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# A PRELIMINARY STUDY OF THE MAYFLIES OF HONDURAS[1]

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The following study presents a summary of the results of six months of field study and the subsequent laboratory investigations on the taxonomy and ecology of the mayflies (Ephemeroptera) of Honduras. The investigation is based mainly on nymphal collections of this order of insects, as adult forms were, for various reasons, not commonly found. In North America, it is possible to readily identify the nymphs of mayflies to genus, although they frequently are not identifiable to species. In South and Central America even generic assignment of the nymph is frequently uncertain and there are virtually no descriptions which enable one to identify the species of nymphs. Even the adults are largely unknown. There are no revisional studies completed on any genus in the fauna, although several are now in progress. There are, in fact, no published records of the occurrence of Ephemeroptera in Honduras and only fragmentary reports on Ephemeroptera from all of Central America. For these reasons this particular study is of a preliminary nature. It reflects the pioneering nature of the investigation with the advantage of most of the data representing new contributions to knowledge but with little opportunity to make meaningful generalizations from such data.

## MATERIALS AND METHODS

Due to various stream conditions described below, the most valuable fectively. These consist of a piece of small mesh copper wire stretched benymphs from rocks lifted from the stream bottom.

Hand screens were extremely valuable where they could be used effectively. These consist of a piece of small mesh copper wire stretched between two handles. The collector holds the poles apart, stirs up the rocks and debris in front of the screen and the insects are then washed onto the screen. The catch thus obtained is placed in a white pan, where the organisms can easily be seen against the white background. Unfortunately, in many of the streams of Honduras the hand screen method was not effective; therefore, hand picking of the nymphs off rocks was most often employed.

1. Part of a thesis submitted to the University of Utah in partial fulfillment of the requirements for the degree of Master of Arts. The writer expresses his gratitude to Dr. G. F. Edmunds Jr. for his excellent guidance and counsel in making this study.

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Nymphs taken with the above methods were immediately put in vials containing a solution of Carnoy's fluid (six parts alcohol, three parts chloroform, one part acetic acid). The vials were completely filled with liquid, stopped with a cotton plug and packed securely in a jar. Within two to three days after collection, the specimens were transferred to eighty per cent alcohol.

Adults were captured by an aerial net during the day and a few were taken at night by use of a lantern placed in front of a white sheet. These adults were preserved in eighty-five per cent alcohol.

Rearing of adults from nymphs was done in tubular wire cages with clear plastic bottoms. These cages were placed in a protected area of the river or stream, so that current flowed through the bottom half of each cage while the upper half was in the air. Cotton gauze was placed over the top to prevent escape of the emerged subimagos and imagos.

## DISCUSSION

Although the streams and rivers of Honduras show variety, there is one type that predominantes. The waters of this type of stream are milky with silt and suspended matter. The bottom of these sierran streams consists of large rocks (three or more inches in diameter), oftentimes heavily silted in with sand. This rocky bottom alternated with sand, and at times gravel and rubble bottoms, with the latter two constituting a distinct minority. Almost all of the streams have steep gradients owing to the mountainous country, and level out only on the narrow coastlines. Rapids alternate with pools, these pools invariably being covered with sand that is dropped as the current loses speed. This sandy bottom is generally recognized as being the least productive bottom type, and large rock bottoms usually have fewer mayfly species than a rubble bottom of rocks of about one half to one-quarter inch in diameter (Edmunds, 1949). A hand screen produced little or no results in the type of stream described above because of the paucity of stream life and difficulty in moving the large rocks.

The type of stream above was not universally present although it was the most common. Occasionally a clear stream was found and when these were small, they usually had a rubble bottom. Two larger rivers had clear water (Guayape and Telica), but were in a low water stage, and both had an extremely poor fauna. The rivers that drain Lake Yojoa have a constant flow, are clear, and are much more productive than most of the other streams; the Rio Blanco contained nymphs of *Isonychia, Baetis, Thraulodes, Traverella,* and *Leptohyphes*. Locality number five, a small, clear stream just east of Danli produced *Baetodes, Lachlania, Thraulodes, Traverella, Leptohyphes,* and *Tricorythodes*. Use of a hand screen was effective in collecting these streams.

