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LIFE HISTORY NOTES ON SOME WEST INDIAN COENAGRIONINE DRAGONFLIES (ODONATA)

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In the following pages I wish to bring together some scattered notes and observations on the life histories of a number of West Indian damselflies observed during five recent visits to the West Indies.

In 1930, while on an airplane trip to Paramaribo and back, I did a little collecting at the stops made in Cuba, Hayti, Puerto Rico, Trinidad, and British Guiana. Most of the nymphal material obtained on this trip was turned over to Dr. Elsie Broughton Klots, and was used by her in the preparation of her fine paper on the Odonata of Puerto Rico, but there were questions left open concerning certain of the nymphs of Coenagrioninae.

In 1935 I spent the months of February and March in Puerto Rico collecting jointly with Dr. Julio García-Díaz in all the principal streams of the Island. The Odonate material thus obtained, in the collecting of which Dr. García fully shared, was used by him in his excellent paper; "An Ecological Survey of the Fresh Water Insects of Puerto Rico: I. Odonata," published in the JOURNAL OF AGRICULTURE OF THE UNIVERSITY OF PUERTO RICO, 22: 43–97, 1938. Still there remained unknown the nymphs of several genera.

In 1937, on the kind invitation of Dr. Thomas Barbour, I spent the month of April at the Atkins Institution of Harvard University, Soledad, near Cienfuegos, Cuba, collecting and rearing dragonflies. In that work I was greatly aided by two members of the staff of the Botanical Garden; Mr. Walsingham and Mr. Parsons. The results there obtained were incorporated in part in my paper with Dr. Elizabeth Fisher on The Nymphs of Libellulinae that was published in *Trans. Amer. Entom. Soc.*, 62: 107–116, 1 pl., 1936. In part they will be used in the following pages to fill several gaps that still remained.

In 1939 I went again to Cuba, accompanying Dr. J. C. Bradley. We went by automobile, first to Soledad. While there we were taken by the director of the Garden, Mr. David Sturrock, on a very delightful and profitable trip eastward into the Trinity Mountains, where we found good collecting.

We then went to the Agricultural Experiment Station at Santiago de las Vegas, where we joined four members of the Station staff in a collecting trip to the western province of Piñar del Rio. Dr. C. S. Bruner, Chief entomologist of the Station, Dr. J. Acuña, Mr. L. de Zayas and Mr. Leon Bouclé were the ones who went with us, lending us great aid by their knowledge of the country and assisting us in many other ways. Dr. Acuña proved adept at catching adult dragonflies. On the results of that trip I have as yet published only one small paper; a life history of *Neoneura carnatica* (*Entom. News,* 50: 241–245).

In 1940 I spent a second semester (February to May inclusive) teaching in the University of Puerto Rico, and while there I devoted much of my spare time to further rearing and study of Coenagrionine dragonflies. Then I went with Dr. and Mrs. Julio García-Díaz to Santo Domingo for the month of June. We were continuously in the field, collecting and rearing Odonata. We went by automobile, all over the Republic, guided and aided by good friends who live there, and the result was a real harvest of new material. The following pages will present an account of some of it.

The life histories and habits of the West Indian species of four genera are to be dealt with in the following pages: *Hypolestes, Lestes, Enallagma,* and *Leptobasis.* Nymphs of the genera *Protoneura* and *Microneura* even yet have not been found.

HYPOLESTES

To find nymphs of this genus was one of my chief purposes in going to Santo Domingo. Arrived in Barahona, I was very fortunate in obtaining the aid of Mr. George Hamor, and under his guidance Dr. García-Díaz and I were taken into what appeared to be the very headquarters of *Hypolestes.*

The place was Palomino cañon; a steep-walled rocky cleft in the northeast foothills of the Barahuco mountain range. At the head of this cañon is the spring-fed source of the water that the city of Barahona uses for drinking purposes. It is about 15 miles out of Barahona; some two miles northward over the good main highway, and then perhaps 13

miles generally westward over a rocky road, just passable by automobile, up the cañon.

The Palomino river in its course runs around a great flat topped hill, and then across an outwash plain to join the Rio Yaque del Sur. The first part of our rough road up it lay among the outwash cobblestones in the dry stream bed. Then the road mounted the side of the big hill roller-coaster fashion, crossed the upland level, and then descended again toward a living stream of water that here went rushing downward through a narrow rocky gulch. Leaving the car on the down slope of the hill, a short walk brought us to the water supply intake. Here the crystal stream was heavily shaded with trees and vines, and the air was cool and humid, and here we collected *Hypolestes:* adults in numbers and easily, and nymphs, a few, by dint of much searching among the rocks in the swift waters.

