

BULLETIN
OF THE
FLORIDA STATE MUSEUM

BIOLOGICAL SCIENCES.

Volume I

Number 4

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FROM THE PANAMA CANAL ZONE
(ODONATA: COENAGRIIDAE)**

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and
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UNIVERSITY OF FLORIDA
Gainesville
October, 1956

The numbers of THE BULLETIN OF THE FLORIDA STATE MUSEUM, BIOLOGICAL SCIENCES, will be published at irregular intervals. Volumes will contain about 250 to 300 pages, and will not necessarily be completed in any one calendar year.

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All communications concerning purchase or exchange of the publication should be addressed to the Curator of Biological Sciences, Florida State Museum, Seagle Building, Gainesville, Florida. Manuscripts should be sent to The Editor, Department of Biology, University of Florida, Gainesville, Florida.

Published October 30, 1956

Price for this issue \$.25

TWO NEW SPECIES OF *PHILOGENIA* FROM THE PANAMA
CANAL ZONE (ODONATA: COENAGRIIDAE)

MINTER J. WESTFALL, JR. AND ROBERT B. CUMMING¹

The junior author, while on a collecting trip to the Canal Zone and the Republic of Panama during the summer of 1950, several times had occasion to visit Barro Colorado Island, the Canal Zone Biological Area of the Smithsonian Institution. On one of these visits a single male *Philogenia* was taken near a small, rapid stream in dense rain forest. It was not realized that this individual represented an undescribed species until the material collected on the trip was later studied in more detail at the University of Florida. On a trip to Panama during December 1950 and January 1951, another effort was made to collect *Philogenia* on Barro Colorado Island. As a result five specimens of this genus were procured representing a second undescribed species, but no more individuals of the first species were obtained. These two new species are described in this paper.

The most important paper to date on *Philogenia* is Calvert's (1924) summary of the genus. We have found this work to be invaluable, and believe that it must form the basis for any future studies of *Philogenia*. We have patterned our illustrations after those of Calvert so that this paper can be used with greater facility in conjunction with his.

*Philogenia zeteki*² sp. nov.

HOLOTYPE.—Male, fully mature, collected on Barro Colorado Island, Panama Canal Zone, August 30, 1950, by Robert B. Cumming. Deposited in University of Florida Collections. (See figs. 1 to 3.)

DESCRIPTION OF HOLOTYPE.—*Head*.—Dorsal surface of head blackish brown with definite metallic reflection. Indistinct lightened area behind antenna on each side between lateral ocellus and adjacent compound eye. Antennae dark brown. Clypeus black. Labrum light blue green, shades to yellow on proximal fifth; distal border brown. Lateral surface of mandibles blue green and yellow. Genae shining, highly polished, blackish brown dorsally, shade through brown to yellow ventrally. Median lobe of labium black with slender yellowish-brown

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²This species is named for James Zetek, resident manager of the Canal Zone Biological Area, whose enthusiastic aid made possible the collection of the original material on Barro Colorado Island.

