

## A COMPARISON OF ASIATIC AND NORTH AMERICAN SAPSUCKERS

by

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That the rufous-bellied woodpecker, *Hypopicus hyperythrus*, might be an Asiatic sapsucker, *Sphyrapicus*, occurred to Herbert Deignan and he asked Marshall to look at its habits in Thailand. Deignan's suspicion had been aroused by its down undercoat, "a black suit of underwear," characteristic of *Sphyrapicus* as observed by Alexander Wetmore. Thanks to Edward Dickinson a locality was found in western Chiangmai Province where the woodpecker was common. Immediately upon encountering the bird in the oak and pine forest of the Boluang Plateau Marshall found it associated with sap wells such as are made by *Sphyrapicus*. The tongue of freshly-collected specimens was hair-tufted like a brush. He observed the birds repeatedly drinking the flowing sap and took anatomical specimens to Zusi in hopes that a relationship with *Sphyrapicus* might be shown. The radical change this might entail in the North American checklist because of the priority of *Hypopicus* over *Sphyrapicus* in no way diminished the enthusiasm of all conspirators. Bert Deignan was especially gleeful.

*Sphyrapicus* remains secure, however. Zusi's anatomical findings show that "*Hypopicus*" *hyperythrus* is a *Dendrocopos* as we understand that genus from the anatomy of only a few of its many species. *D. hyperythrus* has adapted to sapsucking over a different evolutionary path than did *Sphyrapicus*. It remains for this paper to announce the presence of formalized sapsucker workings in Thailand and to present anatomical evidence by Zusi and field observations by Marshall that tend to prove *Dendrocopos hyperythrus* the author of those workings.

With chagrin we must admit that the rufous-bellied woodpecker has never been caught in the act of chiseling new sap-holes. We are back to the guessing games of Osmaston (1916) and Abdulali (1968) in an effort to incriminate the bird circumstantially. Table 1 combines available observations, which rather convincingly rank "*Hypopicus*" as the only possible maker of the sap-wells. Should observations of sapsucker workings be forthcoming in Manchuria and Korea, representing the rest of the breeding range of the species, our conclusion would be more secure.

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	KASHMIR (Abdulali)	KUMAON (Osmaston)	THAILAND (Marshall)
<i>Picus squamatus</i> <sup>2</sup>	(listed)	observed	
„ <i>vittatus</i> <sup>1, 3</sup>			specimen
„ <i>myrmecophoneus</i> <sup>4</sup>		(listed)	
„ <i>canus</i> <sup>3, 4</sup>		observed	observed
„ <i>erythropygius</i> <sup>1, 3</sup>			observed
„ <i>flavinucha</i> <sup>3, 4</sup>		(listed)	observed, sp?
„ <i>chlorolophus</i> <sup>3, 4</sup>		(listed)	
<i>Dinopium javanense</i> <sup>1, 3</sup>			observed
<i>Dryocopus javensis</i> <sup>3, 4</sup>			observed
<i>Hypopicus hyperythrus</i>	(occurs)	observed	specimens
<i>Dendrocopos himalayensis</i> <sup>2</sup>	(listed)	observed	
<i>Dendrocopos auriceps</i> <sup>2</sup>	observed	observed	
<i>Dendrocopos canicapillus</i> <sup>3, 4</sup>			observed
<i>Chrysocolaptes lucidus</i> <sup>3, 4</sup>			observed

Table 1. Woodpeckers noted in vicinity of sapsucker workings. 1 means geographic range does not include Kumaon, where sap-wells were found by **Osmaston**. 2 means geographic range excludes northern Thailand, where sap-wells were found by **Marshall**. 3 means the ecologic range in Thailand includes, in addition to the pine-oak forest where sap-wells are found, other habitats such as deciduous dipterocarp forest (*Picus erythropygius*) and evergreen forest (*Picus chlorolophus*) where sap-wells are not found. 4 means the geographic range includes areas such as Ceylon, Malaya or the Philippines, where sap-wells have not been seen.

## NATURAL HISTORY

**Sap wells.** Rings of small, close-set holes girdling the trunks of deciduous oaks (fig. 1) can be seen every few hundred yards along miles of roads in Hot and Omgoi districts. Most are decades old, blackened or lined with lichens. The oldest holes are run together in a crack with raised edges. One large tree had individual holes in transverse rows with unpuckered edges; they had evidently been made between visits in 1967 and 1969. A small *Tristania rufescens*, Myrtaceae (kindly identified by Tem Smitinand), had at 12 inch intervals inactive rings of separate holes in 1967 and appeared to be dead. There were twice as many rings (at 6 inch intervals) in November 1969 and the tree had leaves. In January 1970 a closer examination revealed that the lowest four rings, from 2 to 4 feet above ground, had been renewed, so that fresh reddish-brown bark gleamed from the holes instead of the gray of adjacent more ancient excavations.