The first dragonfly that I saw here was a *Hypolestes.* It was sitting calmly on a trailing vine at my feet with wings *quite horizontally outspread.* I stood stock still, and with extreme care planned the stroke that landed the specimen in my net. Such caution proved to be wholly unnecessary, for it made no effort to elude me. Soon we were finding others, and taking them with ease. Every few steps along that shaded streamside pathway, another one would rise and flutter slowly away and quickly settle again.

The adult *Hypolestes* is easy to catch; the easiest of all the Odonata that I have ever taken. It sits quietly in the shade with wings outspread, and when flushed from one restingplace it flies quickly to another near by; and instead of seeking the shelter of denser vegetation, it perches again, apparently by preference, on the most exposed leaf or spray, and again stupidly awaits approach. No strategy at all is needed for securing specimens. Indeed, I found that by approaching very slowly and cautiously I could catch specimens with my fingers. After using a net long enough to insure a good lot of specimens, I caught a number more of them bare handed.

It was not so easy to collect nymphs. After an hour or more of fruitless searching among the big rocks in the swiftest water I finally found one nymph among smaller stones in a riffle that was overspread with leaf drift. Then I settled down to explore this riffle: I placer-mined it, so to speak. I held a screen in the outwash, and stirred the stones above it, picking the nymphs from the material carried by the water on to the screen. Mr. Hamor assisted me with this, and we

together obtained ten nymphs. They live among the stones, clinging to the rough surface on the lee side.

The only other Odonate nymphs found in the course of our search at this place were a few specimens of *Macrothemis celeno* and a single one of *Scapanea frontalis.*

Afterward Dr. García-Díaz and I found *Hypolestes* occurring sparingly in three other parts of the Island, all on the north side of the central mountain range:

1. On the Maymon river just above its crossing of the Duarte Highway (Route 1) and near Piedra Blanca. This was just north of the divide and at an altitude of about 800 feet. Here I found a single cast nymphal skin sticking to the exposed top of a boulder in the stream bed a few inches above the water. Then I caught a few adults among the streamside vegetation.

2. On the Bajamillo river in the pine lands among the hills near San Jose de las Matas. Here two nymphs were sifted from among coarse gravel and small stones in the river bed, and one adult was taken in a nearby arroyo.

3. On a small river, Nigua near San Francisco de Macoris, far northward and at a much lower elevation, I got one more nymph. Sr. Alberto García Godoy, who was our guide to this place, lifted a small boulder from the river bed and this lone specimen was found clinging to the rough surface of the stone. No others were found, though many boulders were lifted and searched for them.

Thus *Hypolestes* appears to be very localized, but rather widely distributed in the island, where suitable conditions of environment remain.

The nymph of Hypolestes was described and figured by me in 1911 (*Entom. News,* 22: 137) from specimens in the Museum of Comparative Zoology. The best I could do at that time toward identifying it was to label it "An unknown nymph from Jamaica." However, I mistakenly associated it with nymphs of the Calopteryginae, because at that time damselfly nymphs having such inflated gills and lacking raptorial setae on the labium were known only in members of that group. The size and habitat of the nymph together with such venational characters as I was able to make out in the wing pads of one imperfectly preserved specimen would have justified its reference to *Hypolestes;* but I have waited thirty years for further evidence.

In January, 1934, when my naturalist colleague Dr. E. L. Palmer was visiting Jamaica I asked him to go up the Wag Water River (the

source of the M. C. Z. material) and try to find it there. After considerable searching of stones in that turbulent stream he found a single specimen that is now in the Cornell University collection. Unfortunately it was too young to show wing venation.

Now the evidence is adequate even though no nymph has been reared under control; for 1) nymphs and adults have been found together at their season of transformation in one locality in some numbers where no other Zygopterous nymphs were present, and 2) there is complete accord between the two stages in all venational characters.

The details of structure are well enough shown in my figures of 1911, but the figure of the whole nymph was reproduced from a photograph of an incomplete specimen—the best one then available. A new whole figure (Fig. 1), drawn by Dr. May Gyger Eltringham, is herewith presented.

