

# Encyrtidae of Costa Rica (Hymenoptera: Chalcidoidea): the genus *Aenasius* Walker, parasitoids of mealybugs (Homoptera: Pseudococcidae)

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## CONTENTS

Synopsis .....	117
Introduction .....	117
Depositories .....	118
Acknowledgements .....	119
<i>Aenasius</i> Walker .....	119
Systematic note .....	119
Diagnostic characters .....	119
Biology .....	119
Use in biocontrol .....	120
Distribution .....	120
Identification of species .....	120
Abbreviations used in text .....	121
Key to Costa Rican species of <i>Aenasius</i> .....	121
Review of species .....	123
References .....	144
Illustrations .....	146
Index to scientific names .....	163

**SYNOPSIS.** The species of *Aenasius* from Costa Rica are revised. Of these, 16 are named and a further 20 recognised from males, but not named. Six species are described as new and 9 new specific synonymies are proposed. A dichotomous key to all species is provided and each species is further characterised by a diagnosis and notes are provided on their distribution and hosts.

## INTRODUCTION

Until recently, tropical parasitic Hymenoptera have received relatively little attention from tax-

onomists in comparison with those of temperate areas such as Europe and North America. Early European taxonomists concentrated their attention on their home ground because that is where it was easiest to obtain material on which

to work. The early work of North American taxonomists largely related to agriculture and the control of insect pests. Thus, it was not until relatively recently, with the use of modern collecting and preservation techniques, that the focus of these studies changed significantly. In particular, the use of Malaise traps greatly enhanced collection of parasitic Hymenoptera on a scale never before achieved. For instance, the work of Henry Townes revolutionised the study of Ichneumonidae by making available huge numbers of specimens collected from all over the world using his lightweight version of the Malaise trap (Townes, 1972). He also perfected a rapid technique for mounting specimens on the sides of pins. Although the use of a Malaise trap was seen as a valuable method for collecting microhymenoptera, there was still one serious problem with using material collected by this method for taxonomic purposes. Small, weakly sclerotised specimens, such as Chalcidoidea, shrivelled badly when air-dried from alcohol. This made taxonomic work very difficult. The problem was overcome when it was realised that the use of critical-point drying could prevent specimens from collapsing (Gordh & Hall, 1976). This was an extremely important development in the study of weakly sclerotised microhymenoptera because it allowed specialists to remove specimens from alcohol and dry them without the danger of their integument collapsing. This revolutionised the study of smaller Chalcidoidea in tropical areas because it has allowed specialists to study a large amount of good-quality material from a wide area.

The use of Malaise traps for collecting parasitic Hymenoptera has led to some surprising findings. Owen & Owen (1974) observed that Ichneumonidae were no more diverse in tropical Africa than in temperate areas such as USA (Michigan) and Sweden. This was contrary to the generally accepted view that species richness, or diversity, increases with a decrease in latitude. Many plausible theories were put forward as to why at least some parasitic Hymenoptera in general follow this reverse trend. Yet findings for northern Sulawesi (Noyes, 1989) indicated strongly that whatever might be true for Ichneumonidae did not seem to be the case for other groups of parasitic Hymenoptera, particularly the Chalcidoidea. The view that there is not an increase in species richness in Ichneumonidae in lower latitudes now seems to be well supported by some extensive studies in Costa Rica and elsewhere (Gauld, 1986; Gauld *et al.*, 1992). These studies suggest that species richness in this group may be influenced by a number of factors

including the possibility that many tropical insects may be unsuitable to act as hosts for ichneumonids because of an increase in toxins accrued by them from the plants upon which they feed ('poison host hypothesis'; Gauld *et al.*, 1992). This work has been supported by the extensive use of hundreds of Malaise traps to survey Ichneumonidae in Costa Rica since 1985. As a side-product of this survey, a vast quantity of microhymenoptera has become available for study.

This unique collection has now made it possible to survey in detail the microhymenopteran fauna of a tropical country for the first time. The results of the survey can be used for comparisons of species richness with similarly well-known temperate areas such as Great Britain. The collection can also be used for comparative studies on distribution within Costa Rica. Perhaps most important, by providing a sound framework for future work on this poorly studied group, taxonomic studies can ultimately provide the basis for future work on this group over a much wider area, perhaps the whole of South America.

The present paper results directly from the above mentioned Malaise trap survey and from the collecting efforts of many other entomologists too numerous to mention here. It is intended as the first contribution in a series of studies that will cover the taxonomy, distribution and known hosts of the 700 or so species of one family of Chalcidoidea, the Encyrtidae, that are known to occur in Costa Rica. It is hoped that these studies will encourage more detailed studies of this family in Costa Rica and elsewhere in order to learn more about their biology, in particular their host ranges. Such work may facilitate the use of particular species in biological control programmes in other parts of the world should that become necessary.

This first study is of the genus *Aenasius*, the species of which are relatively easy to recognise (see Fig. 1). The genus includes several species of actual or potential economic importance since their hosts are mealybugs (Homoptera: Pseudococcidae), many of which are important pests of agriculture in most parts of the world.

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## DEPOSITORIES

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| AMNH | American Museum of Natural History, New York, USA |
| BMNH | The Natural History Museum, London, UK            |
| CNC  | Canadian National Collection, Ottawa, Canada      |

IEE	Instituto di Entomología Español, Madrid, Spain
INBio	Instituto Nacional de Biodiversidad, Costa Rica
MBA	Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina
PPRI	Plant Protection Research Institute, Pretoria, South Africa
TAMU	Texas A&M University, College Station, Texas, USA
USNM	United States National Museum, Washington D.C., USA
ZISP	Zoological Institute, Academy of Sciences, St Petersburg, Russia

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### *Aenasius* Walker

*Aenasius* Walker, 1846: 180. Type species *Aenasius hyetus* Walker, by monotypy.

*Neodiscodes* Compere, 1931: 272–274. Type species *Neodiscodes martinii* Compere, by original designation and monotypy. Synonymised with *Aenasius* by Prinsloo, 1988: 1468.

*Pseudanasius* Hayat, Alam & Agarwal, 1975: 21–23. Type species *Pseudanasius clavus* Hayat, Alam & Agarwal, by original designation and monotypy. Synonymised with *Aenasius* by Hayat, 1981: 17.

### Systematic note

Within the Encyrtidae, *Aenasius* belongs to the subfamily Tetracneminae, tribe Aenasiini. The tribal classification of the Tetracneminae has been reviewed by Noyes & Hayat (1994) with six tribes being recognised and diagnoses provided for the subfamily and each of the six included tribes. The genus has been diagnosed in a key to Neotropical encyrtid genera (Noyes, 1980), but

can also be distinguished from all other genera of Encyrtidae using the characters given in the following diagnosis.

### Diagnostic characters

Body generally squat and robust; mandibles bidentate with lower tooth short (Fig. 101), or with a short, upper, third tooth (Fig. 100). FEMALE: frontovertex (Figs 86–91) with conspicuous piliferous punctures giving it the appearance of the surface of a thimble or golf ball; scrobes deep and frequently sharply margined dorsally and laterally; scape varying from almost cylindrical (Fig. 18) to strongly broadened and flattened and less than twice as long as broad (Figs 3, 6); funicle 7-segmented (Figs 2–19), the first segment very small and normally visible only at higher magnifications on slide-mounted material; clava with sensory area enlarged, forming an oblique apical truncation which is longitudinally divided by a straight to sinuate line (Figs 9, 11, 92, 93); forewings infusate (Figs 20–45); apex of postmarginal and stigmal veins frequently connected by a naked, hyaline streak (Figs 32–45); gaster with hypopygium reaching apex; paratergites sclerotised (Figs 46–49); last tergite more or less U-shaped; third valvulae usually free (Figs 50, 52, 55). MALE: frontovertex either with piliferous punctures (Figs 96, 97) or with more irregular, sometimes coarse, sculpture (Figs 94, 95); antennae either with 6 distinct funicle segments and a small, entire clava (Figs 69–75), or with 2–5 anelliform segments and a relatively long, clava (Figs 76–83); wings hyaline (Figs 62–68), rarely distinctly infusate (Fig 65); postmarginal vein conspicuously longer than stigmal; phallobase (Figs 84, 85, 99) with a pair of distinct digits, each with two or three apical hooks, outside each digitus a pair of bristles; aedeagus broad (Fig. 99) and about as long as mid tibial spur.

### Biology

Where their hosts are known, all species are solitary endoparasitoids of mealybugs (Homoptera: Pseudococcidae). Little is known of their development but the egg and newly hatched larva have been described for *Aenasius maplei* Compere from North America (Maple, 1947). In this species the deposited egg is typically encyrtiform with the main part of the egg being attached to a smaller bulb by a narrow stalk. The deposited egg remains attached to the integument of the mealybug host via the stalk which, together with the collapsed bulb, projects

to the exterior of the host. The young larva has a single pair of functioning spiracles and remains attached to the remains of the egg shell and utilises atmospheric air via the protruding egg stalk and bulb.

### Use in biocontrol

Although species of *Aenasius* must play an important role in the natural regulation of populations of their mealybug hosts, there have been few attempts to utilise the species in biocontrol programmes (see Table 1).

### Distribution

Of the 38 described species of *Aenasius*, 29 are known from the New World, eight are Afrotropical and Oriental. The single remaining species, *advena*, is circumtropical, but of Neotropical origin. The Old World species form a group which is distinguished by the frontovertex being not more than one-sixth the head width, whilst in the New World species the frontovertex is conspicuously wider, normally at least one-quarter head width. We have examined many undescribed species from South America.

Within Costa Rica, species of *Aenasius* generally tend to be most common in drier habitats at or below 500 m altitude, eg. Guanacaste, San José Province, and west of the central range. Malaise trap catches suggest that, although they are generally more common during the drier parts of the year (January to March in Guanacaste), they can also be common if there are longish dry spells during the wetter parts (eg. September-October in Guanacaste). This either reflects a real build-up in numbers due to the rapid population growth of their mealybug hosts, or greater parasitoid activity during drier periods, or perhaps a combination of both.

### Identification of species

Several keys have been published to the species: Compere (1937) for New World species, Kerrich (1967) for all known species (Old World species as *Neodiscodes*), Kaul & Agarwal (1985) for Old World species (as *Neodiscodes*) and Prinsloo (1988) for Afrotropical species.

Some of these keys are based on characters which may be unreliable, e.g. coloration of antennal segments, or very small differences in the relative width of the scape or frontovertex. During our study we found that some characters appear to be reliable in defining species or groups of species. In the female these are: a) the presence or absence of a hyaline streak at the apex of the venation, b) the relative width and shape of the scape, c) the size and depth of the antennal scrobes, d) the appearance and distribution of the piliferous punctures, e) the shape of the lower distal margin of the forewing, and f) the shape of the posterior margin of the last tergite of the gaster. In the male, four characters appear to be useful: a) the number and relative size of the funicle segments, b) the relative size of the clava, c) the sculpture of the frontovertex, and d) the presence or absence of particular sensilla on F6 or the clava (see Figs 102-105). The male genitalia of *Aenasius* do not seem to show a great deal of variation, although we have noted some variation in the relative size of the bristles at the bases of the digiti. However, we have not examined enough slide mounted material of any single species to determine the amount of intraspecific variation in this character.

Although the present work deals with 16 described species, we have recognised a further 20 species from males collected in Costa Rica. As with most Encyrtidae, the taxonomy of *Aenasius* species is based entirely on female characters, and therefore these additional species are not being named in this paper, although some prob-

**Table 1** A summary of the use of *Aenasius* spp. in biological programmes worldwide (Abbreviations: E – established; NR – not released; ?? – no subsequent information; P – partial control; R – released, but no further information available; SC – successful control).

Target pest species	<i>Aenasius</i> sp.	Country	Year first used	Result	Source
<i>Phenacoccus herreni</i>	<i>vexans</i>	Colombia	1994	SC	J. Castillo (pers comm.)
<i>Dysmicoccus brevipes</i>	<i>cariocus</i>	Hawaii	1935	??	Swezey <i>et al.</i> (1939)
<i>Ferrisia virgata</i>	<i>advena</i>	Hawaii	1923, 1929, 1958	P	Bartlett in Clausen (1978), Funasaki, <i>et al.</i> (1988)
	<i>advena</i>	California	1966-1967	R	DeBach & Warner (1969)
<i>Phenacoccus manihoti</i>	<i>phenacocci</i>	Africa	1978	NR?	CIBC (1979, 1980)
<i>Pseudococcus maritimus</i>	<i>paulistus</i>	USA	?	E?	Compere (1937)

ably represent undescribed species. In order to facilitate their future recognition we include below short diagnoses of the males of all unassociated species and include them in the key to species.

**Abbreviations used in text**

CL	Length of costal cell of forewing
CW	Maximum width of costal cell of forewing
F1.F2,etc	First funicle segment, second funicle segment, etc
EL	Maximum eye length
EW	Maximum eye width
FV	Minimum frontovertex width
FWL	Forewing length
FWW	Forewing width
GS	Maximum length of gonostylus (or third valvula)
HW	Head width
HWL	Hindwing length
HWW	Hindwing width
MS	Malar space (the shortest distance from the eye to mouth margin)
MT	Mid tibia length
OL	Ovipositor length
OOO	Ocular-ocellar line, or the shortest distance between each posterior ocellus and the adjacent eye margin
POL	Posterior ocellar line, or the shortest distance between the two posterior ocelli
SL	Scape length (excluding radicle)
SW	Maximum scape width

**Key to Costa Rican species of *Aenasius***

(Females and males)

- 1 Clava three-segmented with an oblique apical truncation (Figs 2–5, 8–19, 98) never long and sausage-shaped). Females ..... 2
  - [Funicle 7-segmented, the first segment sometimes very small, anelliform and easily overlooked]
  - Clava entire, with apex rounded and frequently very long and sausage-shaped (Figs 69–83, 102–105). Males ..... 17
    - [Funicle 3- to 6-segmented]
- 2 Forewing without a naked, hyaline streak at apex of venation (Figs 20–31) ..... 3
  - Forewing with naked, hyaline streak present (Figs 1, 32–45) ..... 12
- 3 Scape less than 2.5 × as long as broad (Figs 2, 8, 12, 98) ..... 4
  - Scape more than 2.5 × as long as broad (Figs 3–15) ..... 8
- 4 Apex of last tergite broadly concave not with a

- median incision (Figs 46, 47), either tegulae yellow or head and thorax with conspicuous silvery setae ..... 5
- Apex of last tergite with a median incision (Fig. 48, also as in Fig. 49), tegulae dark brown, head and thorax without conspicuous, lamellate silvery setae ..... 6
- 5 Head and thorax clothed in silvery setae, tegulae dark brown ..... *dives*
  - Head and thorax clothed in brown setae, tegulae yellow ..... *vexans*
- 6 Funicle completely dark brown without yellow segments ..... *phenacocci*
  - Funicle with several yellow segments ..... 7
- 7 Scape mostly dark brown, piliferous punctures immediately above facial impression completely smooth and very shiny ..... *advena*
  - Scape completely yellow, piliferous punctures immediately above facial impression dull ..... *lua*
- 8 Antenna almost completely yellow, only the pedicel dark brown ..... *cirrha*
  - Antenna with scape and clava variously marked with brown ..... 9
- 9 Large piliferous punctures of frontovertex not, or hardly, extending between eyes and facial cavity; costal cell normally gradually tapering distally (Fig. 27) rarely abruptly incised ..... *insularis*
  - Large piliferous punctures extending at least half way between top of facial cavity and malar sulcus (as in Figs 86–90); costal cell subrectangular, its apex abruptly incised at the point where the submarginal vein and marginal veins meet (Figs 29, 31) ..... 10
- 10 Frontovertex more than one-third head width ..... *kerrichi*
  - Frontovertex less than one-third head width ... 11
- 11 Marginal vein about as long as stigmal vein (Fig. 29) ..... *pelops*
  - Marginal vein not more than two-thirds length of stigmal vein (Fig. 31) ..... *paulistus*
- 12 Scape not more than 2 × as long as broad, or hardly so (Figs 3, 4, 10) ..... 13
  - Scape at least about 3 × as long as broad (Figs 16–19) ..... 15
- 13 Scape about twice as long as broad and widest in middle with lower margin more or less evenly curved from apex to base (Fig. 18); funicle completely black or with some yellow segments ..... *frontalis*
  - Scape less than 1.9 × as long as broad and widest beyond middle, with lower margin distally bulging

- beyond insertion of pedicel and thus not evenly curved to base (Figs 3, 4, 6); funicle never with yellow segments, always completely black ..... 14
- 14 Facial impression acutely margined dorsally and relatively narrow and deep at this point, delimited by a concave or straight line (Fig. 88); dorsal surface of costal cell with setae relatively sparse, arranged in two or three lines (Fig. 34) ..... *bolowi*
- Facial impression not acutely margined dorsally and relatively broad and shallow at this point, delimited by a biconcave line (Fig. 89); dorsal surface of costal cell with setae dense and arranged in three or four lines (Fig. 38) ..... *caeruleus*
- 15 Lower part of apical margin of forewing straight or even slightly convex (Fig. 40); sensory area of clava not more than 2/3 as long as clava (both measured along longest axis) (Fig. 16); apex of last tergite without a median incision (as in Fig. 47) ..... *brasiliensis*
- Lower part of apical margin of forewing slightly emarginate (sometimes almost imperceptibly so) (Figs 42, 44); sensory area of clava more than 2/3 as long as clava (Fig. 19); apex of last tergite with a distinct median incision (as in Fig. 49) ..... 16
- 16 Scape longer than maximum width of eye; dorsum of thorax with a moderately strong blue-green lustre ..... *mitchellae*
- Scape slightly shorter than maximum eye width; dorsum of thorax dull, blackish, with a weak greenish or purple lustre ..... *longiscapus*
- 17 Funicle composed of six distinct segments, none obscured by base of clava (Figs 69-75, 102-105) ..... 18
- Funicle with fewer than six segments, these frequently hidden by base of clava, the latter sometimes very long and sausage-shaped (Figs 76-83) ..... 30
- 18 Funicle with both F1 and F2 relatively small, neither with longitudinal sensilla and not wider than pedicel or hardly so; F1 not longer than pedicel (Figs 70, 72) ..... 19
- Funicle with at least F2 clearly wider than pedicel and usually with longitudinal sensilla; F1 frequently longer than pedicel (Figs 71, 73-75) ..... 20
- 19 Tegulae and alary sclerites dark brown, more or less concolorous with mesoscutum; forewings with post-marginal vein slightly longer than stigmal vein ..... *sp. A*
- Tegulae and alary sclerites orange brown, conspicuously paler than mesoscutum; forewings with post-marginal vein at least about 1.5 × as long as stigmal vein (Fig. 62) ..... *vexans*
- 20 Forewing with a naked, hyaline streak at the apex of the venation ..... *sp. B*
- Forewing without a naked, hyaline streak at the apex of the venation ..... 21
- 21 Pedicel not larger than F1 and usually shorter (Figs 73-75, 104) ..... 22
- Either pedicel longer than F1 (measured dorsally or medially, excluding any ventral process, if present) or pedicel clearly larger than F1 (Figs 71, 102, 105) ..... 25
- 22 Hind tarsi dark brown or dark orange-brown, as dark as hind tibiae or nearly so ..... *sp. C*
- Hind tarsi yellow to yellow-brown, clearly paler than hind tibiae ..... 23
- 23 Mesoscutum and scutellum with similar, fairly smooth and shallow imbricate-reticulate sculpture ..... *sp. D*
- At least scutellum with rough, reticulate, or punctate-reticulate sculpture ..... 24
- 24 Clava on external ventral surface near base, and usually F6, with an oval patch of specialised sensilla or setae which are clearly more dense than other setae present on these segments (Fig. 104) .. *sp. E*
- Neither clava nor F6 with a similar patch of specialised sensilla or setae ..... *sp. F*
- 25 Costal cell or forewing with at least three complete lines of setae dorsally (Fig. 64); clava with two oval sensory areas basally on outer ventral surface (Fig. 102) ..... *bolowi*
- Costal cell of forewing with only two complete lines of setae dorsally, only occasionally with a few scattered setae comprising a partial third line; clava with at most only one oval sensory area basally . 26
- 26 Antenna with only a very short, inconspicuous perpendicular seta on ventral surface of F6, this only about as long as adjacent recumbent setae and clearly less than one-third diameter of segment; forewings normally infusate in basal half; larger species, generally >1 mm, smaller specimens rare ..... *brasiliensis*
- Antenna with a conspicuous perpendicular seta on ventral surface of F6 which is clearly much longer than the adjacent recumbent setae and at least nearly half as long as diameter of segment (Figs 103, 105); forewings entirely hyaline; smaller species <1 mm ..... 27
- 27 Frontovortex, below anterior ocellus, with regular, distinct piliferous punctures (as in Figs 96, 97) . 28
- Frontovortex, below anterior ocellus, without piliferous punctures or if present than they are very indistinct and obscured by irregular, rough sculpture (as in Figs 94, 95) ..... 29
- 28 Antenna with ventral sensory areas on both F6 and clava; clava with a line of peg-like sensilla on inner surface extending from base to a little more than

