STUDIES ON THE FAUNA OF CURAÇAO AND OTHER CARIBBEAN ISLANDS: No. 96.

THE HETEROPTERA OF THE NETHERLANDS ANTILLES - VI

NOTONECTIDAE

by

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The material studied was mainly collected during Dr. P. WAGENAAR HUMMELINCK's voyages to the West Indies in the years 1930, 1936/37, 1948/49, 1955 and 1963/64, and on a special entomological collecting trip by Ir. R. H. COBBEN in 1956/57. Unless otherwise stated, a date in the years 1956 and 1957 indicates specimens collected by Ir. COBBEN, and a date in another year indicates specimens collected by Dr. WAGENAAR HUMMELINCK.

Contrary to the first five papers on "Heteroptera of the Netherlands Antilles" (*Stud. fauna Cur. 11*, 1960), THIS CONTRIBUTION ALSO DEALS WITH SPECIMENS COLLECTED ON OTHER CARIBBEAN ISLANDS.

Descriptions of the islands and data on the localities 1930–1949 and 1956–1957 are given in WAGENAAR HUMMELINCK 1933, 1940a–c, 1953, and in COBBEN 1960.

The author is deeply indebted to Dr. P. WAGENAAR HUMMELINCK (Rijksuniversiteit, Utrecht) and to Ir. R. H. COBBEN (Landbouwhogeschool, Wageningen) on whose collections this work is based, and whose valuable suggestions and criticisms have contributed to its completion. He wishes also to express his thanks to Drs. P. H. VAN DOESBURG, Jr. (Rijksmuseum van Natuurlijke Historie, Leiden) for the loan of specimens. Miss E. TAAT (Rijksuniversiteit, Utrecht) kindly read the greater part of the manuscript pointing out various inaccuracies regarding English orthography and grammar; the author is to blame for remaining faults.

The NOTONECTIDAE are to be distinguished from other families of Hemiptera-Heteroptera by the following characteristics:

Antennae shorter than the head; eyes prominent; rostrum 4-segmented; head not fused with prothorax, without ocelli. Abdomen higher than wide, without respiratory

funnel, with a ventral median carina laterally beset with hairs. – The animals are aquatic raptorial insects and swim on their backs.

The family Notonectidae is divided into two subfamilies and comprises nine genera (LANSBURY 1965), four of which occur in the Western Hemisphere. These are to be separated by the following KEY based on HUNGERFORD 1933 and TRUXAL 1953.

1a. Hemelytral commisure without a definite hair-lined pit at anterior end (generally living close to the surface) NOTONECTINAE 2
1b. Hemelytral commisure with a definite hair-lined pit at anterior end (adapted to pelagic mode of life) ANISOPINAE . . . . . *Buenoa*

2a. Anterolateral margins of pronotum not foveate . . . . . *Notonecta*
2b. Anterolateral margins of pronotum foveate 3

3a. Intermediate femur with subapical spur . . . . . *Enithares*
3b. Intermediate femur without subapical spur . . . . . *Martarega*

Buenoa Kirkaldy, 1904: is restricted to the Western Hemisphere, where it has a wide distribution. Most species are to be encountered in subtropical and tropical regions.

Notonecta Linnaeus, 1758: has a world-wide distribution; the number of species per area being higher in the temperate and subtropical regions than in the tropics. In the Gulf Region only *N. indica* is abundant (THOMAS 1939).

Enithares Spinola, 1837: has a world-wide tropical distribution. In the Western Hemisphere, however, up to now only two species have been recognized (BROOKS 1953). No species of this genus was represented in the material studied.

Martarega F. B. White, 1879: is principally a continental neotropical genus. One species is known to occur in Trinidad (HYNES 1948, TRUXAL 1949). No species of this genus was represented in the material studied.

Eight species have been recognized (Table 5). TRUXAL 1953 mentions six more species known from the Caribbean Islands. As *Buenoa* is by far the most important genus in this region, in the following emphasis lies on this genus.

MATERIALS AND METHODS

Notonectidae are to be collected with an ordinary hand net. Capturing with subaquatic light traps does not seem to be very suited for this family (HUNGERFORD e.a. 1955). On the other hand there is a record of Notonectidae being attracted to a light over the water (HUNGERFORD 1933, p. 17).

The best method to preserve captured specimens is killing them in one of the usual vapours and preparing them directly afterwards. *Buenoa* can be glued or pinned; if males are glued care must be taken that the inner side of the fore legs and the rostrum are visible. *Notonecta* is to be pinned. Wetting of specimens with killing fluid, or storing in fluid, has to be avoided if possible, as especially in *Buenoa* most colours fade rapidly and the animals become entirely sordid white in dorsal view, giving the collection an extremely monotonous appearance. For this reason no value can be attached to colour characters, except when it is certain that the specimens have not been wetted before preparation.

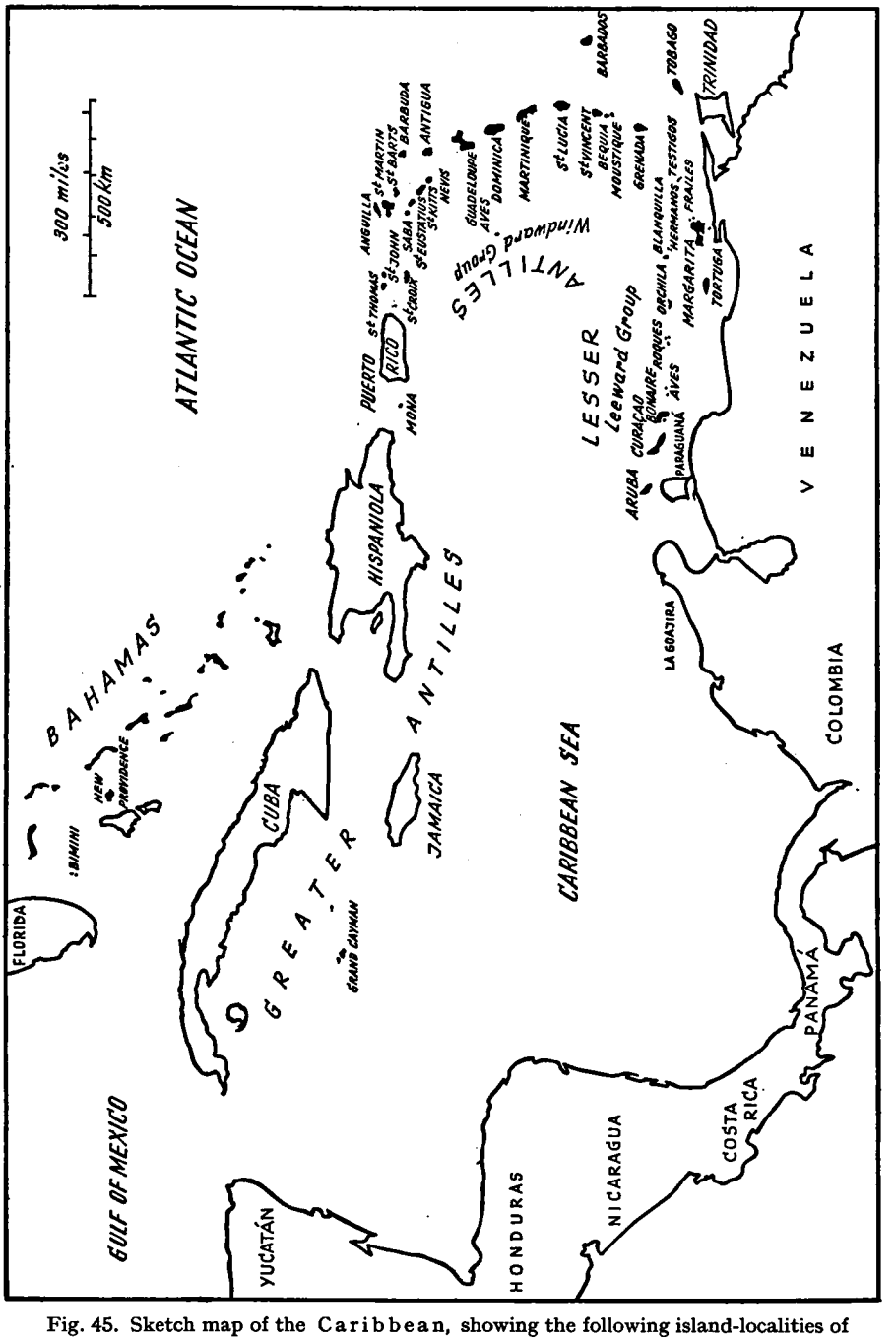

Fig. 45. Sketch map of the Caribbean, showing the following island-localities of Notonectidae treated in this paper: Cuba, Puerto Rico, St. Thomas, St. John, St. Martin, St. Barts (= St.-Barthélemy), Saba, St. Eustatius, Barbuda, Guadeloupe (its satellite islands La Désirade and Marie-Galante are not indicated), St. Vincent, Barbados, Trinidad, Margarita, Blanquilla, Bonaire, Curaçao (Klein Curaçao not indicated), and Aruba.

TABLE 5.

SPECIES AND LOCALITIES OF THE NOTONECTIDAE TREATED IN THIS PAPER.

Species	Cuba	Puerto Rico	St. Thomas	St. John	*St. Martin*	St.-Barthélemy	Barbuda	Guadeloupe	La Désirade	Marie-Galante	St. Vincent	Barbados	Trinidad	Margarita	Blanquilla	*Bonaire*	*Klein Curaçao*	*Curaçao*	*Aruba*	Venezuela mainl.	figures	page
Notonecta indica					×		×			×		×						×			49, 50, 51	166
Buenoa antigone					×					×				×	×	×		×	×		53, 60, 70, 75	168
Buenoa albida	×	×			×					×					×	×		×	×		52, 61, 67, 79	171
Buenoa scimitra					×		×			×		×				×		×	×		57, 62, 68, 74	174
Buenoa gracilis					×	×	×	×	×	×		×				×	×	×	×	×	56, 59, 63, 71, 76	178
Buenoa platycnemis					×				×	×						×		×		×	58, 64, 69, 80	181
Buenoa pallipes	×		×	×					×		×	×									55, 65, 72, 77	182
Buenoa rostra													×								54, 66, 73, 78	184
					6											*5*	*1*	*6*	*4*			

Six species have been collected on the Netherlands Antilles (in italics). The main reason for the absence of Notonectidae on *Saba*, *St. Eustatius* and *Klein Bonaire* may be the lack of suitable habitats.