stripe down center, proximal and lateral parts become yellowish brown. Lateral labial lobes blackish brown. *Thorax*.—Pronotum and mesepisternum light brown. Proepimeron and mesinfraepisternum black. Metinfraepisternum brown. Sides of thorax below humeral suture blackish brown except as follows: Narrow light brown stripe on middle three-fifths of border of mesepimeron along humeral suture; light brown stripe on anterior corner of mesepimeron between mes- and metinfraepisterna and bordering first lateral suture for anterior third its length; narrow light brown stripe along first lateral suture for about one-fourth its length and slightly above its center; metepimeron bordered in light brown except at posterior extremity. Ventral part of thorax and leg bases almost completely covered with pruinosity. Legs light brown with darker brown on distal ends of femora. Prothoracic tibiae and tarsi dark brown. Wings hyaline except for tips which have borders of dark brown 1 mm. wide. *Abdomen*.—Dark brown with anterior end of each segment slightly lighter. Faint suggestion of narrow, light-brown or yellow stripe down midlateral surface of segments one and two, yellow spot on side of anterior end of segment three, followed (after an interrupting area of dark brown) by yellow streak, which gradually fades out and ends about halfway back on segment three. Abdomen darker posteriorly; segments seven through ten and abdominal appendages black. Conspicuous spot of pruinosity on dorsum of segment nine. Segment ten bifid dorsally for posterior half its length; margins of incision rounded. *Superior abdominal appendages*.—Length 1.5 mm., about twice as long as segment ten. In dorsal view almost straight, of uniform width and parallel to each other in basal two-fifths, thence strongly incurved to apices which overlap each other. In distal three-fifths each appendage greatly enlarged to about twice as wide as basal width. In profile view upper and lower margins almost straight and parallel in basal two-thirds of appendage. In distal third, appendage narrowed and bent ventrad to rounded apex; small mesial tooth on ventral margin, its base about one-fifth as wide as appendage. *Inferior appendages*.—Length 1.1 mm., about three-fourths as long as superiors, bases terminate distally about mid-length of superiors and proximal ends extend farther cephalad than superiors. In ventral view each appendage narrowed for about three-fifths its length to a width about one-fourth its basal width, thence it continues almost straight caudad without further narrowing for additional fifth its length; terminal fifth diverges at angle of about 40° and narrows to rounded point. In profile view each appendage abruptly decreases in thickness for about proximal two-thirds its length; terminal third a slender, sharp process, at first directed slightly ventrad,

thence curves dorsad with terminal one-fifth of appendage parallel to base of superiors. *Measurements*.—See table.

REMARKS—By Calvert's key to *Philogenia* (1924), this species goes to couplet H-HH (*raphaella* and *berenice*), but differs from Calvert's figures 50 and 51 of *raphaella* in that the inferior appendages are divergent at the apices in ventral view and curved slightly dorsad in profile view instead of being straight and parallel; it differs from figures 46, 47, and 48 of *berenice* in that the inferior appendages in ventral view are acute and divergent at the apices, not truncated and parallel. The type locality of *P. raphaella* is Bogota, Colombia, and the type locality of *P. berenice* is Equitos, in the Amazon drainage of Peru. From a study of Calvert's figures 21 and 22 of *P. helena* from Bogota, Colombia, it would seem that this species is a near relative of *P. zeteki*. These species do not appear close together in the key. *P. helena* is segregated by the second couplet since the slender apex of the inferior abdominal appendage describes an arc of more than 90° when seen in ventral view. The tip of the inferior appendage in *P. zeteki* is also divergent, but describes an arc of only 40° and is acute at the apex, not expanded as in *P. helena*. *P. helena* is also much larger in size than *P. zeteki*, the abdomen being 48 mm. long in *P. helena* as opposed to 41 mm. in *P. zeteki*, and the hind wing being 44 mm. long in *P. helena* as opposed to only 34 mm. in *P. zeteki*.

Photostats of the original drawings were submitted to Calvert for study. In a letter he has suggested that *P. zeteki* might be the unknown male of either *P. expansa* or *P. lankesteri* from Costa Rica. At present we cannot entirely rule out this possibility. Considering the restricted range of the known species of *Philogenia*, it seems very likely that *P. zeteki* is neither *P. expansa* nor *P. lankesteri*. In 1924 when Calvert's *Philogenia* paper was published, no species was known to have been collected from two localities more than 100 kilometers apart, and Calvert considered specimens taken 160 kilometers apart as probably distinct on the basis of locality. Rácenis (1953) extended the known range of a single species of the genus when he recorded for *P. cassandra* localities in Venezuela which are over 200 kilometers apart. This, however, is still not an extreme distance, and it appears that geographical distribution is still a valid factor to take into consideration when designating new species in this group. In his description of *P. lankesteri*, Calvert (1924: 52) states the following:

The unassociated males of *Philogenia* which one would first seek to associate specifically with these females are those of *P. championi* from the southern slopes of the Volcan de Chiriqui, Panama. The distance between this locality and Cachi

in a straight line is about 160 kilometers (100 miles) with a cordillera, rising to 3000 meters (9800 feet) and more, between. The dimensions of *championi* males, the only features comparable to those of the females, agree just as well with those of the females referred to *carrillica* and *expansa* as with those of *lankesteri*. The best course, therefore, seems to be to designate these structurally different, un-associated females by distinct names until males associated with them are found.

