

**TWO NEW SPECIES OF *CORYPHAESCHNA*
FROM MIDDLE AMERICA, AND A DISCUSSION
OF THE RED SPECIES OF THE GENUS
(ANISOPTERA: AESHNIDAE)**

D.R. PAULSON

Slater Museum of Natural History, University of Puget Sound,
Tacoma, Washington 98416, United States

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C. apeora sp.n. (holotype ♂: Costa Rica, Heredia Prov., La Selva, 1-1/2 mi. S. Puerto Viejo, 2-VII-1967; allotype ♀: Costa Rica, Guanacaste Prov., Hacienda Taboga, 27-VII-1967) and *C. diapyra* sp.n. (holotype ♂: Costa Rica, Heredia Prov., La Selva, 1-1/2 mi. S Puerto Viejo, 12-VIII-1967; allotype ♀: Costa Rica, Guanacaste Prov., Hacienda Taboga, 29-VI-1967; all deposited at FSCA, Gainesville/FL, USA) are described and compared with congeners. Both are widespread in Mexico and Central America, the latter extending into northern South America. In addition, the diagnostic characters and distribution of *C. perrensi* and *C. amazonica* are clarified, and differences among all spp. of the genus are briefly discussed.

INTRODUCTION

Until recently the New World genus *Coryphaeschna* was thought to comprise 9 species (CALVERT, 1956; DAVIES & TOBIN, 1985; DE MARMELS, 1989; MACHET, 1991). CARVALHO (1992a) removed 3 of the species from the genus into a related genus *Remartinia* and described still another species in the latter genus. Thus *Coryphaeschna* as presently known contains 6 species, although two undescribed species have been known for some time (PAULSON, 1982). In this paper I describe these two species, one of which was relatively recently discovered and the other of which has been confused with *C. perrensi* (McLachlan, 1887) from CALVERT (1901-1908) to the present.

For this study I borrowed material from the Florida State Collection of Arthropods (FSCA), National Museum of Natural History (NMNH), University of Michigan Museum of Zoology (UMMZ), Carnegie Museum (CM), University of California at Berkeley (UCB), and the collections of J. Belle (JB), T.W. Donnelly (TWD), R.W. Garrison (RWG) and M.J. Westfall, Jr. (MJW). The majority of

the specimens examined are in my own collection (DRP). Venational data were taken on both pairs of wings of each specimen.

While studying Odonata in the Rio Tempisque basin in northwestern Costa Rica, I repeatedly observed an unfamiliar large green and brown *Coryphaeschna* flying in feeding swarms, often with congeners. Most individuals flew high, out of net range, but several were collected by shooting them with fine dust shot, and they proved to be an undescribed species. Later, additional specimens came to light, but the species has remained rarely observed and collected.

CORYPHAESCHNA APEORA SPEC. NOV.

Figures 1-3

Material. — **Holotype** ♂: COSTA RICA, Heredia Prov., La Selva, 1-1/2 mi. S. Puerto Viejo, 200' elevation, 2-VII-1967, D.R. Paulson. — **Allotype** ♀: COSTA RICA, Guanacaste Prov., Hacienda Taboga, 27-VII-1967, D.R. Paulson. — **5 paratypes**: ♂, COSTA RICA, Heredia Prov., "Finca El Uno", near La Virgen, 17-III-1986, Milwaukee Public Museum Expedition; — ♂, Guanacaste Prov., Hacienda Taboga, 100' elevation, 7-VII-1966, D.R. Paulson; — ♂, 24-VIII-1966, D.R. Paulson; — ♂, MEXICO, Veracruz, Catemaco, Motel Playa Azul by Lago Catemaco, 17-VIII-1976, R.W. Garrison; — ♀, Veracruz, 11 mi. S Tecolutla near hwy 180, 31-VII-1968, R.W. Garrison. — Holotype and allotype deposited in FSCA, paratypes (in order) in FSCA, NMNH, DRP, RWG and UCB.

Etymology. — *apeora* is Greek, meaning "on high", referring to the high foraging and patrol flights of this species.

DIAGNOSIS. — A large *Coryphaeschna* with relatively short superior appendages (inferior greater than half-length of superior). Penis unique in the genus by projecting median part of dorsal process of terminal segment. Coloration diagnostic: green face with frons typically entirely dark above, green thorax with a prominent brown oval spot on the mesepisternum, and reddish-brown abdomen.

MALE holotype. — Parenthetical designations from coloration in life. (Eyes and entire face green). Labium pale greenish, yellower toward front and brown at anterior borders. Labrum green, outer edges yellow, edged below with brown. Postclypeus greenish-brown. Anteclypeus green. Narrow brown line on frontoclypeal suture. Frons green, shading to dark brown (dark brown) on upper surface. Vertex green in front, brown behind. Occiput pale green bordered by brown. Rear of head dark brown, fading to greenish along rear margins of eyes.

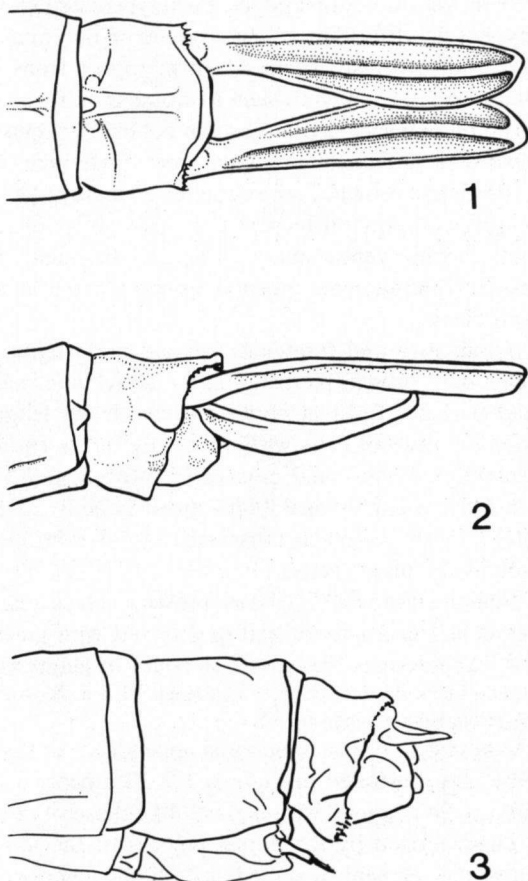
Prothorax brown. Pterothorax greenish (green), with brown markings as follows: a stripe along the middorsal carina and narrower stripes along the humeral and second lateral sutures and along the carina surrounding the wing bases; an oval spot (or partial stripe) occupying about one-fourth of the mesepisternum midway between its outer edges, wider and rounded above and narrower and almost pointed below, narrowly separated from both top and bottom of plate. Legs black, front femora brown (pale greenish on posterior surface) and mid and hind femora dark brown (black).

Wings largely hyaline, the basal half except for the anal loop area faintly suffused with yellow, veins uniformly dark brown to black. Pterostigma brown above, slightly lighter brown below. Membranule gray. Radial sector forks at about one-third the length of the pterostigma in both wings, 2 rows of cells within the fork for its entire length. Cubito-anal crossveins 6-6-4-5 (forewing [FW] followed by hindwing [HW] counts); 5-6-4-4 cells in supratrangles and 5-5-4-4 in triangles; anal loop with 9 cells; 21-22-14-14 antenodal crossveins; 11-11-13-13 postnodal crossveins; 3-3-3-4 bridge crossveins; pterostigma surmounts 3.3 to 3.5 cells.