A second kind of sap well is a large, solitary deep hole drilled through thick bark (fig. 1) of *Quercus kerrii* (also identified by Dr. Tem). Such holes are discovered only by seeing the birds drink.

**Foraging.** Nine days were spent in sapsucker areas during three visits of three days each when 8 individual birds, 1-3 at a time, were kept track of for a total of about 16 hours. All were seen at km 60 of the Maesarieng highway in Hot District. Never was a bird seen feeding at the rings of holes. During the dry, leafless season of March 1967, when sap was abundantly flowing, a pair of *Dendrocopos hyperythrus* fed mostly at several deep holes in a *Quercus kerrii*, one of which on the underside of a branch was dripping delicious amber sap to the ground. The birds visited this oak about every 20 minutes all day, but spent only about a minute each visit in actually drinking the sap. They paid no attention to the many insects attracted to the sweet fluid. Some feeding was also done by poking the bill into bark crevices, and once, probing at ant workings plastered over a tree-trunk.

In November 1969 and again in January 1970, when the trees were in leaf and sweet sap was not flowing, no sap-feeding could be seen. Foraging was either by hard pecking at loose bark or (mostly)

by turning the head sharply to the side and thrusting the bill under the loose edges of bark. This feeding was doubtless in pursuit of insects, but none of it for those deep larvae which require concerted chipping at one spot.

A possible interpretation of these rather mysterious data is that *Dendrocopos hyperythrus*, the only one of 9 species of woodpeckers in the area that was ever seen to drink sap there, does indeed drill the sap wells during a brief period, perhaps when the leaves bud in spring. That only a part of its work is on new holes, plus a brief sap season, minimizes the chance of catching it in the act. There is much reopening of old holes, hence the conspicuousness throughout the forest of these seemingly ancient rings of deeper holes with rims puckered up due to layers constantly added from beneath. Without this constant reworking, one would expect the rings to be pushed outward to the outer bark layers and eventually to disappear, which is certainly not the case in the Boluang forest.

**Other behavior.** In November and January only single birds were seen. In March there were pairs or trios. A paired male chased off an unattached male interloper which had perched in the same tree with the female. Three specimens taken at that time had moderately enlarged gonads and no brood patch. Nesting had not yet taken place although there was frequent dawn drumming by the pair and the male was constructing a nest hole. Whistler (1930:248) reports of birds from northwest India that "Fresh eggs may be found in the latter half of April and during May."

**Calls.** Drumming is an accelerated loud roll of five to 15 notes, fading toward the end. It is shorter than some *Dendrocopos* drums but is not divided into the separate long and short syllables of *Sphyrapicus*. There is a "wicka-wicka" call of the pair when its members are close together, and a typically *Dendrocopos* dry trill, usually given three in succession. No harsh nasal snarls or squirrel calls such as are uttered by *Sphyrapicus* were heard. All these drums and calls, including strident alarm notes, were preserved on tape recordings.

## ANATOMY

Two spirit specimens and a single skeleton of *Dendrocopos hyperythrus* were compared with woodpeckers in the United States National Museum.

**PTERYLOSIS.** *Sphyrapicus* has a thicker downy undercoat than other woodpeckers (Wetmore, unpublished). Its two or three irregular rows of semiplumes with downy aftershafts on either side of the sternal keel fill in much of the ventral apterium (fig. 2). *Dendrocopos hyperythrus*, *D. villosus*, *D. pubescens*, and *Centurus carolinus* have only a single row on each side. (Burt [1929: 436, fig. 4] shows a single row in *Sphyrapicus varius* and calls it the Inner Abdominal Region.)

The median capital apterium of *Sphyrapicus* extends forward only to the frontal region (Burt 1929), stopping well short of the bill (fig. 2). Feathers cover the anterior area which in *Dendrocopos* is bare to facilitate movement of the long hyoid horns that curve over the skull, reaching the bill in most species. In *D. hyperythrus* the hyoid horns extend forward on the skull roof only to the anterior limit of the cerebellum, but the apterium goes forward to the bill. This suggests former long hyoid horns, which have suffered evolutionary reduction. *Sphyrapicus* has even shorter hyoid horns and a curtailed apterium, suggesting reduction of both hyoid and apterium or ancestors that were short-tongued to begin with.