Measurements (in mm) were taken with the longitudinal and transverse axes of the animal in a horizontal plane. As head length in dorsal view is very variable according to preparation (glued *versus* pinned specimens) this measure was not used. Measurements of length of the whole body or parts of it always tend to vary according to preparation, but not as strongly as length of head. The humeral width of pronotum was taken as principal measurement for the width of the animal; this being somewhat better defined and less variable than the greatest width of body. Greatest width of head, synthlipsis, anterior width of vertex, length of rostral prong, length of femur and its apical width have been measured as indicated by TRUXAL 1953. Figs. 46–48 give diagrammatical indications for these measurements, redrawn after TRUXAL 1953, figs. 17–19. Following a suggestion of ŠTYS 1960, the ocular index was calculated in *Buenoa*. Although this ratio did not provide excluding characters, it was in several cases a valuable auxiliary in separating females of some species.

Apart from various measurements and ratios males of *Buenoa* possess some distinct secondary sexual characters. Contrary to various groups in Heteroptera the male genitalia, as a rule, do not show useful characters for specific identification in this genus. In the species studied the spine on the tergum of the seventh abdominal segment did not show good specific differences either. To illustrate this the right genital clasper (Figs. 67–73) and the spine (Figs. 60–66) are figured in each species. The remaining structural characteristics to be used in identification of males are thus: the rostral prong, the stridulatory area on the fore femur and the stridulatory comb on the

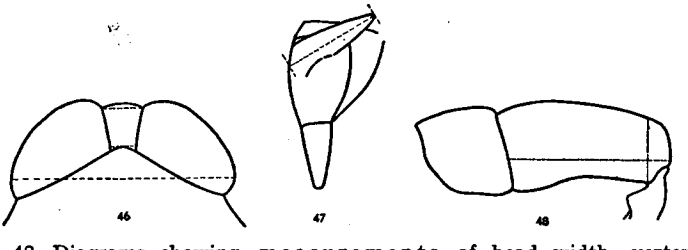

Fig. 46–48. Diagrams showing measurements of head width, vertex and synthlipsis (46), length of rostral prong (47), length and apical width of fore femur (48).

fore tibia. In some species the male possesses some additional structural characteristics which will be mentioned in the description of the species.

Drawings were made by means of a camera lucida, from preparations cleared in KOH. The best results in clearing were obtained with a 10% KOH solution at room temperature; in boiling, the limbs especially tend to break up.

To analyze variation of populations from the Netherlands Antilles, statistical tests have been used. Body length and ocular index were arbitrarily chosen as variables. The tests used are Student's t-test, Snedecor's F-test and Wilcoxon's test. A 5% significance level was used.

Measurements and proportions considered important are given with statistical parameters. All values have been calculated for the samples only, no corrected values or best estimates are given. The symbols used are $\bar{x}$ = mean value; s = standard deviation of sample and n = number of individuals in sample. Assuming a normal distribution in the population for a given measurement, the extreme values to be found lie between $\bar{x} - 3s$ and $\bar{x} + 3s$. If the sample is representative, generally only one specimen out of 200 will fall outside these limits.

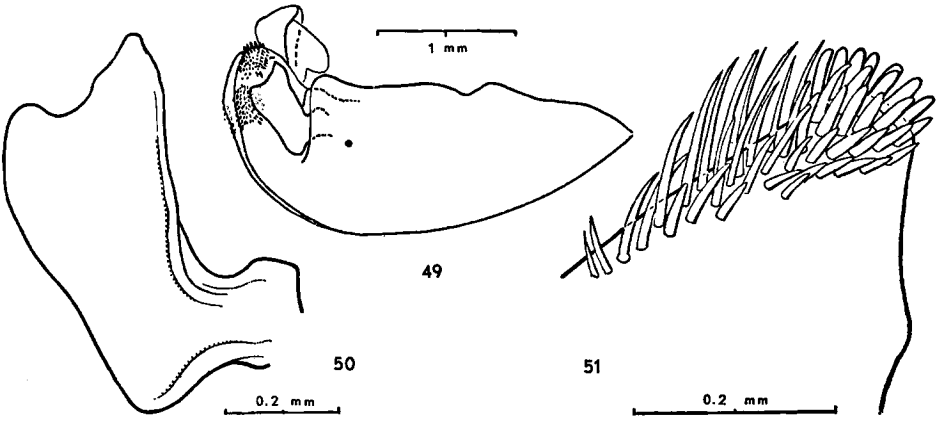

Fig. 49–51. Male genital capsule (49), clasper of genital capsule (50), and female ovipositor valve (51) in *Notonecta indica* from St. Martin (*467a* and Koolbaai) and Curaçao (♀, *81*).

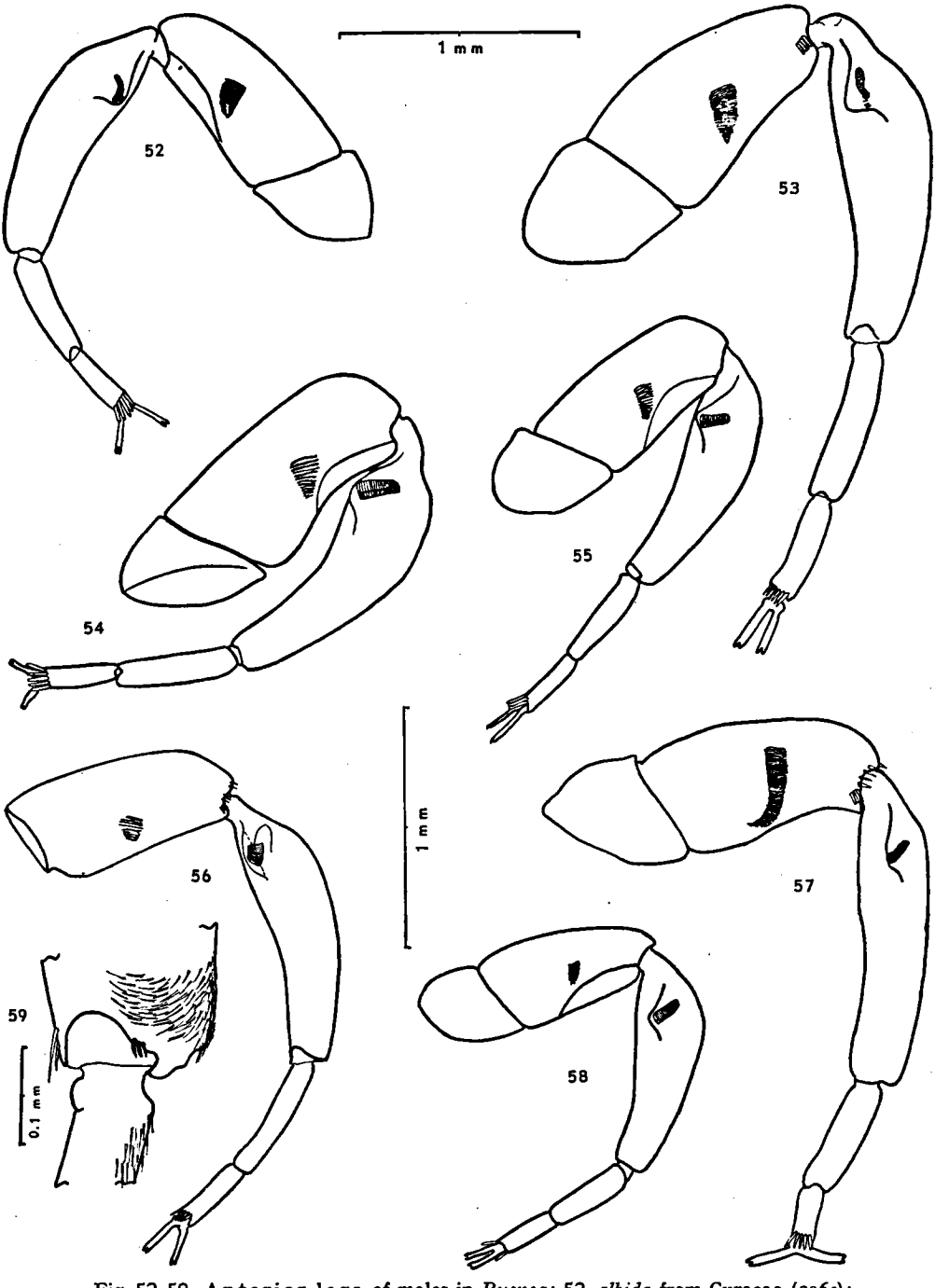

Fig. 52–59. Anterior legs of males in *Buenoa*: 52, *albida* from Curaçao (*396c*); 53, *antigone antigone* from St. Martin (*467a*); 54, *rostra* from Trinidad (*795*); 55, *pallipes* from Cuba (San Blas); 56, *gracilis* from Curaçao (Nieuwpoort); 57, *scimitra* from St. Martin (*528A*); 58, *platycnemis* from Bonaire (Dos Pos.) – 59. Apex of anterior fore tibia in *B. gracilis* from Curaçao (Nieuwpoort).

The systematic part of this paper – dealing with references and synonymy, distribution of species, specimens seen, ecology, measurements, structural characteristics and variation – is based on the newly collected material.

The synonymy given with the species of older authors is abridged. In the case of *Notonecta indica* references after 1933 are included; the older references not given are to be found in HUNGERFORD 1933. In the case of *Buenoa* additional references before 1953 are to be found in TRUXAL 1953; more recent references have been included.

In the distributional records an exclamation mark indicates a new locality.

WAGENAAR HUMMELINCK's specimens have been presented to the Zoölogisch Museum of Amsterdam and the Rijksmuseum van Natuurlijke Historie at Leiden. COBBEN's material has been deposited in the collections of the Entomologisch Laboratorium of the Landbouwhogeschool at Wageningen. A few specimens only are in the Zoölogisch Museum at Utrecht and in the author's collection.

GENERAL LITERATURE

TRUXAL 1952 gives a fine account of the structure of the male genitalia in the family; other anatomical publications are generally restricted to one genus.