- one-third to apex (Fig. 103) ..... *sp. G*
- F6 and clava without any visible ventral sensory areas; clava with one or two peg-like sensilla about half way along ventral surface (Fig. 105) .... *sp. H*
- 29 Clava basally with a single oval, ventral sensory area (similar to those in Fig. 102) and with a pair of basal peg-like sensilla on inner surface (similar to Fig. 105) ..... *sp. I*
- Clava without an oval, ventral sensory area near base and without peg-like sensilla on inner surface ..... *sp. J*
- 30 Funicle with more than two segments, distal segments always obscured by base of clava, these sometimes only visible on slide-mounted specimens (Figs 77, 80, 81) ..... 31
- Funicle with two, clearly visible segments (if obscured dorsally by base of clava, then clearly visible ventrally) (Figs 78, 79, 82, 83) ..... 35
- 31 Frontovortex with distinct piliferous punctures which are smooth, or nearly so, and which give it the appearance of the surface of a thimble or golf ball (Fig. 97) ..... 32
- Frontovortex with piliferous punctures obscure, sculpture irregular and rough in appearance, not like the surface of a thimble or golf ball (Figs 94, 95) ..... 33
- 32 Facial impression shallow and clearly remote from eye margins; piliferous punctures extending to nearly level with tops of antennal toruli ..... *sp. K*
- Facial impression relatively steep and more or less touching eye margins; piliferous punctures not extending between facial impression and eyes (Fig. 97) ..... *phenacocci/advena?longiscapus*
- 33 Clava at most about 1.5 × as long as scape .. *sp. L*
- Clava at least about 2 × as long as scape (Figs 80, 81) ..... 34
- 34 All tarsi dark brown and more or less concolorous with tibiae; funicle 5-segmented; clava about 4.5 × as long as broad (Fig. 80) ..... *sp. M*
- At least mid basitarsus yellow or testaceous-brown and conspicuously paler than mid tibia; funicle 3-segmented; clava at least 7 × as long as broad (Fig. 81) ..... *sp. N*
- 35 Forewing hyaline ..... 36
- Forewing infusate ..... 38
- 36 Clava about 3 × as long as scape and without a naked, ventral ridge (Fig. 79) ..... *sp. P*
- Clava not more than 2.5 × as long as scape and with a naked, longitudinal, ventral ridge (Fig. 76, 78) ..... 37
- 37 Clava about 2 × as long as scape (Fig. 78); fron-

- tovertex not more than one-third head width and at most about as wide as distance of anterior ocellus from facial impression ..... *sp. O*
- Clava about 2.5 × as long as scape (Fig. 76); frontovortex slightly more than one-third head width and nearly 1.5 × as broad as distance from anterior ocellus to facial impression ..... *paulistus*
- 38 Forewings strongly infusate; clava with a conspicuous, naked ventral ridge extending along most of its length (Fig. 82) ..... 39
- Forewings only weakly infusate; clava without a naked, ventral area (Fig. 83) ..... 40
- 39 Head about 2.5 × as wide as frontovortex; frontovortex about 1.5 × as wide as distance between anterior ocellus and facial impression ..... *sp. Q*
- Head about 2.25 × as wide as frontovortex; frontovortex a little more than twice as wide as distance between anterior ocellus and facial impression ..... *sp. R*
- 40 Antenna with F1 subquadrate, nearly as long as pedicel, clava about as long as scape ..... *sp. S*
- Antenna with F1 strongly transverse, clearly much shorter than pedicel; clava about 2 × as long as scape (Fig. 83) ..... *sp. T*

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## REVIEW OF SPECIES

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### *Aenasius dives* sp. n.

(Figs 2, 20, 21, 46, 52, 53, 56)

DIAGNOSIS. Female: head, dorsum of thorax and sides of gaster basally clothed in very conspicuous whitish setae; antenna uniformly black; scape about 1.5 × as long as broad; sensory area of clava obliquely divided; frontovortex about one-quarter head width; piliferous punctures below anterior ocellus very shiny; scrobes deep, delimited dorsally and laterally; forewings with apex hyaline but with no hyaline streak present at apex of venation; lower part of outer margin of forewing slightly convex; scutellum with a deep, longitudinal median groove in basal half; apex of last tergite of gaster evenly and shallowly concave.

MALE. Unknown.

FEMALE. Length: 1.42–1.65 mm (holotype 1.62 mm). Frontovortex metallic green, slightly coppery in ocellar area, below anterior ocellus piliferous punctures metallic green or blue-green, ridges between punctures purple, setae contrasting snow-white; temples and genae metallic green or blue green; facial impression metallic

green mixed coppery, interantennal prominence mixed with purple; antennae black-brown; dorsum of thorax dull dark blue, mixed with purple, almost black and clothed in very conspicuous pale brown, almost white setae; tegulae dark brown; propodeum medially blackish; mesopleuron blue-green; sides of propodeum coppery purple clothed in conspicuous pale setae; forewings (Fig. 20) more or less uniformly brown basally, but past apex of venation becoming gradually paler so that apical one-eighth or so is hyaline; no hyaline streak joining apices of post-marginal and stigmal veins (Fig. 21); hindwing hyaline; all coxae dark brown, fore coxae distinctly metallic blue-green; femora and tibiae dark brown, but femora testaceous distally; fore tarsi almost completely brown, mid and hind tarsi yellow-testaceous, pretarsi dark brown; mid tibial spur dark brown; gaster dark purple-brown with conspicuous pale setae laterally at base.

Head below anterior ocellus with large, conspicuous, shiny piliferous punctures, each separated by a sharp ridge, punctures in ocellar area shallower less shiny, between antennal scrobes and anterior ocelli these punctures of slightly smaller diameter than anterior ocellus; two lines of punctures extending between facial impression and eyes nearly to level of lowest eye margin; scrobes delimited dorsally and at sides by a shallow carina; head in side view about twice as long as deep, evenly curved to top of scrobes, sides of facial impression slightly bulging outwards and then abruptly angled inwards towards mouth; scape (Fig. 2) slightly bulging outwards at apex; clava slightly shorter than funicle, its apical sensory part about three times as long as ventral, straight margin of clava and divided by an oblique conspicuously sinuate line (as in Fig. 93); ocelli forming a distinctly acute. Relative measurements (holotype): HW 43.5; FV 10.5; EL 31; EW 21; MS 9; SL 24.5; SW 16; other proportions of antenna as in Fig. 2.

Thorax without distinct piliferous punctures; sculpture on mesoscutum relatively deep, regular, imbricate-reticulate, almost polygonally reticulate; scutellum with similar but slightly finer sculpture; scutellum about as long as broad and with a distinct marginal carina dorsally in apical one-fifth or so and with a deep, very conspicuous, longitudinal groove in its basal half; mid tibial spur clearly shorter than mid basitarsus; forewing with distribution of setae at base and proportions of venation as in Figs 20, 21; submarginal vein with a distinct subapical hyaline break; costal cell almost rectangular and conspicuously incised at apex, dorsally with three or four lines of setae; no hyaline streak at apex of

venation, lower part of apical margin slightly convex. Relative measurements (holotype): FWL 81, FWW 36, CL 36, CW 3; HWL 60, HWW 20.

Gaster with last tergite apically slightly, but evenly concave (Fig. 46); ovipositor (Fig. 52, 53, 56) with outer apical part of second valvifer strongly obliquely truncate and apically acute. Relative measurements (paratype): OL 37; GS 9; MT 55.

MALE. Unknown.

VARIATION. Very little of note in material available. The frontovertex varies from slightly less than to more than one-quarter head width and the ovipositor varies from two-thirds to three-quarters as long as mid tibia.

HOSTS. Unknown.

DISTRIBUTION. Costa Rica.

MATERIAL EXAMINED.

Type material. Holotype ♀: COSTA RICA, Guanacaste Prov., Santa Rosa NP, Hacienda-3-0, 29.xi-20.xii.1986 (Janzen & Gauld). Paratypes: COSTA RICA, 1♀, Guanacaste Prov., Santa Rosa NP, Bosq. Hum.-11-0, 13.iv-4.v.1986 (Janzen & Gauld); 1♀, Santa Rosa NP, Hacienda-3-0, 20.x.1986-10.i.1987 (Janzen & Gauld); 2♀, Guanacaste NP, Est. Mengo Vn Cacao, v.1988 (Janzen & Gauld); 1♀, Guanacaste NP, near HQ, 2-10.iii.1990 (J.S. Noyes); 1♀, San José, Ciudad Colon, Hda El Rodeo, 16.ii.1991 (Hym. Parataxonomists). Holotype and paratypes in BMNH, paratype in INBio.

COMMENTS. *Aenasius dives* is distinctive and can be separated from all other known species of the genus by the very conspicuous whitish setae on the head, dorsum of thorax and sides of propodeum and gaster.

### *Aenasius vexans* Kerrich

(Figs 22, 23, 47, 50, 51, 62, 70, 86, 98, 99, 101)

*Aenasius vexans* Kerrich, 1967: 202-203. Holotype ♀, Brazil, USNM, examined.

*Aenasius ?vexans* Kerrich; Williams *et al.*, 1981.

*Aenasius* sp. nr *vexans* Kerrich; Löhr *et al.*, 1990.

DIAGNOSIS. Female (length: 0.76-1.35 mm): head metallic green, dorsum of thorax similar, but duller; antenna more or less uniformly dark brown; tegulae orange basally; antenna (Fig. 98) with scape about 1.5 × as long as broad, sensory area of clava divided obliquely; head in side view about twice as long as deep and evenly curved to



top of scrobes, sides of facial impression slightly bulging outwards and then abruptly angled inwards towards mouth; frontovertex (Fig. 86) about one-third to one-quarter head width, piliferous punctures below anterior ocellus shiny, scrobes moderately deep, not sharply delimited laterally; forewings (Fig. 22) apically hyaline with hyaline streak absent at apex of venation; postmarginal vein slightly longer than stigmal (Fig. 23); lower part of outer margin of forewing clearly convex; apex of last tergite of gaster almost straight, hardly concave (Fig. 47); ovipositor as in Figs 50, 51. Male (length: 0.65–0.87 mm): very similar to female but scape (Fig. 70) about  $2.5 \times$  as long as broad, all funicle segments transverse F4–6 subequal and each nearly twice as broad as long, clava about as long as F3–6 and without any conspicuous differentiated sensory areas or sensilla; forewings (Fig. 62) not or hardly infusate; tarsi yellow; mid tibial spur yellow, occasionally pale brown; lateral bristle on phallobase (Fig. 99) about  $0.25 \times$  as long as aedeagus which is broad, spatulate and about one-third as long as mid tibia.

**HOSTS.** Recorded as a parasitoid of *Phenacoccus herreni* Cox & Williams (Williams *et al.*, 1981, as *Aenasius ?vexans* from yellow mealybug; Löhr *et al.*, 1990), a pest of cassava in areas of Brazil and a potential pest of cassava in Colombia, Venezuela and the Guyanas (J.A. Castillo L., pers comm.). The eggs are laid into the 2nd and 3rd instar nymphs and adult females (Castillo L., pers comm.)

**USE IN BIOCONTROL.** The species successfully controls *Phenacoccus herreni* Cox & Williams on cassava in Colombia (J. Castillo, pers. comm.).

**DISTRIBUTION.** Mexico, Costa Rica, Tobago, Trinidad, Colombia, Venezuela, Guyana, French Guiana, Ecuador, Peru, Brazil.

**MATERIAL EXAMINED.**

Type material. Holotype ♀: BRAZIL, Sao Paulo, ex *Phenacoccus* sp., xii.1935 (E. Hambleton) (USNM). Paratypes: MEXICO, 2♀, Magdalena Is., Tres Marias, v.1925 (H.H. Kiefer); BRAZIL, 1♀, Sao Paulo, ex *Phenacoccus* No 3, xii.1935 (E. Hambleton) (BMNH).

Non-type material: COSTA RICA, 6♀, Guanacaste, Santa Rosa NP, various dates i.1986–iii.1987 (Janzen & Gauld); TOBAGO, 1♀, St Paul, Pamatuvier Valley, edge of rainforest, 20.vii.1976 (J.S. Noyes); TRINIDAD, 1♀, I.C.T.A., ex *Phenacoccus hibisci* on *Hibiscus*, No 25, v.1953 (F.D. Bennett); 2♀, Curepe, Santa Margarita Circular Road, 26.ix–26.x.1974

(M.N. Beg); 5♀, St George, various localities and dates, vi–vii.1976 (J.S. Noyes); 5♀, Nariva, Cocos Bay, coastland and mangrove swamp, 28.vii.1976 (J.S. Noyes); 1♀, St. Augustine, ex mealybug on *Lantana montividenensis*, V.1982 (M.W.J. Cock); 6♀, Curepe, ex *Phenacoccus* sp. on tomato, ix.1983 (F.D. Bennett); COLOMBIA, 33♀, 26♂, Cali, CIAT, lab culture from Venezuela, Bolivia Sta (Upsta) and Sucre Sta (Ayacucho and Cumana), ex *Phenacoccus herreni* on cassava, xi.1991 (J. Castillo); VENEZUELA, 11♀, 11♂, Sucre, ex *Phenacoccus herreni* 15.vi.1989 (J. Castillo); GUYANA, 1♀, 1♂, Enmore Est., x.1979, ex *Phenacoccus herreni* (as *P. manihoti* misident.) on cassava, x.1979 (F.D. Bennett); 1♀, Enmore Est., ex *Phenacoccus* on cassava, 11.xi.1977 (M. Yaseen); 1♂, Dalgin, ex *Phenacoccus herreni* (as *P. manihoti* misident.) on cassava, xi.1978 (M. Yaseen); 1♂, Diamond, ex *Phenacoccus herreni* (as *P. manihoti* misident.) on cassava, xi.1979 (M. Yaseen); FRENCH GUIANA, 1♀, Km 30 Highway, ex *Phenacoccus herreni* (as *P. manihoti* misident.) on cassava, xi.1978 (M. Yaseen); 3♀, Sinnamary, ex *Phenacoccus herreni* (as *P. manihoti* misident.) on cassava, xi.1978 (M. Yaseen); 2♀, 5♂, Mana, ex *Phenacoccus herreni* (as *P. manihoti* misident.) on cassava, xi.1978 (M. Yaseen); ECUADOR, 1♀, Pichincha, Tinlandia, 800m, 2.ii.1983 (Masner & Sharkey); PERU, Cuaco, Quilambamba, 24–26.xii.1983 (L. Huggert); 1♀, Madre de Dios, Pto Maldonado, 3.i.1984 (L. Huggert); BRAZIL, 3♀, 2♂, Santa Lucia, xi.1977, ex *Phenacoccus* on cassava, xi.1977 (M. Yaseen); 4♀, 3♂, Macapa, ex *Phenacoccus* on cassava, 22.xi.1977 (M. Yaseen); 2♀, Porto Grande, ex *Phenacoccus* on cassava, 24.xi.1979 (M. Yaseen); 6♀, 2♂, Pará, Alanquer, ex *Phenacoccus herreni* on cassava, 11.x.1985 (B. Löhr). Material in BMNH, CNC, USNM, TAMU, ZISP, PPRI, INBio.

**COMMENTS.** *Aenasius vexans* can be mistaken for *phenacocci* but is separated on the coloration of tegulae and relative length of postmarginal vein (see comments under *phenacocci*).

***Aenasius phenacocci* Bennett**

(Figs 8, 9, 24, 25, 48, 55, 63)

*Aenasius phenacocci* Bennett, 1957: 569–570.

Holotype ♀, Trinidad, USNM, examined.

*Aenasius flandersi* Kerrich, 1967: 204, 221. Holotype ♀, USA, USNM, examined. **syn. n.**

**DIAGNOSIS.** Female (length: 0.88–1.84 mm): head mostly metallic green or blue green; antenna uniformly black brown; pronotum and

mesoscutum weakly metallic green or blue-green; scutellum with a weak purple or blue-green lustre; tegulae dark brown; antenna (Fig. 8) with scape about  $1.6 \times$  as long as broad; sensory area of clava divided obliquely into almost equal portions (Fig. 9); head in side view very slightly more than twice as long as deep; slightly curved above scrobes, below scrobes more strongly curved towards mouth; frontover-text about one-third (small specimens) to one-fifth (large specimens) head width, piliferous punctures below anterior ocellus shiny, scrobes moderately deep, not sharply delimited; forewings (Fig. 24) apically hyaline without a hyaline streak at apex of venation; postmarginal vein not quite reaching level with apex of stigmal (Fig. 25); lower part of outer margin of forewing very slightly convex; apex of last tergite of gaster inconspicuously medially incised (Fig. 48); ovipositor (Fig. 55) about as long as mid tibia. Male: indistinguishable from that of *advena* Compere (see diagnosis); forewing hyaline (Fig. 63).