Abdomen entirely reddish-brown, anteriormost segments faintly tinged with greenish, where pattern faintly visible. Most sutures with darker lines. (Segment 1 mostly pale green, brown dorsally; 2 mostly brown above, pale green

below with brown markings; 3 with some greenish anteroventrally, remainder brown; 4-8 brown [slightly reddish], 9 darker, 10 very dark brown; 3-5 with narrow tan dorsal stripe, 3-8 with tan transverse band). Cerci and epiproct brown with black margins.

Group of tiny denticles on midline near posterior edge of segment 1. Genital lobe smooth, without denticles, rounded and only slightly projecting in lateral view. Auricles with 5 sharp conical teeth pointing posterad, not visible from front or sides. Spines of anterior lamina blade-like, parallel-sided, rounded at tip up to point on dorsal edge (left one not fully developed). Ventral hamular processes 0.9 mm long, abruptly widened behind



Figs 1-3. *Coryphaeschna apeora* sp.n. (Hacienda Taboga, Costa Rica): (1) dorsal view of male appendages; — (2) lateral view of male appendages; — (3) lateral view of female abdomen tip.

middle. Cerci gradually widening to widest point at 0.6-0.9 length, narrowing abruptly to truncate ends, longest on outer edge; low dorsal ridge from 0.3 length to tip; in lateral view, slightly arched at base, then straight to tip. Epiproct narrows quickly to a blunt point, reaches 0.7 length of cerci; smoothly curved upward from base to tip.

Measurements (mm). — Total length including cerci 79, abdomen without cerci 55, cerci 5.5, hind wing 52, pterostigma of forewing 4.7, pterostigma of hindwing 4.2.

FEMALE (allotype). — Parenthetical designations from coloration in life. (Eyes blue above, green below). Labium greenish, brown at anterior margins. Labrum brown, yellow at outer edges. Postclypeus brown with yellow central spot. Anteclypeus and frons brown, latter green on outermost part of upper surface. (Entire face dull greenish, sutures brown; top of frons brown, with faintly indicated black area at front equivalent to crossbar of T-spot of other species). Vertex green (pale blue-green) in front, brown behind. Occiput greenish (chartreuse). Rear of head dark brown (black), gray-green (pale green) around rear margins of eyes.

Prothorax brown. Thorax colored as male holotype (green and maroon-brown), but brown spots on mesepisternum slightly longer, curving slightly to outside and reaching ventral margin of plate. Interalar sclerites green. Femora reddish brown (first one pale green anteriorly), black at extreme distal ends, tibiae and tarsi black.

Hindwings and forewings beyond pterostigma lightly suffused with brown, veins dark brown, pterostigma tan above and below. Membranule gray-brown. Radial sector forks at about one-fourth the length of the pterostigma in both wings, 2 rows of cells within the fork for its entire length (one row of 3 in one forewing). Cubito-anal crossveins 6-6-5-5; 6-7-5-6 cells in supratrangles and 6-6-4-5 in triangles; anal loop with 10-11 cells; 25-25-15-16 antenodal crossveins, 14-14-15-18 postnodal crossveins; 4-4-3-3 bridge crossveins; pterostigma surmounts 3.7 to 4.4 cells.

Abdomen brown (7-10 dark brown to black), darker at sutures and on carinae. Segment 1 and anterior half of 2 tinged with green (pale green, also evident on 3-4). Appendages broken off at 1 mm in length (Fig. 3).

Measurements (mm). — Total length 82, abdomen 61, hindwing 57, pterostigma of forewing 6.0, pterostigma of hindwing 5.5.

VARIATION. — The abdominal appendages of the paratype from Taboga, 7 July 1966, are illustrated in Figures 1-2. The penis (examined in the paratype from Taboga, 24 August 1966) is much like those of other *Coryphaeschna* species but is characterized by the dorsal process of the terminal segment being elevated above the segment by a median fold, the anterior end of the median part visible in ventral view. The paired spiny patches on the dorsal process are horizontally oriented, separated, and parallel. The hamular processes are much like those of most other *Coryphaeschna*, for example *C. amazonica* (Fig. 8).

The four other males are colored much like the holotype, except one in which the thoracic color is obscured by postmortem changes. One shows a distinct

suffusion of brown around the metastigmal spiracle. The male from Mexico has the first two abdominal segments largely green, the first with brown at the base dorsally and laterally, the second with an extensive brown suffusion on the dorsal base and behind the transverse carina. All of the sclerites at the wing base are bright green. In the preserved specimens, abdominal color varies from dull brown to rich reddish-brown. Three of the other males have wings entirely suffused with brown except the extreme base; that from Finca El Uno, probably recently emerged, has entirely hyaline wings. Two males collected at Hacienda Taboga 7 and 9 July 1966 (only wings preserved from the latter) were described as "eyes and face bright green, thorax green with brown markings, abdomen brownish-red".

The female paratype is identical to the allotype except the spot on the mesepisternum is slightly narrower, about 1 mm wide, and there is a distinct brown T-spot on the green frons, the stem concave and 0.6 mm wide at its narrowest. This individual and the male from Finca El Uno are the only specimens of the seven I examined that show a T-spot, and this may more likely be present in females or younger individuals. However, T.W. Donnelly (in litt.) collected an apparently mature male in Veracruz with a very clear T-spot.

The following counts are for all 5 males, with means and ranges. Cubito-anal crossveins 5.7 (5-7) in FW, 4.2 (4-5) in HW; 5.2 (4-7) cells in supratrangles in FW and 4.4 (4-5) in HW; 5.6 (5-6) cells in triangles in FW, 4.4 (4-5) in HW; anal loop with 9 cells in nine wings, 10 in one; antenodal crossveins 22.5 (21-24) in FW, 14.9 (13-17) in HW; postnodal crossveins 12.2 (11-14) in FW, 14.1 (13-16) in HW; bridge crossveins 3.9 (3-4) in FW, 3.4 (3-4) in HW. The radial sector forks at about one-third to two-thirds the length of the pterostigma in FW, one-third to one-half in HW; 2 rows of cells within the fork for its entire length except 3 rows for one cell in one FW of one, and 3-4 rows distally in all wings in another. Three of the male paratypes have longer pterostigmas than the holotype (5.0 mm, surmounting 3.5-4.0 cells), probably because they are slightly larger; the Finca El Uno paratype has pterostigmas 4.5 mm in length, surmounting 3.5-4.3 cells.

In the female paratype, the radial sector forks at one-half the length of the pterostigma in the forewing and one-third its length in the hindwing. Cubito-anal crossveins 5-6-4-4; 5-5-4-4 cells in supratrangles, 5-5-4-4 cells in triangles; anal loop with 9 cells; 22-22-14-15 antenodal crossveins, 13-14-15-15 postnodal crossveins; bridge crossveins 4 in FW, 3 in HW; pterostigmas surmount 3.7-4.8 cells.