Notonecta, especially the European *N. glauca* L., is often used in physiological experiments. There is much literature in this field e.g. BAERENDS 1940, LÜDTKE 1953a, b, 1954, POPHAM 1962, QUADRI 1951, DE RUITER e.a. 1952, SCHENKE 1965, STADDON 1963, VLASBLOM 1966, WOLDA 1961. HUNGERFORD 1930 gives, with

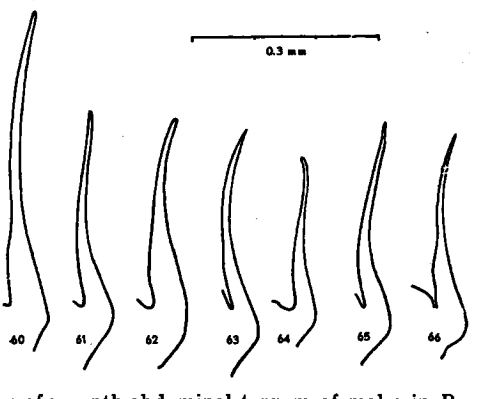

Fig. 60–66. Spines of seventh abdominal tergum of males in *Buenoa*: 60, *antigone antigone* from St. Martin (Koolbaai); 61, *albida* from Curaçao (*396c*); 62, *scimitra* from St. Martin (*528a*); 63, *gracilis* from Curaçao (Nieuwpoort); 64, *platycnemis* from Bonaire (Dos Pos); 65, *pallipes* from Cuba (San Blas); 66, *rostra* from Trinidad (*795*).

regard to important publications, a complete list of the older literature. The present author is, however, unaware of a recent treatment of anatomy in *Notonecta* with the exception of detailed observations in connection with physiological work.

The anatomy of *Buenoa* is extensively treated by BARE 1928, while POISSON 1925 deals with *Anisops*, the Old World counterpart of *Buenoa*, both giving biological data too. The most interesting feature of both *Anisops* and *Buenoa* – which seem to be very much alike anatomically and physiologically – are the haemoglobin cells which were discovered in *Buenoa* by HUNGERFORD 1922, and whose existence induced the studies by BARE and POISSON. Recently MILLER 1964 did experimental work to elucidate the function of these structures. His results support the hypothesis that the external airstore is used principally as a means to maintain neutral buoyancy during the greater part of a dive. The oxygen necessary for respiration should be derived from the haemoglobin.

Concerning ecology, the basal publication is by HUNGERFORD 1919 which gives extensive references. Recently most work is done with *Anisops*. It has been demonstrated that several species can be harmful in fish culture, not only by competing for food with the fry but also in predating directly on young fishes (cf. JULKA 1964, *A. bouveri*; and others). On the other hand, these animals possibly can be useful in mosquito control as they may predate on mosquito wrigglers (HUNGERFORD 1933, LAIRD 1956, ZAMAN e.a. 1962). The references available indicate that the Anisopinae are far less specialized with regard to their food habits as was formerly believed (e.g. HUNGERFORD 1919) and will, just like Notonectinae, predate on every animal they can master. BARE 1928 found in a few instances chlorophyll in the stomachs of specimens of *Buenoa margaritacea* Hungf. held in captivity.

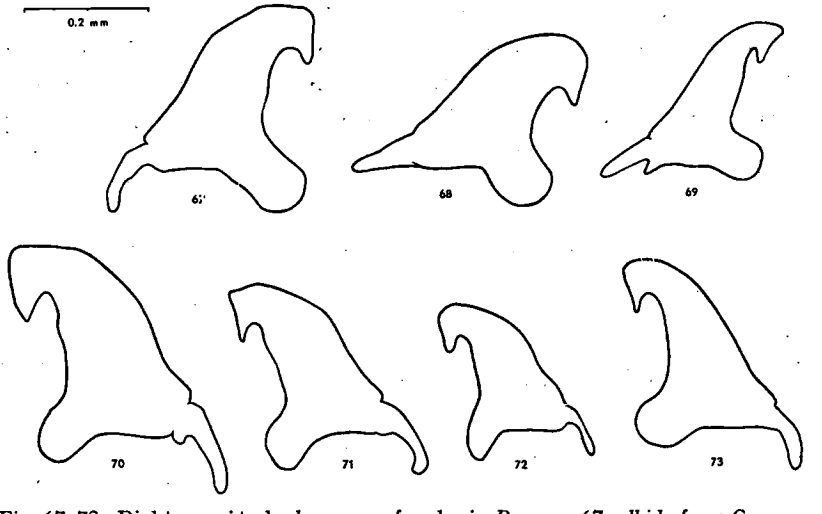

Fig. 67–73. Right genital clasper of males in *Buenoa*: 67, *albida* from Curaçao (*396c*); 68, *scimitra* from St. Martin (*528a*); 69, *platycnemis* from Bonaire (Dos Pos); 70, *antigone antigone* from St. Martin (*467a*); 71, *gracilis* from Curaçao (Nieuwpoort); 72, *pallipes* from Cuba (San Blas); 73, *rostra* from Trinidad (*795*).

Notonecta Linnaeus, 1758

For extensive synonymy the reader is referred to HUNGERFORD 1933.

Notonecta indica Linnaeus, 1771

Notonecta indica LINNAEUS, 1771, p. 534 ("West Indies").
Notonecta americana FABRICIUS, 1775, p. 690 ("America").
Notonecta variabilis FIEBER, 1852, p. 477 [var. *scutellaris*: only those from "Portorico"].
Notonecta variabilis; GUÉRIN-MÉNEVILLE 1857, p. 421–422 (Cuba).
Notonecta undulata Say, KIRKALDY 1899, p. 29–30 (Jamaica).
Notonecta undulata; CHAMPION 1901, p. 370, pl. 22 fig. 10.
Notonecta howardii BUENO, 1905, p. 151.
Notonecta indica; HUNGERFORD 1930, p. 130.
Notonecta indica; HUNGERFORD 1933, p. 113–117, pl. 1 fig. 2, pl. 13 fig. 3 (Cuba, Jamaica, Puerto Rico, St. Thomas, St. Croix).
Notonecta indica; THOMAS 1939, p. 1–8.
Notonecta indica; HUNGERFORD 1940, p. 255–256 (Grand Cayman).
Notonecta indica; RICE 1942, p. 57–59, pl. 1 fig. 3, pl. 2 figs. 3 and 11.
Notonecta indica; PENN & ELLIS 1949, p. 159.
Notonecta indica; HERRING 1951, p. 21–22.
Notonecta indica; USINGER 1956, p. 182–228.
Notonecta indica; WILSON 1958, p. 144–145.
Notonecta indica; DE ABATE 1960, p. 16–17.

U.S.A., Maryland, N. and S. Carolina, Kentucky, Tennessee, Georgia, Florida, Mississippi, Louisiana, Arkansas, Texas, New Mexico, Arizona, California; MÉXICO, Tamaulipas, Sinaloa, Guadalajara, Cuernavaca, Yucatán; GUATEMALA; COSTA RICA (Heredia, one specimen known); COLOMBIA, Cundinam; CUBA, La Habana; JAMAICA; GRAND CAYMAN; HISPANIOLA, República Dominicana; PUERTO RICO; ST. THOMAS; ST. CROIX; ST. MARTIN!; ST.-BARTHÉLEMY; BARBUDA!; MARIE-GALANTE!; BARBADOS!; CURAÇAO!.

ST. MARTIN: Old Battery Cistern, *Sta. 529*, 18. V. 1949 (1♀); St. Peter Slob, *537*, 29. VI. 1955 (1♂, 1♀); Simson Bay Lagoon, 22. XI. 1956 (1 ♂); Cul de Sac, 27. XI. 1956 (1 ♂, 1♀); Koolbaai binnenbak, 5. XII. 1956 (6 ♂, 1 ♀); Koolbaai buitenbak, 5. XII. 1956 (2 ♂, 1 ♀); Belvedère, 6. XII. 1956 (1 ♀).
BARBUDA: Pool at Warden's, *676*, 5. VIII. 1955 (4 ♂, 3 ♀).
MARIE-GALANTE: Mare Médicinié, Meynard, *753*, 31. I. 1964 (1 ♂).
BARBADOS: Sedge Pond, W. of Belleplaine, *782*, 17. II. 1964 (1 ♂).
CURAÇAO: Pos di Wanga, *81*, 9. XI. 1936 (2 ♂); St. Martha, X. 1956 (1 ♀); Klein St. Martha, 1. II. 1957 (1 ♂, 1 ♀).

The salt-content in the habitats of which this is known varies from 90–170 mg Cl'/l. The species seems to have a preference for fresh to slightly brackish waters.

Length (in mm)

male $\bar{x}$ = 10.58 s = 0.29 n = 10 *female* $\bar{x}$ = 10.81 s = 0.37 n = 10

Humeral width of pronotum (in mm)

male $\bar{x}$ = 3.54 s = 0.08 n = 10 *female* $\bar{x}$ = 3.53 s = 0.06 n = 10

Ocular index

male $\bar{x}$ = 0.38 s = 0.0239 n = 10 *female* $\bar{x}$ = 0.41 s = 0.0245 n = 10

Colour: variable, ranging from entirely luteous specimens to black brownish specimens with vertex, anterior part of pronotum, patch along the border between clavus and corium, legs and parts of venter luteous to brownish.

Head: greatest width somewhat more than anterior width of pronotum (1.05–1.06). Anterior width of vertex about two and a half times as wide as synthlipsis (♂ 2.2–*2.4*–2.6, ♀ 2.1–*2.3*–2.6).

Pronotum: trapezoidal; sides slightly sinuated with concavity in posterior half; anterior angles obtusely truncate to somewhat pointed. Anterior width of pronotum, ♂ 2.45–*2.49*–2.53, ♀ 2.45–*2.50*–2.56 mm. Scutellum with basal width greater than anterior width of pronotum (1.1–1.2); broader than long, with visibly sinuated lateral margins; apex acuminate ; basal width : median length ♂ 1.1–*1.2*–1.4, ♀ 1.1–*1.3*–1.4.

Legs: anterior trochanter in male with a ventrobasal hook and a slightly shorter dent on the ventral surface. Length of trochanter: length of dent 8–*12*–18. Mesofemur with a stout hook in apical third; length of hook : width of femur at apex ♂ 1.6–*1.8*–2.2, ♀ 1.4–*1.7*–2.0.

Abdomen: last sternite in female not or slightly notched; ovipositor valve as in Fig. 51; male genital capsule Fig. 49; clasper of male genital capsule Fig. 50.

Buenoa Kirkaldy, 1904

For extensive synonymy in various species the reader is referred to TRUXAL 1953. The following key is restricted to species actually found on the Netherlands Antilles. As still other species are to be expected identifications are to be checked with the figures and descriptions.