**TONGUE AND HYOID.** In *Dendrocopos villosus* and *D. nuttalli*, processes from the lateral edges of the tongue are grouped into barbs (fig. 3). The tip of the tongue is pointed and stiff, suitable for spearing or snagging insects in tunnels or crevices. The processes of *Melanerpes*, *Dendrocopos hyperythrus*, and *Sphyrapicus* are softer and evenly distributed along the edges of the tongue. Only in *Sphyrapicus* is the tip of the tongue also brushy. Tongues of this sort would better retain sap or insects stuck in sap than the barbed tongue. The rest of the tongue of *hyperythrus* agrees more with *Dendrocopos villosus* than with *Sphyrapicus* (see fig. 3).

The short hyoid horns of *Sphyrapicus* are compared in figure 4 where bar lengths are independent of the size of the specimen. *Sphyrapicus* is distinctive in its long paraglossale, short basihyobranchiale, and short ceratobranchiale II (terminology of Engels, 1938). *Dendrocopos hyperythrus* resembles other *Dendrocopos* but approaches *Sphyrapicus* in some of these proportions, as does *Picooides tridactylus*. *Dendrocopos* species, including *hyperythrus*, have equally narrow, thread-like first and second ceratobranchiales, whereas the first is broader than the second and tapers at both ends in *Sphyrapicus*.

Unique among woodpeckers is the tracheohyoideus (or laryngo-hyoideus) muscle of *Sphyrapicus* originating from the ventral surface of the larynx instead of the trachea. The muscle inserts on the basihyale and retracts the tongue and hyoids. Short hyoid horns and a short retractor muscle in *Sphyrapicus* limit protrusion of the tongue. In other woodpeckers with longer hyoid horns the muscles gain length by winding dorsally around the trachea and originating from its dorsal surface behind the larynx, or by making additional loops around the trachea. In *hyperythrus* the right and left muscles attach on the dorsal surface of the trachea after making a half loop around it (see fig. 5), and their fibers interdigitate to a slight degree, resembling the figure of *Chrysocolaptes guttacristatus* (= *lucidus*) shown in Steinbacher's paper on the tongue of woodpeckers (1934: 401). Although the muscle of *hyperythrus* is shorter than that of some other species of *Dendrocopos* (*mahrattensis*, *villosus*) in no way does it resemble the unique form of the origin of the muscle as found in *Sphyrapicus*.

SKULL. X-rays (fig. 6) reveal concentrations of trabeculae within the interorbital septum and an interorbital foramen in *Dendrocopos* including *hyperythrus*, whereas the septum of *Sphyrapicus* is thick, lacks the interorbital foramen, and has fewer trabeculae.

Other features (fig. 6) in which *Sphyrapicus* is distinct from all *Dendrocopos* including *D. hyperythrus* are the prominent scalloped outline of the cerebellum (indistinct in *Dendrocopos*) visible in a lateral x-ray of the skull; the more pronounced forward bulging of the anteroventral surface of the brain; the absence (or very small size) of a mandibular foramen; an otic notch in which the medial rim has no lateral projection. The skull shape of both *Sphyrapicus* and *Dendrocopos* agrees with Burt's (1930) characterization of those woodpeckers which do much pecking on wood.

## DISCUSSION

RELATIONSHIPS. The coarse ladder-backed pattern in black and white and the red crown and vent of *D. hyperythrus* differ from *Sphyrapicus* but agree with several other species of *Dendrocopos* (*atratus*, *macei*, *leucotis*). The rich bay underparts are unusual in this generally light-bellied genus but other dark forms occur; for example the local races of the hairy woodpecker, *D. villosus*, in El Salvador and on the Queen Charlotte Islands are even a darker, more chocolate brown. Some races of *D. pubescens*, *D. major*, and *D. minor* are also dark beneath. These characters of plumage and others of the voice, skeleton, and muscles already presented show *hyperythrus* to be a somewhat aberrant species of *Dendrocopos* rather than a relative of *Sphyrapicus*.

The monotypic genus *Hypopicus* was distinguished from *Dendrocopos* by a short nasal ridge (a feature also of *Sphyrapicus*) and shorter bristles at the base of the bill. In both *Sphyrapicus* and *hyperythrus* the bill is long and slender, laterally compressed for the distal half, and its nasal ridge ends short of the half-way point. These features follow from the short, broad-based bony upper jaw to which the nasal ridge corresponds. About half the bill is pure rhamphotheca, extending forward past the premaxilla. But this specialization and reduced bristles seem to us not to warrant generic separation of *hyperythrus*, since they are approached by other *Dendrocopos*, such as *atratus*.