Barro Colorado Island is, of course, much farther from Cachi (about 450 kilometers in a straight line) than is Volcan de Chiriqui, and is separated from it by the same mountains and others. This is also more than twice as far as the 200 kilometers previously mentioned as the greatest presently known range for any one species of *Philogenia* (Rácenis, 1953).

In the summer of 1952, the senior author visited the Academy of Natural Sciences, Philadelphia and compared the holotype of *P. zeteki* with the holotypes of *P. lankesteri* and *P. expansa*. In addition we have borrowed paratypes of both species from the Academy for further detailed study at the University of Florida. As Calvert pointed out, size seems to be the only comparable character for associating the sexes in this genus. The females of *expansa* and *lankesteri* are within a size range so that either could be associated with *zeteki* from the standpoint of this character. We can find, however, no other character which would tend to indicate that *zeteki* is one of these species.

*Philogenia leonora*³ sp. nov.

HOLOTYPE.—Male, collected on Barro Colorado Island, Panama Canal Zone, December 27, 1950, by Robert B. Cumming. Deposited in University of Florida Collections.

ALLOTYPE AND PARATYPES.—Allotype, female, collected December 27, 1950; paratypes, one male, collected December 20, 1950, and two females collected December 26 and 27, 1950; all from Barro Colorado Island, Panama Canal Zone, collected by Robert B. Cumming. Allotype and paratype male (the latter with the last three abdominal segments cleared in sodium hydroxide and stored in alcohol) deposited in University of Florida Collections; one paratype female (December 27) deposited in Academy of Natural Sciences, Philadelphia; other paratype female (December 26) deposited in Williamson Collection, Museum of Zoology, University of Michigan. (See figs. 4 to 9, and 12.)

³This species is named for Leonora K. Gloyd who has been very generous in advising us on some of the Panamanian material.

DESCRIPTION OF HOLOTYPE.—*Head.*—Dorsal surface of head light brown with slight metallic reflection; frons, anterior to antennal bases, black. Narrow dark-brown lines form network to give reticulated appearance to top of head (lines may be produced by internal structures). Posterior part of head behind compound eyes dark brown above, light brown below. Antennae light brown basally, become dark brown on distal third of second segment. Postclypeus dark brown, anteclypeus light brown to yellow. Labrum dark blue green with distal border striped with dark brown, proximal border bears yellow stripe. Lateral surfaces of mandibles bluish grey. Median lobe of labium black distally, proximal part becomes yellow. Lateral labial lobes dark brown.

Thorax.—Pronotum mostly light brown, becomes dark brown to black on hind margin of posterior lobe and ventrolateral margin of anterior lobe. Proepimeron dark brown, hind margin darker. Mesepisternum chestnut brown with reddish cast, middorsal and alar carinae black. Short impressed area on upper part of humeral suture dark brown. Mesepisternum mostly dark brown, chestnut brown along much of dorsal margin. Anteroventral corner of mesepimeron between mes- and metinfraepisterna yellowish, light color extends along first lateral suture about three-fourths its length. Metepisternum dark brown anteriorly, becomes lighter posteriorly adjacent to mesepimeron. Metepimeron yellowish anteriorly and where it borders metepisternum, becomes dark brown posteriorly. Mesinfraepisternum mostly dark brown, lower corner bordering mesepimeron yellowish, becomes darker along margin bordering metepisternum. Ventral part of thorax and leg bases yellowish. Legs light brown with darker brown on tarsi and distal ends of femora. As in other known species of genus, tarsal claws toothed. Wings hyaline.

Abdomen.—Predominantly dark brown. Light lateral stripe on segments one and two. Segment three with basal, lateral yellow spot followed by streak which gradually disappears about midlength of segment. Segments four through seven with yellow basal spots on sides, only slightly produced caudally; these markings diffusely continuous over dorsum of segments four through six forming transverse basal rings. Segments eight through ten and abdominal appendages entirely black. Segment ten bifid dorsally for almost entire length. Segments nine and ten with some pruinosity.