KEY FOR IDENTIFICATION OF MALES IN *Buenoa*

1a. Stridulatory area of fore femur sword shaped, about as long as three quarters of the width of fore femur at same level, consisting of approximately 60 sclerotized ridges (Fig. 57) . . . . . *B. scimitra* Bare

1b. Stridulatory area on fore femur distinctly shorter. 2

2a. Rostral prong about as long as or slightly shorter than third rostral segment. Ocular index small, varying from 0.120–0.075. Fore femur with 3–4 small pegs at apex (Fig. 64) . . . . . *B. gracilis* Truxal

2b. Rostral prong distinctly longer than third rostral segment . 3

3a. Tylus (the more or less swollen base of rostrum) inflated with wide median depression, so that the edges form blunt carinas . . . . . *B. albida* (Champion)

3b. Tylus not with wide median depression 4

4a. Small species, length 4.2–5.6 mm *B. platycnemis* (Fieber)

4b. Greater species, length 6.6–8.9 mm . . . . . *B. antigone antigone* (Kirkaldy)

Buenoa antigone antigone (Kirkaldy, 1899)

Anisops antigone KIRKALDY 1899, p. 30 (Jamaica).
Buenoa antigone (Kirkaldy) KIRKALDY 1904, p. 120, 122, 134.
Buenoa antigone; KIRKALDY & TORRE-BUENO 1909, p. 200 (Cuba, Jamaica, S. Domingo).
Buenoa antigone; HUNGERFORD 1940, p. 256 (Grand Cayman, Cayman Brac).
Buenoa antigone antigone; TRUXAL 1953, p. 1376–1379, fig. 42 (Cuba, Cayman Islands, Jamaica, Haïti, Puerto Rico, St. Croix).
Buenoa antigone antigone; DE ABATE 1960, p. 23.

MÉXICO, Tamaulipas, Veracruz, Chiapas, Campeche; GUATEMALA; CUBA, La Habana; GRAND CAYMAN; CAYMAN BRAC; JAMAICA; HISPANIOLA, Haïti; PUERTO RICO; ST. CROIX; St. MARTIN!; MARIE-GALANTE!; MARGARITA!; BLANQUILLA!; BONAIRE!; CURAÇAO!; ARUBA!.

ST. MARTIN: Doctor's Well, Rockland, *Sta. 538A*, 24. V. 1949 (3 ♀); Old Battery Cistern, *529b*, 3. VI. 1955 (1 ♂); Little Bay Pond E., *680*, 4. VI. 1955 (1 ♀); Slob of St. Peter, *467a*, 29. VI. 1955 (7 ♂, 6 ♀); Langs Simson Bay Lagoon, N. E., 22. XI. 1956 (1 ♂); Koolbaai, binnenbak, 5. XII. 1956 (6 ♂, 7 ♀); Koolbaai, buitenbak, 5. XII. 1956 (12 ♂, 4 ♀); Belvedère, 6. XII. 1956 (1 ♂, 11 ♀).

MARIE-GALANTE: Mare Médecinié, Meynard, *753*, 31. I. 1964 (1 ♀); Mare Lagon, Les Galeries, Capesterre, *749*, 2. II. 1964 (9 ♂, 12 ♀).

MARGARITA: Toma de Agua de La Asunción, *21*, 6. VII. 1936 (1 ♀).

BLANQUILLA: Pozo de la Playa del Jaque, *36*, 22. VII. 1936 (2 ♂, 4 ♀).

BONAIRE: Pos Baca, 53b, 17. V. 1930 (2 ♂); same, *s.n.*, 27. IX. 1930 (1 ♂, 1 ♀); same, *53d*, 21. II. 1949 (1 ♀); Tanki Onima, *46a*, 23. V. 1930 (3 ♀); Pos Chikitoe, NE of Goto, *s.n.*, 26. V. 1930 (4 ♂, 2 ♀); Pos Hoeba, N of Goto, *s.n.*, 26. V. 1930 (1 ♂); Pos Bronswinkel, *44a*, 31. V. 1930 (13 ♂, 10 ♀); same, *44b*, 23. VIII. 1955 (2 ♀); Pos Tjoebatoe, S of Slagbaai, *s.n.*, 3. VI. 1930 (2 ♂, 3 ♀); Poos Mangel, Washington, 31. VI. 1957 (1 ♂, 2 ♀).

CURAÇAO: Chinese Bak, 4. I. 1950 (1 ♂), de Jong coll.; Groot St. Joris, 19. X. 1956 (1 ♂); Hofje Knip, 3. XI. 1956 (1 ♂, 1 ♀); Westpunt Vuurtoren, 31. I. 1957 (1 ♂); Plantage Noordkant, 27. III. 1957 (19 ♂, 17 ♀).

ARUBA: Picarón, 17. V. 1957 (6 ♂, 6 ♀).

As far as the salinities of the habitats are known, they range from 50–2,100 mg Cl'/l. If the number-of-specimens collected in water with a certain salt-content is divided by the number-of-habitats involved, the following indexes are obtained: fresh water 1.5, oligohaline water 6.7, mesohaline water 4.3 (definitions of brackish waters according to REDEKE 1932, p. 5). These indexes may indicate a preference for oligohaline habitats in the area studied. However the data are not numerous enough to allow more detailed conclusions. The Margarita sample was collected in flowing fresh water in a hilly region. Other samples are from stagnant water, mostly small and not rarely temporary pools.

Length (in mm)

male $\bar{x}$ = 7.70	s = 0.356	n = 41	*female* $\bar{x}$ = 8.08	s = 0.330	n = 50

Humeral width of pronotum (in mm)

male $\bar{x}$ = 2.12	s = 0.122	n = 42	*female* $\bar{x}$ = 2.29	s = 0.147	n = 50

Ratio vertex: synthlipsis

male $\bar{x}$ = 1.81	s = 0.0139	n = 42	*female* $\bar{x}$ = 1.94	s = 0.0170	n = 50

Ratio greatest width of head: vertex

male $\bar{x}$ = 5.92	s = 0.386	n = 42	*female* $\bar{x}$ = 5.16	s = 0.155	n = 50

Ocular index

male $\bar{x}$ = 0.208	s = 0.013	n = 42	*female* $\bar{x}$ = 0.221	s = 0.018	n = 50

MALE. Disk of pronotum faintly to distinctly tricarinate. Ratio median length scutellum : median length pronotum 0.83–1.40. Ratio humeral width pronotum: median length pronotum 1.42–1.94. Rostral prong somewhat longer than third rostral segment. Length of fore femur (Fig. 53) more than three times its width at apex.

Stridulatory area of femur triangular with its length about half the width of femur at same level, consisting of 15–32 sclerotized ridges. Stridulatory comb of fore tibia with 40–52 teeth, the apical ones thicker than the basal ones. Spine of seventh abdominal tergite normal (Fig. 60). Genital claspers normal (Fig. 70).

FEMALE. Disk of pronotum not tricarinate. Ratio median length scutellum: median length pronotum varying from 0.88–1.42. Ratio humeral width pronotum : median length pronotum varying from 1.48–2.03. Ovipositor normal (Fig. 75).

Investigating the differences between populations of various islands, statistical tests were applied on length and ocular index of samples composed of animals collected on one island. Only samples from the Netherlands Antilles have been considered, as the series from other islands were generally too fragmentary. The following results were obtained.

Length in *males* (in mm)

Aruba	$\bar{x}_A = 8.26$	$s_A = 0.206$	$n_A = 5$
Bonaire	$\bar{x}_B = 7.39$	$s_B = 0.278$	$n_B = 5$
Curaçao	$\bar{x}_C = 7.70$	$s_C = 0.220$	$n_C = 15$
St. Martin	$\bar{x}_M = 7.60$	$s_M = 0.270$	$n_M = 18$

The estimates of population variance based on these samples are close enough to apply Student's t-test analysing the means. $\bar{x}_A$ proved to be significantly higher than $\bar{x}_C$ and $\bar{x}_M$; no significant difference between $\bar{x}_A$ and $\bar{x}_B$ was observed, possibly owing to the low values of n_A and n_B.

Length in *females* (in mm)

Aruba	$\bar{x}_A = 8.34$	$s_A = 0.331$	$n_A = 6$
Bonaire	$\bar{x}_B = 7.93$	$s_B = 0.323$	$n_B = 7$
Curaçao	$\bar{x}_C = 8.10$	$s_C = 0.117$	$n_C = 18$
St. Martin	$\bar{x}_M = 8.10$	$s_M = 0.307$	$n_M = 22$

The variance estimate based on the Curaçao sample differs significantly from variance estimates based on the other samples. No significant differences between the means of the samples have been found.

Ocular index in *males*

Aruba	$\bar{x}_A = 0.212$	$s_A = 0.0147$	$n_A = 6$
Bonaire	$\bar{x}_B = 0.194$	$s_B = 0.0174$	$n_B = 5$
Curaçao	$\bar{x}_C = 0.207$	$s_C = 0.0114$	$n_C = 15$
St. Martin	$\bar{x}_M = 0.209$	$s_M = 0.00742$	$n_M = 18$

The variance estimate based on the St. Martin sample is significantly smaller than the variance estimates based on the Aruba and Bonaire samples, while the difference with the estimate based on the Curaçao sample is very near significance. No significant differences between the means of the samples have been found.

Ocular index in *females*

Aruba	$\bar{x}_A = 0.223$	$s_A = 0.01155$	$n_A = 6$
Bonaire	$\bar{x}_B = 0.214$	$s_B = 0.0131$	$n_B = 7$
Curaçao	$\bar{x}_C = 0.210$	$s_C = 0.0165$	$n_C = 18$
St. Martin	$\bar{x}_M = 0.232$	$s_M = 0.0149$	$n_M = 22$

Here in all cases the variance estimates did not show significant differences. $\bar{x}_M$ was significantly greater than $\bar{x}_B$ and $\bar{x}_C$.

This analysis of island populations of *Buenoa antigone antigone* leads to the following conclusions:

1. Presumably the Aruba population is composed of individuals which generally have a greater length than those on the other three islands.
2. The ocular index tends to vary independently from the mean length in a population.
3. The population of St. Martin will probably differ from those of the other islands with regard to the value of the ocular index.

Buenoa albida (Champion, 1901)

Anisops albidus CHAMPION, 1901, p. 371–373, pl. 22 fig. 14.
Buenoa albida (Champion) KIRKALDY, 1904, p. 121, 134.
Buenoa albida; TRUXAL 1953, p. 1412–1414, fig. 54 (Puerto Rico).

U.S.A., Texas; MÉXICO, Sonora, Sinaloa, Veracruz, Hidalgo, Morelos, Guerrero; CUBA!, Pinar del Río; PUERTO RICO; ST. MARTIN!; MARIE-GALANTE!; BLANQUILLA!; BONAIRE!; CURAÇAO!; ARUBA!.