Lastly, many of the larger rivers with a high water volume, while retaining the characteristic of milky water mentioned above, had a much different bottom type. Rubble bottoms in these rivers were more common, and the streams were much more productive, at least in numbers of individuals if not in variety of genera. The Nacaome and Chamelecon rivers were of this type. The

Nacaome River produced an abundance of three genera, *Baetis*, *Thraulodes* and *Leptohyphes*. *Thraulodes and Traverella*, were found in abundance in the Chamelecon River. Resorting to picking nymphs off the rocks was unnecessary here, as a hand screen produced adequate results.

Nymphs picked off rocks in the first type of stream discussed above usually belonged to the family Leptophlebiidae (*Traverella*, *Hermanella*, *Thraulodes*), Tricorythidae (*Leptohyphes*, *Tricorythodes*), or Baetidae (*Baetodes*). These genera of the first two families have somewhat flattened bodies that enable them to creep into narrow crevices under stones and debris and avoid rapid currents. *Baetodes* has a round, streamlined body and strong claws and inhabits the tops of rocks. All of these nymphs were extremely well camouflaged and blended into their backgrounds perfectly. The nymphs were extremely difficult to find when a stone was picked up unless they moved, as they would invariably do, either to the other side of the rock or into a crack or crevice.

## DATA ON COLLECTING LOCALITIES

1 Departamento El Paraiso, 38 kilometers east of Zamorano on highway No. 4. 29-VIII-64.

This stream was eight to ten feet in width and had a maximum depth of three feet. The current was swift and turbulent and there was little gravel present. Most of the rocks were of fist size and larger. Very little debris and no microscopic vegetation was present. This stream drained into the Choluteca River. Very few nymphs were taken with the use of a hand screen, but more were picked off rocks on the edge of the current. Perhaps the many predaceous dragonfly nymphs taken in this area could have greatly reduced the mayfly populations.

1a Same locality, 31-X-64.

On this date, the water flow had diminished noticeably, and the water was somewhat clearer.

2 Departamento El Paraiso, approximately 3 kilometers east of Danli. 29-VIII-64.

A small stream about four feet wide, with a maximum depth of one foot and a moderate current. The bottom was covered with large rocks and the water was milky in color. Drainage was into the Guayambre River system.

3 Departamento El Paraiso, approximately 8 kilometers east of Danli. 29-VIII-64.

This was one of the very few clear streams collected. It was eight to ten feet wide, with alternating sandy and rocky bottoms. Maximum depth was one foot. Six genera of mayflies were collected here. Drainage was into the Guayambre River system.

4 Departamento El Paraiso, 50 kilometers east of Danli, at the junction of Highway No. 4 and the Guayambre River. 29-VIII-64.

This rather large river was thirty to forty feet wide with a maximum depth of about four feet. The water was milky in color and the bottom was entirely rocky. There were no pools in this area. The current was rapid and turbulent. Nymphs were taken off rocks in the shallow region near the shore, but only the genus *Euthyplocia* was found in the waters one to two feet deep, and none were found in the deepest part of the current.

5 Departamento El Paraiso, near Santa Maria, a small stream. 3-IX-64.

This was a small clear stream that had six genera of mayflies present. The current was moderate with pools and riffles and a rubble bottom.

6 Departamento El Paraiso, at the Escuela Agricola Panamericana. Pond. 15-X-64.

This was one of three bodies of still water collected. This pond on the property of the Escuela Agricola Panamericana contained only two genera of mayflies. The pond was large with heavy vegetative growth on the pond edges.

7 Departamento Choluteca, 1 mile south of Moramulca Bridge, on highway No. 1, Pespire River. 9-X-64.

This large river was sixty to seventy feet wide with alternating deep sandy pools and riffles. The riffles, however, were composed of large rocks, many embedded in sand, that proved difficult to move. Nymphs were picked off rocks except in the area where small stones graded into sand at the head of a pool. Hand screen collecting was possible in this area. The water was milky. This river drains into the Pespire River.