Superior abdominal appendages.—Length 1.5 mm., subequal in length to segment ten. In dorsal view directed caudad. (In figure 8, right superior slightly twisted so lower edge more mesial than normal. Left appendage in approximately natural position.) Outer margin of superior appendage almost straight or slightly concave in basal half followed by slight emargination to form small hump, thence curves slightly

mesad to broadly blunt tip. Inner margin straight for about basal sixth, then curves laterad to reduce width of appendage about one-third for a third its length, then turns mesad again for distance equal to a sixth of length of appendage. Margin then proceeds almost straight caudad to blunt tip. Dorsal surface about middle third beset with several large denticles; proximal part of ventral lamella projects cephalad to point (figs. 6, and especially 8). In profile view dorsal margin almost straight from point near base to apex. Inner or mesial margin, in dorsal view, prolonged ventrally as lamella which forms ventral margin of appendage in distal four-fifths its length. Ventral edge of lamella convex near apex (fig. 7), then slightly concave for about a fourth the length of appendage, then proceeds in convex curve to deepest part about basal third. Distinct concavity formed there between two, sharp, toothlike projections; then margin runs almost straight dorsad to join body of appendage. *Inferior appendages*.—In dorsal view about two-thirds as long as superiors, strongly divergent from each other through most of basal three-fourths, then convergent to pointed tips in distal fourth; tips farther apart than apices of superiors (fig. 8). In profile view extend farther cephalad than superiors (fig. 7); highest at base, superior sharp ridge descends from near base of superiors in almost smooth concave sweep to upturned tip; mesial margin bears long slender spine which projects dorsad and cephalad to almost touch hind margin of segment ten, apex hidden beneath ventral edge of superior appendage near base. (Figure 9 shows in ventral view, dorsal margin of right inferior twisted slightly mesad—due to distortion of specimen—making more of dorsally directed tip visible.) Basally appendage about twice as wide as in distal part just anterior to upturned tip. Inner margin with two distinct convexities, one a short distance each side of middle, distal one more prominent and at point where inner margin bends laterad to noticeable degree. Outer margin begins to diverge strongly from midline at about one-third its length from base, then sweeps near apex in broad arc to tip. *Measurements*.—See table.

Superior appendage, when viewed obliquely from above and within, has proximal edge of ventral lamella prolonged above into distinct process directed cephalad and slightly mesad. This is process whose tip shown from dorsal view on right superior in figure 8 and in dotted lines in figure 6. Inferior appendage seen in this view to possess on dorsal surface a slender process directed dorsad and applied almost against posterior surface of abdominal segment ten when in natural position. One on right inferior appendage (fig. 12) slightly pulled away from segment ten by distortion of specimen.

TABLE OF COUNTS AND MEASUREMENTS

SPECIMEN	DEPOSITED	ABDOMEN	HIND WING	POSTNODALS		STIGMA			
						Length		Surmounting Cells	
				Front Wing	Hind Wing	Front Wing	Hind Wing	Front Wing	Hind Wing
<i>P. zetekii</i>									
Aug. 30, 1950♂*	UF	41 mm.	34 mm.	25-28	25-26	2.6 mm.	2.6 mm.	6 + 1-6 + 1	5 + 0-5 + 1
<i>P. leonora</i>									
Dec. 27, 1950♂*	UF	47	37	29-31	27-30	2.7	3.0	8 + 0-8 + 1	7 + 1-8 + 1
Dec. 20, 1950♂	UF	46	37	28-30	26-27	2.7	3.0	6 + 1-6 + 2	6 + 2-7 + 1
Dec. 27, 1950♀*	UF	41	36	26-27	22-23	3.0	3.0	6 + 0-6 + 1	5 + 1-5 + 1
Dec. 27, 1950♀	ANSP	37	36	26-26	22-25	2.9	3.1	4 + 1-5 + 1	4 + 0-4 + 1
Dec. 26, 1950♀	UMMZ	38	34	25-28	24-25	2.7	2.8	5 + 1-5 + 2	4 + 2-5 + 1

Holotype males and allotype female are designated by asterisks. The number of postnodals and the number of cells surmounted by the stigma on the front and hind wings are absolute counts. The plus numbers in the right hand columns indicate the number of fractional cells surmounted at the ends of the stigma. ANSP, Academy of Natural Sciences, Philadelphia; UMMZ, University of Michigan, Museum of Zoology; UF, University of Florida Collections.