CUBA: Pinar del Río, 16/29. V. 1933, coll. H. J. Mac Gillavry (1 ♂).
PUERTO RICO: Tanque Papayo, Parguera, *Sta. 707*, 19. IX. 1963 (2 ♂, 53 ♀).
ST. MARTIN: Slob of St. Peter, *537*, 24. V. 1949 (2 ♂, 1 ♀); Doctor's Well, Rockland, *538A*, 24. V. 1949 (2 ♂); Little Bay Pond, *680*, 4. VI. 1955 (2 ♂); N.O. (= N.E.) langs Simson Bay Lagoon, 22. XI. 1956 (4 ♂, 3 ♀); Koolbaai, binnenbak, 5. XII. 1956 (2 ♀); Koolbaai, buitenbak, 5. XII. 1956 (3 ♂, 10 ♀); Belvedère, 6. XII. 1956 (6 ♂, 4 ♀).
MARIE-GALANTE: Mangles de Folle Anse, S. of St.-Louis, *755*, 31. I. 1964 (2 ♀).
BLANQUILLA: Poza de Aguada, N. of El Jaque, *38*, 22. VII. 1936 (1 ♂).
BONAIRE: Tanki Onima, *46a*, 23. V. 1930 (41 ♂, 43 ♀); same, 2. VI. 1957 (1 ♂, 6 ♀);

Tanki Kerkhof, Kralendijk, *51*, 31. III. 1937 (9 ♂, 6 ♀); Pos Baca Grandi, *397b*, 27. XII. 1948 (1 ♀); Flor de Cuba, 2. V. 1957 (18 ♂, 5 ♀); same, 12. V. 1957 (1 ♂, 7 ♀); Dam N. of Wanapa, 6. V. 1957 (3 ♂, 14 ♀); Tanki near Lagoen, 13. V. 1957 (14 ♂, 21 ♀); Guatemala, Seroe Grandi, 13. V. 1957 (55 ♂, 56 ♀); Tanki West van Rincón, 26. V. 1957 (15 ♂, 18 ♀); Pos Mangel, Washington, 31. V. 1957 (6 ♂, 6 ♀).

CURAÇAO: Tanki Mamaja, Hato, *75*, 6. X. 1936 (14 ♂, 15 ♀); Tanki Nobo di Malpays, *398*, 28. X. 1948 (9 ♂, 1 ♀); Tanki di Tera Corá, *396*, 20. VIII. 1948 (2 ♂); same, *396c*, 11. II. 1949 (6 ♂, 1 ♀); Tanki Martha-Koosje, *397b*, 29. I. 1949 (2 ♂); same, *397c*, 11. II. 1949 (6 ♂, 4 ♀); Tanki Grandi, Steenen Koraal, *392*, 17. IV. 1949 (1 ♂, 3 ♀); St. Martha, X. 1956 (6 ♀); Westpunt, Vuurtoren, 31. I. 1957 (4 ♂, 5 ♀); Westpunt, 31. I. 1957 (5 ♂, 2 ♀); Klein St. Martha, bij hoge dam, 1. III. 1957 (2 ♂, 6 ♀); Pannekoek, III. 1957 (4 ♂, 1 ♀).

ARUBA: Tanki di Tibusji, Westpunt, *99*, 9. XII. 1936 (2 ♂); Tanki Mon Plaisir, Oranjestad, *97*, 15. XII. 1936 (1 ♂, 2 ♀); Tanki Leendert, *100*, 16. XII. 1936 (1 ♂); Tanki Hooiberg, *400e*, 11. V. 1955 (3 ♂, 11 ♀); Salinja Balashi, *1013*, 31. V. 1955 (6 ♂, 4 ♀); Rooi Tamboe, 9. IV. 1957 (1 ♂, 1 ♀).

Specimens have been found in fresh to moderately brackish water, with salt-content ranging from 10–3500 mg Cl'/l. If the ratio's number-of-specimens collected: number-of-habitats in which they were collected are calculated, the following indices are obtained: fresh water 51.5, oligohaline water 13.3 and α-mesohaline water 5.3. This may indicate that this species is avoiding moderately to strongly brackish habitats, somewhat in contrast with the ecologically much related species *B. scimitra*.

Length (in mm)

male $\bar{x}$ = 6.005	s = 0.224	n = 36	*female* $\bar{x}$ = 6.88	s = 0.323	n = 212

Humeral width of pronotum (in mm)

male $\bar{x}$ = 1.43	s = 0.043	n = 16	*female* $\bar{x}$ = 1.57	s = 0.109	n = 211

Ratio vertex: synthlipsis

male $\bar{x}$ = 2.26	s = 0.109	n = 36	*female* $\bar{x}$ = 2.35	s = 0.164	n = 218

Ratio greatest width of head: vertex

male $\bar{x}$ = 5.39	s = 0.197	n = 36	*female* $\bar{x}$ = 4.70	s = 0.186	n = 212

Ocular index

male $\bar{x}$ = 0.175	s = 0.0156	n = 36	*female* $\bar{x}$ = 0.200	s = 0.0147	n = 218

MALE. Disk of pronotum distinctly tricarinate. Ratio median length scutellum : median length of pronotum 0.91–1.08. Ratio humeral width pronotum : median length pronotum 1.44–1.68. Rostral prong longer than third rostral segment. Tylus inflated with wide median depression so that the lateral edges form blunt carinas. Fore femur (Fig. 52) not enlarged at apex, length about four times the width at apex. Stridulatory area of fore femur nearly always of the same colour as the surroundings (often difficult to see under low magnification), oblong, suboval, consisting of fifty-

three to forty-six fine sclerotized ridges. Stridulatory comb of fore tibia with thirty-three to forty teeth, basals slightly narrower than apical ones. Spine of seventh abdominal tergite normal (Fig. 61). Right genital clasper normal (Fig. 67).

FEMALE. Disk of pronotum not carinate. Ratio median length scutellum : median length pronotum 0.93–1.55. Ratio humeral width pronotum : median length pronotum 1.50–1.97. Ovipositor normal (Fig. 79).

Females of this species are often difficult to distinguish from females of *B. scimitra*, see under that species. TRUXAL 1953 enters in his key to males of *Buenoa* this species two times. On page 1371 he says, referring to *B. albida* and some other species: "30 . . . femoral stridulatory area with less than twenty-five sclerotized ridges". As this character is used to differentiate *B. albida* from *B. communis* Truxal (which has twenty-six to thirty-one sclerotized ridges), the phrase referring to the group of species containing *B. albida* could be altered in: 30 . . . femoral stridulatory area either with less than twenty-five or with thirty-five or more sclerotized ridges.

Length in *males*

Bonaire	$\bar{x}_B = 5.86$	$s_B = 0.156$	$n_B = 12$
Curaçao	$\bar{x}_C = 5.80$	$s_C = 0.278$	$n_C = 12$
St. Martin	$\bar{x}_M = 5.99$	$s_M = 0.148$	$n_M = 12$

The variance estimate based on the Curaçao sample differed significantly from those based on the other two samples. As to the means, $\bar{x}_B$ and $\bar{x}_M$ showed a significant difference.

Length in *females*

Aruba	$\bar{x}_A = 6.29$	$s_A = 0.193$	$n_A = 13$
Bonaire	$\bar{x}_B = 6.54$	$s_B = 0.262$	$n_B = 117$
Curaçao	$\bar{x}_C = 5.96$	$s_C = 0.406$	$n_C = 39$
St. Martin	$\bar{x}_M = 6.50$	$s_M = 0.164$	$n_M = 16$

The variance estimate based on the Curaçao sample differs significantly from all other variance estimates. Between the estimates based on the Bonaire and St. Martin samples there also exists a significant difference. As to means, only between $\bar{x}_B$ and $\bar{x}_M$ a non-significant difference was found.

Ocular index in *males*

Bonaire	$\bar{x}_B = 0.174$	$s_B = 0.0160$	$n_B = 12$
Curaçao	$\bar{x}_C = 0.177$	$s_C = 0.01705$	$n_C = 12$
St. Martin	$x_M = 0.176$	$s_M = 0.02245$	$n_M = 12$

Neither between variance estimates nor between mean values of samples significant differences have been found.

Ocular index in *females*

Aruba	$\bar{x}_A = 0.191$	$s_A = 0.0118$	$n_A = 14$
Bonaire	$\bar{x}_B = 0.198$	$s_B = 0.01115$	$n_B = 117$
Curaçao	$\bar{x}_C = 0.199$	$s_C = 0.0119$	$n_C = 39$
St. Martin	$\bar{x}_M = 0.208$	$s_M = 0.0145$	$n_M = 16$

The variance estimates based on the Bonaire and St. Martin samples show a just significant difference. As to means, a significant difference between all pairs except $\bar{x}_B$ and $\bar{x}_C$ has been found.

From this analysis the following conclusions may be drawn:
1. The material treated shows far more greater variability in females than in males. This can be a true quality of the species as there are more examples of aquatic Heteroptera in which variability in females is far greater than in males. – However, the possibility that this greater variation in females is due to a proportion of misidentified specimens is not to be overlooked, as the author did not succeed in finding sharp distinguishing characters between females of *B. albida* and *B. scimitra*.
2. The population of St. Martin seems to diverge more from those of the three other islands than these latter populations diverge from each other.

Buenoa scimitra Bare, 1925

Buenoa scimitra BARE, 1925, p. 226–228 fig. 1.
Buenoa scimitra; HYNES 1948, p. 354 (Trinidad).
Buenoa scimitra; HERRING 1951, p. 24.
Buenoa scimitra; TRUXAL 1953, p. 1404–1409, fig. 52 (Cuba, Jamaica, Puerto Rico).
Buenoa scimitra; USHINGER 1956, p. 182–288.
Buenoa scimitra; WILSON 1958, p. 145.

U.S.A., Kansas, Virginia, California, Oklahoma, Tennessee, Arizona, New Mexico, Arkansas, South Carolina, Texas, Louisiana, Missis-

sippi, Alabama, Georgia, Florida; MÉXICO, Tamaulipas, México; CUBA, La Habana; JAMAICA; PUERTO RICO; ST. MARTIN!; BARBUDA!; MARIE-GALANTE!; BARBADOS!; TRINIDAD; BONAIRE!; CURAÇAO!; ARUBA!.