**HOSTS.** Recorded as a parasitoid of *Phenacoccus madeirensis* Green (as *P. gossypii*, probable misidentification, D. Williams, pers. comm.) (Bennett, 1957) and from the same host on *Acalypha* sp., *Hibiscus* sp. and an unidentified mealybug on *Pittosporum* and cotton (Kerrich, 1967). Also recorded from *Phenacoccus herreni* Cox & Williams (Löhr *et al.*, 1990). The records below from *P. gossypii* Townsend & Cockerell on *Lantana montividenis*, *Phenacoccus grenadensis* Green & Laing on *Cordia curassavica* and *Tussacia* sp. are probably all misidentifications of *P. madeirensis* (D. Williams, pers. comm.). Also noted here as a parasitoid of *Ferrisia virgata* (Cockerell) on *Sida* sp.

**DISTRIBUTION.** USA (California), Costa Rica, Cayman Islands, St Vincent, Trinidad, Colombia, Guyana, French Guiana, Ecuador, Peru, Uruguay.

#### MATERIAL EXAMINED.

Type material. Holotype ♀ of *Aenasius phenacocci*, TRINIDAD, I.C.T.A., ex *Phenacoccus gossypii* on *Acalypha*, v.1955 (F.D. Bennett) (USNM Type No 63501). Paratypes of *Aenasius phenacocci*: TRINIDAD, 2♀, I.C.T.A., St. Augustine, ex *Phenacoccus gossypii* on *Acalypha*, vi.1955 (F.D. Bennett) (in BMNH). Holotype ♀ of *Aenasius flandersi*: USA, California, San Diego, Balboa Park, on *Pittosporum*, 15.viii.1958 (S. Flanders) (Type No 2122 USNM).

Non-type material. COSTA RICA, 1♀, Guanacaste, Santa Rosa NP, Hacienda 1-0,

14.viii-6.ix.1986 (Janzen & Gauld); 1♀, San José, Ciudad Colón, 800m, iii-iv.1990 (L. Fournier); CAYMAN ISLANDS, Grand Cayman, West Bay, Willie Farrington Drive, ex *Ferrisia virgata* on *Sida*, 16.x.1987 (F.D. Bennett); ST VINCENT, 1♀, 207, West Indies 99-331, *Aenasius hyettus* Wlk. How.(H.H. Smith); TRINIDAD, 4♀, I.C.T.A., ex *Phenacoccus gossypii* on *Hibiscus*, v-vi.1953 (F.D. Bennett); 15♀, St. Augustine, ex *Phenacoccus gossypii* on *Acalypha*, v.1955 (F.D. Bennett); 2♀, 1♂, St. Augustine, ex mealybugs, iii.1961 (F.D. Bennett); 2♀, Curepe, Sta. Margarita, 26.ix-26.x.1974 (M.N. Berg); 1♀, St. George, San Juan, ex mealybug; 18.vii.1976 (F.D. Bennett); 1♀, St Augustine, Malaise trap; ix.1976 (F.D. Bennett); 11♀, St George, various localities, vi-viii.1976 (J.S. Noyes, F.D. Bennett); 1♀, St. Andrew, Oropuche, cocoa and banana plantations, 28.v.1976 (J.S. Noyes); 3♀, CIBC lab culture ex *Phenacoccus grenadensis*, 1977 (M. Yaseen); 1♀, Maracas Valley, xii.1977 (F.D. Bennett); 3♀, Curepe, ex *Phenacoccus gossypii* on *Lantana montividenis*, iv.1977 (F.D. Bennett); 5♀, Curepe, ex *Phenacoccus grenadensis* on *Cordia curassavica*, iii.1979 (F.D. Bennett); 2♀, Curepe, CIBC lab culture on *Phenacoccus grenadensis*, iv.1979 (F.D. Bennett); 1♂, ex *Phenacoccus grenadensis* on *Tussacia*, x.1979 (F.D. Bennett); 1♀, St George, Arima Valley (1st mile), edge of rainforest, 3.vii.1976 (J.S. Noyes); 1 gynandromorph, St George, St Augustine, malaise trap, 15.vii-13.viii.1976 (J.S. Noyes); GUYANA, 1♀, Georgetown, on ornamentals; 15.x.1961 (F.D. Bennett); 4♀, Enmore, ex *Phenacoccus ?manihoti* on cassava, x.1979 (M. Yaseen); COLOMBIA, 2♀, Cali, CIAT, ex *Phenacoccus grenadensis* on cassava, xi.1977 (F.D. Bennett); 1♀, Palmira, ex *Phenacoccus* on *Acalypha*, 14.xi.1979 (F.D. Bennett); ECUADOR, 1♀, Rio Palenque, forest, 4.ii.1983 (L. Huggert). Material in BMNH, INBio.

**COMMENTS.** We have been unable to find any significant differences between the type material of *flandersi* examined and the series of *phenacocci* listed above. We therefore treat the two names as synonymous. *A. phenacocci* is extremely close to *advena* differing only in the colour of the funicle segments, other differences given by Kerrich (1967) are seemingly unreliable. For the present, we continue to treat the two species as valid until further material becomes available.

Superficially, *Aenasius phenacocci* may be mistaken for *vexans*, but is distinguished on the completely brown tegulae and postmarginal vein

of forewing not being longer than the stigmal. In *vexans* the tegulae are largely yellow and the postmarginal vein is slightly longer than the stigmal.

### *Aenasius advena* Compere

(Figs 12, 77, 84, 97)

*Aenasius advena* Compere, 1937: 384, 388–389, 393. Holotype ♀, Hawaii, USNM, examined.

*Aenasius ianthinus* Compere, 1937: 388, 391, 393–394. Holotype ♀, Panama, USNM, not examined. *syn. n.*

*Pseudanasius clavus* Hayat, Alam & Agarwal, 1975: 23–24. Holotype, gynandromorph, India, BMNH, examined. Synonymised with *advena* by Hayat, 1981.

**DIAGNOSIS.** Female (length: 1.14–2.16 mm): as for *phenacocci* but antenna with at least some funicle segments yellow (Fig. 12) (see also discussion below); ovipositor generally about one-third longer than mid tibia. Male (length: 0.83–1.40 mm): duller than female; forewings hyaline; tarsi yellow, mid tibial spur dark brown; scape (Fig. 77) about  $2.5 \times$  as long as broad and widest in middle, funicle with 5 anelliform segments, distal 3 or 4 enclosed by base of clava which is about  $7-8 \times$  as long as broad,  $3-3.5 \times$  as long as scape and without a longitudinal naked ventral ridge; frontovertex (Fig. 97) about one-third head width and with distinct piliferous punctures which do not extend between eyes and facial impression, facial impression touching eyes; distance from anterior ocellus to facial impression about  $0.6 \times$  minimum width of frontovertex; genitalia as in Fig. 84.

**HOSTS.** *Aenasius advena* has been recorded throughout its range as a parasitoid of *Ferrisia virgata* (Cockerell) on a variety of plants (Bennett, 1957; Compere, 1937; Kerrich, 1967; DeBach & Warner, 1969; Shafee *et al.*, 1975; Hayat *et al.*, 1975; Prinsloo & Annecke, 1979; De Santis, 1980), also from Brazil as a parasitoid of *Pseudococcus longispinus* (Targioni-Tozzetti) (De Santis, 1980) and *Pseudococcus* sp. on *Macquilla tomentosa* (Kerrich, 1967).

**USE IN BIOCONTROL.** *Aenasius advena* has been introduced into Hawaii (Bartlett in Clausen, 1978; Funasaki *et al.*, 1988) and California in 1966–1967 (DeBach & Warner, 1969) for the control of *Ferrisia virgata*, a mealybug pest of ornamentals and other plants. It has been partially successful in controlling this pest in Hawaii.

**DISTRIBUTION.** A circumtropical species found

throughout most of the Neotropical, Afrotropical and Oriental regions (see below and above references).

### MATERIAL EXAMINED.

Type material. Holotype ♀ of *Aenasius advena*: HAWAII, Oahu, Flates west of Makapuu Head, on wild cotton, 11.ii.1934 (O.H. Swezey) (Type No 51984 USNM). Paratypes of *Aenasius advena*: HAWAII, 2♀, 2♂, Oahu, Koko Head, 15.iii, 13.ii, 20.ii, 27.ii.1934 (O.H. Swezey). Holotype (gynandromorph) of *Pseudanasius clavus*, INDIA, Tamil Nadu, Shencottah, ex *Ferrisia virgata*, 6.iii.1967 (M. Hayat) (BMNH). Paratype of *Pseudanasius clavus*: INDIA, 1♂, Tamil Nadu, Shencottah, ex *Ferrisia virgata*, 16.iii.1967 (M. Hayat) (BMNH).

Non-type material. USA, 1♀, Florida, Key Largo, 26.xii.1954 (H.V. Weems jr); COSTA RICA, 1♀, Guanacaste Prov., Finca Taboga, 6mi S, 6mi W. Cañas, 10°19'N 89°09'W, ii.1967 (H.A. Hespeneheide); 1♀, Guanacaste Prov., Santa Rosa NP, Hacienda 2–C, 22.vi–13.vii.1985 (Janzen, Gauld); 4♂, Guanacaste Prov., Santa Rosa NP, Hacienda 3–0, 14.viii–18.x.1986 (Janzen & Gauld); PANAMA, 1♀, Aquadulce, 27.vii.1976 (F.D. Bennett); TRINIDAD, 1♀, Manzanilla, ex *Ferrisia* on coconut, v.1952 (F.D. Bennett); 1♀, No. 1 (Bennett); 3♀, I.C.T.A., ex *Ferrisia* on *Gliricidia*, viii.1953 (F.D. Bennett); VENEZUELA, 1♀, Bahia del Mar, ex *Ferrisia virgata* on ornamental, 7.xii.1981 (M. Yaseen); BRAZIL, 1♀, Rio de Janeiro, on citrus; 27.x.1962 (A. Perachi); 1♀, Sao Paulo, Araras, on citrus, 27.iv.1984 (F.D. Bennett); BOLIVIA, 2♀, La Cororada, ex *Phenacoccus manihoti*, 20.vi.1982 (M. Yaseen); P.R. CONGO, 1♀, 3♂, Brazzaville, ex *Saissetia oleae* on cassava, 1987 (A. Biassangama); INDIA, 1♀, 2♂, Delhi, IARI area, x.1979 (Z. Boucek); 2♀, Gujarat, Jungadh, ex mealybug in croton, 28.viii.1988 (V.N. Patel); 1♀, 2♂, Madhya Pradesh, Jabalapur, ex *Ferrisia virgata* 25.xi.1966 (B.N. Modi); 5♀, Karnataka, Bangalore, ex *Ferrisia virgata* on *Thervetia nervifolia*, 2.iv.1982; 2♀, Karnataka, Bangalore, Hessaraghatta, ex *Planococcus citri*, iii.1989; 6♀, Karnataka, Shanthigadu, ex *Ferrisia virgata* on cashew, iv.1990 (Sundararaju); 3♀, 3♂, Karnataka, Theerthalli, Bakalapura Est., ex *Ferrisia virgata* on coffee, v.1990 (P.K. Bhat); 3♀, 6♂, Karnataka, Netragonda Est., ex *Ferrisia virgata* on coffee, v.1990 (Sreedharan, Balakrishnan); 1♀, Tamil Nadu, Coimbatore, 25.ix–1.x.1979 (J.S. Noyes); 1♀, Tamil Nadu, 3Km E. Manjaler Dam, 15–18.x.1979 (J.S. Noyes); 3♀, 1♂, Kerala, Wynad, ex *Ferrisia virgata* on robusta coffee, 15.v.1987 (C.

Prakasan); 1♂, Kerala, ex *Ferrisia virgata* on cashew, 17.xi.1989 (Fathima); 4♀, Andaman Islands, Port Blair, ex mealybug on citrus, 22.iii.1988 (B.S. Bhumannaver); BANGLADESH, 1♀, Dacca, ex *Pseudococcus virgatus*, 1963 (Gov't Entom.); THAILAND, 2♀, 2♂, Bangkok, on *Samanea saman*, 1983 (S. Boonkong); MALAYSIA, 2♀, 2♂, Selangor, RRI, 3222-2-58, CIE Coll. No 16100; 2♀, 1♂, Selangor, Bukit Rotan, Sg. Buloh Estate, 16.viii.1958; PHILIPPINES, 1♀, Manila, guava, xii.1958 (Krauss); FIJI, 6♀, 2♂, Naduruloulou, ii, 1949, ex mealybug on twigs of *Albizia lebbek* (B.A. O'Connor); HAWAII, 1♀, Johnston Island, 3508, on *Virex trifolia*, 8.vii.1948 (L.B. Loring). Material in BMNH

COMMENTS. *Aenasius advena* is close to *phenacocci* and *lua* (see comments under those species).

*Aenasius ianthinus* was treated as a variety of *advena* by Kerrich (1967) and therefore we regard it here as a synonym of *advena*.

### *Aenasius lua* sp. n.

DIAGNOSIS. Female: antenna with scape and funicle segments yellow; scape about twice as long as broad; sensory area of clava divided into two unequal parts by a sigmoidal, oblique line; frontovertex about one-fifth head width; piliferous punctures below anterior ocellus dull; scrobes not deep and not sharply delimited; forewings infusate but with apex hyaline and without a naked hyaline streak at apex of venation; lower part of outer margin of forewing not emarginate; apex of last tergite of gaster with a slight median incision. Male: unknown.

FEMALE. Length: 1.73 mm. Head metallic green, ocellar area and above facial impression slightly coppery; mouth margin, lower genae and temples dark coppery-purple; radicle dark brown and pedicel dark brown, scape and funicle yellow, clava (except sensory area) brown; setae on frontovertex pale translucent brown; dorsum of thorax blackish much less shiny than frontovertex, with only a slight purplish sheen; setae translucent brown; tegulae dark brown; sides of thorax dark brown; forewings more or less uniformly brown in basal half, apical one-eighth or so hyaline; hyaline streak at apex of venation absent; hindwing hyaline; legs, except tarsi, dark brown; mid tibial spur dark brown; tarsi whitish or pale yellow, pretarsi brown; gaster dark brown with an inconspicuous purple sheen.

Head with conspicuous piliferous punctures, each about the same diameter as an ocellus,

those on frontovertex relatively dull with microridges radiating out from the bases of the setae, between eyes and facial impression quite shiny; three lines of piliferous punctures present between facial impression and each eye, these nearly reaching malar sulcus; facial impression not deep and not delimited by sharp carinae, either dorsally or laterally; head in side view almost twice as long as deep, almost flat above scrobes, but below this distinctly curved towards mouth; scape with lamina not bulging outwards at apex; clava about as long as funicle and pedicel together, its apical sensory part about  $0.8 \times$  as long as clava and divided by an oblique line into nearly equal parts; ocelli forming an acute, almost equilateral, triangle. Relative measurements: HW 127; FV 26; EL 83; EW 62; MS 36; SL 45; SW 20; other proportions of antenna similar to *advena* (Fig. 12).

Piliferous punctures on mesoscutum small and shallow, separated by more than their own diameters, those on scutellum more indistinct; sculpture on mesoscutum shallow, regular imbricate-reticulate, nearly polygonally reticulate posteriorly; scutellum with similar sculpture; scutellum about as long as broad and with a distinct marginal carina dorsally in apical one-fifth or so; mid tibial spur about as long as mid basitarsus; forewing with distribution of setae at base and proportions of venation similar to *phenacocci* (Fig. 24), but costal cell with only two lines of setae dorsally; hyaline streak absent at apex of venation, lower part of apical margin of forewing straight or even slightly convex. Relative measurements (holotype): FWL 195, FWW 91; HWL 141, HWW 55.

Gaster with last tergite hardly concave but with a slight median incision; ovipositor at least a little longer than the mid tibia.

MALE. Unknown.

HOSTS. Unknown.

DISTRIBUTION. Costa Rica.

MATERIAL EXAMINED.

Holotype ♀: COSTA RICA, Puntarenas, Monteverde, 15-16.vii.1988 (L. Masner) (CNC).

COMMENTS. *Aenasius lua* is very close to *advena*, females of both species having a relatively broad scape, dark tegulae, lack of a hyaline streak at apex of venation and the posterior margin of the last abdominal tergite with a median notch. The species can be separated on the sculpture of frontovertex, coloration of scape and density of setae on dorsal surface of costal cell. *A. lua* has the scape completely yellow, the

piliferous punctures of the frontovertex dull and only two lines of setae on the dorsal surface of the costal cell whereas in *advena* the scape is mostly dark brown, the piliferous punctures of the frontovertex are very shiny and, in similar-sized specimens, the costal cell has at least three lines of setae dorsally.

### *Aenasius cirrha* sp. n.

DIAGNOSIS. Female: antenna yellow with pedicel dark brown; scape about three times as long as broad; sensory area of clava not conspicuously divided, division in apical half and longitudinal; frontovertex a little over one-fifth head width; piliferous punctures below anterior ocellus dull; scrobes moderately deep, not sharply delimited laterally; forewings infuscate proximally, slightly less than apical one-third hyaline; apex of venation without a naked, hyaline streak; costal cell gradually tapering to its apex, but with a slight apical incision before the marginal vein; lower part of outer margin of forewing slightly convex; apex of last tergite of gaster evenly and shallowly concave, slightly incised medially.

FEMALE. Length: 1.62 mm. Ocellar area and area above facial impression metallic coppery and purple; temples, scrobes and genae metallic green with a coppery sheen; interantennal prominence and mouth margin quite strongly coppery purple; piliferous punctures between anterior ocellus and facial impression rather dull; setae on frontovertex translucent brown; antenna with radicle orange-brown, pedicel dark brown dorsally, the remainder yellow; dorsum of thorax blackish with a slight purple and brassy sheen; setae dark brown; tegulae dark brown; sides of thorax brown; forewings brown proximally, but gradually fading distally so that a little less than apical one-third is hyaline; apex of venation without a naked, hyaline streak; hindwing hyaline; all coxae dark brown; femora dark brown, paler apically, especially hind femora; fore and mid tibia brown with apices yellowish; hind tibia mostly yellow, slightly infuscate along dorsal margin proximally; tarsi pale yellow, mid tarsi slightly darker; mid tibial spur dark brown; gaster dark brown with an inconspicuous blue or purple sheen.

Head with conspicuous, dull piliferous punctures, each separated by a sharp ridge, punctures in ocellar area shallower less shiny, between facial impression and anterior ocellus these punctures slightly smaller than ocelli; punctures not extending between eyes and facial impression; scrobes sharply delimited dorsally but not later-

ally; head in side view about twice as long as deep, slightly convex above facial impression; more strongly curved towards mouth about level with top of impression; clava at least slightly longer than funicle and pedicel together, its apical sensory part about two-thirds as long as clava and not conspicuously divided, the division only slightly oblique and almost entirely in apical half; ocelli forming a hardly acute angle. Relative measurements: HW 125; FV 29; EL 84; EW 61; MS 30; SL 46; SW 15; other proportions of antenna similar to *insularis* (Fig. 13).