8 Departamento Choluteca, west of junction of highway No. 2 and the Marcovia road. Small stream. 10-X-64.

This small, rocky (large rocks) stream had only a moderate current. *Thraulodes* nymphs were abundant on the large rocks. The water was milky in color. The stream was only about four or five feet wide and a maximum of two feet in depth in the pools.

9 Departamento Choluteca, near Choluteca on the Pan American Highway. Small stream. 10-X-64.

This stream was in great contrast to most others collected. The current was slow and the water very clear. The stream was about twenty feet wide with a maximum depth of approximately four feet. The bottom was sandy, with very few rocks.

10 Departamento Choluteca, approximately 16 miles east of the Jicaro-Galan junction on the Pan American Highway. Small stream. 10-X-64.

A small stream with milky water, a moderate current with large rocks buried in the stream channel. Nymphs collected were picked off rocks.

11 Departamento Choluteca, Nacaome Bridge on Pan American Highway. Nacaome River. 10-X-64.

An extremely large river, more than 100 feet wide, the Nacaome River is one of the major rivers in Honduras. The edges of the rapid current

presented a rubble bottom. Collecting on a hand screen yielded numerous individuals of three genera. There were many areas of riffles present. The main channel was too deep and swift to permit collecting.

12 Departamento Comayagua, 5 miles south of Comayagua on highway No. 1 at bridge. 17-X-64.

A swift stream with riffles and pools, but with large stones in the current, heavily sanded in and difficult to dislodge. The water was milky. Nymphs picked off rocks.

13 Departamento Comayagua, 1 mile north of Comayagua, at bridge, Humuya River. 17-X-64.

A slow, large river with milky water and a gravel and sand bottom. Repeated hand screen samples provided a few aquatic forms.

14 Departamento Comayagua, at bridge, near Comayagua on highway No. 1, Selguapa River. 17-X-64.

A large river with rapid current, and deep pools and rapids. Large rocks were heavily sanded in, preventing hand screen use. The water was milky in color. Nymphs were picked off rocks.

15 Departamento Cortes, 2 miles north of Caracol, at bridge on highway No. 1, Rio Blanco. 18-X-64.

A clear water stream approximately thirty feet wide and at a maximum, four feet deep. A rubble bottom and alternating pools and riffles presented comparatively good collecting conditions. Five genera were collected.

16 Departamento Cortes, Chamelecon, Chamelecon River. 18-X-64.

A very large river, close to the north coast, with milky water. The main channel was very deep and swift. Hand screen samples along the margin of the river in a rubble bottom situation produced an abundance of two genera only.

17 Departamento Atlántida, 25 miles south of Tela on highway No. 9, small stream at bridge. 19-X-64.

A clear stream with a very steep gradient. No riffles were present, only pools and falls. The rocks here were very large and the pools were all sandy. Some nymphs of three genera were collected.

18 Departamento Comayagua, on highway No. 1. Lake Yojoa at southern end. 20-X-64.

Lake Yojoa is about twenty-five miles long by eight miles wide. Collecting was done at the south end in very still, clear water with a heavy growth of lily pads and other vegetation. Only one genus, *Callibaetis*, was collected here.

19 Departamento Comayagua, 3 miles north of Taulabe on highway No. 1, large river. 20-X-64.

A large clear river about one hundred feet in width, with very clear water. The river drains Lake Yojoa at the southern end. Collecting was done in water two to three feet deep, with a rapid current, using a hand screen. An abundance of five different genera were present.

20 Departamento Comayagua, near El Rosario, Humuya River. 20-X-64.

A large river, milky with silt and about 120 feet in width. Large rocks well buried in sand prevented use of a hand screen and very few nymphs were picked off rocks.

21 Departamento El Paraiso, Escuela Agricola Panamericana, Yeguare River. 15-VII-64 to 26-X-64.

This river was collected more than any other due to its proximity to the home of the writer while in Honduras. The water was milky and riffles alternated with pools. From July through the middle of October, populations were low. After this time however, these populations greatly increased.