ST. MARTIN: Slob of St. Peter, *Sta. 537*, 2. V. 1949 (1 ♂, 3 ♀); Doctor's Well, Rockland, *538A*, 24. V. 1949 (1 ♂, 8 ♀); Old Battery Cistern, *529b*, 3. VI. 1955 (3 ♂); Little Bay Pond, *680A*, 4. VI. 1955 (5 ♂); Pond of Point Blanche, *528a*, 5. VI. 1955 (7 ♂, 11 ♀); same, *528b*, 27. IX. 1963 (1 ♂, 5 ♀); Langs Simson Bay Lagoen, N. O. [= N. E.], 22. XI. 1956 (1 ♂, 2 ♀); Devils Hole, 28. XI. 1956 (1 ♀); Koolbaai, binnenbak, 5. XII. 1956 (1 ♂, 1 ♀); Koolbaai, buitenbak, 5. XII. 1956 (16 ♂, 9 ♀); Belvedère, 6. XII. 1956 (1 ♂).

BARBUDA: Pool at Warden's, *675*, 5. VII. 1955 (2 ♂, 1 ♀); Bull Hole, *667*, 9. VII. 1955 (7 ♀).

MARIE-GALANTE: Mare Medecinié, Meynard, *753*, 31. I. 1964 (2 ♀).

BARBADOS: Sedge Pond, W. of Belleplaine, *782*, 17. II. 1964 (5 ♂, 3 ♀).

BONAIRE: Tanki Onima, *46a*, 23. V. 1930 (9 ♂, 19 ♀); same, 20. V. 1957 (1 ♀); Pos Bronswinkel, *44a*, 31. V. 1930 (1 ♀); Tanki Kerkhof, Kralendijk, *51*, 31. III. 1937 (88 ♂, 12 ♀); Pos Baca Grandi, *379*, 2. IX. 1948 (6 ♂, 3 ♀); same, *379a*, 16. IX. 1948 (1 ♂, 1 ♀); same, *379d*, 2. IX. 1949 (3 ♂, 7 ♀); same, *379g*, 4. XII. 1963 (6 ♂, 4 ♀); Sheet of water, N. of Kralendijk, *377*, 3. IX. 1948 (1 ♀); Pos Ichi, *52d*, 27. XII. 1948 (5 ♂, 1 ♀); Pos Francés, *58b*, 1. IV. 1955 (1 ♂); Flor de Cuba, 2. V. 1957 (25 ♂, 5 ♀); Guatemala, Seroe Grandi, 13. V. 1957 (13 ♂, 9 ♀).

CURAÇAO: Tanki di Tera Corá, *396c*, 11. II. 1949 (1 ♀); St. Martha, X. 1956 (2 ♀); Hofje Knip, 3. XI. 1956 (1 ♂, 1 ♀); Westpunt, Vuurtoren, 31. I. 1957 (1 ♂); Dokterstuin, 7. III. 1957 (1 ♂); Río Magdalena, 20. VI. 1957 (1 ♀).

ARUBA: Tanki Chikitoe, *96*, 12. II. 1937 (1 ♀); Tanki Hooiberg, *400e*, 11. V. 1955 (4 ♂, 6 ♀); Rooi Tamboe, 9. IV. 1957 (4 ♂, 6 ♀).

Specimens were found in fresh to strongly brackish waters, with salt-content ranging from 35- ca. 10,000 mg Cl'/l. If the ratio's number-of-specimens collected: number-of-habitats in which they were collected are calculated, the following indices are obtained: fresh water 4.2, oligohaline water 17.2, α-mesohaline water 5.16, and β-mesohaline water 1. If the large sample from Bonaire, Tanki Kerkhof is not taken into account the index for oligohaline habitats is still 8.0. These indices may indicate a preference for oligohaline habitats in the area studied.

Length (in mm)

male $\bar{x}$ = 6.13	s = 0.259	n = 29	*female* $\bar{x}$ = 6.47	s = 0.269	n = 112

Humeral width of pronotum (in mm)

male $\bar{x}$ = 1.57	s = 0.0713	n = 35	*female* $\bar{x}$ = 1.67	s = 0.264	n = 113

Ratio vertex: synthlipsis

male $\bar{x}$ = 2.79	s = 0.190	n = 35	*female* $\bar{x}$ = 2.76	s = 0.264	n = 113

Ratio greatest width of head : vertex

male $\bar{x}$ = 5.73	s = 0.196	n = 35	*female* $\bar{x}$ = 4.95	s = 0.204	n = 113

Ocular index

male $\bar{x}$ = 0.134	s = 0.0108	n = 35	*female* $\bar{x}$ = 0.160	s = 0.0165	n = 113

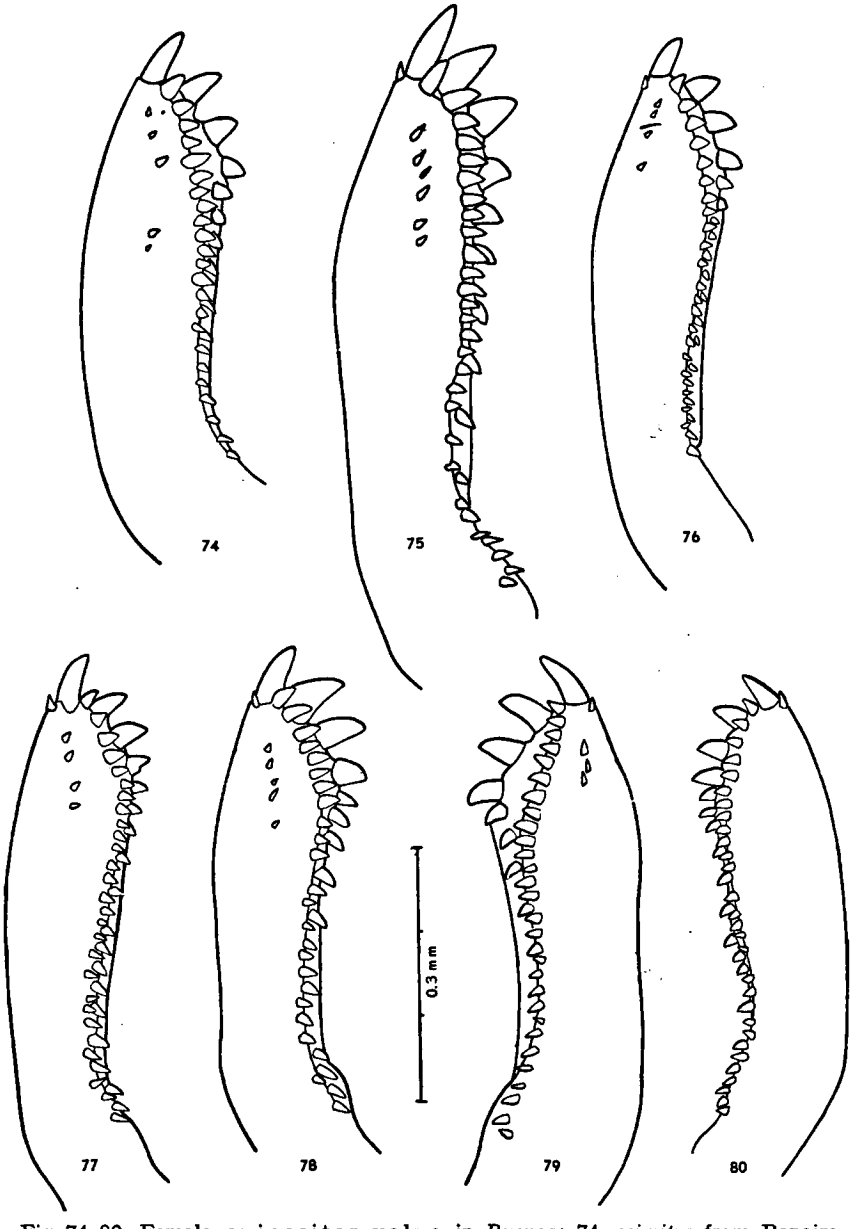

Fig. 74–80. Female ovipositor valve in *Buenoa*: 74, *scimitra* from Bonaire (*46a*); 75, *antigone antigone* from St. Martin (*467a*); 76, *gracilis* from Curaçao (Nieuwpoort); 77, *pallipes* from Cuba (San Blas); 78, *rostra* from Trinidad (*795*); 79, *albida* from Curaçao (*396c*); 80, *platycnemis* from Marie-Galante (*754*).

MALE. Disk of pronotum distinctly tricarinate. Ratio median length scutellum : median length pronotum, 0.88–1.18. Ratio humeral width of pronotum : median length pronotum, 1.50–1.88. Rostral prong shorter than third rostral segment. Length of fore femur (Fig. 57) slightly less than three times its width at apex. Stridulatory area of fore femur very characteristic, sword shaped, with its length about three quarters of the width of femur at same level, consisting of about sixty sclerotized ridges. Stridulatory comb of fore tibia with eighteen to twenty-four teeth, no clear differences in width between the apical and basal ones. Spine of seventh abdominal tergite normal (Fig. 62). Right genital clasper normal (Fig. 68).

FEMALE. Disk of pronotum not or, seldom, faintly tricarinate. Ratio median length scutellum: median length pronotum, 0.94–1.41. Ratio humeral width pronotum: median length pronotum, 1.62–2.04. Ovipositor normal (Fig. 74).

Female specimens of this species are in some cases hardly or not separable from female specimens of *B. albida* with the characters known. In opinion of the author the best character is the ocular index but this too shows a considerable overlap. As in the region studied in more than 90% of the habitats where one of these species was found, the other was present too, it is quite difficult to obtain a long series of females which all belong certainly to either species.

Length in *males*

Bonaire	$\bar{x}_B = 6.07$	$s_B = 0.269$	$n_B = 12$
Curaçao	$\bar{x}_C = 6.32$	$s_C = 0.216$	$n_C = 5$
St. Martin	$\bar{x}_M = 6.11$	$s_M = 0.202$	$n_M = 12$

No significant differences between the estimates of population variance based on these samples have been found, likewise the means did not show significant differences.

Length in *females*

Aruba	$\bar{x}_A = 6.41$	$s_A = 0.1665$	$n_A = 9$
Bonaire	$\bar{x}_B = 6.53$	$s_B = 0.283$	$n_B = 63$
Curaçao	$\bar{x}_C = 6.505$	$s_C = 0.209$	$n_C = 4$
St. Martin	$\bar{x}_M = 6.28$	$s_M = 0.228$	$n_M = 16$

The estimates of population variance based on the Aruba and Bonaire sample showed a significant difference. Regarding the means, $\bar{x}_B$ and $\bar{x}_M$ showed a significant difference.