Thorax with small, indistinct piliferous punctures; sculpture on mesoscutum regular imbricate-reticulate; scutellum similar but sculpture more reticulate; scutellum about as long as broad and with a distinct marginal carina dorsally in apical one-fifth or so; mid tibial spur about as long as mid basitarsus; forewing with distribution of setae at base and proportions of venation similar to those of *pelops* (Figs 28, 29), postmarginal vein about as long as stigmal; submarginal vein with a distinct subapical hyaline break; costal cell slightly more than  $6 \times$  as long as broad, gradually tapering apically, but with apex slightly incised before marginal vein, dorsally with two or three lines of setae; apex of venation without naked, hyaline streak, lower part of apical margin slightly convex. Relative measurements (holotype): FWL 226, FWW 98, CL 85, CW 13.5; HWL 146, HWW 55.

Gaster with last tergite apically biconvex either side of a median incision.

HOSTS. Unknown.

DISTRIBUTION. Costa Rica.

#### MATERIAL EXAMINED.

Holotype ♀, COSTA RICA, Puntarenas, Monteverde, 15–16.vii.1986 (L. Masner). In CNC.

COMMENTS. *Aenasius cirrha* is close to *paulistus* and *insularis*, all three species lacking the hyaline streak at the apex of the venation, having a scape more than  $2.5 \times$  as long as broad and costal cell gradually tapering in apical half or so. *A. cirrha* can be separated from these species by the almost entirely yellow antennae, the apex of the costal cell slightly but distinctly incised, whilst in the other named species the scape and clava are largely brown and the costal cell more or less gradually tapers at this point. In addition, it can be separated from *paulistus* by the piliferous punctures not extending between the eyes and facial impression.

*Aenasius insularis* Compere

(Figs 13, 26, 27, 49, 54, 58)

*Aenasius insularis* Compere, 1937: 392, 400–401.

Holotype ♀, Mexico, USNM, examined.

DIAGNOSIS. Female (length 1.11–2.03 mm): as for *cirrho* but frontovertex generally metallic green; antenna (Fig. 13) with scape marked variously with brown proximally; pedicel, clava and sometimes F6 brown; remainder of antenna yellow; dorsum of thorax with a strong purple and blue-green lustre; scape about 3–4 × times as long as broad; frontovertex between one-sixth and nearly one-quarter head width; costal cell (Fig. 26) usually gradually tapering to its apex and without an apical incision before the marginal vein (Fig. 27), rarely distinctly incised apically; lower part of outer margin of forewing slightly convex; apex of last tergite of gaster with a median incision (Fig. 49); ovipositor as in Figs 54, 58. Male: unknown, but possibly *sp. O.*

HOSTS. Unknown.

DISTRIBUTION. Mexico, Costa Rica, Trinidad, Peru, Brazil.

## MATERIAL EXAMINED.

Type material. Holotype ♀, MEXICO, Tres Marias Islands, Magdalena I., 19.v.1925 (H.H. Kiefer) (USNM Type No 51989). Paratypes: 1♀, Tres Marias Islands, Maria Madre I., Arroyo Honda, 17.v.1925 (H.H. Kiefer); 1♀, Magdalena I., 20.v.1925 (H.H. Kiefer). Holotype in USNM, paratypes in BMNH.

Non-type material. COSTA RICA, 15♀, Guanacaste, Santa Rosa NP, various localities, various dates 11.v.1985–21.ii.1987 (Janzen & Gauld); 1♀, Alajuela, Peñas Blancas, rainforest, iii.1987, (E. Cruz); 2♀, Heredia, La Selva BS, 50m, 22.i–3.ii.1991 (J.S. Noyes); 1♀, Heredia, 3Km S. Puerto Viejo, OTS-La Selva, 100m, ii–iii.1993 (P. Hanson); 5♀, Puntarenas, Osa Peninsula, Puerto Jimenez, 10m, various dates x.1990–ii.1992 (P. Hanson, C. Godoy); 3♀, Puntarenas, RF Golfo Dulce, 3Km SW Rincon, 10m, x–xii.1990, viii.1991, ii.1992 (P. Hanson); TRINIDAD, 1♀, I.C.T.A., on cocoa, iii.1953 (F.D. Bennett); 4♀, St George, various localities and dates, vi–vii.1976 (J.S. Noyes); 1♀, St George, St Augustine, x.1976 (F.D. Bennett); PERU, 1♀, Madre de Dios, Tambopata Res., 12°50'S 69°20'W, 17.x–1.xi.1983 (N.E. Stork); BRAZIL, 1♀, Bahia, Fazenda Sombra das Neves, 9.x.1978 (F.P. Benton). Material in BMNH, INBio, CNC.

COMMENTS. The Costa Rican material listed above differs from the holotype of *insularis* in the

shape of the apex of the costal cell. In the holotype the costal cell is clearly incised apically whilst in the Costa Rican material the costal cell gradually tapers to its apex. However, the two paratypes of *insularis* examined exhibit a more or less intermediate state and therefore we are treating the Costa Rican material as *insularis*.

*Aenasius insularis* is close to *cirrho* and *paulistus* (see comments under *cirrho*). It is closest to *paulistus* and may prove to be synonymous. For the present we are separating *insularis* and *paulistus* on the degree to which the large piliferous punctures extend between the eyes and the facial impression (see key).

*Aenasius kerrichi* sp. n.

DIAGNOSIS. Female: antenna with scape mostly yellow, funicle yellow and remainder dark brown; scape about 3 × as long as broad; sensory area of clava inconspicuously divided in apical half; frontovertex over one-third head width; piliferous punctures below anterior ocellus shiny; scrobes shallow, not sharply delimited; forewings infuscate in proximal two-thirds or so, apex hyaline; apex of venation without a naked, hyaline streak; lower part of outer margin of forewing convex; apex of last tergite of concave with a distinct median incision.

FEMALE. Length: 1.65 mm. Frontovertex dark, metallic blue-green with a slight purple sheen, especially on antennal scrobes and temples; scape mostly yellow but faintly margined brown proximally; pedicel dark brown; funicle yellow; clava, except sensory area, dark brown; dorsum of thorax blackish, weakly metallic dark blue, axillae a little purplish; tegulae and sides of thorax dark brown; forewings almost uniformly infuscate in slightly more than basal two-thirds, apex hyaline; coxae, femora and tibiae dark brown, the femora and tibiae apically slightly paler; tarsi pale yellow basally tending to amber apically, pretarsi dark brown; gaster dark brown with a slight brassy sheen.

Head with large, conspicuous, shiny piliferous punctures, each separated by a sharp ridge, punctures in ocellar area shallower and less shiny, between facial impression and anterior ocelli these punctures shiny and about the same diameter as anterior ocellus, or perhaps slightly larger; three lines of punctures between eyes and facial impression; facial impression relatively shallow and not sharply delimited; head in side view slightly less than twice as long as deep, and fairly evenly rounded from occipital margin to mouth margin; scape about 3 × as long as broad;

clava longer than funicle and pedicel together, its apical sensory part nearly two thirds as long as clava itself and divided inconspicuously by a hardly oblique line in apical half; ocelli forming a strongly obtuse angle. Relative measurements: HW 126; FV 49; EL 65; EW 50; MS 35; SL 46; SW 15; other proportions of antenna similar to those of *insularis* (Fig. 13).

Thorax dorsally with piliferous punctures distinct but small, each separated by about their own diameters; sculpture on mesoscutum regular imbricate-reticulate; scutellum with similar but slightly coarser sculpture; scutellum about one-sixth broader than long and with a distinct marginal carina dorsally in apical one-fifth or so; mid tibial spur about as long as mid basitarsus; forewing with marginal and postmarginal veins about as long as stigmal; costal cell relatively broad, subrectangular, and abruptly incised at apex, with three lines of setae dorsally; submarginal vein with a distinct subapical hyaline break; apex of venation without a naked, hyaline streak, lower part of apical margin slightly convex. Relative measurements (holotype): FWL 250, FWW 126, CL 98, CW 19; HWL 170, HWW 78.

Gaster with last tergite apically biconvex either side of a short median incision.

MALE. Unknown.

HOSTS. Unknown.

DISTRIBUTION. Costa Rica.

MATERIAL EXAMINED.

Type material. Holotype ♀, COSTA RICA, San José, 3200m, Cerro de la Muerte, 3.iii-7.iv.1985 (L. Masner & H. Goulet). In CNC.

COMMENTS. This species can be immediately separated from all other species of *Aenasius* by the relatively wide frontovertex (more than one-third head width), scape about  $3 \times$  as long as broad and the relatively broad, subrectangular costal cell of the forewing.

### *Aenasius pelops* sp. n.

(Figs 14, 28, 29, 57, 100)

DIAGNOSIS. Female: antennal scape largely yellow marked with brown proximally; pedicel and clava dark brown; funicle mostly yellow but with F1-2 brownish; scape about  $3 \times$  as long as broad; sensory area of clava unequally divided by a sigmoid line running almost its whole length; frontovertex between one-third and one-quarter head width; piliferous punctures below anterior ocellus slightly shiny, but not smooth; facial impression shallow and not sharply delimited;

forewings infusate proximally, apical one-quarter or so hyaline; apex of venation without a naked, hyaline streak; marginal vein about as long as stigmal; costal cell less than  $6 \times$  as long as broad, subrectangular and apically incised; lower part of outer margin of forewing straight; apex of last tergite of gaster biconvex either side of a median incision.

FEMALE. Length: 1.49–1.84 mm (holotype, 1.84 mm). Ocellar area and area above facial impression metallic blue-green; posterior ocellar area dark coppery-purple; temples and scrobes metallic green with a slight brassy sheen; piliferous punctures between anterior ocellus and facial impression not very shiny, dull; setae on frontovertex translucent brown; antenna (Fig. 14) with radicle dark brown, scape largely yellow but proximally and along margins, dark brown; pedicel dark brown; funicle yellow, but with F1-2 brownish; dorsum of thorax blackish, slightly shiny with a slight purple and blue sheen; setae dark brown; tegulae dark brown; sides of thorax brown; forewings (Fig. 28) brown proximally, but with apical one-quarter, or so, hyaline; apex of venation without a naked, hyaline streak; hindwing hyaline; all coxae dark brown; femora dark brown, hind femora distinctly paler apically; fore and mid tibia dark brown with apices yellowish; hind tibia mostly pale brown, but dark brown along margins; tarsi amber, pretarsi and mid tibial spur dark brown; gaster dark brown with an inconspicuous blue or purple sheen.

Head with conspicuous, relatively shallow, dull piliferous punctures, those in ocellar area shallower and very dull; punctures between facial impression and anterior ocellus slightly smaller than ocelli; two rows of punctures extend between eyes and facial impression, these reaching almost half way to malar sulcus from top of facial impression; scrobes not sharply delimited; head in side view nearly  $2.25 \times$  as long as deep, generally evenly rounded from occipital to mouth margin; clava slightly longer than funicle and pedicel together, its apical sensory part about three-fifths as long as clava and unequally divided by a slightly sinuate line running almost its whole length; ocelli forming a hardly obtuse angle; mandible with three teeth (Fig. 100). Relative measurements (holotype): HW 128; FV 36; EL 80; EW 59; MS 32; SL 51; SW 17; other proportions of antenna as in Fig. 14.

Thorax with small, indistinct piliferous punctures, each separated by much more than their own diameters; sculpture on mesoscutum regular imbricate-reticulate; scutellum with similar sculpture; scutellum slightly broader than long and

with a distinct marginal carina dorsally in apical one-fifth or so; mid tibial spur about as long as mid basitarsus; forewing with distribution of setae at base and proportions of venation as in Figs 28, 29; postmarginal and marginal veins about as long as stigmal; submarginal vein with a distinct subapical hyaline break; costal cell slightly less than  $6 \times$  as long as broad, subrectangular and with apex strongly incised before marginal vein, dorsally with three lines of setae; apex of venation without a naked, hyaline streak, lower part of apical margin slightly straight. Relative measurements (holotype): FWL 253, FWW 121, CL 255, CW 45; HWL 175, HWW 73.

Gaster with last tergite apically biconvex either side of a strong median incision; ovipositor as in Fig. 57. Relative measurements (paratype): OL 37; MT 37.

HOSTS. Unknown.

DISTRIBUTION. Costa Rica (montane areas).

#### MATERIAL EXAMINED.

Holotype ♀, COSTA RICA, Heredia, Vara Blanca, Finca Georgina, 2100m, v-vi.1990 (P. Hanson). Paratype: COSTA RICA, 1♀, Puntarenas, Monteverde, 15-16.vii.1986 (L. Masner). Holotype and paratype in BMNH.

COMMENTS. *Aenasius pelops* is closest to *kerrichi* and *paulistus*, all three species having the costal cell subrectangular and conspicuously incised apically. It is closest to *paulistus* and, in addition to differences in venation (see key), it can be separated on having generally dark brown legs (largely amber in *paulistus*) and costal cell of the forewing less than  $6 \times$  as long as broad (nearly  $7 \times$  as long as broad in *paulistus*). This species can be separated from *kerrichi* by the relatively narrower frontovertex (more than one-third head width in *kerrichi*).

#### *Aenasius paulistus* Compere

(Figs 15, 30, 31, 60, 76)

*Aenasius paulistus* Compere, 1937: 392, 401-403.

Holotype ♀, Brazil, USNM, examined.

DIAGNOSIS. Female (Length 1.19-1.53 mm): as *pelops* but differs as follows: antennal scape (Fig. 15) mostly yellow but marked with brown proximally; funicle yellow; forewing (Fig. 30) with marginal vein not more than two-thirds length of stigmal (Fig. 31); costal cell about  $7 \times$  as long as broad; last tergite of gaster apically concave with a shallow median incision; ovipositor as in Fig. 60. Male (Length 1.10-1.16 mm): forewings hyaline; tarsi yellow, mid tibial spur yellow; funicle

(Fig. 76) 2-segmented, F1 transverse, clava with a naked ventral ridge, about  $4.5 \times$  as long as broad and about  $2.5 \times$  as long as scape; frontovertex a little more than one-third head width and with piliferous punctures distinct but partly obscured by shallow reticulate sculpture, facial impression hardly remote from eyes; distance from anterior ocellus to facial impression about  $0.7 \times$  minimum width of frontovertex.

HOSTS. Recorded as a parasitoid of *Pseudococcus sociabilis* Hamleton (see Flanders, 1940), and also laboratory reared on *Pseudococcus maritimus* (Ehrhorn)(Compere, 1937) and recorded from *Pseudococcus calceolariae* (Maskell) (= *fragilis* Brain) and *Pseudococcus longispinus* (Targioni-Tozzetti) on *Hedera helix* and from *Phenacoccus* sp. on *Bougainvillea* (Kerrich, 1967).

USE IN BIOCONTROL. Imported to California from Brazil for the control of *Pseudococcus maritimus* (Compere, 1937). The species is possibly established (Gordh, 1979).

DISTRIBUTION. USA (California, introduced), Costa Rica (lower altitudes), Brazil.

#### MATERIAL EXAMINED.

Type material. Holotype ♀, BRAZIL, Sao Paulo, ex *Pseudococcus maritimus*, xii.1034 (H. Compere) (Type No USNM 51988). Paratype: 1♂, USA, California, Riverside, ex *Pseudococcus maritimus*, from Sao Paulo, Brazil, reared by S. Flanders. Paratype in BMNH.

Other material. COSTA RICA, 1♀, Guanacaste Prov., Sta Rosa NP, Hacienda 2-C; 5-26.x.1985 (Janzen & Gauld); 1♀, Santa Rosa NP, Boq. Hum. 11-0, 24.viii-14.ix.1985 (Janzen & Gauld); BRAZIL, 1♀, 1♂, Sao Paulo, 4.xii.1934 (H. Compere); 1♀, 1♂, Sao Paulo, on *Hedera helix*, captured by *P. gahani* and *P. longispinus*, 4.xi.1934 (H. Compere). In BMNH.

COMMENTS. *Aenasius paulistus* is very close to *pelops* and they were treated as altitudinal forms of the same species. However, the consistent differences in venation and relative width of the costal cell (see key and under *pelops*) lead us to believe that they as distinct species.

As pointed out by Kerrich (1967), *paulistus* is also very close to *insularis* Compere described from Mexico. The two species differ principally in the relative size of the facial impression. In *paulistus* the facial impression is relatively small and not touching the eye margins so that the piliferous punctures extend at least half the way to the malar sulcus from the top of the impression whilst in *insularis* the facial impression



almost touches the eyes and the piliferous punctures do not extend below the dorsal margin of the impression. The sculpture of the facial impression is relatively deep and rough in *insularis* and the mid tibial spur is amber whilst in *paulistus* the mid tibial spur is generally dark brown, although in the holotype it is amber-brown.

### *Aenasius frontalis* Compere

(Figs 1, 10, 11, 32, 33, 61, 87)

*Aenasius frontalis* Compere, 1937: 388, 392.

Holotype ♀, Panama, USNM, not examined

DIAGNOSIS. Female (length: 1.40–2.22 mm) (Fig. 1): frontovertex between piliferous punctures dark metallic green, blue or purplish, the piliferous punctures very shiny green or blue and contrasting strongly with the areas between them; antenna dark brown, usually with at least some funicle segments yellow, apex of scape testaceous-yellow; dorsum of thorax with a moderately strong but variable, green, blue or purple sheen; tegulae dark brown; antenna (Fig. 10) with scape about  $2 \times$  as long as broad, sensory area of clava divided by an oblique, sinuate line, the apical part much the smaller; head in side view about  $2.5 \times$  as long as deep, almost flat above scrobes, below this strongly curved towards mouth; frontovertex (Fig. 87) about one-quarter head width, piliferous punctures below anterior ocellus very smooth and shiny, scrobes deep, sharply delimited laterally and dorsally; forewings (Fig. 32) completely infuscate but paler towards apex; naked, hyaline streak present at apex of venation (Fig. 33), lower part of outer margin of forewing weakly emarginate; apex of last tergite of gaster medially incised; ovipositor as in Fig. 61. Male: unknown.

HOSTS. Recorded from *Ferrisia virgata* on cacao (see below, and Bennett, 1957; Kerrich, 1967)

DISTRIBUTION. USA (Texas), Mexico, Costa Rica, Panama, Trinidad, Peru, Brazil.

#### MATERIAL EXAMINED.

Non-type material. USA, 1♀, Texas, Cameron Co., Sabal Palm Grove Sect., 6.vii.1982 (G.A.P. Gibson); 2♀, Texas, Cameron Co., Brownsville, viii.1983 (M. Kaulbars); MEXICO, 1♀, 20m E of Concordia, 3000ft, viii.1964 (W.R.M. Mason); COSTA RICA, 23♀, Guanacaste Prov., Santa Rosa NP, various dates and localities, 3.viii.1985–21.ii.1987 (D. Janzen & I.D. Gauld); 1♀, Guanacaste Prov., Guanacaste NP, Est. Pitilla, yellow pan trap, iii.1990 (J.S.