Variation in measurements (mm). — Male abdomen 54-59 (mean 56.3), hind wing 51-56 (53.4), N=5. Female abdomen 61-63 (62.0), hind wing 55-57 (56.0), N=2.

COMPARISON WITH CONGENERS. — *C. apeora* is one of the largest species of the genus, exceeded only by the North American *C. ingens* (Rambur, 1842) and approached in Middle America only by *C. viriditas* Calvert, 1952. It is the only

species in which the inferior appendages reach two-thirds the length of the superiors. The penis is unique (see above). It is the only *Coryphaeschna* in which the T-spot of immatures usually becomes obscured with dark brown in mature individuals. It is unique in the genus because adults of both sexes have a greenish thorax and reddish-brown abdomen, although female and immature *adnexa* (Hagen, 1861), *diapyra*, and *amazonica* De Marmels, 1989, share this characteristic. It is also the only member of the genus with a conspicuous large spot (incomplete stripe) on the mesepisternum in both sexes. All other congeners have the thorax either virtually unmarked (*diapyra*, *amazonica*, and *perrensi*), with fine dark lines in the sutures (*adnexa*, *viriditas*) or vividly striped green and brown (*ingens*). Female *amazonica* and *viriditas* have a small elongate spot at the location of the considerably larger mesepisternal spot of *apeora*.

DISTRIBUTION. — The species is known from specimens only from the Pacific and Caribbean lowlands of Costa Rica and the Caribbean lowlands of Mexico (Veracruz); in addition, I have seen it at two other localities in Caribbean Mexico. At Palenque, Chiapas, a female foraged over a clearing on 9 November 1983, and at Uxmal, Yucatan, a female flew past me about 2 m above a forest pond on 16 November 1983 (PAULSON, 1984). It will doubtless be found in the intervening countries but has not been reported from either Panama or Venezuela, both relatively well-studied.

BIOLOGY. — Nothing is known of the larval ecology of *apeora*, but I saw males on several occasions flying rather high (4–6 m) over woodland ponds and semi-wooded marshes at Hacienda Taboga and three males and a female over a small forest marsh at La Selva during a sunny morning; presumably these individuals were at breeding habitats.

Adults also have been taken in feeding flight over open areas in or near tropical dry and moist forests, during both wet and dry seasons. I visited Hacienda Taboga weekly during the rainy season and monthly during the dry season from July 1966 to August 1967 and saw the species in July, August and October 1966 and March and July 1967. I visited La Selva four times from September 1966 to August 1967 and again in February 1969 and saw the species there only on 2 July 1967. The male from Veracruz was taken during crepuscular (18:00–18:30 h) feeding flight. The known flight season is 17 March to 24 August.

Coryphaeschna perrensi was long thought to be the only red species of the genus (CALVERT, 1956). DE MARMELS (1989) described *C. amazonica*, a second red species closely related to *perrensi*, from a single male from Venezuela and noted the existence of still another undescribed red species in that country. MACHET (1991) distinguished both sexes of *amazonica* from *viriditas* but did not compare it with *perrensi*. The third red species is indeed quite distinct from both of the others, especially structurally, and occurs with *amazonica* over a wide range.

CORYPHAESCHNA DIAPYRA SPEC. NOV.

Figures 4-7, 9

Material. — **Holotype** ♂: COSTA RICA, Heredia Prov., La Selva, 1-1/2 mi. S Puerto Viejo, 200' elevation, 12-VIII-1967, D.R. & M.L. Paulson. — **Allotype** ♀: COSTA RICA, Guanacaste Prov., Hacienda Taboga, 100' elevation, 29-VI-1967, D.R. Paulson. — **Paratypes**: 38 ♂, 35 ♀, all from COSTA RICA, all collected by D.R. & M.L. Paulson and all in DRP collection unless otherwise indicated: La Selva, 1 ♂, 1 ♀, 23-IX-1966; 23 ♂, 9/12-IV-1967; 8 ♂, 12/13-VIII-1967; — Hacienda Taboga, 5 ♀, 6/9-VII-1966; 1 ♀, 17-VII-1966; 1 ♀, 9-VIII-1966; 1 ♀, 24-VIII-1966; 1 ♂, 30-IX-1966; 1 ♂, 26-X-1966; 1 ♂, 1 ♀, 14/15-VI-1967; 4 ♀, 28/29-VI-1967; 3 ♀, 4/6-VII-1967; 7 ♀, 11/13-VII-1967; 1 ♀, 27-VII-1967; 1 ♀, 10-VIII-1967; 2 ♀, 27/28-VI-1967, M.J. & D.N. Westfall (FSCA); 5 ♀, 27/29-VI-1967, O.S. Flint & M.A. Ortiz (NMNH); 2 ♀, 25/26-VII-1967, O.S. Flint & M.A. Ortiz (NMNH); 2 ♀, Guanacaste Prov., 1.5 mi. S Potrerillos, 27/28-VII-1967, O.S. Flint & M.A. Ortiz (NMNH); — 1 ♀, Guanacaste Prov., 1 km N Los Angeles, 20-VI-1962, T.W. Donnelly (TWD); — 2 ♂, Heredia Prov., Puerto Viejo, 1-IV-1965, J. Hadley (NMNH). — Holotype and allotype deposited in FSCA, paratypes in FSCA, NMNH, UMMZ, TWD, RWG, DRP, and collections of J. Belle, C. Cook and S.W. Dunkle.

Additional material: MEXICO, Nayarit, Tepic, 7-XI-1923, J.H. Williamson, 1 ♀ (UMMZ); — Colima, 5.1 mi. E El Colomo, 21-VIII-1965, D.R. Paulson, 1 ♀ (DRP); — Colima, 11.2 mi. W Armeria, 21-VIII-1965, D.R. Paulson, 1 ♀ (DRP); — Quintana Roo, Akumal, 8-IV-1990, D.R. Paulson, 1 ♂, 1 ♀ (DRP); — BELIZE, Ambergris Cay, San Pedro, 18-X-1987, D.R. Paulson, 1 ♂ (DRP); — HONDURAS, Copan, Copan, 18/19-VII-1971, T.W. Donnelly, 1 ♂ (TWD); — PANAMA, Canal Zone, Summit, 1-IX-1950, R.B. Cumming, 1 ♂ (FSCA); — Canal Zone, Summit Park near Summit, 15-VIII-1970, T.W. Donnelly & E.S. Morton, 1 ♂ (TWD); — Canal Zone, Barro Colorado Island, 25-III-1965, W.D. Duckworth, 1 ♀ (NMNH); — TRINIDAD, N Valencia, 13-IV-1965, T.W. Donnelly, 1 ♂ (TWD); — ECUADOR, Napo, Limoncocha on Rio Napo, 300 m, larva, XI-1980, emerged 1-XII-1980, M.J. Westfall (FSCA).

Etymology. — *diapyra* is Greek, meaning "fiery coal", referring to the brilliant red-orange coloration of males.

DIAGNOSIS. — By its generally reddish coloration very similar in overall appearance to *C. perrensi* and *C. amazonica* but differs from those species by dark brown basal wing veins and reddish tibiae. Male further distinguished by strongly projecting genital lobe, narrow ventral hamular process of anterior hamule, and slightly longer, hairier, and differently shaped cerci. Penis unique by being widest in the genus and with paired spiny patches of dorsal process of terminal segment divergent and visible in ventral view.