ADAPTATIONS. *Sphyrapicus varius* feeds chiefly on insects such as mayflies, ants, flies and wasps, which it takes to sap holes, working the insects into wet sap before swallowing them (Foster and Tate, 1966). It also eats fruits and cambium, and drinks pure, concentrated sap. Other species known to drill holes for sap are *Dendrocopos major*, *D. pubescens*, *Dryocopus martius*, *Picus viridis*, and *Picoides tridactylus* (Turček 1954; Forbush, 1921). The European species use sap only in the spring and are not known to feed sap to the young as does *Sphyrapicus*. Still other species—*Centurus carolinus*, *Melanerpes erythrocephalus*, *Dendrocopos villosus* (cited in Foster and Tate, 1966)—on occasion eat sap from holes made by *Sphyrapicus varius*.

That *Dendrocopos hyperythrus* feeds on insects is indicated by Marshall's observations, two stomach contents with two small insect larvae and a katydid, as well as the following published reports: "gizzard of adult from 8 Sept., taken at Lighthouse Island contained the remains of the caterpillars of moths" (Swinhoe, 1875 : 124); "On one occasion I saw a male catching white butterflies at chestnut blossoms" (Whistler, 1930 : 248); "This bird had been feeding on ants and beetles. . ." (Stanford and Mayr, 1941 : 484). Dissections reveal a diet of 96% insects during migrations in China (May and September) of which 64% "were ants, which were eaten by four birds" (Cheng, 1963 : 352).

*Dendrocopos hyperythrus* thus appears to feed on sap only in spring and upon insects taken from surfaces and crevices or even in the air, rather than deep within wood. Its adaptations include the brushy tongue for sapsucking, and a long slender bill for forceps-feeding and probing crevices and deep sap holes. Reduced protrusion of the tongue, indicated by short hyoids and short tracheohyoideus, must limit any search for wood-tunnelling insects.