LESTES

Four species of *Lestes* have been reported from the West Indies; none of them from Santo Domingo. In the course of my collecting in that country I found three of them: *L. forficula* was common in nearly every pond in which I did any collecting at all; *L. spumarius* I found in two very different localities; and of *L. scalaris* I saw but a single specimen, and that I took from a spider's web. Nymphs of two of the four species appear to have been made known hitherto, and I got the nymphs of the other two in Santo Domingo. Doctor P. P. Calvert adequately described and figured the nymph of *L. forficula* from Antigua (1928, 12: 8), with brief comparative notes (p. 9) on the nymph of *L. tenuatus*, reared by himself in Costa Rica. I reared the nymphs of *L. spumarius* from both of the above mentioned localities, and collected exuviae of what I take to be the fourth species *L. scalaris*. Nymphs of both are described herewith.

Dr. Elsie B. Klots (1932, p. 76) has given a key for the separation of the four species, together with adequate figures. I herewith add

A KEY TO THE NYMPHS

1.—The middle hinge of the labium extends backward only midway between the bases of the middle legs.....*tenuatus* *
—This hinge extends backward beyond the bases of the middle legs.....2.
2.—Mental setae of labium 4-5 each side; gill tips pale.....*forficula*
—Mental setae of labium 6 each side; gill tips blackish.....*scalaris*
—Mental setae of labium 7 each side; gill tips broadly black.....*spumarius*

* *Teste* Calvert 1927, p. 9.

Lestes spumarius Selys

This species is distinguishable from the others by its larger size (hind wing 22 mm.). Adults are more sluggish and easier of approach than other species. The superior appendages of the male are strikingly different in being much longer, not incurved to their very end, but extended beyond their point of incurvature in a pair of slender parallel tips. Adults are found in the midst of rather dense vegetation, growing in shallow permanent pools. In a pool near the mouth of the Jicomé river off the Monte Christi road, where the water was very muddy but not stagnant, I found them in a hip-high growth of *Polygonum sp. ?* hanging to the stems above the water. Nymphs were in the submerged tangle of the same stems, beneath. Transformations were taking place a few inches above the surface of the water.

I found them even more abundant in a clear-flowing mountain stream in Arroyo Sabana Miguel, near San José de las Matas. The brook was overgrown with tall weeds and rushes. A loose pile of dead brush in the midst of a stream pool was the place of greatest abundance.

The nymph may be described as follows:

Length 19 mm. plus gills 8 additional; hind femur 4; width of head 4; of abdomen 2.5.

This is a greenish species, heavily overlaid with brown. The labium (Fig. 2) is of the usual Lestine form with three lateral setae, two of which are on the movable hook, and with seven mental setae. The antennae are pale with a brown terminal segment; the relative length of the segments from the base outward is as 6:8:10:9:8:7:6. Underparts pale.

The legs are pale with brown knee-caps, femora and tibiae faintly striped with brown and with a suggestion of a subterminal ring of brown on the former. The wing cases reach backward hardly to the fifth abdominal segment. There is a wash of brown along the costal margin of each that is darkest at nodus and stigma.

The abdomen is cylindric, diffusely crossbanded with brown on the apices of the segments. There are lateral spines on segments five to nine. The one on five is small but distinct. There is a double line of paired darker dots bordering a pale middorsal stripe, and there is a submarginal longitudinal line of darker brown each side. This lateral band is widened on each of the middle segments to inclose a pale spot on each segment at its rear margin.

The gills (Fig. 2*a*) are widest before the middle, and regularly taper thereafter to bluntly rounded apices. They are heavily overlaid with brown, that color being darkest along the axis and in two diffuse cross bands one before and one beyond the middle, and there is a small brown spot on the broader side of the inequilateral base. The apical area is pale.

Lestes scalaris Gundlach

This species appears to be rather rare and local. Dr. Julio García-Díaz and I, in two months collecting in Puerto Rico found a very few specimens in two localities. In Santo Domingo I collected a single adult specimen, and that one with the aid of a spider: I found it entangled in a spider's web. The web was attached to an emergent weed that stood in the edge of a mountain pond near El Llano, province of Puerto Plata. The fine male specimen was still living, well colored, and quite adequate for determination.

Lower down on this same weed was the empty skin from which a *Lestes* had emerged. It looked as if it might once have belonged to my adult specimen until I noticed that it was the skin of a female! Nevertheless, it looked different from *L. forficula*—the other *Lestes* occurring at this pond—and on closer examination it proved to be different. Wherefore I am describing it here, and attributing it by supposition to *L. scalaris*.

The following description is based on the above mentioned cast skin.

Length 18 mm., with gills 10 mm. additional; abdomen 12; hind femur 4.