MALE (holotype). — Entirely reddish-brown, relieved only by narrow black lines on abdominal sutures and black distal one-eighth of femur, proximal one-eighth of tibia, last tarsal segment and claws of each leg.

Wings very faintly suffused with light brown, veins uniformly brown to black. Pterostigma medium brown above and below. Membranule dark gray. Radial sector forks at about one-fourth the length of the pterostigma in FW and barely past the proximal end of the pterostigma in HW, 2 rows of cells within the fork for its entire length. Cubito-anal crossveins 5-5-4-4; 5-5-4-4 cells in supratrangles and 6-5-4-4 in triangles; anal loop with 9-10 cells; 24-24-15-15 antenodal cross-

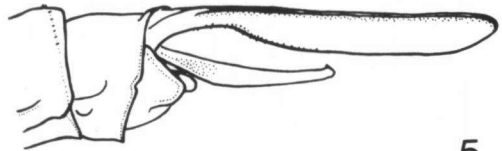
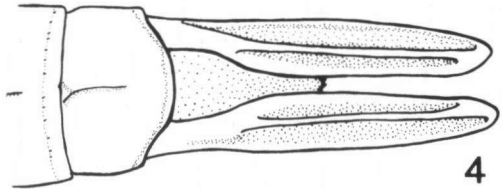
veins; 13-15-16-16 postnodal crossveins; 4-3-3-3 bridge crossveins; pterostigma surmounts 2.5 to 3.6 cells.

Group of tiny denticles at middle of posterior edge of abdominal segment 1. Genital lobe smooth, rounded, strongly projecting in lateral view. Auricles with two black posterad-pointing teeth visible from side. Spines of anterior lamina bladellike, parallel, curved up to point on straight upper edge. Ventral hamular processes 1.1 mm long, narrow throughout length but widest at rear. Cerci almost straight on outer edge, narrow at base and abruptly expanded at 0.2 length on mesal edge to widest at 0.3-0.4 length, rounded at tip; low dorsal ridge from 0.3 length to tip; row of dense, dorsad-projecting hairs about one-third width of cercus along entire mesal edge; in lateral view, arched at base, then straight to tip. Epiproct narrows quickly to blunt point, reaching 0.5 length of cerci; curved upward from base to tip.

Measurements (mm). — Total length including cerci 75, abdomen without cerci 50, cerci 6.3, hindwing 46, pterostigma of FW 3.8, pterostigma of HW 3.5

FEMALE (allotype). — Head entirely reddish. Pterothorax reddish-brown, washed with green. Abdomen entirely reddish, with brown suture lines. Femora reddish-brown, black on distal third and that of foreleg greenish on anterior surface; tibiae and tarsi black, except distal 4/5 of hind tarsi brown.

Wings hyaline, suffused with yellowish from base to nodus; veins dark brown. Pterostigma light brown above and below. Membranule gray-brown. Radial sector forks at about one-third the length of the pterostigma in FW



Figs 4-6. *Coryphaeschna diapyra* sp.n. (La Selva, Costa Rica): (4) dorsal view of male appendages; — (5) lateral view of male appendages; — (6) lateral view of female abdomen tip.

and barely past the proximal end of the pterostigma in HW, 2 rows of cells within the fork for about 10 cells, then 3 rows for last 4 cells. Cubito-anal crossveins 7-8-4-5; 6-5-4-4 cells in supratrangles and 5-5-5-4 in triangles; anal loop with 12 cells; 26-24-17-18 antenodal crossveins; 12-12-15-17 postnodal crossveins; 4-4-3-3 bridge crossveins; pterostigma surmounts 3.0 to 4.0 cells.

Measurements (mm). — Total length 74, abdomen 55, hindwing 51, pterostigma of FW 4.5, pterostigma of HW 4.0. End of abdomen illustrated in Figure 6.

VARIATION. — The penis (examined in two paratypes from La Selva, 12-13 August 1967) is much like those of other *Coryphaeschna* species, but the terminal segment is relatively wider. The flattened dorsal process of the terminal segment is elevated above the segment by a median process, and the pair of darkened spiny patches on the dorsal process diverge distally, their rounded tips visible in ventral view. The male appendages, hamules and abdominal base in Figures 4-5, 7 and 9 are based on a paratype from La Selva, 13 August 1967.

There is little variation in coloration in adults but substantial ontogenetic change. As postmortem changes often obscure coloration, I base this discussion on notes taken from living dragonflies, both in the field and in the hand. Some of them are documented by photographs.

Mature males from La Selva were uniformly colored, on the orange side of bright red, some with a hint of green on the thorax and the lower parts of the eyes tan. Females from Taboga and La Selva typically had eyes reddish-brown but varied to yellow-orange, red-brown above and green below, and green with some reddish above; face typically reddish but orange in one; thorax green and abdomen reddish-brown, one individual with segments 1 and 2 and lateral base of 3 greenish. Perhaps males showing green were not fully mature.

Two-day-old teneral males from Taboga were colored as follows: eyes gray; face dull greenish, more brownish above; top of frons green, T-spot brown; labium green, rear of head yellow; prothorax brown with greenish tinge, pterothorax green, with brown suture lines; brown triangle surrounding dorsal carina with apex dorsal; abdominal segment 1 brown anteriorly and dorsally, green posteriorly and ventrally; 2 brown dorsal one-third, remainder green; 3 green beneath on anterior half, brown above and posteriorly; rest of abdomen brown, narrow yellow ring just posterior to lateral carina on 3-7; middorsal hairline of yellow-green on 2 and black on 3-8; cerci and epiproct brown; femora and tibiae brown, the former black distally; tarsi blackish.

The male from Belize was colored rather similarly, but the eyes were blue above and green below. The male from Quintana Roo, Mexico, was similar but had yellow-orange eyes with a limited area of reddish above and an orange face, and the tibiae and base of femora were reddish-brown. The female from the same place and time was colored exactly like the males except her eyes were greenish with the same dorsal reddish area, and her tibiae were very dark reddish brown (the only individual of the species in which the tibiae were not clearly reddish).

The two northern males differed from those from Costa Rica by having the apical third rather than eighth of the hind femur black.

Female specimens may darken to brown, with no visible green. In the oldest ones, with very brown wings, the hind tibiae are dark, almost black.

Variation in measurements (mm). — Male abdomen 48-53 (mean 51.1, N=27), hind wing 46-53 (mean 49.8, N=42). Female abdomen 50-58 (mean 54.3, N=28), hind wing 48-53 (mean 50.7, N=40).

COMPARISON WITH CONGENERS. — *C. diapyra* is superficially most similar to *C. perrensi* and *C. amazonica*, the only other species in which mature males are entirely reddish and virtually lack conspicuous markings. It differs structurally by its prominent genital lobes (Figs 9-10), narrow ventral hamular processes (Figs 7-8), and more constricted cerci (Figs 5-6). From their narrow bases, the cerci begin to expand at about 0.2 length, whereas in *perrensi* and *amazonica* the expansion begins at about 0.1 length. *C. diapyra* also differs from these two species and all other *Coryphaeschna* except *ingens* by the conspicuous long hairs along the inner edge of the cerci. Oddly, in a few specimens of both *diapyra* and *ingens* these hairs are missing; perhaps they can be rubbed off, either in life or during collection. The penis is unique in the genus (see above).