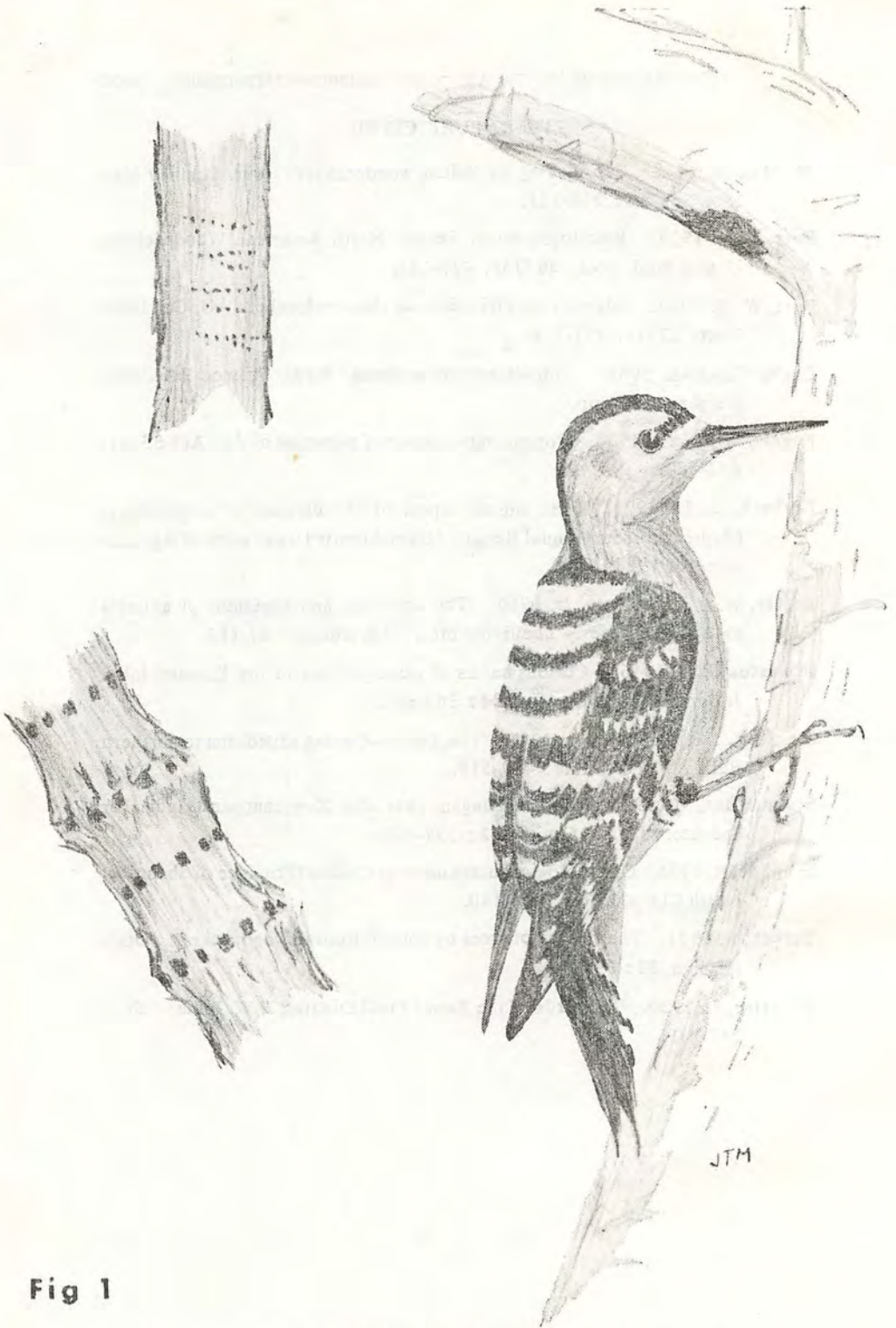
### CONCLUSIONS

Field impression of *Dendrocopos hyperythrus*, the rufous-bellied woodpecker, is of a quiet, inconspicuous, long-billed *Dendrocopos* with plumage and voice typical of that genus. It is properly included in the genus of pied woodpeckers, among which it has a greater specialization for feeding on sap than any other whose anatomy is known. Some of this specialization is retrograde—evolutionary shortening of the tongue, hyoid horns, and tracheohyoideus muscle. These traits and the brushy tongue are developed more fully in *Sphyrapicus* but both birds feed at sap flowing from holes cut in bark. *Sphyrapicus*, with its reduced median capital arterium, may have descended from birds which had a short tongue to begin with. *Sphyrapicus* must have evolved its sapsucking capability, together with its peculiar skull and unique tracheohyoideus muscle, along a different path or earlier than did *Dendrocopos hyperythrus*.



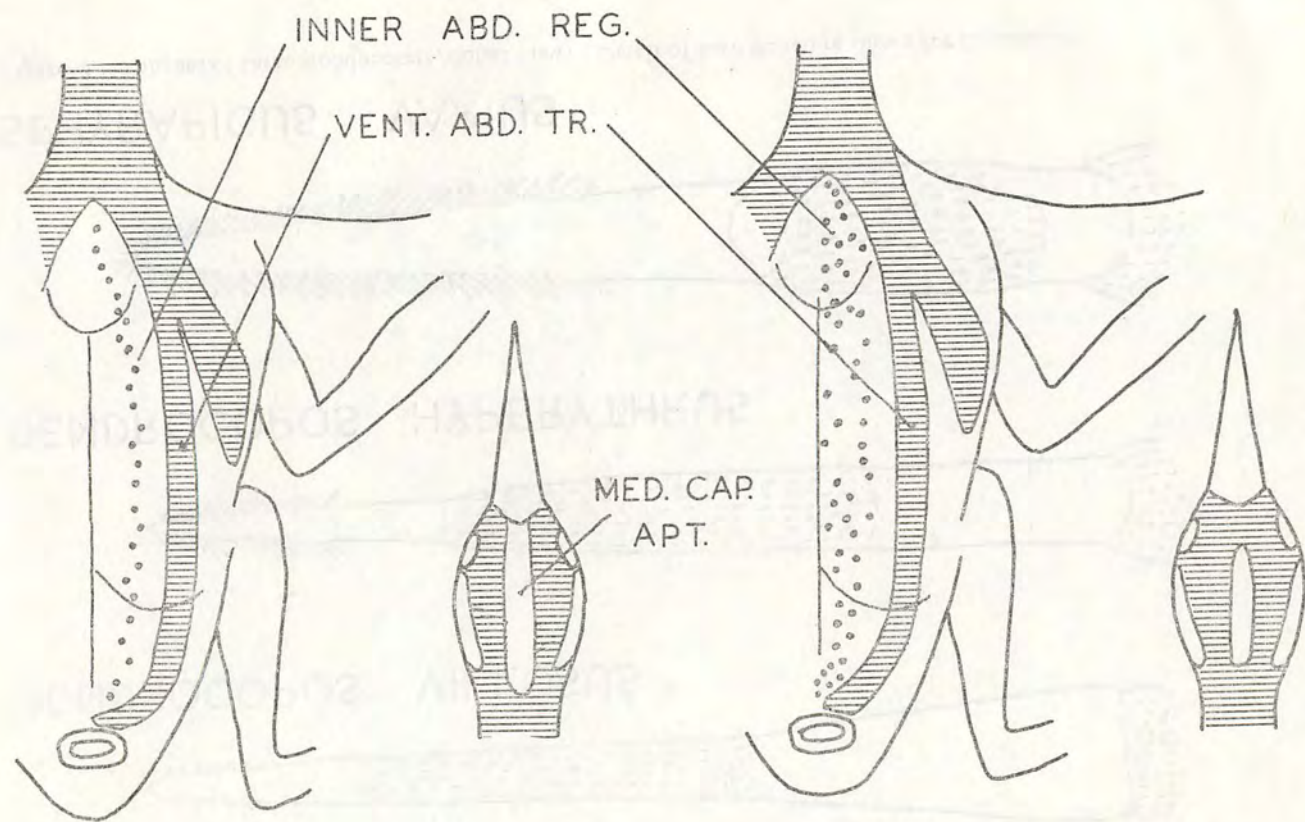
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**Fig 1**