Noyes); 1♀, Puntarenas Prov., Monteverde, St Luis Valley, 17.viii.1986 (L. Masner); 2♀, Puntarenas, Manuel Antonio NP, viii.1986 (L. Masner); 1♀, Puntarenas, Manuel Antonio NP, 23–28.viii.1988 (L. Masner); 6♀, Puntarenas, Pen. Osa, Puerto Jimenez, 10m, various dates ii–x.1992 (P. Hanson); 1♀, Heredia, La Selva Biol. Sta., 3Km S P. Viejo, 10°26'N 84°01'W, 18.v.1990 (H.A. Hespeneheide); 1♀, Heredia, La Selva BS, 50m, ii.1991 (J.S. Noyes); 2♀, 3Km S. Puerto Viejo, OTS-LaSelva, 100m, ii–iii.1993 (P. Hanson); 1♀, Limon, RB Hitoy-Cerere, 14–19.i.1991, 100m, 14–19.i.1991 (J.S. Noyes); PANAMA, 1♀, Canal Zone, Barro Colorado, 14.vi.1982 (R.B. & L.S. Kimsey); TRINIDAD, 1♀, I.C.T.A., ex *Ferrisia* on cocoa, v.1952 (F.D. Bennett); 2♀, I.C.T.A., ex *Ferrisia virgata* on cocoa, 1952–53 (F.D. Bennett); 1♀, St. George, Point Gourde, secondary forest, 8.viii.1976, (J.S. Noyes), 2♀, St. George, St. Augustine, Malaise trap, 15.vii–13.viii.1976 (J.S. Noyes); 1♀, St. George, St. Augustine, wasteground, 16.vi.1976 (J.S. Noyes); PERU, 1♀, Loreto, Iquitos, Quisto Cocha, 5.ii.1984 (L. Huggert); BRAZIL, 2♀, Bahia, Mucuri, xi.1978 (F.Benton). Material in BMNH, INBio, CNC.

COMMENTS. *Aenasius frontalis* can be separated from other species of the genus by the characters given in the key, most notably the very characteristic appearance of the piliferous punctures on the frontovertex (see diagnosis).

### *Aenasius bolowi* Mercet

(Figs 4, 6, 34, 35, 64, 71, 88, 92, 96, 102)

*Aenasius bolowi* Mercet, 1947: 466–467. Lectotype ♀, Costa Rica, IEE, examined.

*Aenasius similis* Kerrich, 1967: 196–197, 219.

Holotype ♀, Panama, USNM, examined. **syn. n.**

DIAGNOSIS. Female (length: 1.40–2.50 mm): head generally dull, metallic green; thorax black with a dull metallic blue or purplish sheen; antenna uniformly blackish; tegulae dark brown; antenna (Figs 4, 6) with scape about  $1.6 \times$  as long as broad, sensory area of clava divided by a slightly oblique longitudinal line (Fig. 92); head in side view evenly curved to top of scrobes, sides of facial impression slightly bulging outwards and then abruptly angled inwards towards mouth; frontovertex (Fig. 88) about one-quarter head width, piliferous punctures below anterior ocellus dull, scrobes deep, sharply delimited dorsally and laterally; forewings (Fig. 34) hyaline or distinctly paler towards apex with hyaline streak

present at apex of venation (Fig. 35), lower part of outer margin of forewing straight; apex of last tergite of gaster slightly concave. Male (length: 0.88–1.78 mm): forewings hyaline (Fig. 64); tarsi brown, the basal segment proximally yellowish, mid tibial spur dark brown; funicle (Figs 71, 102) 6-segmented, pedicel longer than F1 and about as wide as F1 or narrower, funicle segments very broad appearing oblique and each with a conspicuous ventral projection, F6 and clava with distinct ventral oval sensory areas (Fig. 102), clava about 1.5 × as long as broad; frontovertex about one-third head width with distinct piliferous punctures descending part way between eyes and facial impression (Fig. 96), but facial impression remote from eyes; distance from anterior ocellus to facial impression about equal to minimum width of frontovertex.

HOSTS. Unknown.

DISTRIBUTION. Guatemala, Belize, Costa Rica, Panama, Grenada, Trinidad, Venezuela, Ecuador, Peru, Brazil.

#### MATERIAL EXAMINED.

Type material. Lectotype ♀ of *Aenasius bolowi*: COSTA RICA, San Mateo (Bollow) (IEE). Holotype ♀ of *Aenasius similis* Kerrich: PANAMA, 1♀, Montilerio, v.1924 (Fullaway) (Type No 71128 USNM); paratypes: GUATEMALA, 1♀, on banana debris (at Philadelphia, USA), 20.vii.1934; PANAMA, 2♀, Montelirio, v.1924 (Fullaway); 1♀, unlocalised, vii.1914 (D.T. Fullaway); 1♀, Canal Zone, Paraizo, 20.iii.1911 (E.A. Schwarz); 1♀, unlocalised, on banana, viii.1932; 1♀, Barro Colorado Isl., running on banana leaf, viii.1932 (D.T. Fullaway); 2♀, Canal Zone, summit, xi.1946 (N.L.H. Krauss); 1♀, Aquadulce, xi.1946 (N.L.H. Krauss); VENEZUELA, 1♀, San Esteban, xi.1939 (P. Anduze); PERU, 1♀, reared at South American Parasite Lab. (Berry). Paratypes in BMNH, USNM.

Non-type material. BELIZE, 2♀, San Ignacio, 21.vii.1978 (P.S. Broomfield); 1♀, Toledo, 25m NW of Punta Gorda, Salamanca, 28.viii–4.ix.1978 (P.S. Broomfield); COSTA RICA, 67♀, 38♂, Guanacaste Prov., Santa Rosa NP, various localities and dates 1985–1991 (Gauld & Janzen); 1♀, Guanacaste Prov., Santa Rosa NP, 300m, v.1988 (Gauld & Mitchell); 1♂, Guanacaste, 13 Km E. Filadelfia, Hda El Viejo, 40m, v–vi.1989 (M. Garcia); 14♀, 8♂, Guanacaste Prov., Guanacaste NP, various localities, 2–20.iii.1990 (J.S. Noyes); 1♀, Guanacaste Prov., Palo Verde, dry forest, 4–12.vi.1988 (B.V. Brown); 1♀, Guanacaste Prov., NW Volcan

Orosi, Cerro el Hacha, 1988; 1♀, San José, San Pedro, Tigra Cacao, iii–iv.1990 (P. Hanson); 1♀, San José, Ciudad Colon, iii–iv.1990 (P. Hanson); 1♀, 4♂, San José, Ciudad Colon, Hda El Rodeo, 16.ii.1991 (Hym. Parataxonomists); 5♀, 18♂, Heredia Prov., La Selva Biol. Sta., 3 km S. Pto Viejo, 10°26'N 84°01'W, on leaves of *Alchornea costaricensis* Pax & Hoffm., various dates 23.iii–7.iv.1987 (H.A. Hespeneheide); 5♀, 4♂, Heredia Prov., La Selva Biol. Sta., 3 km S. Pto Viejo, 10°26'N 84°01'W, 7.iv.1987 (H.A. Hespeneheide); 1♀, 1♂, Puntarenas, Manuel Antonio NP, 23–28.viii.1986 (L. Masner); 1♀, Puntarenas, Osa Peninsula, 80 mi. (=128 km) SW Rincon, 08°42'N 83°29'W, iii.1987 (H.A. Hespeneheide); 1♀, Puntarenas, Osa Peninsula, Puerto Jimenez, 10m, x–xi.1990 (P. Hanson); 1♀, 2♂, Puntarenas, Golfito, 20.iii.1990 (J.S. Noyes); 1♂, Cartago, Turrialba, CATIE, 700m, 14–15.iii.1980 (J. S. Noyes); 1♀, Cartago, San Ramon, Tres Rios, 1500m, on *Conostegia xalepeh*, 2.vi.1990 (P. Hanson); 1♀, Limon, 7Km SW Bribri, ix–xi.1989 (P. Hanson); 1♀, Limon, RB Hitoy-Cerere, 100m, 14–19.i.1991 (J.S. Noyes); PANAMA, 1♂, Canal Zone, on banana trees, iv.1924 (D.T. Fullaway); 1♀, Canal Zone, Barro Colorado I., 14.vi.1982 (R.B. & L.S. Kimsey); 1♀, Santiago de Veraguas, 27.vii.1976 (F.D. Bennett); GRENADA, 1♂, Granville (windward side), 36 (H.H. Smith); TRINIDAD, 1♀, Caroni, Caroni Swamp, 1.vii.1976 (J.S. Noyes); ECUADOR, 2♀, Pichinchas, Tinlandia, 800m, 8.ii.1983 (L. Huggert); BRAZIL, 2♀, Amazonas, Manaus, Campus Univ., 29.vi.1982 (J.A. Rafael). Material in BMNH, USNM, INBio.

COMMENTS. *Aenasius bolowi* is very close to *hyettus* (Figs 7, 36) and may be synonymous. We are only able to separate the two species on the difference in the shape of the scape as noted by Kerrich (1967), which in some cases is very small and may be related to body size. In general specimens from St Vincent and Grenada (*hyettus*) are smaller and tend to have the distal part of the scape more evenly tapering (Fig. 7) whilst those from elsewhere (*bolowi*) are larger and tend to have the distal part of the scape slightly bulging outwards distad of the pedicel insertion (Fig. 6). For the present we prefer to treat the two species as distinct until we are able to examine larger specimens from St Vincent to assess the range of variation more accurately.

*Aenasius bolowi* is superficially very similar to *caeruleus* but can be separated by having the apical part of the scape not very strongly bulging outwards, the scrobal impression dorsally sharply

margined, different sculpture of the antennal scrobes and interantennal prominence (compare Figs 88 and 89), piliferous punctures below the anterior ocellus relatively dull, and the division of the sensory part of the clava more or less longitudinal and straight (Fig. 92). *A. caeruleus* has the apical part of the scape distinctly bulging outwards, the scrobal impression not sharply margined, the piliferous punctures of the frontovertex very shiny below the anterior ocellus and the division of the sensory part of the clava distinctly transverse and sigmoidal (Fig. 93). There are also further differences between these two species in the shape of the apex of the outer part of the base of the second valvifers and shape of the hypopygium.

### *Aenasius caeruleus* Brues

(Figs 3, 38, 39, 89, 93)

*Aenasius caeruleus* Brues, 1910: 84–85. Holotype ♀, Mexico, AMNH, examined.

*Aenasius personatus* Kerrich, 1967: 198, 199, 221. Holotype ♀, USA, USNM, examined. **syn. n.**

**DIAGNOSIS.** Female (length: 1.01–2.30 mm): head metallic violet to green, ridges between piliferous punctures occasionally purplish; antenna more or less uniformly dark brown; dorsum of thorax with a moderate metallic green, blue, purple or violet sheen, occasionally hardly metallic; tegulae dark brown, normally with a blue or purple sheen; antenna (Fig. 3) with scape widest beyond middle, 1.4–1.9 × as long as broad, sensory area of clava divided obliquely by a sinuate line (Fig. 93); head in side view about 2 × as long as deep, evenly curved above scrobes, straight below this but sometimes distinctly angled towards mouth below eyes; frontovertex (Fig. 89) about one-third to less than one-quarter head width, piliferous punctures below anterior ocellus shiny, sometimes extremely so; scrobes moderately deep, not sharply delimited dorsally; eyes with conspicuous dark hairs; forewings (Fig. 38) with a naked, hyaline streak at apex of venation (Fig. 39), costal cell with at least three lines of setae dorsally, lower part of outer margin of forewing straight; apex of last tergite of gaster hardly concave. Male: Probably very similar to that described for *maplei* Compere and may be that described here as sp. M.

**VARIATION.** Notable variation mentioned under the diagnosis includes the variation in the relative width of the frontovertex and scape and coloration of the head and thorax. There is also some

significant variation in the relative length of the sensory area of the clava, in some specimens it is only about twice as long as the distance separating it from the base of the clava, whilst in other it is about three times as long. The sculpture of the mesoscutum also varies from quite smooth to finely reticulate.

**HOSTS.** Recorded below and by Kerrich (1967) as a parasitoid of *Ferrisia virgata* (Cockerell) on cacao and *Gliricidia*, and from *Ferrisia* sp. on *Gliricidia*.

**DISTRIBUTION.** USA (Texas, Florida), Mexico, Belize, Costa Rica, Panama, Puerto Rico, Trinidad, Venezuela, Ecuador, Peru, Brazil, Uruguay.

### MATERIAL EXAMINED.

Type material. Holotype ♀ of *caeruleus*, Type No. A.M.N.H., Am. Mus. Nat. Hist. Dept. Inver. Zool. No 21120, 411 Petrun, *Aenasius caeruleus* Brues Type (according to Brues, the specimen was collected in Vera Cruz, MEXICO by A. Petrunkevitch) (AMNH). Holotype ♀ of *personatus*, USA, Florida, Hialeah, on *Hibiscus tiliaceus* 24.viii.1953 (O.D. Link) (USNM). Paratypes: USA, 2♀, Florida, Hialeah, on *Hibiscus tiliaceus*, 24.viii.1953 (O.D. Link); TRINIDAD, 3♀, I.C.T.A., ex *Ferrisia virgata* on cocoa, iii.1952 (F.D. Bennett); 1♀, I.C.T.A., ex *Ferrisia virgata* on cocoa, 1952–1953 (F.D. Bennett); 1♀, I.C.T.A., ex *Ferrisia* on *Gliricidia*, ix.1953 (F.D. Bennett); 1♀, San Juan, ex *Ferrisia* on *Gliricidia*, xi.1953 (F.D. Bennett). Paratypes in BMNH.

Non-type material. USA, 2♀, Texas, Brewster Co., Big Bend NP, 23–28.vi.1982 (G.A.P. Gibson); MEXICO, 1♀, Nuevo Leon, San Pedro, Garza Garcia, 20.ix.1983 (M.A. Rodriguez); 1♀, Vera Cruz, 33Km NE Catemaco, vii.1983 (M. Kaulbars); 1♀, Chicana, Ruins 6m E Xpujil, vii.1983 (R. Anderson); BELIZE, 1♀, Hantlover, 10.vii.1978 (P.S. Broomfield); COSTA RICA, 4♀, Guanacaste Province, Santa Rosa NP, Hacienda 1–0, various dates viii.1985–x.1986 (D. Janzen & I.D. Gauld); 1♀, Alajuela, ex mealybug on *M. aesculifolia*, 6.v.1981 (CIE 13352); 1♀, Alajuela, Chiles de Aguas, Zarcas café, xii.1989 (R. Céspedes); 1♀, Heredia, La Selva Biol. Sta., 3 Km S P. Viejo, 10°26'N 84°01'W, 17.iv.1988 (H.A. Hespeneheide); 1♀, Heredia, 3Km S. Puerto Viejo, OTS-La Selva, 100m, ii–iii.1993 (P. Hanson); 2♀, Cartago, La Cangreja, 1950m, vii.1991 (P. Hanson, C. Godoy); 2♀, Puntarenas Prov., Manuel Antonio, 23–28.viii.1988 (L. Masner); 3♀, Puntarenas, San Vito, Est. Las Alturas, 1500m,

i-ii.1992 (P. Hanson); PANAMA, 1♀, Canal Zone, Paraiso, 6.ii.1911 (E.A. Schwarz); PUERTO RICO, 1♀, Mun Dorado, beach 2Km W. Pt. Salinas, 25.v.1982 (S.L. Heydon); TRINIDAD, 1♀, I.C.T.A., ex *Ferrisia* sp. on cocoa, v.1952 (F.D. Bennett) (paratype of *Aenasius regularis* Kerrich, misidentification); 1♂, I.C.T.A., ex *Ferrisia* on *Gliricidia*, ix.1953 (F.D. Bennett) [det G.J. Kerrich, 1967; probable misidentification of *bolowi*]; 1♀, I.C.T.A., ex *Ferrisia virgata* on *Gliricidia*, vi.1955 (F.D. Bennett); 1♀, Caroni, Gran Couva, wasteground, 16.vii.1976 (J.S. Noyes); 1♀, St. Patrick, Coora, coffee plantation and rainforest, 14.viii.1976 (J.S. Noyes); 1♀, St. George, St. Augustine, wasteground, 18.vi.1976 (J.S. Noyes); 1♀, St. George, St. Augustine, Malaise trap, 15.vii-13.viii.1976 (J.S. Noyes); 1♀, Curepe, Sta Margarita Circular Rd., 21-23.xi.1977 (W.R.M. Mason); ECUADOR, 1♀, Rio Palenque, forest, 4.ii.1983 (L. Huggert); 2♀, Napo, 10km N.E. Tema, Rio Hollin, 400m, 19.ii.1983 (L. Masner); 1♀, Napo, Misahualli, 20.ii.1983 (L. Huggert); 2♀, Napo, Sacha, 7.iii.1983 (L. Huggert); PERU, 1♀, Cuzco, Quilambamba, 24-26.xii.1983 (L. Huggert); 3♀, Madre de Dios, Tambopata Res., 12°50' 69°20'W, 17.x-1.xi.1983 (N.E. Stork); 1♀, Huanuca, Tingo Maria, 26.i.1984 (L. Huggert); BRAZIL, 2♀, Santa Catarina, Nova Teutonia, xi.1949, 19.xii.1951 (F. Plaumann). Material in BMNH, INBio, CNC.

COMMENTS. Included here are specimens which vary considerably in the relative width of the scape and frontovertex and in the length of the sensory area of clava and general coloration of the body. Initially, we considered that more than one species might be represented, but we now believe that only one variable species is present. The differences between *caeruleus* and *personatus* fall within the limits of this variation and therefore we treat the two names as synonymous. *Aenasius maplei* Compere is also very close to *caeruleus* and may be synonymous, but we hesitate to formally propose this synonymy until further North American material can be examined.

The close relationship of *caeruleus* with *maplei* leads us to assume that the male of *caeruleus* is probably very similar to that of *maplei* (see Compere, 1937). This suggests that *Aenasius* sp. M may be the male of *caeruleus* and not that identified as *personatus* by Kerrich (BMNH collection) which we are sure is the male of *hyettus*.

*Aenasius caeruleus* can be confused easily with *hyettus* (see comments under *hyettus*) and *regularis* Kerrich. Females of *caeruleus* can be sepa-

rated most conveniently from those of *regularis* by the less strongly curved stigmal vein (compare Figs 37 and 39).

### *Aenasius brasiliensis* (Mercet)

(Figs 16, 40, 41, 65, 69, 90)

?*Blepyrus tachigaliae* Brues, 1921: 229-230.