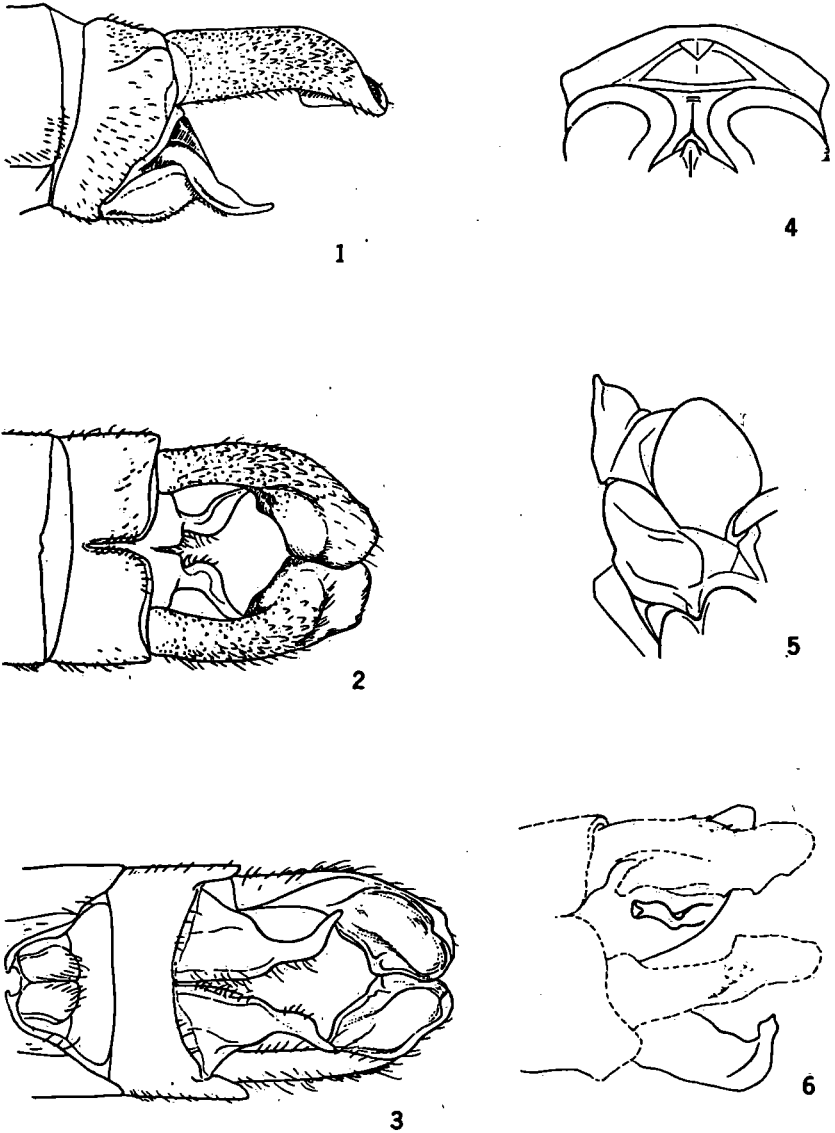
DESCRIPTION OF ALLOTYPE.—Differs from male as follows: ridge between ante- and postclypeus much darker than remainder of clypeus; depression in center of labrum dark brown; abdominal segments with yellow areas larger, lateral horizontal streak on segment three extends three-fourths length of segment, those on segments four through six disappear about midlength; segment nine with dorsal yellow spot; segment ten apparently bifid dorsally about half the length of segment, though, due to pressure after capture, ends of abdomens so flattened in our specimens that this is difficult to see. No pruinosity evident on allotype or paratype females, though all somewhat teneral. Abdominal appendages subequal in length to segment ten, conical, thickly covered with small denticles and terminating in several longer spinules. Palps of genital valves about 0.7 mm. in length, extend beyond level of tips of abdominal appendages, apex of ovipositor about level of tips of appendages. Posterior lobe of pronotum, viewed anterodorsally, has hind edge straight in middle and each lateral extremity strongly angulate (fig. 4). In lateral view, median lobe shows strongly convex anterior part which bears number of long, thin hairs. In lateral view hind margin of posterior lobe of pronotum almost straight, with slight concavity near middle. Dorsal margin descends abruptly for about a fifth its length, then sweeps in convex curve almost to anterior border of lobe.