The skin is very transparent, and shows hardly any color pattern except for a narrow darkening of the joinings of the leg segments and of the abdomen. The labium (Fig. 3) is armed with the usual three lateral setae and with six mentals each side. Of the latter the fifth is a little smaller and the sixth very much smaller than the others. The middle prominence on the outer end of the lateral labial lobe between the movable hook and the end hook is itself hooklike, and not at all squarely truncated as in most other species.

The abdomen is armed with sharp lateral spines on segments 5 to 9. The gills are well enough pigmented to show a definite color pattern, but the condition of the middle gill is apparently the result of loss and regeneration; for it is only two fifths as long as the others, and is nearly colorless. The lateral gills (Fig. 3*a*) are rather heavily pigmented along the axis. The apical third of the gill is wholly suffused with brownish. The basal two thirds is paler, with two touches of brown on each margin,

and with a brown cloud on the lower broader basal angle. The gills are narrowed beyond the middle, and in their apical third the sides are nearly parallel, with the apex rounded.

This nymph differs from that of *L. forficula* in having six mental setae instead of four, in having the middle portion of the end of the lateral labial lobe more hook like, and in the general distribution of pigment of the gills.

ENALLAGMA

Five species of this genus have long been known from the West Indies.* They may be distinguished as follows:

A KEY TO THE SPECIES

Adults (males only)

1.—Abdominal segment 8 black, 9 blue; excessively slender.....*truncatum*
—Abdominal segments 8 and 9 both blue, at least dorsally.....2
2.—Body dark blue or purple or violet and black; inhabits running water...*coecum*
—Body light blue and black; pond species.....3
3.—Face all yellow.....*cultellatum*
—Face pale with crossband of black on postclypeus.....4
4.—Humeral stripe of black about as wide as the pale stripe before it; postocular pale spots narrow, transversely elongated.....*doubledayi*
—Humeral stripe of black much narrower than the pale stripe before it; postocular pale spots roundish.....*civile*

Nymphs

1.—Gills about as long as abdomen.....*truncatum*
—Gills much shorter than abdomen.....2
2.—Gills with heavy crossbands of brown.....*coecum*
—Gills without distinct cross bands of brown.....3
3.—The spinulose border of the gill ends midway of its length.....*cultellatum*
—The spinulose border ends beyond the middle.....*doubledayi*
—The spinulose border ends before the middle.....*civile*

The nymphs are less known than the adults. Those of three West Indian species that occur also in the United States have been described from there. They are:

1. The nymph of *E. civile*, by myself and T. D. A. Cockerell in *Psyche*, **10**: 137, 1903 from New Mexico.

2. The nymph of *E. coecum*, by myself (as "Leptobasis sp.?"; an incorrect placement by supposition) in *Proc. U. S. Nat. Mus.*, **27**: 718, 1904.

* This is omitting for the present *Enallagma cardenium* Selys, generally considered a variety of *E. coecum* Hagen.

3. The nymph of *E. doubledayi*, by Garman in his Odonata of Connecticut, p. 71, 1927.

These three species were again briefly characterized by Byers (1930) in a table of Florida nymphs, and again correctly diagnosed by Klots (1932) in a key to West Indian nymphs. Also, Dr. Julio García-Díaz (1938) in his excellent paper on Puerto Rican Odonata redescribed the nymph of *E. coecum*, and added the first description and figures of the then recently discovered nymph of *E. cultellatum*.

I wish now to add a few notes on distribution and habits of each of these species, together with a description of the nymph of the one remaining species, *E. truncatum*.

Enallagma truncatum Gundlach

This rare little Cuban damselfly, the slenderest of its genus, I collected and reared at Soledad. The place was a little weedy pond just north of Mr. Gray's house and outside the Botanical Garden. The shore where I got it was densely overgrown with the long half-floating and densely intertwined stems of a panic grass (*Panicum barbinode*). The buoyancy of the floating mat of grass stems would almost support one's weight, and collecting was difficult for it was hard to push the net through the tangle of stems. Mr. Pastor of the Garden gave me much assistance.