There are subtle differences in life coloration between *diapyra* and *amazonica*, with which it occurs. *C. diapyra* appears to be redder, the mature males with no trace of green on eyes, head, thorax, or abdomen. Although male specimens of *amazonica* look essentially reddish-brown, most if not all show green on at least eyes and thorax in life (see below).

Female specimens of the two species are very similar but usually can be distinguished by the combination of brown wing veins and reddish-brown hind tibiae in *diapyra*, reddish basal wing veins and black hind tibiae in *amazonica* (and *perrensi*). Distinction is complicated because the tibiae are very dark brown in the oldest individuals of *diapyra*, and the basal wing veins are brown in *amazonica* in parts of northern South America. Also, immature adults of all red species have pale reddish wing veins. However, female *amazonica* have a faintly indicated T-spot and a dark mesepisternal dash; female *diapyra* lack these markings.

If the ontogenetic change in coloration and partially green females in these two red species (and *perrensi*?) are phylogenetically significant, the group is probably derived from a green ancestor.

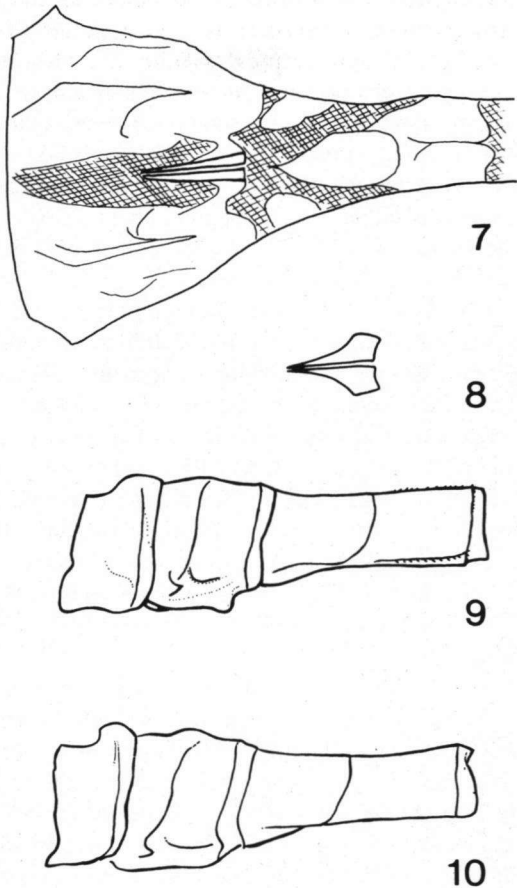
DISTRIBUTION. — The northernmost specimens I examined come from Nayarit in western Mexico and Quintana Roo in eastern Mexico. CALVERT (1956) cited two *perrensi* from Atoyac, Veracruz, examined at an earlier time, that I consider *diapyra* from his illustration (CALVERT, 1905), and J.J. Daigle (in litt.) collected a male *diapyra* still farther north at Cascadas Micos, north of Ciudad Valles and east of highway 85, San Luis Potosí, 25 June 1990. To the south *diapyra* is known from Belize, Honduras, Costa Rica, and Panama, although only in Costa Rica has it been found common — and there, only in a small part of Guanacas-

te Province and around Puerto Viejo, Heredia Province. No specimens have been taken in the southwestern part of Costa Rica, around Rincón de Osa, from which 6 specimens of *C. amazonica* are known.

From the Canal Zone of Panama I examined 3 specimens of *diapyra* and 23 specimens of *amazonica*. The only South American specimens of *diapyra* I have seen were from Trinidad and Ecuador, but this is surely the undescribed species DE MARMELS (1989) cited from Venezuela. There are few specimens of red *Coryphaeschna* in collections from the western part of the Amazon basin, and they include a *diapyra* from Ecuador and two *amazonica* from southern Peru. The two species probably overlap over a large area in northern South America, but the details of distribution and possible ecological differences remain to be worked out.

BIOLOGY. — Perhaps the most peculiar property of this species was the abundance of each sex at one of the localities where I found it common but not the other.

Males were common at La Selva in September 1966 and April and August 1967. They flew in sexual patrol flights over two grassy marshes surrounded by primary forest. They typically flew 2-3 m above both tall grass and open water, their territories averaging about 6 m in length. Only occasionally did the flight paths of two males intersect, at which time they would ascend rapidly into the air together, quickly separating and each returning to its own territory. They were



Figs 7-10. *Coryphaeschna* species. *C. diapyra*, sp.n. (La Selva, Costa Rica): (7) ventral view of male abdomen base, with hamular processes; — (9) lateral view of male abdomen base. — *C. amazonica* De Marmels (Rincón de Osa, Costa Rica): (8) ventral view of male hamular processes; — (10) lateral view of male abdomen base.

present during sunny periods both morning and afternoon but would cease flying whenever the sun became obscured by clouds. During sunny periods in September, two females were seen ovipositing in grass just below the water surface.

Males were replaced at one marsh almost as rapidly as I collected them. Twenty-three were collected at one marsh as they flew patrol flights over a three-day period, yet about the same number (4-5) were present on my last as on my first visit. Clearly the site was sufficiently large for only that many males, and there was either a large population of "floaters" or the turnover in territorial individuals was high during the course of a day. I saw only one female at La Selva, on 23 September 1966.

Contrarily, at Hacienda Taboga only females were common during frequent visits in the rainy season from 6 July to 30 September 1966. On many visits, *C. diapyra* was the most commonly seen diurnal (as opposed to crepuscular) aeshnid. They flew about over pastures on sunny days, often in mixed swarms with congeners, and oviposited in shallow grassy marshes. At this locality, in the relatively dry part of Costa Rica, a few male *diapyra* were seen at a seldom-visited forested swamp, a habitat more like the forest marshes at La Selva than the open marshes elsewhere in the Taboga area. This was clearly breeding habitat, as two just-emerged males were collected there on 30 September. I assume larval development took place rapidly in the shallow marshes of the area and that adults could emerge in September from eggs laid in May, the usual beginning of the rainy season.

Several additional young males were seen in the dry forest at Taboga on 26 October, but none was identified through the end of the year and into the early part of the next, although a few large *Coryphaeschna* were seen on a November visit. The next seen were single mature males in wooded areas — where perhaps they spent the dry season — during May 1967, and both males and females became common and reproductively active by mid June, several weeks after the rainy season started. By late June, females were again much more in evidence than males, and I estimated 20 in a grassy marsh of < 0.5 ha in area. They oviposited in herbaceous plant stems both above and below the water level. By early July, males again were virtually absent from the marshes where females oviposited and the open hillsides where they foraged. Females were still common during my last visit in mid August.

Both sexes of *C. diapyra* were abundant in coastal scrub at Akumal, Quintana Roo, in April 1990, along with *C. viriditas*. Like many other tropical species, I suspect the adults spend the dry season in forested areas and move back to seasonal wetlands to breed when the rains begin. The known flight season is 25 March to 1 December.