*Dendrocopos hyperythrus* at sap holes. Holes may be small and in rings, or larger, scattered on trunk and limbs.



DENDROCOPOS HYPERYTHRUS

SPHYRAPICUS VARIUS

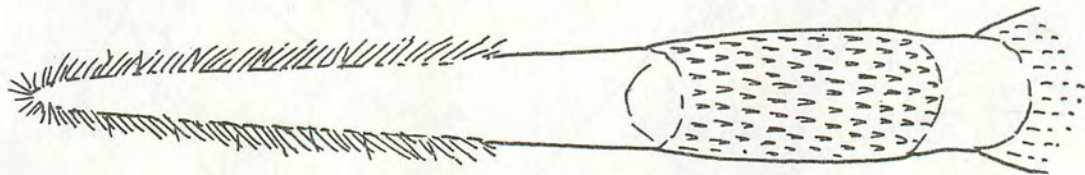
Figure 2. Diagram of pterylography showing body from below, and top of head. Abbreviations: abd.—abdominal, apt.—apterium, cap.—capital, med.—median, reg.—region, tr.—tract, vent.—ventral.



DENDROCOPOS VILLOSUS



DENDROCOPOS HYPERYTHRUS



SPHYRAPICUS VARIUS

Figure 3. Tongues of three woodpeckers, dorsal view. Detail of barb structure shown for *D. villosus*.