Ocular index in *males*

Bonaire	$\bar{x}_B = 0.144$	$s_B = 0.00894$	$n_B = 12$
Curaçao	$\bar{x}_C = 0.1306$	$s_C = 0.00975$	$n_C = 5$
St. Martin	$\bar{x}_M = 0.127$	$s_M = 0.0118$	$n_M = 12$

There are no significant differences between the estimates of population variance based on these samples. In comparing the means, $\bar{x}_B$ deviates significantly from the other values.

Ocular index in *females*

Aruba	$\bar{x}_A = 0.169$	$s_A = 0.00529$	$n_A = 8$
Bonaire	$\bar{x}_B = 0.165$	$s_B = 0.0129$	$n_B = 63$
Curaçao	$\bar{x}_C = 0.135$	$s_C = 0.00387$	$n_C = 4$
St. Martin	$\bar{x}_M = 0.152$	$s_M = 0.0129$	$n_M = 18$

There are no significant differences between the estimates of population variance based on these samples. In comparing the means there proved to be only a non-significant difference between $\bar{x}_A$ and $\bar{x}_B$.

This analysis indicates a difference between the population on Bonaire and those from the other islands. As however, only few specimens of Aruba and Curaçao were available it is quite possible that a greater collection will show other results.

Buenoa gracilis, Truxal, 1953

Buenoa gracilis Truxal, 1953, p. 1439–1442, fig. 64 (Cuba, Jamaica, Puerto Rico, St. Croix, Grenada).
Buenoa gracilis; De Abate 1960, p. 23.

México, Veracruz, Guerrero, Oaxaca, Chiapas, Campeche; Honduras; Panamá; Venezuela, Paraguaná; Perú; Cuba, La Habana, Oriente; Jamaica; Puerto Rico; St. Croix; St. Martin!; St.-Barthélemy!; Barbuda!; Guadeloupe!; La Désirade!; Barbados!; Grenada; Bonaire!; Curaçao!; Aruba!.

St. Martin: Slob of St. Peter, *Sta. 537*, 24. V. 1949 (14 ♂, 12 ♀); Pond of Point Blanche, *528a*, 5. VI. 1955 (1 ♂); Devils Hole Swamp, 27. XI. 1956 (2 ♂, 2 ♀).
St.-Barthélemy: Mare des Palmiers, Lorient, *524*, 3. VI. 1949 (2 ♂).
Barbuda: Low Pond, N. of Village, *674*, 5. VII. 1955 (2 ♂, 5 ♀).
Guadeloupe: Pond de Boisvin, S. of Moule, *729*, 29. I. 1964 (9 ♂, 7 ♀).

LA DÉSIRADE: Saline de Grande Anse, *1436A*, 23. I. 1964 (1 ♂, 4 ♀); Grande Source, Baie Mahault (trough), *741*, 24. I. 1964 (1 ♂).

MARIE-GALANTE: Mangles de Folle Anse, S. of St.-Louis, *755*, 31. I. 1964 (1♂, 2 ♀); Mare Médecinié, Meynard, *753*, 31. I. 1964 (1 ♂, 3 ♀); Rivière du Vieux Fort, Vangout, *752*, 31. I. 1964 (2 ♂, 3 ♀); Rivière de St.-Louis, Les Sources, *756*, 1. II. 1964 (1 ♂); same, *756A*, 1. II. 1964 (1 ♂, 3 ♀).

BARBADOS: Sedge Pond, W. of Belleplaine, *782*, 17. II. 1964 (1 ♂).

BONAIRE: Pos Shiki, N. Lima, *629*, 19. VIII. 1955 (2 ♂, 1 ♀); Pos Francés, *58b*, 1. IV. 1955 (2 ♂, 1 ♀).

KLEIN CURAÇAO: 23. VI. 1957 (3 ♂, 7 ♀).

CURAÇAO: Tanki Mamaja, *75a*, 11. X. 1936 (1 ♂); Pos Europa, *82*, 27. X. 1936 (1 ♂); Tanki di Tera Corá, *396c*, 11. II. 1949 (2 ♀); St. Martha, 28. X. 1956 (9 ♂, 11 ♀); Westpunt, richting Vuurtoren, 1. XI. 1956 (1 ♂, 2 ♀); Hofje Knip, 3. XI. 1956 (5 ♂, 3 ♀); Willemstad, Marchena, vuil poeltje [small dirty pond], 10. XI. 1956 (1 ♀); Nieuwpoort, Pos Cajuda, 13. I. 1957 (7 ♂, 16 ♀); Westpunt, Vuurtoren, 31. I. 1957 (1 ♀); Klein St. Martha, 1. II. 1957 (1 ♂, 1 ♀); Plantage v.d. Mark [Klein Piscadera], 27. II. 1957 (2 ♀); Dokterstuin, 7. III. 1957 (1 ♂, 1 ♀); Plantage Noordkant, 27. III. 1957 (1 ♂).

ARUBA: Rooi Tamboe, 9. IV. 1957 (1 ♂); Sirabana, 28. IV. 1957 (1 ♂).

VENEZUELA: Paraguaná, Peila de Buena Vista, *s.n.*, 18. II. 1937 (2 ♂).

Specimens have been found in fresh to quite strongly brackish waters with salt-content ranging from 20–6,200 mg Cl'/l. If indices, number-of-specimens: number-of-habitats in which they were collected, are calculated the following results are obtained: fresh-water habitats 10; oligohaline waters 2; α-mesohaline waters 3; β-mesohaline waters 3. This may indicate a preference for fresh-water habitats.

Length (in mm)

male $\bar{x} = 5.83$	$s = 0.158$	$n = 30$	*female* $\bar{x} = 5.94$	$s = 0.237$	$n = 32$

Humeral width of pronotum (in mm)

male $\bar{x} = 1.40$	$s = 0.070$	$n = 30$	*female* $\bar{x} = 1.41$	$s = 0.090$	$n = 35$

Ratio vertex : synthlipsis

male $\bar{x} = 4.0$	$s = 0.43$	$n = 30$	*female* $\bar{x} = 4.1$	$s = 0.45$	$n = 35$

Ratio greatest width of head: vertex

male $\bar{x} = 5.63$	$s = 0.255$	$n = 30$	*female* $\bar{x} = 5.10$	$s = 0.253$	$n = 35$

Ocular index

male $\bar{x} = 0.095$	$s = 0.0072$	$n = 29$	*female* $\bar{x} = 0.1015$	$s = 0.00925$	$n = 32$

MALE. Disk of pronotum distinctly tricarinate. Ratio median length scutellum: median length pronotum 0.99–0.7. Ratio humeral width pronotum: median length pronotum 1.26–1.52. Rostral prong equal to or slightly shorter than third rostral segment. Length of fore femur (Fig. 56) more than three times its width at apex. Stridulatory area on fore femur small, consisting of six to nine strong, thick sclerotized ridges; colour of the area characteristically dark with conspicuous yellowish centre. Stridulatory comb of fore

tibia with twenty-four to twenty-eight teeth; the apical ones longer but narrower than the basal ones. Apex of tibia on the inner side with three to four small pegs (Fig. 59). Spine of seventh abdominal tergite normal (Fig. 63). Right genital clasper normal (Fig. 71).

FEMALE. Disk of pronotum not or very faintly tricarinate. Ratio median length scutellum : median length pronotum 0.94–1.3. Ratio humeral width of pronotum: median length of pronotum 1.52–1.84. Ovopositor normal (Fig. 76).

Only from Curaçao and St. Martin were samples of sufficient size available to allow statistical analysis.

Length in *males*

Curaçao	$x_C = 5.76$	$s_C = 0.206$	$n_C = 19$
St. Martin	$x_M = 5.86$	$s_M = 0.132$	$n_M = 7$

Neither the variance estimates nor the means show significant differences.

Length in *females*

Curaçao	$x_C = 5.96$	$s_C = 0.218$	$n_C = 21$
St. Martin	$x_M = 5.91$	$s_M = 0.177$	$n_M = 7$

Neither the variance estimates nor the means show significant differences.

Ocular index in *males*

Curaçao	$x_C = 0.0945$	$s_C = 0.0081$	$n_C = 20$
St. Martin	$x_M = 0.0970$	$s_M = 0.0040$	$n_M = 7$

Neither the variance estimates nor the means show significant differences.

Ocular index in *females*

Curaçao	$x_C = 0.1015$	$s_C = 0.0079$	$n_C = 20$
St. Martin	$x_M = 0.1014$	$s_M = 0.0102$	$n_M = 7$

Neither the variance estimates nor the means show significant differences.

As there are only two samples with comparatively small numbers of specimens which allow statistical analysis, the conclusion suggested by this analysis, that *B. gracilis* varies in respect to length and ocular index far less than other species of *Buenoa* analysed, must be considered with reserve.

Buenoa platycnemis (Fieber, 1851)

Anisops platycnemis FIEBER, 1851, p. 485 (Puerto Rico).
not *Buenoa platycnemis* (Fieber) KIRKALDY, 1904, p. 134 [changes *Anisops* into *Buenoa*].
Buenoa platycnemis; TRUXAL 1953, p. 1421–1426, fig. 57 (Cuba, Grand Cayman, Hispaniola, Jamaica, Mona, Puerto Rico, St. Thomas, St. Croix, Martinique).
Buenoa platycnemis; TRUXAL 1957, p. 16.
Buenoa platycnemis; DE ABATE 1960, p. 21–22.

U.S.A., Texas, Florida; MÉXICO, Sonora, Jalisco, Veracruz, Michoacán, México D.F., Morelos, Guerrero, Chiapas, Campeche, Yucatán; COSTA RICA; PANAMÁ; CANAL ZONE; COLOMBIA; VENEZUELA; BRASIL, Maranhao, Goiás; PERÚ, Amazonas; CUBA, La Habana, Matanzas; GRAND CAYMAN; JAMAICA; HISPANIOLA, Haïti; MONA; PUERTO RICO; ST. THOMAS; ST. CROIX; ST. MARTIN!; MARIE-GALANTE!; LA DÉSIRADE!; MARTINIQUE; BONAIRE!; CURAÇAO!.

ST. MARTIN: Old Battery Cistern, *Sta. 529b*, 3. VI. 1955 (1 ♂); Slob of St. Peter, *467a* 29. VI. 1965 (3 ♂).
LA DÉSIRADE: Grande Source, Baie Mahault (trough), *741*, 24. I. 1964 (2 ♂, 1 ♀).
MARIE-GALANTE: Mangles de Folle Anse, S. of St. Louis, *775A*, 31. I. 1964 (1 ♀); Mare du Moulin de Grand Pierre, *754*, 1. II. 1964 (17 ♂, 16 ♀); Mare Lagon, Les Galeries, Capesterre, *749*, 2. II. 1964 (15 ♂, 12 ♀).
BONAIRE: Dos Poos, 16. V. 1957 (11 ♂, 10 ♀).
CURAÇAO: Klein St. Martha, 1. III. 1957 (1 ♂, 1 ♀); Dokterstuin, 7. III. 1957 (1 ♂).
VENEZUELA: N. Higuerote, *1*, 30. VII. 1936 (1 ♀).