Among the many dragonfly nymphs obtained from this pond on the eighth of May 1937 (most of which were Libellulinae) the few that I got of the above named species were very inconspicuous. In fact I did not observe them in the field at all; but when the contents of my collecting pail were dumped out in a white dish of clean water on my laboratory table their long gills and peculiar posture * at once attracted my attention. A nymph standing on a submerged grass blade would elevate its abdomen and spread out its long lanceolate gills in perfect imitation of the swaying of slender leaves in the water. When disturbed its swimming was very like that of the larger *Lestes:* sudden darts and dashes from place to place with the swiftness of a minnow, but for a distance of only six or eight inches at each shift. I obtained but one full grown nymph along with several smaller ones. The grown one was nearly ready for transformation and I put it at once in a rearing cage. That was on the eighth of May, and I was to leave for home on the

* The posture is very like that of the nymph of *Platycnemis annulata*, that I figured in my "Dragonflies of China," Plate 18, figure 5*b*.

twelfth. Early in the morning of the twelfth I peeked into the cage, and to my great disappointment saw that it was still a nymph with no sign of immediate transformation. At the end of my packing up that forenoon I went to the cage for the last time with a vial of alcohol in hand, ready for its preservation, and to my great delight, saw that it was out of its old skin and had its adult wings fully expanded. I could allow it half an hour more to develop its color pattern before leaving for the airport and home; and as the very last act on departure I preserved it with its cast nymphal skin. The adult is a fine male specimen. From the cast skin the following characterization of the nymph is drawn.

The nymph measures in length of body 11 mm.; gills 7.5 additional; abdomen 7.5; hind femur 3; width of head 3; of abdomen 2.

The single cast skin available for description shows no color pattern at all except in the gills, and their pattern as shown in figure 4*a*, is fainter than it appeared in life. The labium (Fig. 4) is slender, with four lateral and three mental raptorial setae each side. The antenna seems to be but 6-jointed, with the joints in length about as 8:9:10:9:8:7. Perhaps the last joint represents the usual two terminal segments, which in other species are often weakly differentiated.

The gills are as long as the entire abdomen, widened posteriorly to their terminal fifth, with their margins in life slightly undulating, then contracted to a rather slender point. The serrated margin ends indistinctly at about the first third of their length and the only vestige of a transverse joint is a blackish mark on the gill axis. Beyond this there are three indefinite crossbands of darker coloration, one nearby, one where the gill begins to narrow, and a broader and more diffuse one between these two; all are mere filmy clouds that tend to be darkened a little on the gill margins.

The younger specimens show no more color pattern in the body than does the cast skin.

Enallagma coecum Hagen

This is a lotic species, found in practically all the streams of the Greater Antilles. I have found it the dominant species in every stream in which I have collected in Puerto Rico, Santo Domingo and Cuba, more abounding than any other Odonate whatever. It is distinguishable from other Enallagmas first of all by its darker color; dark blue, or purple, or violet striped with black. Females are sometimes green. The humeral black stripe is constricted at its upper end near the crest,

and widened by a quadrangular dilation to rearward in its lower fourth. Unfortunately, in dried specimens most of the color pattern may disappear through post-mortem changes, and as in the other species of the genus, it may become overcast with dull black.

It differs in flight also from the others. It is swifter and more elusive. When flushed by the streamside, if not taken at the first stroke of the net it is likely to escape altogether among the weeds, where it hides, and becomes undiscoverable among the dark shadows.

The species was first described by Hagen (1861, p. 84) as *E. coecum* from St. Thomas and Cuba. Later Hagen sent Cuban specimens to de Selys bearing the manuscript name *E. cardenium,* and Selys (1876, p. 530) described them under that name as a new variety. Meanwhile Scudder (1866, p. 189) had described the living colors of specimens he obtained in the Isle of Pines under the name *E. coecum.* Hagen after examining Scudder's specimens said (1873, p. 373) they were certainly *E. cardenium.* Calvert (1919, p. 350) made a careful study of all museum material available and presented figures showing such differences as he was able to discover. He concluded that *cardenium* could not be considered to be more than a variety of *coecum.* Dr. Klots (1932, p. 97) concurred in this opinion, and gave a full bibliography for the species, which need not here be repeated.

My Puerto Rican specimens come from places not far distant from nearby St. Thomas, the type locality. They show two slight trends in the form of the superior appendages of the males that differ somewhat from my Cuban specimens. The "sky-line" of these appendages in lateral view is nearly straight from end to end whereas the Cuban specimens show it more or less sagged in the middle. Also, the lower so called branch of that appendage is longer and the angle between it and the upper branch is narrower than in the Cuban specimens; and in the latter the lower branch is shorter and broader, and the angle between the branches is wider, often approaching a right angle.

There are little differences in other parts of the male superior appendages. The inferior "branch" is rather a broad downwardly projecting and incurving plate. As viewed obliquely from above it may appear rounded or truncated at the tip. It changes its appearance with each directional change of viewpoint. It may be subject to warping or other distortion in drying for its inner surface is but little chitinized. On the inner side of the upper branch at its base there is a little chitinized obliquely placed ridge whose margin may be entire or may be cut in one to four minute denticles.