22 Departamento El Paraiso, small pond on Mt. Uyuca, near Zamorano. 27-X-64.

A very small, clear pond, about, two feet wide by three feet long, and about a foot deep, that lies about three to four hundred yards below the cloud forest of Mt. Uyuca. This pond yielded only *Callibaetis* nymphs.

23 Departamento Francisco Morazan, 10 miles east of Guaimaca on highway No. 3. 6-XI-64.

A very small, clear stream only three to four feet wide but with an abundance of nymphs, many of them mature. The rubble bottom of the riffles produced many individuals of six genera.

24 Departamento Olancho, 45 miles east of the junction of highway No. 3 and the road to Salama. 6-XI-64.

Another small, clear stream, with shallow water with a rubble bottom in the riffles. Nymphs were abundant and many of them were mature.

25 Departamento Olancho, 10 miles west of Juticalpa, at the Rio Juticalpa. 6-XI-64.

The Juticalpa River at this point was about twenty-five feet wide with clear water. Riffles were collected with a hand screen and yielded good quantities of six genera of mayflies.

26 Departamento Olancho, 6 miles east of Juticalpa, on highway No. 3, at the Rio Telica. 6-XI-64.

Although a large river and with conditions very similar to locality number eleven, only a few nymphs were collected in this river.

27 Departamento Olancho. 1.6 miles west of the Campamento Galera turn-off on highway No. 3. 7-XI-64.

A clear stream about six to eight feet wide, but very deep. Collecting was possible only along the narrow edges and not many specimens were taken.

28 Departamento Olancho, 1 mile west of Campamento on highway No. 2. 7-XI-64.

This stream was small and clear, but with a gravel and sand bottom. Collecting yielded but few nymphs.

29 Departamento Francisco Morazán, 6.5 miles from the junction of highway No. 3 and highway No. 5, on highway No. 5. 7-XI-64.

A small milky stream with large rocks in a slow current. Nymphs of three genera were collected on a hand screen, although not in abundance.

30 Departamento Francisco Morazán, near La Venta, at the junction of highway No. 3 and the Rio Choluteca. 7-XI-64.

The Choluteca River is clear and very large here and the current is swift with very large stones on the bottom. No success was obtained with a hand screen and nymphs had to be picked off stones.

31 Departamento El Paraiso, 29 kilometers east of Zamorano on highway No. 4. 29-VIII-64.

A very small, milky stream that probably dries up in the dry season. The only mayflies present were a few specimens of *Thraulodes*.

32 Departamento El Paraiso, a small stream 48 kilometers east of Zamorano on highway No. 4. 29-VIII-64.

A small, milky stream with a bottom of large rocks. Pools were sand filled. The only nymphs obtained were picked off the rocks in the stream.

33 Departamento El Paraiso, a tributary to the Rio Guayambre at the junction of highway No. 4 and the Rio Guayambre, 50 kilometers east of Danli. 29-VIII-64.

A small tributary stream in the same area as locality number four with a rubble bottom and riffles that provided good collecting with a hand screen.

*Generic representation at localities*

Figure 1 illustrates the occurrence of the different genera of mayflies of Honduras at the sites collected. The writer must emphasize the tentative nature of this chart. Mayfly representation was not complete during the time the author collected and thorough collecting of Honduras was not possible.

It is worth noting that only ten localities had five or more genera present. Locality twenty-one has more representatives on the chart because this was a river within a mile of the residence of the writer during his stay in Honduras and was collected often.