Holotype ♀, Guyana, ?lost.

*Chalcaspis brasiliensis* Mercet, 1926: 46-48.

Holotype ♀, Brazil, IEE, examined.

*Aenasius cariocus* Compere, 1937: 390, 399, 404.

Holotype ♀, Brazil, USNM, examined. **syn. n.**

*Aenasius colombiensis* Compere, 1937: 403-404.

Holotype ♀, USNM, not examined. **syn. n.**

Synonymised with *cariocus* by Kerrich, 1967.

*Aenasius brasiliensis* (Mercet); Compere, 1937: 390, 398.

*Aenasius theobromae* Kerrich, 1953: 796-797.

Holotype ♀, Trinidad, BMNH, examined.

**syn. n.** Synonymised with *cariocus* by Kerrich, 1967.

DIAGNOSIS. Female (length: 1.21-1.90 mm): head generally metallic green or blue green, ridges between piliferous punctures purplish, ocellar area duller; antenna with scape yellow, variously marked with brown proximally and along dorsal and ventral margins; pedicel and clava dark brown; funicle segments yellow sometimes marked extensively with brown; dorsum of thorax relatively dull, but with a slight greenish or purple sheen; tegulae dark brown; antenna (Fig. 46) with scape normally about 3-3.5 × as long as broad, sensory area of clava divided obliquely into two almost equal halves; head in side view about 2 × as long as deep, almost flat above scrobes, below this more strongly curved towards mouth; frontovertex (Fig. 90) between one-quarter and one-third head width, piliferous punctures between anterior ocellus and facial impression shiny, scrobes moderately deep, not sharply delimited; forewings (Fig. 40) with apical half hyaline, or at least conspicuously paler than basal half; naked, hyaline streak at apex of venation present (Fig. 41); lower part of outer margin of forewing straight; apex of last tergite of gaster hardly concave and not medially incised; ovipositor about two-thirds as long as mid tibia. Male (length: 0.65-0.1.27 mm): forewings normally with base infuscate (Fig. 65), rarely completely hyaline; tarsi yellow, mid tibial spur dark brown; scape (Fig. 69) about 2.5 × as long as broad and widest in middle, funicle 6-segmented, pedicel longer than F1 and about as wide, funicle segments disc-like and without a conspicuous ventral projection, F6 with an oval

sensory area, clava about twice as long as broad; frontovertex about one-third head width with distinct piliferous punctures which do not descend between eyes and facial impression, but facial impression remote from eyes; distance from anterior ocellus to facial impression about 0.65–0.8 × minimum width of frontovertex.

**HOSTS.** Recorded from *Pseudococcus* sp. in Brazil and Colombia (Compere, 1937; Kerrich, 1967) and from *Dysmicoccus brevipes* (Cockerell) in Trinidad (Bennett, 1957; Kerrich, 1953, 1967).

**USE IN BIOCONTROL.** The species was apparently introduced into Hawaii in 1935 for the control of *Dysmicoccus brevipes* (Cockerell) (Swezey *et al.*, 1939, as *colombiensis*), but no further information is available.

**DISTRIBUTION.** Mexico, Costa Rica, Panama, Trinidad, Colombia, Ecuador, Peru, Brazil, Bolivia.

**MATERIAL EXAMINED.**

Type material. Holotype ♀ of *Chalcaspis brasiliensis*: BRAZIL, Corumba, Matt. Grosso (IEE). Holotype ♀ of *Aenasius cariocus*: BRAZIL, Campinas, 26.xi.1934 (H. Compere) (Type No 51987 USNM) (antenna and wings on slide, but slide missing). Paratypes: *A. colombiensis*, COLOMBIA, 3♀, 2♂, Barbosa, x.1935 (E.G. Salas); *A. theobromae*, TRINIDAD, 1♀, 2♂, Maracas, ex *Pseudococcus brevipes* on cacao pod, x.1949 (T.W. Kirkpatrick). Unless otherwise stated material in BMNH.

Non-type material. MEXICO, 1♀, Vera Cruz, 20 Km NE Tlachinol, vi.1983 (M. Kaulbars); 1♀, Campos, 10 Km W Xpuliil, Chincanna, 300m, viii.1983 (M. Kaulbars); COSTA RICA, 9♀, Guanacaste Prov., Santa Rosa NP, various localities and dates, vii.1985–ix.1991 (Janzen & Gauld); 1♀, 2♂, Guanacaste NP, near HQ, and 7Km E. HQ, 2–10.iii.1990, (J.S. Noyes); 7♀, 1♂, Alajuela, Rio Peñas Blancas, 10°19'N 84°43'W, 800m, 2517, ex *Cataenococcus* sp. [det. D.J. Williams] in stems of *Cecropia insignis* inhabited by *Azteca xanthochroa*, 10–13.v.1989 (J. Longino); 1♀, Alajuela, Rio Peñas Blancas, 18.vii.1986 (L. Masner); 4♀, Puntarenas, 4Km E. Palmar Norte, 8°58'N 83°25'W, 40m, 2665, ex *Pseudococcus* near *neobrevipes* [det. D.J. Williams] in domatium *Cordia alioidera*, nest of *Crematogaster curvispinosa*, 26.iii.1990 (J. Longino); 1♀, Puntarenas, Golfo Dulce, 3Km DW Rincon, 10m, ii–v.1989 (P. Hanson); 2♀, San José, Ciudad Colon, Hda El Rodeo, 18.ii.1991 (Hym. Parataxonomists); 1♀,

Heredia, Braulio Carillo NP (HQ), 250–500m, 10.vi.1985 (L. Masner, H. Goulet); 10♀, Heredia, La Selva Biol. Sta., 3km S Porto Viejo, 10°26'N 84°01'W', v.1990–vii.1991 (H.A. Hespeneheide); 1♀, Heredia, La Selva BS, 50m, 22.i–3.ii.1991 (J.S. Noyes); 3♀, Heredia, 3 Km S. Puerto Viejo, OTS-LaSelva, 100m, ii–iii.1993 (P. Hanson); 7♀, Limon, RB Hitoy-Cerere, 100m, 14–19.i.1991 (J.S. Noyes); TRINIDAD, 1♀, Chatham, on grass, 1913 (F.W. Ulrich); 1♀, unlocalised, vial No 1 (F.D. Bennett); 3♀, Caracas Valley, ex [*Dysmicoccus*] *brevipes* on cocoa, No 18, iii.1953 (F.D. Bennett); 1♀, Curepe, Sta Margarita Circ. Rd., 26.ix–26.x.1974 (F.D. Bennett); 1♀, St George, El Tucuche (West Slope), 26.vi.1976 (J.S. Noyes); 1♀, St George, St. Augustine, Malaise trap, 15.vii–13.viii.1976 (J.S. Noyes); 3♀, Arima Valley, 5th mile, edge of rainforest, 3.vii.1976 (J.S. Noyes); COLOMBIA, 2♀, Bucaramanga, ix.1935 (E.G. Salas); 1♀, Barbosa, x.1936 (E.G. Salas); 3♀, Vaupes, River Vaupes, ex coccid, x–xii.1952 (D.J. Taylor); ECUADOR, 1♂, Pichincha, Tinlandia, 800m, 8.ii.1983 (L. Huggert); 1♀, 2♂, Napo, Tena, 16.ii.1983 (L. Huggert); 1♀, Napo, Misahualli, 20.ii.1983 (L. Huggert); 2♀, 2♂, Napo, Sacha, 7.iii.1983 (L. Huggert); PERU, 88♀, 15♂, Madre de Dios, Rio Tambopata Res., 12°50'S 69°20'W, 1–13.xi.1983 (N.E. Stork); 7♀, 8♂, Madre de Dios, Pto Maldonado, 3.i.1984 (L. Huggert); 4♀, 3♂, Junin, Satipo, 18–24.i.1984 (L. Huggert); 4♀, Loreto, Iquitos, Quisto Cocha, 5.ii.1984 (L. Huggert); 2♀, Loreto, Iquitos, NE Rio Nanay, 8.ii.1984 (L. Huggert); 3♀, 1♂, Loreto, Iquitos, Granja Unap, 9.ii.1984 (L. Huggert); 3♀, 1♂, Loreto, Iquitos, Barillal, 10.ii.1984 (L. Huggert); BRAZIL, 1♀, Sao Paulo, ex *Phenacoccus* sp. on *Boiugainvillia*, 28.xii.1934 (E. Hambleton); 5♀, Sao Paulo, Guaraja, ex *Pseudococcus* sp 16, vii.1935 (E. Hambleton); 1♂, Sao Paulo, ex *Pseudococcus* sp 15, viii.1935 (E. Hambleton); 1♀, Sao Paulo, Teodora Sampaio, xii.1977 (M. alvarenga); 5♀, Santa Catarina, Nova Teutonia, various dates, ix.1943–x.1949 (F. Plaumann); 3♀, Campinas, No 12, ex *Pseudococcus*, ii.1936 (E. Hambleton); 1♀, Pará, Oriximiná, Alcoa Hine Raçao, Rio Trombetas, 7–25.x.1982 (Rafael, Binda & Vidal); 1♀, Mato Grosso, Sinop., 19.ii.1956 (O. Roppa); 1♀, Bahia, Mercuri, xi.1978 (F.P. Benton); 1♀, Bahia, Buerarema, Faz Casne e Damaio, 2.x.1980 (F.P. Benton); 2♀, Bahia, Itabuna, iv.1983 (F.P. Benton); 3♀, Bahia, Itabuna, CEPEC, ex mealybug in *Azteca* nest in *Cecropia* stem, ix.1986 (F.P. Benton); 1♀, Minas Gerais, Aguas Vermelhas, xii.1983 (M. Alvarenga); 1♀, Rondonia, Vil-

hena, xi.1973 (M. Alvarenga); 1♀, Amazonas, Manuas, CDC trap, 15.i-25.ii.1981 (J. Arias); 1♀, Amazonas, Sao Gabriel de Cachoeria, 20-29.iv.1982 (J. Arias); 5♀, Amazonas, Manaus, Univ. campus, Malaise trap, vi.1982 (J.A. Rafael); BOLIVIA, 1♀, Yungas, 15 Km NE Caranavi, 920m, 26.i.1973 (J. Helava). Material in BMNH, CNC, INBio, USNM, TAMU.

COMMENTS. We have examined the respective holotypes of *C. brasiliensis* and *A. cariocus* and conclude that the two belong to the same species. The apparent difference in the relative width of the scape noted by Kerrich (1967) is due to the lamina of the scape slightly curling inwards on the holotype of *brasiliensis* which gives it the appearance of being narrower.

*A. brasiliensis* is similar to, and probably closely related to, *longiscapus* Compere from which it can be reliably separated using the characters given in the key to species. In addition to these characters the two can be separated on the relative length of the ovipositor. In *brasiliensis* the ovipositor is only about 2/3 the length of the mid tibia whereas in *longiscapus* it clearly longer than the mid tibia.

### *Aenasius mitchellae* sp. n.

(Figs 17, 42, 43, 59)

DIAGNOSIS. Female: antenna with scape mostly blackish, funicle with yellow and brown segments; club dark brown; scape about  $4 \times$  as long as broad and longer than maximum eye width; sensory area of clava inconspicuously divided on inner side in apical half by a slightly oblique line; frontovertex slightly less than one-third head width; piliferous punctures below anterior ocellus relatively dull; scrobes shallow, not sharply delimited; forewings infusate, basal area darkest; apex of venation with a naked, hyaline streak; lower part of outer margin of forewing almost imperceptibly emarginate; apex of last tergite of concave with a distinct median incision.

FEMALE. Length: 2.09-2.35 mm (holotype 2.35 mm). Frontovertex in ocellar area dark green, almost black and hardly shiny, below this gradually becoming more metallic and blue-green; scrobes metallic green with brassy reflections and with some coppery reflection dorsally, interantennal prominence margined violet dorsally; genae with some purple reflections; scape mostly blackish, slightly metallic blue and purple, apex yellow; pedicel, F1-3 and clava blackish, slightly metallic; F4-6 yellow; dorsum of thorax with a strong metallic blue-green lustre mixed with cop-

pery and purple; tegulae and sides of thorax dark brown, almost black; forewings strongly infusate, weakest towards wing apex; coxae, fore femora and fore tibiae almost black; mid femur dark brown in basal half, apex amber; hind femur similar but darker; mid tibia amber; dorsally dark brown; hind tibia similar but also margined brown ventrally; mid tibial spur dark brown; tarsi amber, pretarsi dark brown; gaster dark brown with a slight brassy, blue and purple lustre.

Head with conspicuous, piliferous punctures which are mostly dull, but becoming more shiny towards facial impression, those immediately above facial impression quite smooth; punctures about the same diameter as anterior ocellus, or perhaps slightly larger; three lines of punctures between eyes and facial impression; facial impression shallow and not sharply delimited; head in side view about  $2.25 \times$  as long as deep, and fairly evenly rounded from occipital margin to mouth margin; scape (Fig. 17) about  $4 \times$  as long as broad; clava about as long as funicle and pedicel together, its apical sensory part slightly more than two thirds as long as clava and divided on inner side in its apical half by a hardly oblique line; ocelli forming a very slightly obtuse angle. Relative measurements (holotype): HW 140; FV 40; EL 81; EW 61; MS 40; SL 75; SW 18.

Thorax dorsally with piliferous punctures indistinct, each separated by much more than their own diameters; sculpture on mesoscutum very fine but regular transversely elongate, imbricate-reticulate; scutellum with similar but polygonal, almost reticulate sculpture; scutellum slightly broader than long and with a distinct marginal carina dorsally in apical one-fifth or so; mid tibial spur about as long as mid basitarsus; forewing (Fig. 42) with stigmal vein nearly twice as long as marginal and about  $1.5 \times$  as long as postmarginal (Fig. 43); costal cell gradually tapering distally, not abruptly incised apically and with two lines of dorsal setae; submarginal vein with a distinct subapical hyaline break; apex of venation with a naked, hyaline streak, lower part of apical margin at least slightly emarginate. Relative measurements (holotype): FWL 320, FWW 140, CL 123, CW 19; HWL 213, HWW 83.

Gaster with last tergite slightly concave and with a median incision; ovipositor (Fig. 59) nearly one quarter longer than mid tibia.

MALE. Unknown.

HOSTS. Unknown.

DISTRIBUTION. Costa Rica.

## MATERIAL EXAMINED.

Type material. Holotype ♀, COSTA RICA, Heredia, Vara Blanca, vii–viii.1990 (P. Hanson). Paratypes: COSTA RICA, 1 ♀, San José, Zurquí de Moravia, 1600m, ii.1989 (P. Hanson); 2 ♀, San José, Cerro de la Muerte, 19Km S, 3Km W. Empalme, 2600m, iv–vii.1992, iv–v.1993 (P. Hanson, C. Godoy). Holotype in BMNH, paratypes in BMNH, INBio.

COMMENTS. *A. mitchellae* is close to *longiscapus* Compere, both having a hyaline streak at the apex of the venation; scape more than  $3 \times$  as long as broad; outer margin of forewing emarginate; and frontovertex more than one-quarter head width. It differs from *longiscapus* Compere in the sculpture of the facial impression being very nearly smooth whereas in *longiscapus* it is very rough; the postmarginal vein in *longiscapus* is very nearly as long as the stigmal (clearly shorter in *mitchellae*); the scape in *longiscapus* is  $3\text{--}3.5 \times$  as long as broad and generally yellow (blackish and more than  $4 \times$  as long as broad in *mitchellae*). Further to this the line dividing the sensory area of the clava in *longiscapus* is in the outer half (inner half in *mitchellae*).

*Aenasius longiscapus* Compere

(Figs 18, 19, 44, 45, 91)

*Aenasius longiscapus* Compere, 1937: 388–391, 398–399. Holotype ♀, USNM, examined.

*Aenasius pacificus* Compere, 1937: 388–391, 399–400. Holotype ♀, USNM, examined. **syn. n.**

*Aenasius vadosus* Kerrich, 1967: 214. Holotype ♀, Puerto Rico, BMNH, examined. **syn. n.**

*Aenasius acuminatus* Kerrich, 1967: 215. Holotype ♀, Trinidad, BMNH, examined. **syn. n.**

DIAGNOSIS. Female (length: 1.19–2.09 mm): head with ocellar area slightly lustrous purple-brown, below this metallic green, occasionally slightly coppery or brassy; antenna mostly yellow usually with proximal two-fifths of scape narrowly margined dark brown ventrally, pedicel dark brown and clava completely grey-brown or brown (Fig. 18) sometimes proximal segment yellowish (Fig. 19); dorsum of thorax blackish with a dull green, blue or purple sheen; tegulae blackish; antenna (Figs 18, 19) with scape about  $3\text{--}5 \times$  as long as broad, sensory area of clava divided by an oblique, slightly sinuate line in apical half or so; head in side view about  $2.5 \times$  as long as deep, gradually and evenly curved above scrobes, below top of scrobes angled towards mouth at about  $45\text{--}60^\circ$ ; frontovertex (Fig. 91)

between one-third and one-quarter head width, piliferous punctures below anterior ocellus dull, but above scrobes and between eyes and scrobes moderately shiny; scrobal area small and relatively shallow, from mouth margin only about one-quarter head length, sharply delimited laterally; forewings (Fig. 44) with hyaline streak present at apex of venation (Fig. 45), lower part of outer margin of forewing clearly emarginate; apex of last tergite of gaster hardly concave, but with a distinct median incision; ovipositor clearly longer than mid tibia. Male: unknown with certainty, but a slide mounted specimen (see below under material examined) identified by Compere as this species is identical to males of *phenacocci* and *advena* (see diagnosis for *advena*).

VARIATION. A variable species, both in the shape and coloration of the scape, coloration of the clava (Figs 18, 19), head shape, relative length and shape of the hypopygium and length of the ovipositor. Variation in coloration and relative width of the scape has been discussed above. Variation in the shape of the hypopygium is related to the relative length of the ovipositor. In specimens where the ovipositor is about  $1.5 \times$  as long as the mid tibia the hypopygium is significantly more elongate than in specimens where the ovipositor is only about  $1.25 \times$  as long as the mid tibia. The head in facial view varies from being dorsally quite rounded to virtually straight with the dorso-lateral eye margins being relatively angular.

HOSTS. Recorded below from *Ferrisia virgata* (Cockerell), *Ferrisia* sp, on *Glicricidia*, and from *Dysmicoccus brevipes* (Cockerell) on cacao (see also Kerrich, 1967).

DISTRIBUTION. Mexico, Costa Rica, Puerto Rico, Puerto Rico, Trinidad, Peru, Ecuador, Brazil.