Unfortunately these differences occur in individuals from the same lot and locality.

I have collected scores of specimens from widely scattered points in Cuba, in Santo Domingo and in Puerto Rico, and have reared specimens from each of these islands. I find no differences whatever in the nymphs of the entire range, and no characters by which I can set off even a variety with assurance. I have not used the name *cardenium* in this paper because I have not been able to segregate material to which to apply it. I have come to consider that all my material belongs to one highly variable species. My Dominican specimens cover the entire range of variation. They come from all parts of the Island; from southern streams in Barahona; from La Toma, the spring-fed source of San Christobal's water supply; from Aguas Muertas River near San Juan; from Maymón River near the Duarte Road crossing the central mountain range; from Jimenoa River near Jarabacoa, and from a number of streams near San José de las Matas farther north in that range; from Jicomé River in the wide valley toward Monte Christi; from rice field ditches at Vanega near Santiago and others southward of San Francisco de Macorís; from Chavón River near San Pedro de Macorís, and other rivers between Seibo and Higüey; and elsewhere.

Enallagma cultellatum Selys

Among the pond inhabiting species of Enallagma, *E. cultellatum* is easily recognized even in flight by the bright yellow color of its face. In Lake Tortuguero, Puerto Rico, where first found in 1935 by Dr. Julio García-Díaz and myself, I observed something of its habits. Females were laying their eggs in the floating leaves of *Nymphoides humboldtianum,* and on this plant only. Each female in ovipositing would perch on the leaf margin facing inward. Curving her abdomen downward and forward around the edge of the leaf with the upturned ovipositor she would make punctures in the under surface and insert an egg in each of the punctures.

In the ponds of the Botanical Garden at Soledad in Cuba, where *Nymphoides* was lacking I observed females placing their eggs in like manner in the elliptical floating leaves of a water weed *Potamogeton fluitans.* The seed spikes of this species, rising an inch or two above the surface of the water, were favorite perching places.

In Santo Domingo I found *E. cultellatum* only in the southernmost province of Barahona. It occurred sparingly in two lagoons of the plain some miles northwest of Barahona City: Laguna de los Caballeros

and Laguna Chacón. It was quite common in Laguna Fundación which is a bit of an abandoned channel in the lower flood plain of the Río Yaque del Sur a few miles from its mouth. In all of these places its most habitual Coenagrionine associate was *Ischnura ramburii*.

In flight *E. cultellatum* keeps well out from shore, beyond the denser vegetation of the water's edge, and perches on the low emergent tips of isolated water weeds close to the water. It is an artful dodger and a bit wary, and it generally flies so close to the water's surface that collecting it with a net is difficult. One is more apt to dip water with his net than to get his specimen. It is much more easily taken with a light, long-handled swatter.

I observed a curious bit of its behavior at one of the ponds in the Garden at Soledad. There was a bed of *Potamogeton fluitans,* well besprinkled with fruiting spikes protruding above the water, and there was one of these spikes about half an inch taller than the others, and on that account, a favorite perch for several low-flying Odonata. The species that dominated the situation and that occupied this perch most of the time was the Libelluline, *Micrathyria aequalis;* but our little yellow-faced *cultellatum* also liked that perch and was a persistent contender for it. Although driven from the immediate vicinity by repeated charges of a dragonfly many times its own size, *cultellatum* would dodge around its big opponent, keeping just out of reach. As soon as the *Micrathyria* was settled again on the top of the seed spike, the little *cultellatum* would reappear, darting here and there, keeping so close to the surface of the water as to be unapproachable from the air by a Libelluline. Soon it would slip up to the perch from the rear and settle itself on the side of it just above the water line and within an inch or two of the *Micrathyria* seated on the top. This caused the *Micrathyria* evident annoyance; for it would rise in the air, wheel about and come charging down directly toward the little fellow, driving it away again.

This I saw happen again and again while I quietly collected nymphs at the shore near by. Clearly the *Micrathyria* was trying to drive the little intruder from his domain; and it looked as if the little fellow was enjoying the big fellow's discomfiture. Among Corduline dragonflies I have seen a small and agile *Tetragoneuria* pestering a big *Epicordulia* in flight, darting all about it, keeping out of its reach and driving it from the neighborhood (much as a kingbird may embarrass and drive away a crow), but I had never before seen two such contenders as these for the same perching place.