Paratype females do not have anterior part of median lobe of prothorax so strongly convex, but hind margin of posterior lobe has lateral extremities angulate, and in all other characters examined specimens seem to be of same species.

ADDITIONAL MATERIAL EXAMINED.—We have identified as this species three specimens from the C. H. Kennedy Collection, which is now a part of the Williamson Collection at the University of Michigan. Two of these, a female taken January 8, 1946 by Dale W. Jenkins, and a male taken January 1947 by N. L. H. Krauss, are from the type locality, Barro Colorado Island. The third, a female taken January 1947 by N. L. H. Krauss, is of special interest because of its locality. It was collected at El Valle d'Anton, about 64 kilometers in a straight line northwest of Barro Colorado Island, in the province of Coclé. This specimen was from an altitude of over 2500 feet, while those from the type locality are from less than 400 feet. The three specimens are all in poor condition but agree well with our type series.

REMARKS.—*Philogenia carrillica* (Calvert, 1907) seems to be the closest relative of *P. lenora*; however, there are some well marked differences

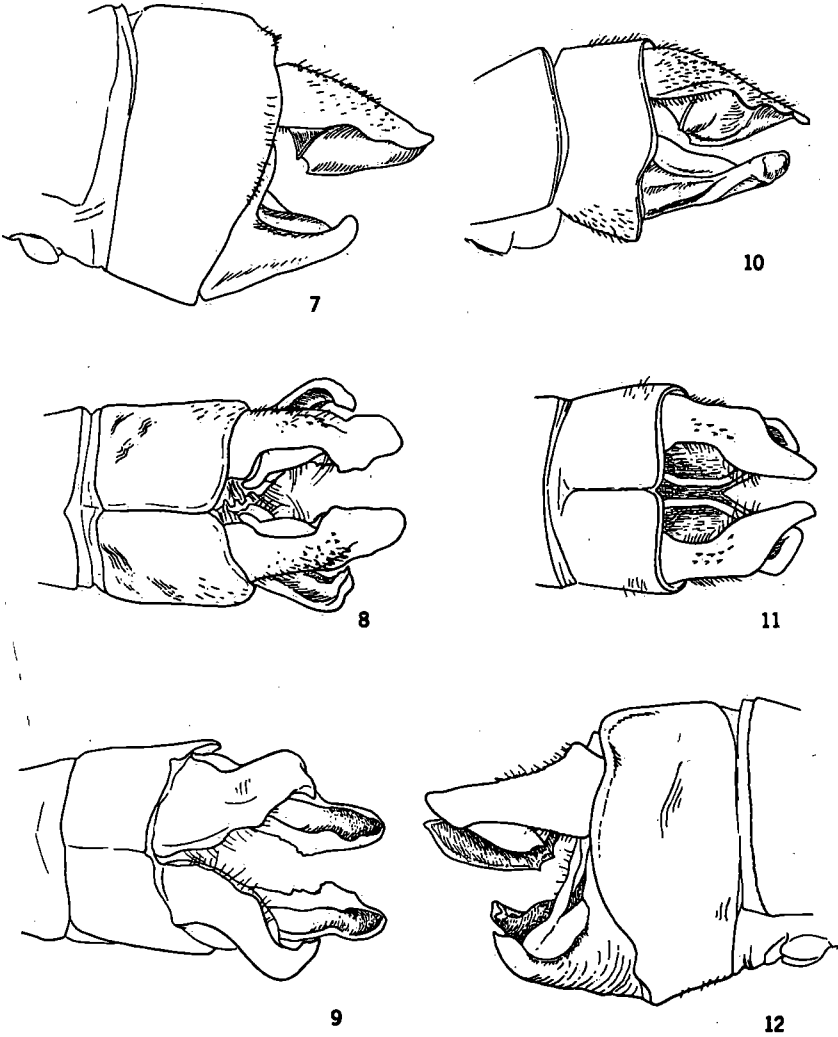
which will clearly separate the known specimens of the two species. The same great distance exists between known localities for *P. carrillica* and the type locality of *P. leonora* as was discussed in the description of *P. zeteki* (about 450 kilometers in a straight line). The specimen of *leonora* from El Valle does not look any more like *carrillica* than those from the type locality. This still leaves about 400 kilometers between the known ranges of these two species, and we believe that more would be revealed about the actual relationships of them if material for study were available from areas closer together. The superior abdominal appendages of *carrillica*, in dorsal view, terminate in a fairly acute point while those of *leonora* are rounded and blunt. On the lateral edge of the appendage of *carrillica*, in this view, there is a strong convexity at about three-fifths of the length of the appendage followed by a gentle concavity which extends to the apex, while in *leonora* no such strong convexity occurs, and the small concavity which does exist is more dorsal, making this whole area gently convex to the rounded tip (figs. 8 and 11). In lateral view the superior appendage of *carrillica* has the lateral edge produced into a thin leaflike structure; the corresponding edge in *leonora* is not thin and leaflike but thick and rounded (figs. 7 and 10). There is a mid-dorsal dark stripe present on the thorax of the male of *carrillica*. Such a stripe is not