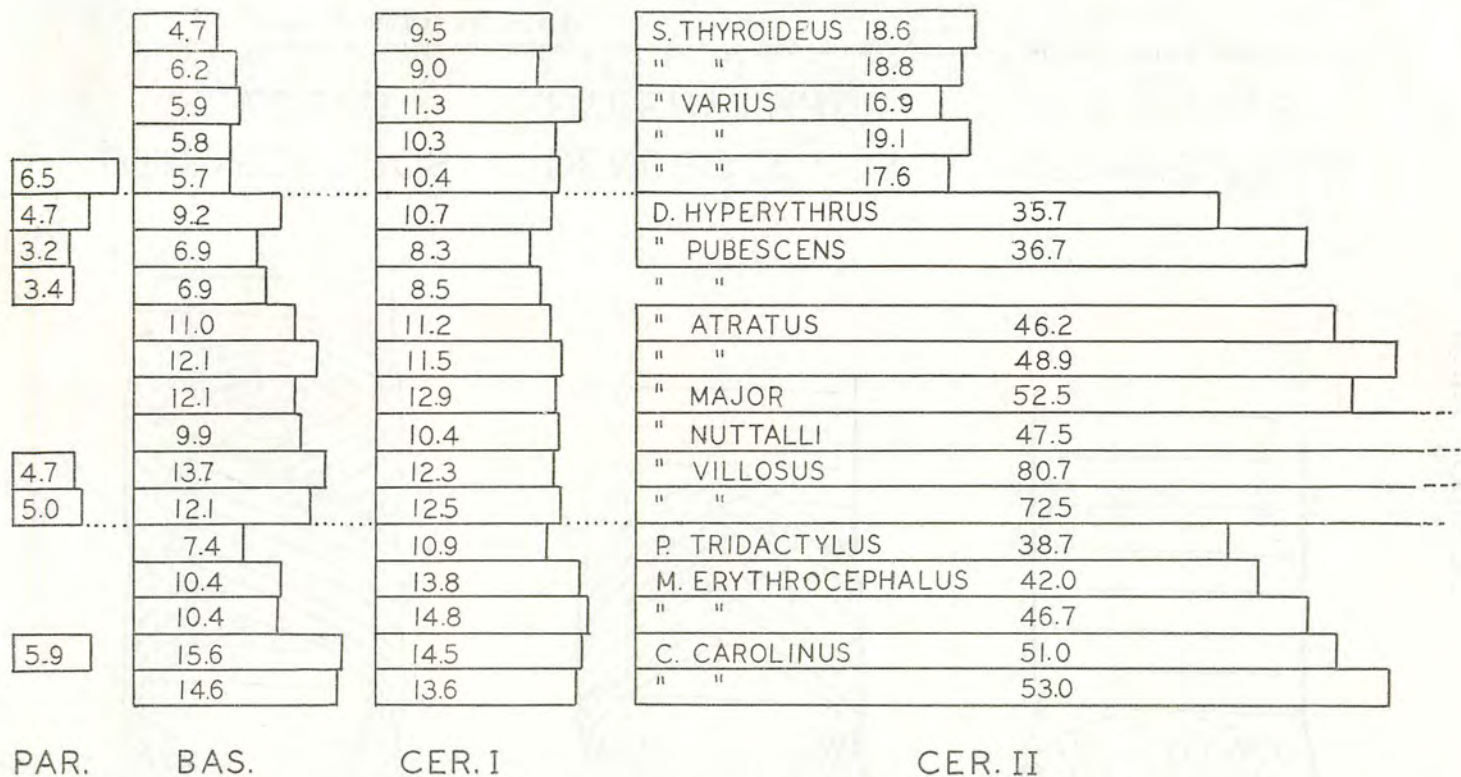
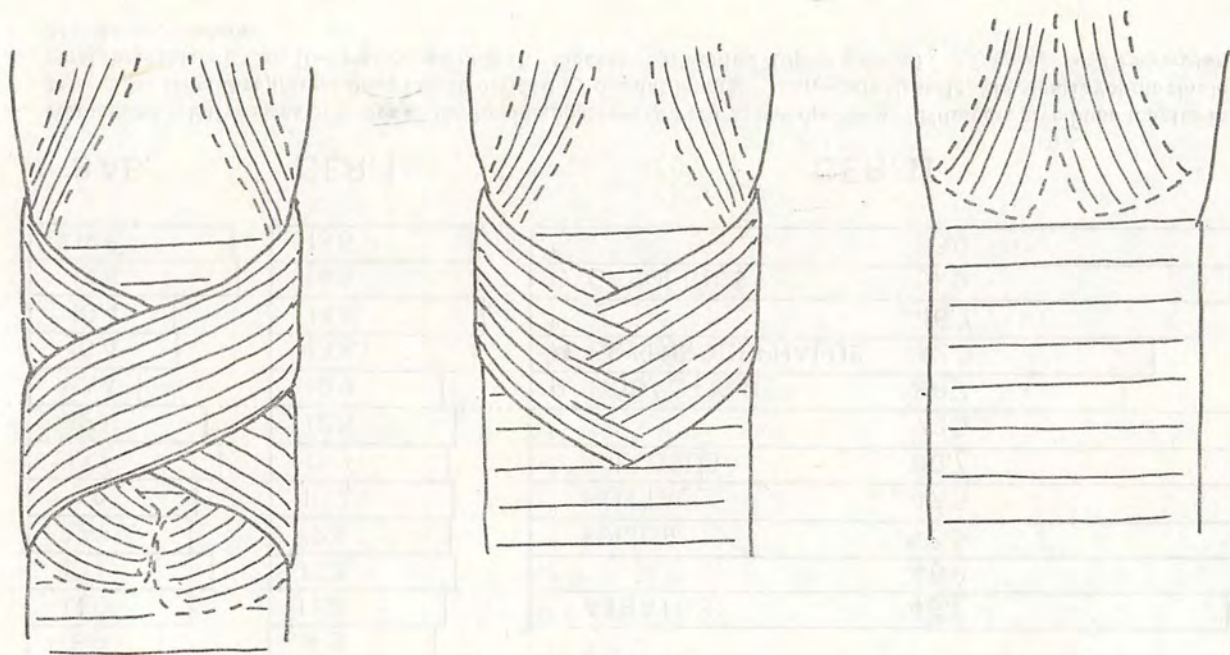


Figure 4. Actual and relative sizes of bones of the hyoid apparatus in various woodpeckers. Numbers give bone lengths in millimeters. Bar lengths represent bone length divided by cranial length. Par.—paraglossale, Bas.—basihyobranchiale, Cer. I.—ceratobranchiale I, Cer. II.—ceratobranchiale II. Genera represented (top to bottom): *Sphyrapicus*, *Dendrocopos*, *Picoides*, *Melanerpes*, *Centurus*.