Enallagma doubledayi Selys

This species, that is so common in the southeastern United States, is apparently very uncommon in the West Indies. I have not collected it there, and the only specimens that I have seen from that source are a few that were collected at Placelas, Santa Clara Province, Cuba by Dr. J. Acuña, and kindly sent me by Dr. C. S. Bruner.

Enallagma civile Hagen

This widely ranging species is generally distributed about the borders of ponds in all the Greater Antilles, but I have nowhere found it very common there. It is much more abundant in many places in the United States. In stature it is larger than any other of the West Indian species of the genus, and it shows a brighter blue coloration. In Santo Domingo I found it in places as different as the little mountain pond in the north coastal range at El Llano, and in the ditches of the rice fields near sea level. Being a good flyer it strays widely from the place of its nativity, and is one of the first damselflies to appear in newly constructed ponds. I found it in a new-made (second season) concrete pool behind the Biology Building on the campus of the University of Puerto Rico. Its associates there were strong flying Anisoptera: *Pantala flavescens, Tramea abdominalis,* and *Orthemis ferruginea.*

LEPTOBASIS

Until my last trip to Santo Domingo in 1940 I had not seen this dainty little damselfly alive, and the poor little faded specimens that I had seen in various collections had given me no idea whatever of its singular beauty of coloration. Old faded teneral specimens stuck on pins—their bodies hardly wider than the pins that impale them—have hardly more color than bits of broomstraw. I had a delightful surprise, therefore, when on a collecting trip with Dr. Julio and Mrs. García-Diaz on June fifteenth we found a colony of *Leptobasis vacillans* Selys.

The place was a pool in the Jicomé River near its junction with the Yaque del Norte, perhaps half way between Esperanza and Monte Christi. The pool was a mere dilation in the river. It was half overgrown with jointweed (*Polygonum* sp.?). Elsewhere in this lower sluggish portion of the stream no rooted aquatic vegetation was seen; but this pool was excluded from surrounding pastures by fences, and so, was exempt from trampling by cattle. The water in it was muddy, due to inflow from the pastures. The surrounding floodplain soil prob-

ably contained some salt; for cattle were seen licking at the white deposits left upon the baked mud where shallow pools had completely evaporated.

Dr. Garcia-Diaz first discovered the dainty little damselfly under cover of some low bushes that grew on a bank beside this pool. First he saw a mere shadow flit from one twig to another. Then he captured a red male; then a red female; then a green female, and then the hunt for more was on!

The coloration of *L. vacillans* in life has an elegance and a brillance that would never be suspected from an examination of the usual museum specimens. The younger red specimens are a rich carmine above shading off to honey yellow beneath in male and female alike. Darker markings are confined to mere hair-lines of black on the edges of the carinae about the wing roots, a Y-mark on the top of the prothorax, a small streak on the top of each side of the head beside a lateral ocellus, and a cross line on the apex of each of the middle abdominal segments. The legs are pale yellow with a touch of black above each knee and with black spines.

I speak of these red specimens as "young" ones with confidence, because I have watched their assumption of this color after emergence from the nymphal skin. They are a very pale yellow on emergence but very quickly become bright red on the dorsum. Later, if they escape their many enemies, they undergo a very remarkable change of coloration and look so different that I took the first I found to represent a different species.

It appears from Dr. P. P. Calvert's account of this species in *Biologia Centrali Americana* (p. 221) that he had the same impression when he began comparing red specimens with black-and-green ones. He could find no structural differences between them. Lacking intermediates, he called the maturely colored specimens by the appropriate descriptive name, var. *atrovirens*. In my own more extensive lot of freshly gathered material both young and old specimens are present, together with intermediates; and the latter seem to show that the color differences merely indicate age differences. The color changes are limited to the top of the head and face and to the front and sides of the thorax. They run parallel in the two sexes.

The prettiest specimens are found among the intermediates in age. The mantle of red overspreading head and thorax changes to olive green, with stripings upon the synthoracic dorsum of rich golden amber brown, that will later change to deep black. Of the three broad stripes

one is middorsal and two overlie the humeral sutures. The three at maturity become united across the crest sharply delimiting and circumscribing the intervening stripes of green. The top of the head and prothorax also partake of the same color changes. A small greenish twinspot on the middle lobe of the prothorax takes on when older a slightly yellowish tinge. Two specimens that may possibly be older than any of the others, have the stripings of a purplish color, overcast with a small measure of pruinosity.

The midventral spine on the eighth abdominal segment of the female is very weak or frequently altogether wanting.