## MATERIAL EXAMINED.

Type material. Holotype ♀ of *longiscapus*: BRAZIL, Sao Paulo, Campinas, 26.xi.1934 (H. Compere) (USNM Type No 51991). Holotype ♀ of *pacificus*: MEXICO, Tres Marias Islands, Maria Madre Arroyo Hondo, 17.v.1925 (H.H. Kieffer) (USNM Type No 51993). Holotype ♀ of *acuminatus*: TRINIDAD, Maracas, ex *Dysmicoccus brevipes* (Ckll.) on cacao, v.1953 (F.D. Bennett) (BMNH). Holotype ♀ of *vadosus*: PUERTO RICO, Mayaguez, on coffee, xi.1959 (F.J. [sic] Bennett) (BMNH).

Other material. COSTA RICA, 5 ♀, Guanacaste, Santa Rosa NP, Hacienda–3–0, various dates 22.vi.1985–8.x.1986 (Janzen & Gauld); 1 ♀,

Guanacaste, Volcan Orosi, Cerro el Hacha, 300m, 1988; 1♀, Guanacaste, 13 Km E. Filadelfia, Hda El Viejo, 40m, v-vi.1989 (M. Garcia); 1♀, Heredia, La Selva Biol. Sta., 50m, ii.1991 (J.S. Noyes); 1♀, Heredia, La Selva Biol. Sta., 3Km S Pto. Viejo, 10°26'N 84°01'W, 14.vi.1991 (H.A. Hespeneheide); 1♀, Heredia, 3 Km S. Puerto Viejo, OTS-La Selva, 100m, ix.1992 (P. Hanson); 1♀, 3Km S. Puerto Viejo, OTS-La Selva, 100m, canopy fog, *Carapa* sp., FOT/02, 15.iii.1993; 2♀, Barra Honda, 150m, v.1988 (I.D. Gauld); 2♀, Puntarenas, Manuel Antonio NP, 24.viii.1986 (L. Masner); 1♀, Puntarenas, Pen. Osa, Puerto Jimenez, 10m, ii.1992 (P. Hanson); 1♀, Limon, P.I. Amistad, San Vito C. Brus, Finca Catrosa, iv-x.1989 (M. Ramirez); TRINIDAD, 1♀, I.C.T.A., ex *F. virgata* on cocoa, vi.1953 (F.D. Bennett); 1♀, I.C.T.A., ex *Ferrisia* on *Gliricidia*, 2.x.1953 (F.D. Bennett); 1♀, I.C.T.A., ex *Ferrisia* on cocoa, xii.1953 (F.D. Bennett); 1♀, I.C.T.A. ex *Ferrisia* sp. on *Gliricidia*, iv.1954 (F.D. Bennett); 1♀, Wallerfield, on *Piper*, xi.1958 (F.D. Bennett); ECUADOR, 1♀, Pichincha, Tinlandia, 800m, 2.ii.1983 (Masner & Sharkey); PERU, 1♀, Madre de Dios, Pto Maldonado, 3.i.1984 (L. Huggert); BRAZIL, 1♂, Sao Paulo, captured near mealybug on grass, 6.xi.1937 (H. Compere) (identified as *longiscapus* by Compere, but probably male of *advena*); 1♀, Bahia, ex *Ferrisiana virgata* on coconut, xi.1964 (F.D. Bennett); 1♀, Bahia, Mucuri, xi.1978 (F.D. Bennett). Material in BMNH, CNC.

COMMENTS. The relative widths of the scape of *pacificus* and *acuminatus* given by Kerrich (1967) are incorrect. We have measured the scape in the holotypes of both and they are almost identical being 4 × and 4.3 × as long as broad respectively. Kerrich also noted several other differences between these species, *longiscapus* and *vadosus*. However, the material we have been able to examine indicates that these differences are unreliable and probably reflect infraspecific variation. We are therefore treating all four names as synonyms.

#### Notes on males

In addition to the species treated above, we have recognised a further 20 species from males only. In order to facilitate their future recognition we provide, below, short diagnoses of the males of these species.

#### *Aenasius* sp. A

(Fig. 72)

DIAGNOSIS. Length 1.02–1.59 mm. Forewings with base infusate; tarsi yellow, mid tibial spur dark brown; scape widest below middle; funicle (Fig. 72) 6-segmented, pedicel longer and wider than F1 and F2 together, these two segments subquadrate; funicle segments disc-like and without a conspicuous ventral projection, clava about twice as long as broad and without any conspicuous differentiated sensory areas or sensilla; frontovertex about one-third head width and with distinct piliferous punctures which descend part way between eyes and facial impression, facial impression remote from eyes; distance from anterior ocellus to facial impression about equal to width of frontovertex; forewing with lower part of apical margin straight.

#### MATERIAL EXAMINED.

COSTA RICA, 1♂, San José, Braulio Carrillo NP, Est. Carrillo, 600m, 13.ii.1991 (Hym. Parataxonomists); 4♂, Limon, RB Hitoy-Cerere, 100m, 14–19.i.1991 (J.S. Noyes); 1♂, PN Cahuita, 5m, 1.iii.1991 (J.S. Noyes). Material in BMNH, INBio.

#### *Aenasius* sp. B

DIAGNOSIS. Length about 1.33 mm. Forewings infusate with a naked, hyaline streak at apex of venation; tarsi yellow, mid tibial spur dark brown; funicle 6-segmented, pedicel longer and wider than F1, funicle segments subquadrate and without a conspicuous ventral projection, F6 and clava and without any conspicuous differentiated sensory areas or sensilla and clava about 2.5 × as long as broad; frontovertex about one-third head width and with distinct piliferous punctures which descend part way between the facial impression and eyes, facial impression remote from eyes; distance from anterior ocellus to facial impression about equal to minimum width of frontovertex.

#### MATERIAL EXAMINED.

COSTA RICA, 1♂, Limon, RB Hitoy-Cerere, 14–19.i.1991 (J.S. Noyes). Material in BMNH.

#### *Aenasius* sp. C

(Figs 68, 73)

DIAGNOSIS. Length 0.83–1.40 mm. Forewings hyaline (Fig. 68), sometimes evenly slightly infusate; tarsi dark brown, mid tibial spur dark brown; scape widest below middle, funicle (Fig.



73) 6-segmented, pedicel shorter and narrower than F1 which is trapezoidal in profile and up to 2 × as long as F2, F2-F6 subquadrate but appearing slightly oblique in profile and with a conspicuous ventral projection, F6 and clava without any conspicuous differentiated sensory areas or sensilla and clava nearly 2.5 × as long as broad; frontovertex about 0.4 × head width or less and with distinct piliferous punctures which do not extend between facial impression and eyes, facial impression touching eyes; distance from anterior ocellus to facial impression about 0.5–0.6 × minimum width of frontovertex.

**MATERIAL EXAMINED.**

COSTA RICA, 52♂, Guanacaste Prov., Santa Rosa NP, various localities, 1985–1989 (D. Janzen, I.D. Gauld); 2♂, Guanacaste Prov., Guanacaste NP, iii.1990 (J.S. Noyes); 1♂, San José, Ciudad Colon, 800m, iii–iv.1990 (L. Fournier); 1♂, San José, Ciudad Colon, Hda El Rodeo, 800m, 16.ii.1991 (J.S. Noyes). Material in BMNH, INBio.

***Aenasius* sp. D**

(Figs 66, 74)

**DIAGNOSIS.** Length 0.73–0.88 mm. Forewings hyaline (Fig. 66); fore and mid tarsi yellow, mid tibial spur white, hind tarsi testaceous; funicle (Fig. 74) 6-segmented, pedicel shorter and narrower than F1, funicle segments subquadrate and without a conspicuous ventral projection, F6 and clava with any conspicuous differentiated sensory areas or sensilla and about 2.5 × as long as broad; frontovertex about 0.4 × head width and with distinct piliferous punctures which descend part way between facial impression and eyes, facial impression remote from eyes; distance from anterior ocellus to facial impression about 0.4 × minimum width of frontovertex.

**MATERIAL EXAMINED.**

COSTA RICA, 17♂, Guanacaste Prov., Santa Rosa NP, various dates 1986–1991 (D. Janzen, I.D. Gauld). Material in BMNH, INBio.

***Aenasius* sp. E**

(Figs 67, 75, 104)

**DIAGNOSIS.** Length 0.76–1.02 mm. Forewings hyaline (Fig. 67); tarsi yellow, mid tibial spur yellow; funicle (Fig. 75) 6-segmented, pedicel shorter and narrower than F1 which is quadrate, funicle segments subquadrate and without a conspicuous ventral projection, F6 and clava (Fig. 104) with an oval sensory area and about 3 × as

long as broad; frontovertex about 0.4 × head width and with distinct piliferous punctures, facial impression touching eyes; distance from anterior ocellus to facial impression about 0.5 × minimum width of frontovertex.

**MATERIAL EXAMINED.**

COSTA RICA: 12♂, Guanacaste Prov., Santa Rosa NP, various dates 1985–1987 (D. Janzen, I.D. Gauld); 1♂, Guanacaste Pv, Guanacaste NP, 11.iii.1990 (J.S. Noyes). Material in BMNH, INBio.

***Aenasius* sp. F**

**DIAGNOSIS.** Length 0.63–0.92 mm. Forewings hyaline; tarsi yellow, mid tibial spur white; funicle 6-segmented, pedicel about as long as F1 but slightly narrower, F1 quadrate; funicle segments disc-like and without a conspicuous ventral projection, clava without any conspicuously differentiated sensory areas or sensilla and about 2.5 × as long as broad; frontovertex about one-half head width and with distinct piliferous punctures which descend part way between eyes and facial impression, facial impression remote from eyes; distance from anterior ocellus to facial impression about 0.5 × minimum width of frontovertex.

**MATERIAL EXAMINED.**

COSTA RICA: 5♂, Guanacaste Prov., Santa Rosa NP, various dates 1985–1986 (D. Janzen, I.D. Gauld); 1♂, Puntarenas, Manuel Antonio, 23–28.viii.1986 (L. Masner). Material in BMNH.

***Aenasius* sp. G**

(Fig. 103)

**DIAGNOSIS.** Length about 0.83 mm. Forewings hyaline; tarsi yellowish brown, mid tibial spur white; funicle 6-segmented, pedicel longer but narrower than F1, funicle segments disc-like and without a conspicuous ventral projection, F6 and clava with conspicuous ventral sensory areas (Fig. 103), clava about twice as long as broad; frontovertex a little more than one-third head width with distinct piliferous punctures which do not descend between facial impression and eyes, facial impression nearly touching eyes; distance from anterior ocellus to facial impression about 0.5 × minimum width of frontovertex.

**MATERIAL EXAMINED.**

COSTA RICA: 2♂, Guanacaste Prov., Santa Rosa NP, Hacienda 1–0, 6–27.ix.1986 (D. Janzen, I.D. Gauld). Material in BMNH.

***Aenasius* sp. H**

(Fig. 105)

DIAGNOSIS. Length 0.76–0.89 mm. Forewings hyaline; tarsi yellow, mid tibial spur yellow or brown; funicle 6-segmented, pedicel longer than F1 which is quadrate and about as wide, funicle segments disc-like and without a conspicuous ventral projection, clava with one or two peg-like sensilla (Fig. 105) and about twice as long as broad; frontovertex a little more than one-third head width and with distinct piliferous punctures which descend part way between eyes and facial impression, but facial impression remote from eyes; distance from anterior ocellus to facial impression about  $0.7 \times$  minimum width of frontovertex.

## MATERIAL EXAMINED.

COSTA RICA, 2♂, Guanacaste Prov., Santa Rosa NP, Bosq. Hum. 11–0, 11.v–1.vi.1985 (D. Janzen, I.D. Gauld); 2♂, Guanacaste Prov., Guanacaste NP, 500m, below Pitilla, 6.iii.1990 (J.S. Noyes). Material in BMNH.

COMMENTS. This material may represent more than one species.

***Aenasius* sp. I**

DIAGNOSIS. Length about 0.7 mm. Forewings hyaline; tarsi yellow, mid tibial spur yellow; funicle 6-segmented, pedicel longer than F1 and about as wide, funicle segments disc-like and without a conspicuous ventral projection, clava with one oval sensory area and about twice as long as broad; frontovertex about one-half head width and without distinct piliferous punctures, facial impression remote from eyes; distance from anterior ocellus to facial impression about  $0.5 \times$  minimum width of frontovertex.

## MATERIAL EXAMINED.

COSTA RICA, 2♂, Guanacaste Prov., Guanacaste NP, near Playa Naranja, 11.iii.1990 (J.S. Noyes). Material in BMNH.

***Aenasius* sp. J**

DIAGNOSIS. Length 0.72–0.79 mm. Forewings hyaline; tarsi yellow to yellowish brown, mid tibial spur yellow; funicle 6-segmented, pedicel longer than F1 and about as wide, funicle segments disc-like and without a conspicuous ventral projection, F6 and clava without conspicuous sensory areas, clava about twice as long as broad; frontovertex a little more than one-third head width, with relatively deep, reticulate sculpture

and without distinct piliferous punctures, facial impression separated from eyes; distance from anterior ocellus to facial impression about  $0.65 \times$  minimum width of frontovertex.

## MATERIAL EXAMINED.

COSTA RICA, 2♂, Guanacaste Prov., Lomas Barbudal Biol. Res. 15 Km SW Bagaces, 28.ii.1990 (J.S. Noyes); 2♂, Guanacaste Prov., Guanacaste NP, near HQ, 2–20.iii.1990 (J.S. Noyes). Material in BMNH.

COMMENTS. This material possibly represents two separate species since there are slight differences in the structure and arrangement of the sensilla on F6 and clava in the specimens from either locality.

***Aenasius* sp. K**

DIAGNOSIS. Length 1.30 mm. Forewings hyaline; tarsi yellow, mid tibial spur brown; funicle 3-segmented, F1 transverse, clava without a naked ventral ridge, about  $7 \times$  as long as broad and  $2.5 \times$  as long as scape; frontovertex nearly half head width and with distinct piliferous punctures, two or three rows descending some of the way between eyes and facial impression; distance from anterior ocellus to facial impression about  $0.4 \times$  minimum width of frontovertex.

## MATERIAL EXAMINED.

COSTA RICA, 1♂, Manuel Antonio NP, 26.viii.1986 (L. Masner). Material in BMNH.

COMMENTS. Possibly a male of *Aenasius phenacocci* or related species.

***Aenasius* sp. L**

DIAGNOSIS. Length 1.06 mm. Forewings hyaline; tarsi yellow, mid tibial spur dark white; funicle 3-segmented, F1 transverse, clava without a naked ventral ridge, about  $3 \times$  as long as broad and about  $1.5 \times$  as long as scape; frontovertex about one-third head width, with piliferous punctures obscured by relatively deep reticulate sculpture; distance from anterior ocellus to facial impression about equal to minimum width of frontovertex.

## MATERIAL EXAMINED.

COSTA RICA, 1♂, Puntarenas Prov., Monteverde, 15–16.vii.1986 (L. Masner). Material in BMNH.

COMMENTS. Possibly a male *Blepyrus* sp.

***Aenasius* sp. M**

(Figs 80, 94)

DIAGNOSIS. Length 0.94–1.44 mm. Forewings hyaline; tarsi dark brown, mid tibial spur dark brown; scape widest beyond middle, funicle (Fig. 80) 5-segmented, F1 transverse, clava without a naked ventral ridge, about  $4.5 \times$  as long as broad and about  $2.5 \times$  as long as scape; frontovertex (Fig. 94) a little more than one-third head width, piliferous punctures indistinct and obscured by relatively deep irregular sculpture; facial impression remote from eyes; distance from anterior ocellus to facial impression about  $0.7 \times$  minimum width of frontovertex.

## MATERIAL EXAMINED.

COSTA RICA, 6♂, Guanacaste Prov., Santa Rosa NP, various dates 1985–1986 (D. Janzen; I.D. Gauld); 1♂, Limon, RB Hitoy-Cerere, 100m, 14–19.i.1991 (J.S. Noyes); 1♂, San José, Ciudad Colon, Hda El Rodeo, 16.ii.1991 (Hym. Parataxonomists). Material in BMNH, INBio.

COMMENTS. This male is very similar to that described for *Aenasius maplei* Compere and is possibly therefore the male of *Aenasius caeruleus* Brues.

***Aenasius* sp. N**

(Figs 81, 95)

DIAGNOSIS. Length 0.83–1.33 mm. Forewings hyaline; tarsi yellow-brown or testaceous-brown, mid tibial spur dark brown; funicle (Fig. 81) 3-segmented, F1 transverse, clava without a naked ventral ridge, about  $7-9 \times$  as long as broad and about  $3 \times$  as long as scape; frontovertex (Fig. 95) about one-third head width, piliferous punctures indistinct and obscured by relatively deep reticulate sculpture, facial impression remote from eyes; distance from anterior ocellus to facial impression about  $0.7 \times$  minimum width of frontovertex.

## MATERIAL EXAMINED.

COSTA RICA, 13♂, Guanacaste Prov., Santa Rosa NP, various localities, various dates 1986 (D. Janzen; I.D. Gauld); 2♂, Guanacaste Prov., Guanacaste NP, near HQ, 2–10.iii.1990 (J.S. Noyes). Material in BMNH, INBio.

***Aenasius* sp. O**

(Fig. 78)

DIAGNOSIS. Length 1.02–.27 mm. Forewings hyaline; tarsi yellow, mid tibial spur yellow;

funicle (Fig. 78) 2-segmented, F1 transverse, clava with a naked ventral ridge, about  $3 \times$  as long as broad and about  $2 \times$  as long as scape; frontovertex a little less than one-third head width and with piliferous punctures obscured by shallow reticulate sculpture, facial impression remote from eyes; distance from anterior ocellus to facial impression about equal to minimum width of frontovertex or less.

## MATERIAL EXAMINED.

COSTA RICA, 7♂, Guanacaste Prov., Santa Rosa NP, various localities, various dates, 1985–1986 (D. Janzen, I.D. Gauld). Material in BMNH, INBio.

COMMENTS. This material probably represents males of *A. insularis* or a related species.

***Aenasius* sp. P**

(Figs 79, 85)

DIAGNOSIS. Length 0.76–0.95 mm. Forewings hyaline; tarsi yellow, mid tibial spur white; funicle (Fig. 79) 2-segmented, F1 transverse, clava without a naked ventral ridge, about  $6 \times$  as long as broad and about  $3 \times$  as long as scape; frontovertex about one-third head width and with piliferous punctures obscured by shallow reticulate sculpture, facial impression remote from eyes; distance from anterior ocellus to facial impression about  $0.75 \times$  minimum width of frontovertex; genitalia as in Fig. 85.

## MATERIAL EXAMINED.

COSTA RICA, 5♂, Guanacaste Prov., Santa Rosa NP, various localities and dates 1985–1987 (D. Janzen; I.D. Gauld). Material in BMNH, INBio.

***Aenasius* sp. Q**

DIAGNOSIS. Length 1.33 mm. Forewings infusate; tarsi yellow, mid tibial spur dark brown; scape widest in middle, funicle 2-segmented, F1 transverse, clava with a naked ventral ridge, about  $4 \times$  as long as broad and about  $2.5 \times$  as long as scape; frontovertex a little wider than one-third head width and with shallow piliferous punctures, one or two rows descending part way between facial impression and eyes; facial impression remote from eyes; distance from anterior ocellus to facial impression about  $0.6 \times$  minimum width of frontovertex.