present in any of the specimens of *leonora* which we have seen. Other differences between the males of these two species are apparent when they are carefully studied, but the differences in the females are even more striking. Females of *P. leonora* will key out to *P. cassandra*-*P. polyxena* in Calvert's key to the females (1924: 17) because the sides of the hind lobe of the pronotum are almost straight and vertical in anterodorsal view. The females of *P. leonora* would be separated from those of *P. carrillica* and five additional species in Calvert's key (1924: 17) because all these have the sides of the hind lobe of the pronotum convex and rounded in anterodorsal view. It should be noted that the association of the males with the females is not established beyond question in either one of these species. Calvert's association of a female with the males of *carrillica* is by supposition inasmuch as the females described by him were not taken with the males, and he described other females (*expansa* and *lankesteri*) which might possibly be *carrillica*. Neither of these forms seems to be closer to the females of *leonora* than does the one referred to *carrillica*. The males and females here described as *leonora* were not taken in copulation, but were taken in the same locality at the same time and are probably correctly associated.



Figures 1-3. *Philogenia zeteki*, holotype, male. Terminal abdominal appendages in lateral, dorsal, and ventral views respectively.

Figures 4-5. *P. leonora*, allotype, female. Middle and hind lobes of the prothorax in anterodorsal and right lateral views respectively.

Figure 6. *P. leonora*, paratype, male. Terminal abdominal appendages in dorso-lateral view.



Figures 7-9, 12. *P. leonora*, paratype, male. Terminal abdominal appendages in left lateral, dorsal, ventral, and right lateral views respectively, showing displacement of appendages.

Figures 10-11. *P. carrillica*, male. Terminal abdominal appendages in lateral and dorsal views respectively. Specimen from Chiriqui River Trail, Peralta, Costa Rica, August 10, 1909 (specimen No. 10 collected and determined by P. P. Calvert); Academy of Natural Sciences, Philadelphia.

ACKNOWLEDGMENTS

We are greatly indebted to Philip P. Calvert for much kind assistance and advice. We are also indebted to the Academy of Natural Sciences, Philadelphia for the loan of specimens and for allowing the senior author to examine some type materials, and also to the Museum of Zoology, University of Michigan, for the loan of specimens. The figures are the work of Miss Esther Coogle, staff artist for the Department of Biology, University of Florida.

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