New Guinea species of *Malaya*, but is immediately distinguished by its normal probocis. The larva looks and moves like a *Malaya* larva, but macroscopically appears smaller and the head appears narrower and darker (presumably due to the eyes). These differences are less obvious microscopically; in *Malaya* the branches of the head setae are markedly unequal and the pecten teeth are fringed scales. *Malaya* pupae have dark areas on the cephalothorax and abdomen, 2 large tufts (setae 6 and 7) laterally on segment VII, and a smooth margin to the paddles.

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