By collecting among the weed beds of the Jicomé River pool I found that that was the place from which the adults were emerging. Very pale teneral specimens fluttered away when the weeds were invaded: only tenerals and red specimens were found in the weeds, and their flights were mainly shoreward. The older green and black forms were found out among the bushes on the banks, and they are much less easily captured. I was unable to see any of them until they took flight. Then it was necessary to catch them quickly; for when flushed from one resting place they would go ever deeper into the clumps of bushes and after two or three short flights would invariably be lost.

I found the nymphs clinging to the submerged stems of *Polygonum;* not in the mats of floating algae, and not on the bottom. They climb just above the surface of the water for transformation. Their most abundant Odonate associates were nymphs of *Lestes spumarius,* some of which were found transforming at the same time. Three other Zygoptera were found there sparingly: *Enallagma civile, Enallagma coecum,* and *Ischnura ramburii.*

Other localities in which I later found *Leptobasis* in Santo Domingo were Arroyo Sabana Miguel near San José de las Matas, and a brook in a pasture near Castillo, eastward from San Francisco de Macoris.

Leptobasis vacillans, nymph reared

Length 10 mm. plus gills 5 mm. additional; hind femur 3; width of head 3; of abdomen 2.

This is a slender little nymph (Fig. 5), brownish or greenish in color, with faint longitudinal streaks of darker color along the sides of the whole body. The legs are pale brownish with hardly any indication of darker bandings. The antennae are about as long as the head is wide: the seven segments are in relative length about as 6:7:10:8:6:6:5. They are very pale beyond the two basal segments. The labium is

moderate, the hinge reaching backward just to the middle coxae. The mentum widens rather regularly from the hinge forward. It is armed with five lateral and five mental setae. The end of the lateral lobe is as shown in figure 5*a*.

The wings reach backward well upon the fifth abdominal segment. The gills (Fig. 5*b*) are lanceolate, long pointed, widest at three fourths their length. The serrate-spinulose border before it ends in a triangular denticle. The tracheation is rather wide-meshed and very irregular, as shown in the figure.

Two specimens one of each sex, collected at Arroyo Sabana Miguel, three miles northwest of San José de las Matas on June 22nd, transformed in my cages on June 24th.

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EXPLANATION TO THE FIGURES

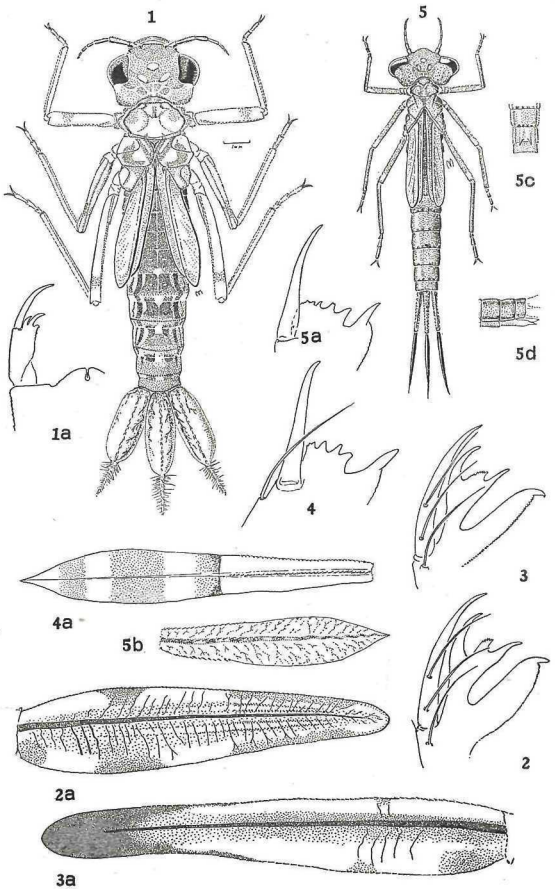
FIG. 1. *Hypolestes clara* Calvert, whole nymph; 1*a*, end of labium showing median and lateral lobes.

FIG. 2. *Lestes spumarius* Selys, lateral lobe of the labium; 2*a*, median caudal gill.

FIG. 3. *Lestes scalaris* Gundlach, lateral lobe of the labium; 3*a*, lateral caudal gill.

FIG. 4. *Enallagma truncatum* Gundlach, end of lateral lobe of labium; 4*a*, median caudal gill.

FIG. 5. *Leptobasis vacillans* Selys, whole nymph; 5*a*, end of lateral lobe of the labium; 5*b*, median caudal gill; 5*c*, male, and 5*d*, female, end of abdomen showing sex characters of the nymph.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