THE OTHER RED SPECIES OF *CORYPHAESCHNA*

Coryphaeschna amazonica DE MARMELS (1989) was described from a single specimen from Venezuela and later found to be numerous in French Guiana (MACHET, 1991). It was distinguished from *C. perrensi* by the following characters: (1) occipital triangle shorter and more recessed; (2) cerci longer; (3) epiproct narrower; (4) costa almost black beyond nodus (red to pterostigma in *perrensi*); (5) pterostigma shorter (costal edge, front wings, 4.3 mm vs. 5 mm in *perrensi*); and (6) triangles longer (costal edge, front wing, 7 mm vs. 6 mm in *perrensi*). The drawings of the penes of the two species in DE MARMELS (1989) are quite different, and De Marmels (in litt.) further stated the two were readily distinguished by penis structure and the presence of a T-spot and thoracic markings in *amazonica*.

Table I
Characters of male *Coryphaeschna amazonica* and *C. perrensi*

Population		CERC	EPBA	EPMI	PTER	TRIA	COSTA
Panama <i>amazonica</i> (N=10)	Mean	5.67	1.52	0.95	4.53	6.84	brown to
	SD	0.25	0.08	0.07	0.31	0.13	reddish-brown
Surinam <i>amazonica</i> (N=6)	Mean	5.88	1.48	0.95	4.55	6.97	brown to
	SD	0.17	0.08	0.11	0.24	0.10	reddish-brown
Paraguay <i>perrensi</i> (N=10)	Mean	5.63	1.56	1.00	5.11	6.47	red
	SD	0.32	0.07	0.09	0.27	0.32	

CERC = length of cercus; - EPBA = width of epiproct at base; - EPMI = width of epiproct at midlength; - PTER = length of costal side of pterostigma in forewing; - TRIA = length of costal side of triangle in forewing; - COSTA = coloration of costa between nodus and pterostigma.

I examined 52 male and 24 female specimens of *perrensi*-type dragonflies from Costa Rica to Peru and Paraguay to determine the distribution of and differences between *amazonica* and *perrensi*. Males in the north (Costa Rica and Panama to Surinam, northern Brazil [Pará, Amazonas] and southern Peru) have the costa typically brown beyond the nodus and the dorsal process of the terminal segment of the penis flattened, with separated patches of black spines; these are *amazonica*. Those from southern Brazil (Sao Paulo, Rio Grande do Sul) and Paraguay have the costa red to the pterostigma and the dorsal process of the terminal segment of the penis with the same patches vertically oriented, parallel and almost touching; these are *perrensi*, originally described from Corrientes, Argentina (McLACHLAN, 1887).

Other than these obvious differences, the two species are very similar, and the differences in proportions pointed out by DE MARMELS (1989) are very slight. Neither the cercal length nor the epiproct width differs between *amazonica* and

perrensi, although *amazonica* does have a slightly shorter pterostigma and longer triangle (Tab. I). Certain venational counts differ between the two species, but there is much variation in these characters within each species of the genus (Tab. II).

Table II
Venational characters of *Coryphaeschna* species
[Means of counts of both wings; *C. guyanensis* omitted]

Species	N	CUF	CUH	SUF	SUH	TRF	TRH	ANF	ANH	POF	POH	BRF	BRH	LOO	PTF	PTH
Males																
<i>adnexa</i>	10	5.3	3.9	4.1	3.8	3.8	4.0	18.3	12.9	9.6	11.7	3.3	2.9	7.7	2.7	2.6
<i>amazonica</i>	10	6.5	4.1	5.1	4.3	5.3	4.4	23.2	15.9	12.9	15.2	4.1	3.4	9.4	3.7	3.3
<i>apeora</i>	5	5.7	4.2	5.2	4.4	5.6	4.4	22.5	14.9	12.2	14.1	3.9	3.4	9.1	3.6	3.5
<i>diapyra</i>	10	6.4	4.2	5.4	4.5	5.5	4.3	22.9	15.6	13.8	16.3	4.2	3.3	9.6	3.6	3.2
<i>ingens</i>	10	5.7	4.1	4.7	4.2	4.4	4.2	20.9	14.9	10.2	12.7	3.2	2.9	9.7	3.5	3.3
<i>perrensi</i>	9	5.3	4.0	4.7	4.1	4.0	4.1	20.3	14.1	10.6	12.6	3.3	2.9	9.3	3.6	3.3
<i>viriditas</i>	10	5.4	3.9	4.7	4.2	4.6	4.2	21.5	15.3	12.3	14.5	3.7	3.2	9.1	3.9	3.7
Females																
<i>adnexa</i>	9	5.2	3.9	4.1	3.9	3.9	4.0	19.0	13.4	10.6	12.4	3.5	2.8	8.3	2.9	2.7
<i>amazonica</i>	9	5.9	4.1	5.4	4.5	5.2	4.3	22.8	15.6	12.3	14.3	3.9	3.4	8.8	3.7	3.3
<i>apeora</i>	2	5.8	4.5	5.8	4.8	5.5	4.3	23.5	15.0	13.8	15.8	4.0	3.0	9.8	4.4	3.9
<i>diapyra</i>	10	6.3	4.3	5.0	4.0	4.3	4.1	22.7	15.4	13.5	16.7	3.9	3.2	10.4	3.5	3.1
<i>ingens</i>	10	5.5	4.1	4.9	4.2	4.2	4.0	20.2	15.0	9.7	12.2	3.0	2.8	9.3	3.6	3.2
<i>perrensi</i>	6	5.4	4.0	4.8	4.3	4.3	4.2	20.4	14.4	11.3	14.1	3.4	2.9	10.6	3.7	3.4
<i>viriditas</i>	10	6.1	4.1	4.9	4.4	4.8	4.3	23.1	16.3	12.8	15.6	3.8	3.0	10.9	3.9	3.4

CU = cubito-anal crossveins; - SU = cells in supratriangle; - TR = cells in triangle; - AN = antenodal crossveins; - PO = postnodal crossveins; - BR = bridge crossveins; - LOO = cells in anal loop; - PT = cells under pterostigma; - F = forewing; - H = hindwing.

To me the penes of the two species (6 *amazonica* and 5 *perrensi* examined) are quite similar, not so different as shown by DE MARMELS (1989, figs 146-147, 153-154), but the differences in the dorsal surface of segment 3 are diagnostic. In addition, the two species apparently differ in coloration, females more than males.

Male *amazonica* from Rincón de Osa, Costa Rica, looked very reddish in flight, but a green tinge on the thorax could be seen at close range. In the hand,

two males had green eyes, one with a red tinge and the other with more substantial reddish on the upper surface; thorax greenish, overlain by red-brown anteriorly and on metepisternum; face reddish; abdomen red-brown, posterior half of segment 1 greenish. Some males, perhaps younger ones, had an almost entirely green thorax.

A male *amazonica* collected at Santa Isabel, Rio Negro, Amazonas, Brazil, 7 July 1922 (UMMZ), was described as follows: eyes brown on top, green below; face (presumably frons) light brown, mouth (labrum) dark brown; lower jaw (labium) green; thorax light reddish-brown on top, shading gradually to pale green on lower sides; legs black with little dark brown at bases; abdomen light reddish-brown on top, getting gradually darker and more red toward the appendages; sutural bars black; a light bar on segments 2-9, sides same as top; appendages brown. I have seen no descriptions of the life coloration of male *perrensi*, although specimens look entirely reddish.