## GENERIC REPRESENTATION AT LOCALITIES COLLECTED

| Localities | 1a | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Isonychia | | | | | | | | | | | | | | | | | | | | x | | x | | x | x | | | | x | | | | | |
| Baetis | x | x | | | | x | | | | | | x | | | | | | x | | x | | x | | x | x | x | | x | | | | | x |
| Baetodes | x | x | | x | | | | | | x | x | | x | | | x | | | | | | x | | x | | x | | x | | | | | x |
| Callibaetis | | | | | | | x | | | | | x | | | | | | | x | | | | x | | | | | | | | | | | |
| Dactylobaetis | x | | x | | | x | | | x | | | | | | x | | | | | | x | | | x | | | | x | | | | | x |
| Lachlania | | | | x | | | | | | | | | | | | | | | | | | x | | | | x | | | | | | | | |
| Epeorus | | x | | | | x | | | | | | | | | x | | | | | | | x | | | x | | | | | | | | | |
| Choroterpes | | | | | | | | | x | x | | | | | | | | | | | | | | | | | | | | | | | | x |
| Hagenulopsis | | x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hermanella | x | | | | | x | | | | | | | | | | | | | | | | x | | | x | | | | | | | | | |
| Thraulodes | x | x | x | x | x | x | | x | x | x | x | x | | | x | | x | x | x | x | x | x | | x | | x | x | x | x | x | x | x | x | x |
| Traverella | | | | x | x | x | | x | | | x | | | | x | x | x | x | | x | x | x | | x | x | x | | | | x | | | | x |
| Leptohyphes | x | | x | x | | x | | | | | x | x | | x | | x | x | | | x | | x | | x | x | x | x | x | x | x | x | | | x |
| Tricorythodes | | | x | x | x | | | | | x | x | | | | | | | | | | | | | | | | | | x | | x | | | |
| Euthyplocia | | | | | x | | | | | | | | | | | x | | | | | | x | | | x | x | | | | | | | | |
| Tortopus | | | | | | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | |
| Caenis | | | | | | | x | | | | | | | | | | | | | | | x | | | | | | | | | | | | |

Figure 1

## RESULTS

The order Ephemeroptera is divided into nineteen families and thirty-six subfamilies (Edmunds, Allen and Peters, 1963) and approximately 190 genera. Representatives of nine families and seventeen genera were found in Honduras. An additional eight genera are reported from other countries in Central America and many of them probably occur in Honduras. These genera are designated in the list below by an asterisk. Because of the paucity of adults, species determinations were extremely difficult and in most cases, species were designated only as species A, B, C, etc., until further research can reveal their true identification. Approximately 45 species were differentiated by morphological characters. Judging from the material studied it seems reasonable that 80% to 90% of the mayfly species in Honduras are undescribed.

The families and genera of mayflies found (and those expected to be present) in Honduras are listed below.

Family Siphlonuridae
  Genus *Isonychia* Eaton

Family Baetidae
  Genus *Baetis* Leach
  Genus *Baetodes* Needham and Murphy
  Genus *Callibaetis* Eaton
  Genus *Pseudocloeon* (? Genus *Neobaetis* Navas*)

Family Oligoneuridae
  Genus *Lachlania* Hagen
  Genus *Homoeoneuria* Eaton*

Family Heptageniidae
  Genus *Epeorus* Eaton
  Genus *Heptagenia* Walsh*
  Genus *Rhithrogena* Eaton*

Family Leptophlebiidae
  Genus *Hermanella* Needham and Murphy
  Genus *Thraulodes* Ulmer
  Genus *Traverella* Edmunds
  Genus *Choroterpes* Eaton
  Genus *Homothraulus* Demoulin*
  Genus *Hagenulopsis* Ulmer

Family Tricorythidae
  Genus *Leptohyphes* Eaton
  Genus *Tricorythodes* Ulmer

Family Euthyplociidae
  Genus *Euthyplocia* Eaton
  Genus *Campylocia* Needham and Murphy*

Family Polymitarcidae
  Genus *Tortopus* Needham and Murphy
  Genus *Campsurus* Eaton*

Family Caenidae
Genus *Caenis* Stephens

Family Ephemeridae*
Genus *Hexagenia* Walsh*

## SUMMARY

Collections of mayflies (Ephemeroptera) were made during a six month stay in Honduras in 1964. Identification to species was extremely difficult due to the few number of adults found and the lack of knowledge of Central American fauna (there are but fragmentary reports of mayflies from other Central American countries and none from Honduras). This study discovered nine families and 17 genera of mayflies present. Approximately 45 species were differentiated as species A, B, C, etc., by morphological and color character, but will not be published until more exact identification can be made.

Nymphs were collected in 33 localities in Honduras. Because of the nature of the streams in this country the collecting was difficult and in many cases nymphs could only be taken by picking them individually from rocks.

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