DENDROCOPOS  
VILLOSUS

DENDROCOPOS  
HYPERYTHRUS

SPHYRAPICUS  
VARIUS

Figure 5. Diagram of trachea and larynx, dorsal view, showing the tracheochoideus muscle. Dotted outline shows muscle position on ventral side.

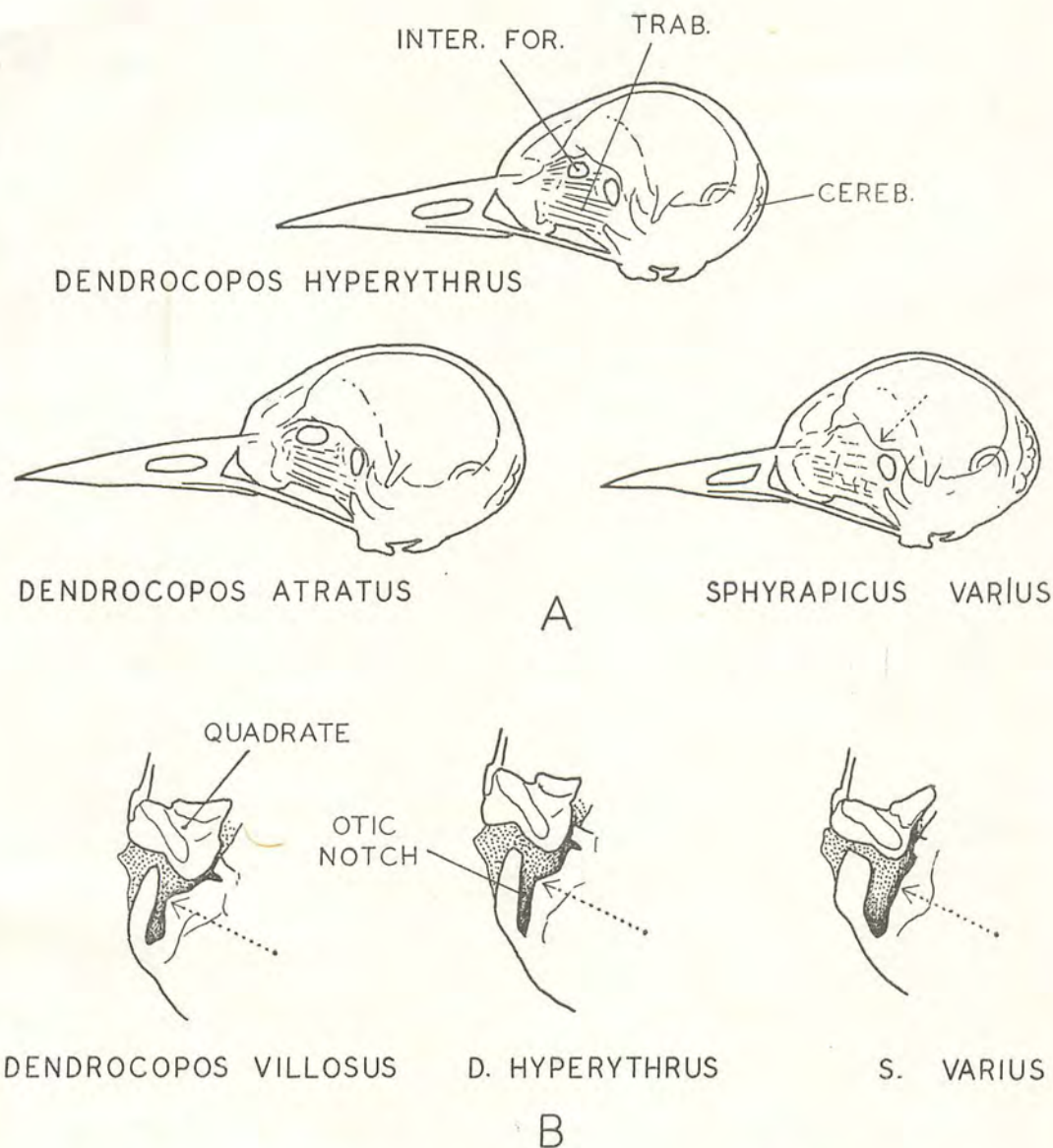


Figure 6. A. Drawing from x-rays of skulls of three woodpeckers. Abbreviations: cereb.—cerebellum, for.—foramen, inter.—interorbital, trab.—trabeculae. For explanation see text.  
 B. Ventral view of right quadrate and otic notch of skull in three woodpeckers.