Specimens have been collected in fresh to slightly brackish water with salt content ranging from 17–495 mg Cl'/l. The two larger samples from Marie-Galante (*749, 754*) are from fresh water habitats. The salt-content of Dos Pos was at 27. III. 1937 450 mg Cl'/l. These data suggest that this species prefers fresh water, which would explain its scarcity in the Netherlands Antilles while it is a common and widely distributed species in the region studied. The Netherlands Antilles are known to have very few fresh water habitats.

Length (in mm)

male $\bar{x} = 4.93$	$s = 0.230$	$n = 15$	*female* $\bar{x} = 5.325$	$s = 0.234$	$n = 14$

Humeral width of pronotum (in mm)

male $\bar{x} = 1.31$	$s = 0.0425$	$n = 15$	*female* $\bar{x} = 1.45$	$s = 0.0681$	$n = 14$

Ratio vertex : synthlipsis

male $\bar{x} = 2.09$	$s = 0.127$	$n = 15$	*female* $\bar{x} = 2.18$	$s = 0.106$	$n = 14$

Ratio greatest width of head : vertex

male $\bar{x} = 5.74$	$s = 0.1435$	$n = 15$	*female* $\bar{x} = 5.46$	$s = 0.220$	$n = 14$

Ocular index
male $\bar{x} = 0.183$ $s = 0.0125$ $n = 15$ *female* $\bar{x} = 0.183$ $s = 0.0105$ $n = 14$

MALE. Disk of pronotum tricarinate, with blunt carinae. Ratio median length scutellum : median length pronotum 0.79–1.08. Ratio humeral width pronotum: median length pronotum 1.36–1.81. Rostral prong distinctly longer than third rostral segment; in lateral view protruding distally anterior to third rostral segment. Length of fore femur (Fig. 58) about two and a half to three times its width at apex. Femoral stridulatory area small, oblong, with twelve to fourteen sclerotized ridges. Tibial comb with thirty to thirty-four teeth, apicals thicker than basal ones. Spine of seventh abdominal tergite normal (Fig. 64). Right genital clasper normal (Fig. 69).

FEMALE. Pronotum not tricarinate, sometimes median carina present and then most strongly developed anteriorly. Ratio median length scutellum : median length pronotum 1.00–1.52. Ratio humeral width pronotum : median length pronotum 1.60–2.41. Ovipositor normal (Fig. 80).

This species is very similar to *B. pallipes* (F.); see under that species for remarks.

The few specimens collected on various islands did not allow statistical analysis. The species is known to be quite variable (TRUXAL 1953).

Buenoa pallipes (Fabricius, 1803)

Notonecta pallipes FABRICIUS, 1803, p. 103.
Anisops pallipes (Fabricius) STÅL, 1868, p. 137.
Buenoa pallipes (Fabricius) KIRKALDY, 1904, p. 123, 134.
Buenoa pallipes; TRUXAL 1953, p. 1418–1421, fig. 56 (Jamaica, Puerto Rico, St. Thomas, Guadeloupe).
Buenoa pallipes; DE ABATE 1960, p. 21.

MÉXICO, Oaxaca, Chiapas; COSTA RICA; CUBA!; JAMAICA; PUERTO RICO; ST. THOMAS; ST. JOHN!; GUADELOUPE; LA DÉSIRADE!; ST. VINCENT!; BARBADOS!.

CUBA: San Blas, Prov. Santa Clara (= Las Villas), 1–9. III. 1933, coll. H. J. Mac Gillavry (6 ♂, 21 ♀).

ST. THOMAS, Klug lgt., (1 ♂, 1 ♀) (not the specimens seen by Truxal 1953, p. 1425) (Leiden Museum).
ST. JOHN: Puddle at Catherineberg, *686*, 19. VI. 1955 (4 ♂, 8 ♀).
LA DÉSIRADE: Source de Cybèle, *Sta. 740*, 24. I. 1964 (1 ♂, 1 ♀).
ST. VINCENT, Hope lgt. (1 ♀, Leiden Museum).
BARBADOS: Sedge Pond, W. of Belleplaine, *782*, 17. II. 1964 (51 ♂, 42 ♀).

The habitat on Barbados had a salt content of 66 mg Cl'/l.; that on La Désirade contained 225 mg Cl'/l.

Length (in mm)					
male $\bar{x} = 5.44$	$s = 0.208$	$n = 10$	*female* $\bar{x} = 5.74$	$s = 0.218$	$n = 10$
Humeral width of pronotum (in mm)					
male $\bar{x} = 1.56$	$s = 0.055$	$n = 10$	*female* $\bar{x} = 1.67$	$s = 0.050$	$n = 10$
Ratio vertex : synthlipsis					
male $\bar{x} = 1.86$	$s = 0.212$	$n = 10$	*female* $\bar{x} = 2.08$	$s = 0.190$	$n = 10$
Ratio greatest width of head: vertex					
male $\bar{x} = 5.93$	$s = 0.240$	$n = 10$	*female* $\bar{x} = 5.65$	$s = 0.230$	$n = 10$
Ocular index					
male $\bar{x} = 0.202$	$s = 0.0185$	$n = 10$	*female* $\bar{x} = 0.191$	$s = 0.0162$	$n = 10$

MALE. Pronotum tricarinate, sometimes faintly. Ratio median length scutellum : median length pronotum 0.68–0.99. Ratio humeral width pronotum : median length pronotum 1.33–2.01. Length of fore femur (Fig. 55) about two to two and a half times the width at apex. Stridulatory area on fore femur with sixteen to twenty sclerotized ridges. Stridulatory comb with about thirty-four to thirty-eight teeth; apical teeth thicker than basal ones. Spine of seventh abdominal tergum normal (Fig. 65). Right genital clasper normal (Fig. 72).

FEMALE. Pronotum not tricarinate. Ratio median length scutellum : median length pronotum 1.00–1.24. Ratio humeral width pronotum : median length pronotum 1.54–1.92. Ovipositor normal (Fig. 77).

Small specimens of this species resemble large specimens of *B. platycnemis* (Fieber). In males useful distinguishing characters are: the apical width of the fore femur, which is distinctly wider relative to its length in *B. pallipes* than it is in *B. platycnemis*, and the base of the rostral prong which does not protrude anterior to

third rostral segment in *B. pallipes* and clearly protrudes in *B. platycnemis*. Isolated females are sometimes unidentifiable. Small collections generally are easily attributable to either species using mean length and the mean values of various ratio's calculated from the sample.

Buenoa rostra Truxal 1953

Buenoa rostra TRUXAL, 1953, p. 1395–1396, fig. 50 (Trinidad).

VENEZUELA; TRINIDAD.

TRINIDAD: Mainroad swamp south of Point Fortin, *Sta. 795*, 16. I. 1964 (29 ♂, 27 ♀). This habitat has a low salt content, 13 mg Cl'/l.

Length (in mm)

male $\bar{x}$ = 5.80	s = 0.218	n = 5	*female* $\bar{x}$ = 5.87	s = 0.282	n = 5
Humeral width of pronotum (in mm)					
male $\bar{x}$ = 1.58	s = 0.0570	n = 5	*female* $\bar{x}$ = 1.56	s = 0.0452	n = 5
Ratio vertex: synthlipsis					
male $\bar{x}$ = 2.14	s = 0.0935	n = 5	*female* $\bar{x}$ = 2.30	s = 0.126	n = 5
Ratio greatest width of head : vertex					
male $\bar{x}$ = 5.63	s = 0.148	n = 5	*female* $\bar{x}$ = 5.51	s = 0.328	n = 5
Ocular index					
male $\bar{x}$ = 0.182	s = 0.085	n = 5	*female* $\bar{x}$ = 0.171	s = 0.137	n = 5

MALE. Pronotum tricarinate, with nearly parallel lateral margins. Ratio median length scutellum: median length pronotum 0.73–0.83. Ratio humeral width pronotum: median length pronotum 1.28–1.39. Length of fore femur (Fig. 54) slightly less than three times its width at apex. Stridulatory area of fore femur nearly triangular, with about thirteen to seventeen sclerotized ridges. Stridulatory comb of fore tibia with twenty-five to twenty-seven teeth, apical ones thicker and stronger than basal ones. Rostral prong stout, distinctly longer than third rostral segment, elbowed in its middle. Spine of seventh abdominal tergum normal (Fig. 66). Right genital clasper normal (Fig. 73).

FEMALE. Pronotum not tricarinate. Ratio median length scutellum : median length pronotum 0.88–1.15. Ratio humeral width pronotum: median length pronotum 1.67–1.92. Ovipositor normal (Fig. 78).

Zoogeographical Remarks

Truxal 1953 mentions several species of *Buenoa* known to occur on various Caribbean Islands, which were not represented in the present collections. As the collecting on the Netherlands Antilles and especially Curaçao has been quite intensive it is not likely that many other species will be found here in future. An obvious explanation for the lack of several species common on other Antilles and in Venezuela is the scarcity of fresh-water habitats on the Netherlands Antilles. The species collected in any numbers here prefer, or, at least, thrive well in, moderately brackish waters.

The abundance of *B. albida* in the collections studied was somewhat surprising as Truxal 1953, found relatively few specimens in the collections of the Kansas University. It is possible that this species has its centre of abundance on the islands of the Leeward Group.

Menke 1963 shows that in the genus *Lethocerus* (Belostomatidae) there are two faunal elements represented on the Antilles: a Central American element which is by far the most important, and a South American element. As far as the distribution of the species of *Buenoa* which occur on the Antilles is known, four elements can be distinguished:

1) North American: *B. scimitra, B. confusa* Truxal.
2) Central American: *B. albida, B. antigone, B. gracilis, B. pallipes, B. platycnemis* and *B. pallens* (Champ.)
3) South American: *B. rostra, B. femoralis* (Fieber).
4) Endemic on the Antilles: *B. macrophthalma* (Fieber).

The Central American element is in *Buenoa*, just as with *Lethocerus*, by far the most important. The distribution of the species mentioned here as South American and Antillean element is still little known. The agreement with the distribution of *Lethocerus* as given by Menke 1963 is obvious.

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