J. De Marmels (in litt.) pointed out that females of the two species were readily distinguishable by pattern. Most of those I examined from Central America and northern South America (*amazonica*) show a faintly indicated T-spot the same brown color as the frons but delineated by greenish on either side of it. In some Surinam specimens the T-spot is a more contrasty darker brown, almost as conspicuous as in species such as *viriditas*. The same T-spot is faintly indicated on three of six southern females (*perrensi*) as well. The mesepisternum in *amazonica* has a dash-shaped mark representing a remnant of the mesepisternal stripe in other *Coryphaeschna*, as described by MACHET (1991). The youngest males I examined from Panama also show the mesepisternal dash faintly, although it is obviously lost in mature males. Two old females from Panama and an old female from Peru also show no indication of the dash, perhaps because of age or discoloration. No trace of this marking is evident on specimens of either sex from Paraguay and southern Brazil (*perrensi*).

A mature female *amazonica* from Tambopata Nature Reserve, Madre de Dios, Peru, 23 December 1986 (DRP), was accompanied by a photograph. The eyes were reddish above, green below, and light blue at the hind margins. The entire face was green, the top of the frons bluish on either side of the T-spot (not visible in photo, if present). The pterothorax was entirely bright green, with brown mesepisternal dash and suture lines. Segment one of the abdomen was mostly green, segment two evenly mixed brown and green, segment three greenish anteroventrally, and the rest of the abdomen (partly mud-covered) was light brown on the middle segments, darkening to black at the posteriormost segments.

Live and well-preserved female *amazonica* are mostly green, while female specimens of *perrensi* look all reddish; it remains to be determined whether the latter shows any hint of green in life.

The wing-vein coloration of female *amazonica* varies geographically. Five mature females from Panama, one from Madre de Dios, Peru, and one from

Amazonas, Brazil, have the basal wing veins reddish about to the nodus, while 10 from Surinam and one from Pará, Brazil, have the same veins brown to reddish-brown. The difference is striking and appears to be independent of age of the female or season.

CALVERT (1956) listed 15 specimens of *C. perrensi* from 12 localities in Panama, Peru, Brazil, and Paraguay (two from Mexico I consider *diapyra*, see above). SANTOS (1969) listed 29 specimens from 17 localities in Brazil and Uruguay. CARVALHO (1992b) examined 84 specimens from southern Brazil, but did not list localities. There is no way to determine which of these were *perrensi* and which *amazonica*, except by supposition, as the two species seem to be allopatric. I examined 76 specimens of the two species from 23 localities, of which only those asterisked below were mentioned in earlier publications.

C. amazonica – COSTA RICA, Puntarenas Prov., Rincón de Osa, 12/13-XI-1966, D.R. Paulson, 3 ♂ (DRP, FSCA); 10-IV-1968, W.W. Benson, 1 ♂ (DRP); 28-II/5-III-1969, 2 ♂ (DRP); – PANAMA, Canal Zone, Barro Colorado Island, 23-VII-1950*, R.B. Cumming, 1 ♂ (FSCA); 29-V-1970, E.S. Morton, 2 ♂ (TWD, DRP); 30-VI-1972, M. Perrone, 1 ♀ (DRP); 23-VII-1972, M. Perrone, 1 ♀ (DRP); 31-XII-1972, M. Perrone, 2 ♂ (DRP); 20-I-1973, M. Perrone, 3 ♂ (DRP); 12-II-1973, M. Perrone, 5 ♂ (DRP); Canal Zone, Pipeline Road, 8/15-VIII-1960, T.W. Donnelly & E.S. Morton, 2 ♂ (TWD); 15-III-1970, E.S. Morton, 1 ♀ (TWD); Canal Zone, Summit Gardens, 11-IV-1970, E.S. Morton, 1 ♂ (TWD); – Canal Zone, Gatun River, 27-VIII-1950, R.B. Cumming, 1 ♂ (FSCA); – Canal Zone, Rio Sandanilla, 5-XII-1916, 1 ♂, 1 ♀ (FSCA); – Canal Zone, Gamboa, Gatun Lake, 5-VIII-1920, J.H. Williamson, 1 ♀ (FSCA); – no other data, 1 ♂ (FSCA); – SURINAM, Stondansi, 24/26-IX-1962, J. Belle, 3 ♂ (JB, DRP); – Zanderij, 17-III-1957, J. Belle, 1 ♂ (JB); 26-VI-1958, J. Belle, 1 ♀ (JB); 7-III-1959, J. Belle, 1 ♀ (JB); 21-X-1962, J. Belle, 1 ♀ (DRP); – Republick, 29-III/4-IV-1957, J. Belle, 2 ♂ (JB); – Rýsdýkweg, 24-II-1957, J. Belle, 1 ♀ (JB); 7-III-1957, J. Belle, 1 ♂ (JB); 6-IV-1957, J. Belle, 1 ♀ (JB); – President Kennedy Hwy, 10/17-III-1957, J. Belle, 4 ♀ (JB); 26-VII-1958, J. Belle, 1 ♀ (JB); – PERU, Madre de Dios, Tambopata Nature Reserve, 30 km SW Puerto Maldonado, 2-VI-1983, M. Frisbie, 1 ♂ with exuviae (DRP); 23-XII-1986, P. Donahue, 1 ♀ (DRP); – BRAZIL, Amazonas, Manaus, 15-VI-1922, J.H. Williamson & J.W. Strohm, 1 ♀ (UMMZ); – Amazonas, Santa Isabel, 7-VII-1922, J.W. Strohm & J.H. Williamson, 1 ♂ (UMMZ); – Pará, Belem, 9-VIII-1922, J.H. Williamson & J.W. Strohm, 1 ♀ (UMMZ). – Flight season all year.

C. perrensi – BRAZIL, Sao Paulo, Barueri, 7-III-1956, K. Lenko, 1 ♂ (FSCA); – Rio Grande do Sul, Pelotas, 17-III-1956, 9-I-1957, 2-I-1958, 19-I-1958, all C. Biezanko, 3 ♂, 1 ♀ (FSCA); – PARAGUAY, Sapucay, XII-1899, II-1900, III-1900, 12-II-1903*, 9-III-1903*, all W.T. Forster, 9 ♂, 3 ♀ (USNM, UMMZ); – Paço-Yobay, 18-I-1939, 1 ♂ (FSCA); – Guairá, Villarica, 15/20-III-1939, 1 ♂, 2 ♀ (FSCA); – Central, Aregua, 28-XI-1979, L. Strickman, 2 ♂ (DRP); – Itapua, San Benito/Pastoreo, 23-I-1980, L. Strickman, 1 ♂ (DRP). – Flight season 28 November to 20 March.

VARIATION IN *CORYPHAESCHNA*

The genus *Coryphaeschna* comprises 7 or 8 species rather similar in characteristics. *C. guyanensis* Machet, 1991, remains known from only a single specimen, apparently identical to *adnexa* except for thoracic pattern. Its validity has been questioned (J. De Marmels, in litt.), and it is excluded from discussion in this paper. Table III shows the size variation within the genus: the hind wing

length and abdomen length of the smallest species, *C. adnexa*, are 74% and 75% respectively of that of the largest species, *C. ingens*. Body proportions vary slightly: relative abdomen length (mean abdomen length/mean hind wing length) in males is shortest in *perrensi* and *diapyra* (1.03) and longest in *adnexa* (1.11), in females shortest in *amazonica* (1.02) and longest in *ingens* (1.12).

Density of venation varies within the genus but not sufficiently to define species (Tab. II); slight average differences do not

allow distinctions, as variation is substantial. For example, mean forewing antenodal counts differ by 4.6 in the species at the extremes of the genus, and the average difference between any pair of species is 2.5 (N=21). However, the same counts in my relatively small samples vary within species by 5-8 veins (mean 6.0). Both *diapyra* and *apeora* are relatively densely veined, while *adnexa* is relatively open veined.

Penis structure has been little used in aeshnid systematics, for example not in generic monographs (WALKER, 1912; WILLIAMSON, 1923; LIEFTINCK, 1968; BELLE, 1989). BELLE (1989: 261) in fact stated "The accessory genitalia are conversely of little importance since they show no or hardly differences in closely allied species." Nevertheless, each of the species of *Coryphaeschna* can be distinguished by penis structure (see Key). The lack of emphasis on this organ in aeshnid systematics may be in part because the penis is scarcely visible in dried specimens without special treatment, and the visible (ventral) surface of segment 3 of the penis in many *Coryphaeschna* looks very similar. The characters differentiating the species of *Coryphaeschna* are best expressed on the dorsal surface of this segment, which is difficult to see even when the penis is extended. For systematic studies of some aeshnid genera, it may be necessary to remove the penis from the specimen to examine it adequately. I found that *Coryphaeschna* penes maintained their structure best in alcohol-preserved specimens and acetone-dried specimens but were more distorted in air-dried specimens.

Table III
Measurements of *Coryphaeschna* species
[*C. guyanensis* not included]

Species	Males			Females		
	Mean	SD	N	Mean	SD	N
	ABDOMEN LENGTH					
<i>adnexa</i>	44.1	1.33	26	46.7	1.48	13
<i>amazonica</i>	49.5	2.65	22	52.2	1.00	16
<i>apeora</i>	56.3	2.11	5	62.0	1.41	2
<i>diapyra</i>	51.2	1.24	27	54.3	1.76	30
<i>ingens</i>	58.6	1.71	34	63.9	1.19	9
<i>perrensi</i>	50.4	1.65	13	54.2	0.84	5
<i>viriditas</i>	54.0	1.55	24	57.6	2.15	22
	HIND WING LENGTH					
<i>adnexa</i>	39.9	0.97	54	42.3	1.06	22
<i>amazonica</i>	48.5	2.29	31	51.1	1.39	18
<i>apeora</i>	53.4	1.95	5	56.0	1.41	2
<i>diapyra</i>	49.8	1.59	42	50.8	1.43	42
<i>ingens</i>	54.2	1.06	43	57.1	0.91	12
<i>perrensi</i>	48.0	1.53	17	52.5	0.84	6
<i>viriditas</i>	51.6	1.65	38	54.4	2.47	28

Table IV
Male *Coryphaeschna* character-state matrix

[Each character state is assigned a number, with 1 equalling the most common state and successively higher numbers for less common states. Where two numbers are separated by a hyphen, the character varies in the species (with the more common state first). *C. guyanensis* is omitted. See key and text for penis character states]

Species	Character state												
	A	B	C	D	E	F	G	H	I	J	K	L	M
<i>adnexa</i>	2	1	2	3	1	3	1	1	2	1	1	1-2	3
<i>amazonica</i>	1	1	1	1	3	2	2	4	3	1	1	3	1
<i>apeora</i>	1	1	1	2	1	1	4-1	1	2	2	1	2	1
<i>diapyra</i>	2	2	2	1	1	2	2	2	3	1	2-1	3	1
<i>ingens</i>	1	2	1	1	1	1	1	3	1	3	1	1	2
<i>perrensi</i>	1	1	1	1	2	2	2	2	3	1	1	3	1
<i>viriditas</i>	1	1	1	2	1	1	1	1	2	2	1	1	2

- A - hamular process of anterior hamule: 1 = greatly widened at anterior end; 2 = rather narrow throughout
- B - male cerci: 1 = widest beyond middle; 2 = widest at or before middle
- C - male cerci: 1 = long hairs not conspicuous along mesal edge; 2 = long hairs conspicuous along mesal edge
- D - male epiproct: 1 = about half length of cerci; 2 = distinctly more than half length of cerci; 3 = distinctly less than half length of cerci
- E - costa: 1 = brown; 2 = red; 3 = brown, then red
- F - face: 1 = green; 2 = red; 3 = blue
- G - T-spot: 1 = distinct; 2 = absent; 3 = indistinct; 4 = obscured by brown
- H - pterothorax: 1 = almost entirely green; 2 = red; 3 = green and brown striped; 4 = red overlain by greenish
- I - pterothorax sutures: 1 = wide brown line; 2 = narrow brown line; 3 = unmarked
- J - inner part of mesepisternum: 1 = unmarked; 2 = spot present; 3 = arm of humeral stripe
- K - tibiae: 1 = black; 2 = red
- L - basic color of abdomen: 1 = black; 2 = brown; 3 = reddish
- M - markings on middle abdominal segments: 1 = dark suture lines only; 2 = narrow pale middorsal stripe and rings at anterior end, middle and posterior end, connected or almost connected at their lower ends by ventrolateral pale stripes; 3 = narrow pale middorsal stripe and rings at middle and posterior end

I have summarized other characteristics that can be used to distinguish species of the genus in Table IV. With the great structural similarity of some of the species, life coloration of mature adults (evident in well-preserved specimens) is an important aid in identification. All species can be distinguished by combinations of morphological and color-pattern characters.

KEY TO THE SPECIES OF *CORYPHAESCHNA* BASED ON PENIS STRUCTURE
(*guyanensis* omitted)

- 1a No dorsal process on terminal segment of penis, instead a pair of prominent flagella *adnexa*

- 1b No flagella, but a dorsal process on terminal segment of penis, typically with paired spiny patches 2
- 2a Dorsal process cylindrical, projecting beyond tip of segment *ingens*
- 2b Dorsal process not cylindrical, projecting or not 3
- 3a Dorsal process folded, so spiny patches at right angles to surface of segment, parallel and close together *perrensi*
- 3b Spiny patches horizontally oriented, if parallel not close together 4
- 4a Dorsal process prominently elevated above segment by medial connection, visible from ventral view 5
- 4b Dorsal process flush with or slightly elevated above segment, not visible from ventral view 6
- 5a Spiny patches divergent and widely separated distally, tips visible from ventral view *diapyra*
- 5b Spiny patches parallel, only medial connection visible from ventral view *apeora*
- 6a Dorsal process slightly elevated by obvious medial fold; spiny patches long and narrow, convergent and approximated distally *viriditas*
- 6b Dorsal process flat; spiny patches shorter and broader, parallel or convergent *amazonica*

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