## MATERIAL EXAMINED.

COSTA RICA, 1♂, Puntarenas Prov., Monteverde, St Luis Valley, 17.viii.1986 (L. Masner). Material in BMNH.

*Aenasius* sp. R

(Fig. 82)

DIAGNOSIS. Length about 1.85 mm. Forewings with basal two-thirds infusate; tarsi yellow, mid tibial spur dark brown; scape widest beyond middle and about 2 × as long as broad, funicle (Fig. 82) 2-segmented, F1 transverse and triangular in profile, clava with a naked ventral ridge, about 4 × as long as broad and about 2 × as long as scape; frontovertex a little less than half head width and with distinct piliferous punctures descending between eyes and facial impression, thus clearly separating facial impression from eyes; distance from anterior ocellus to facial impression about 0.3 × minimum width of frontovertex.

## MATERIAL EXAMINED.

COSTA RICA, 2♂, San José, Hwy 2, km 93, 83°45'W 9°36'W (Cerro de la Muerte), 3200m, 1-7.iv.1985 (H. Goulet, L. Masner). Material in BMNH.

*Aenasius* sp. S

DIAGNOSIS. Length about 1 mm. Forewings infusate; tibiae with apices yellow, tarsi yellow, mid tibial spur yellow; scape widest below middle, funicle 2-segmented, F1 subquadrate, clava without a naked ventral ridge, about twice as long as broad and about as long as scape; frontovertex about one-third head width and with shallow piliferous punctures which extend between eyes and facial impression, facial impression remote from eyes; distance from anterior ocellus to facial impression about equal to minimum width of frontovertex.

## MATERIAL EXAMINED.

COSTA RICA, 2♂, Puntarenas Prov., Monteverde, 15-16.vii.1986 (L. Masner). Material in BMNH.

COMMENTS. This material may belong to the genus *Blepyrus*.

*Aenasius* sp. T

(Fig. 83)

DIAGNOSIS. Length about 0.9 mm. Forewings weakly infusate; tarsi yellow, mid tibial spur brown; funicle (Fig. 83) 2-segmented, F1 trans-

verse and triangular in profile, clava without a naked ventral ridge, about 5 × as long as broad and about 2 × as long as scape; frontovertex about 0.4 × head width and with inconspicuous piliferous punctures which extend between eyes and facial impression, facial impression remote from eyes; distance from anterior ocellus to facial impression about 0.7 × minimum width of frontovertex.

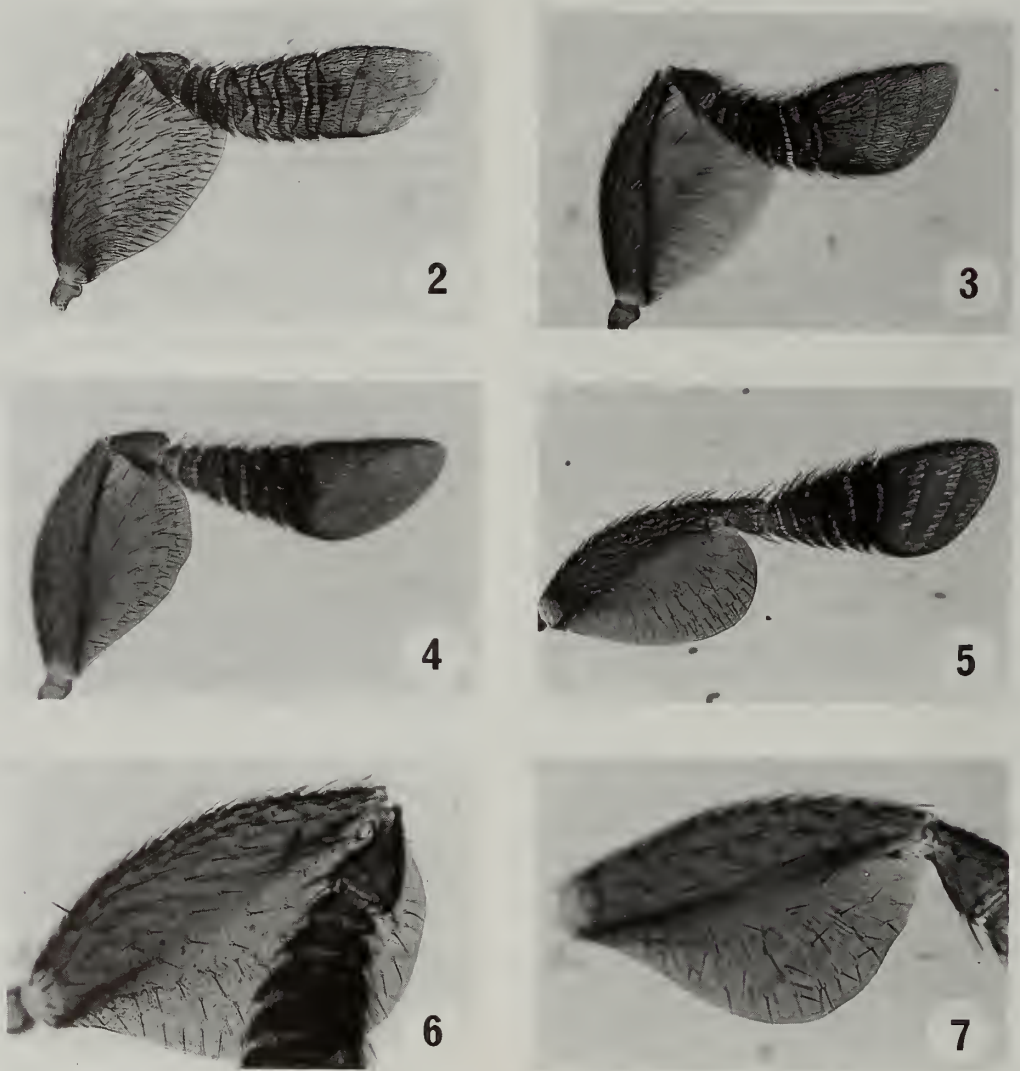
## MATERIAL EXAMINED.

COSTA RICA, 2♂, Puntarenas Prov., Monteverde, St Luis Valley, 17.viii.1986 (L. Masner). Material in BMNH.

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Figs 2-7 2, *A. dives*, antenna, ♀; 3, *A. caeruleus*, antenna, ♀; 4, *A. bolowi*, antenna, ♀; 5, *A. regularis*, antenna, ♀; 6, *A. bolowi*, scape, ♀; 7, *A. hyettus*, scape, ♀.



8



9



10



11

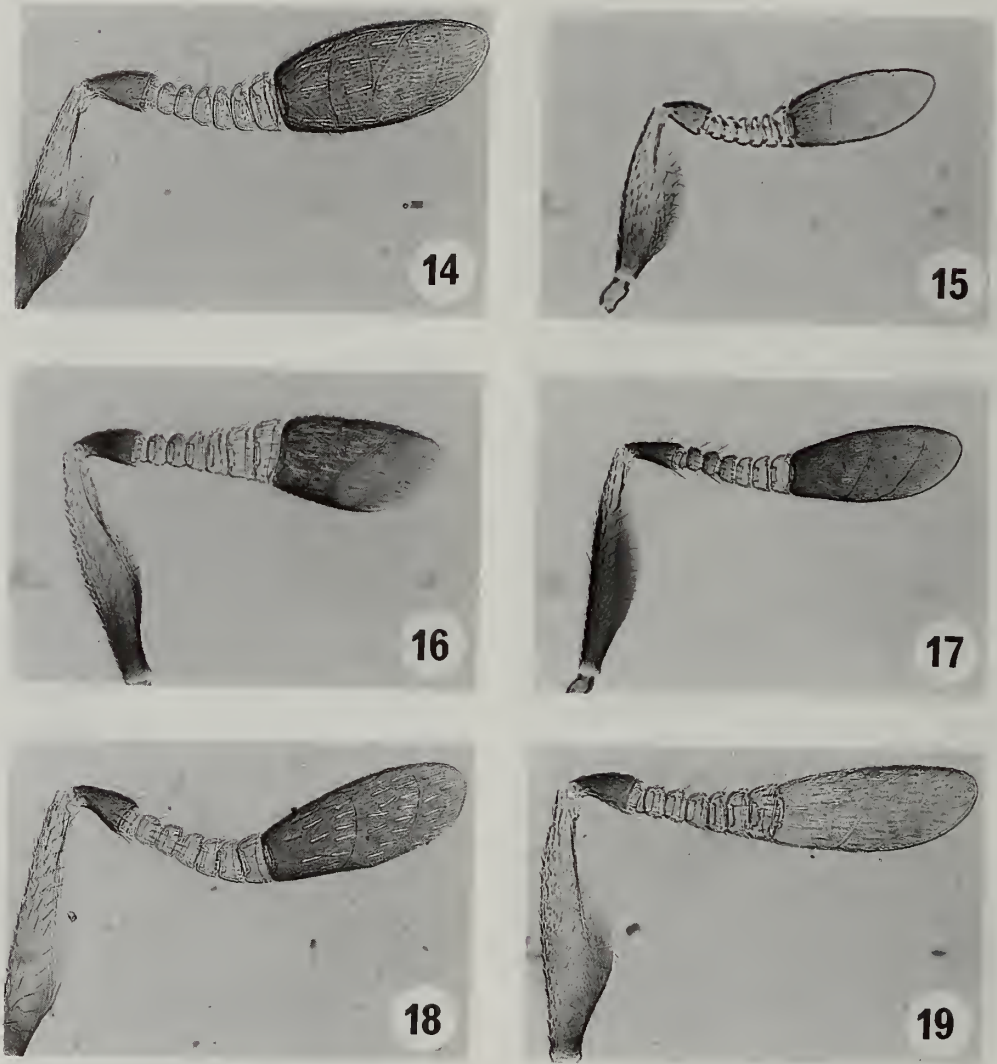


12



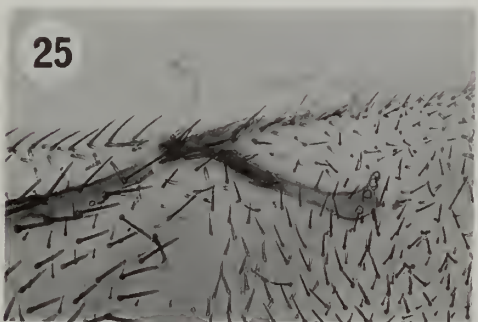
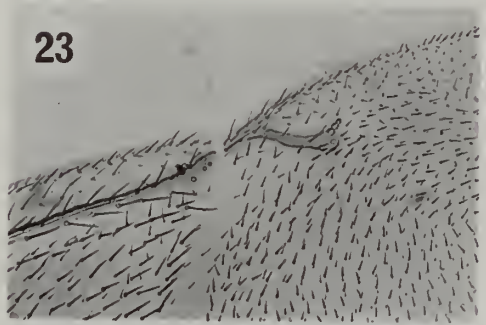
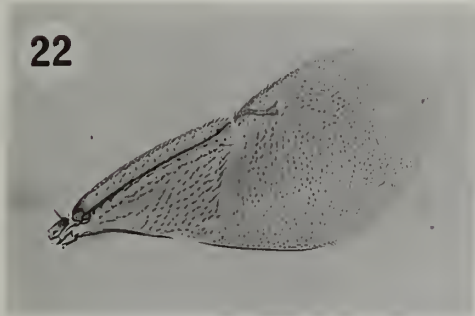
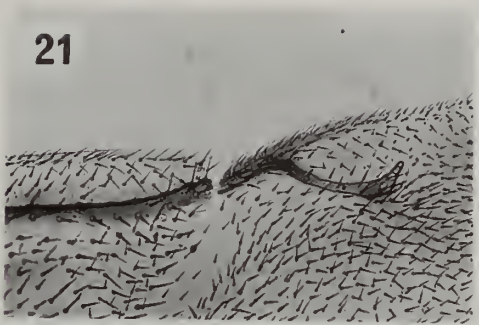
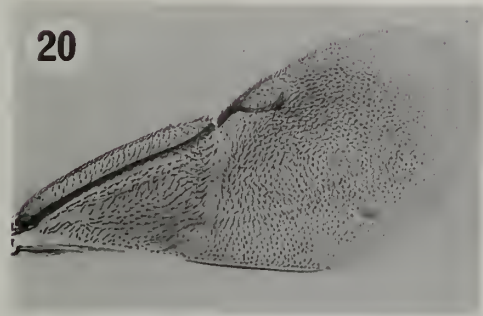
13

**Figs 8–13** 8, *A. phenacocci*, antenna, ♀; 9, *A. phenacocci*, ♀, clava enlarged, showing longitudinal division of sensory area, ♀; 10, *A. frontalis*, antenna, ♀; 11, *A. frontalis*, clava enlarged, ♀, showing longitudinal division of sensory area; 12, *A. advena*, antenna, ♀; 13, *A. insularis*, antenna, ♀.

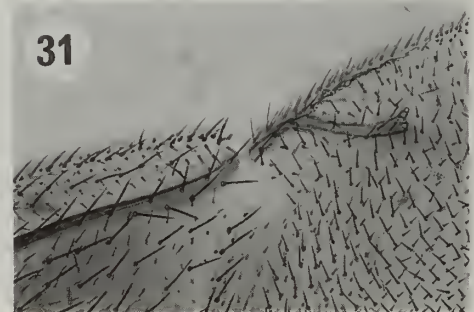
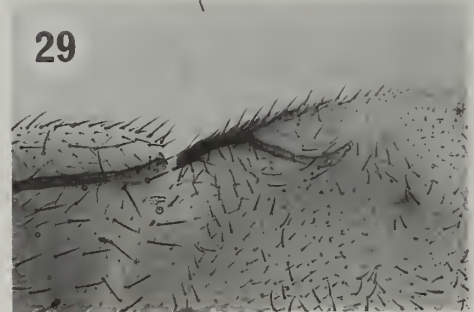
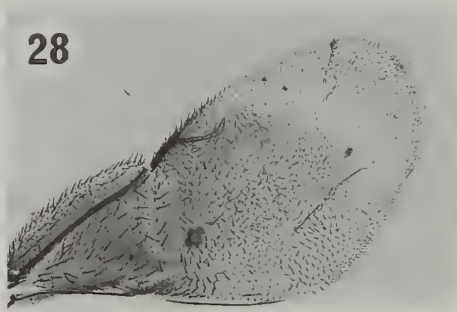
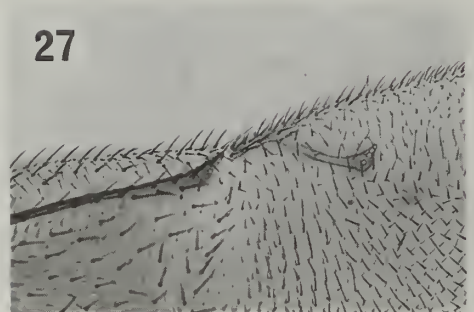
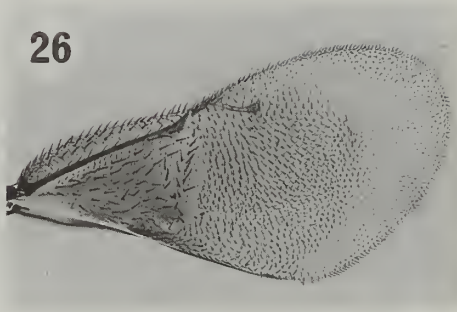


Figs 14–19 14, *A. pelops*, antenna, ♀; 15, *A. paulistus*, antenna, ♀; 16, *A. brasiliensis*, antenna, ♀; 17, *A. mitchellae*, antenna, ♀; 18, *A. longiscapus*, antenna, dark form, ♀; 19, *A. longiscapus*, antenna, pale form, ♀.

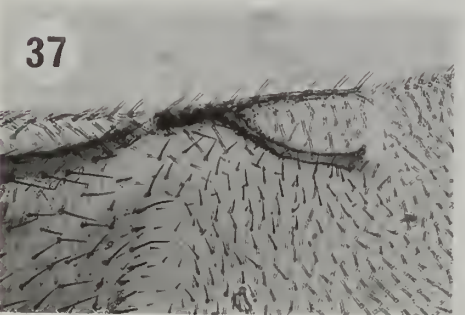
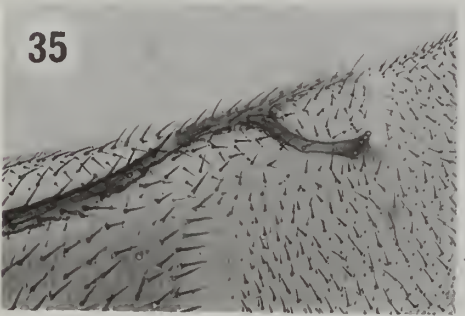
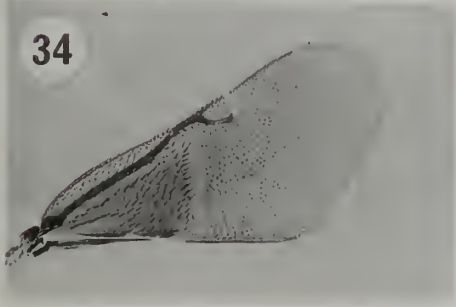
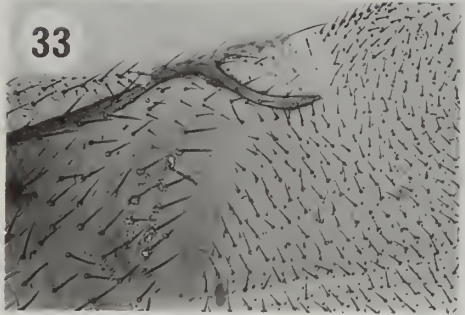




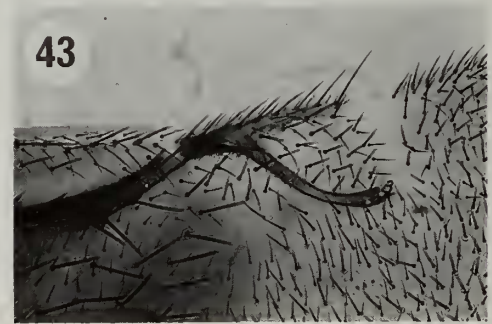
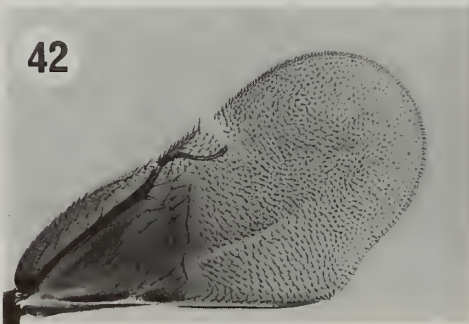
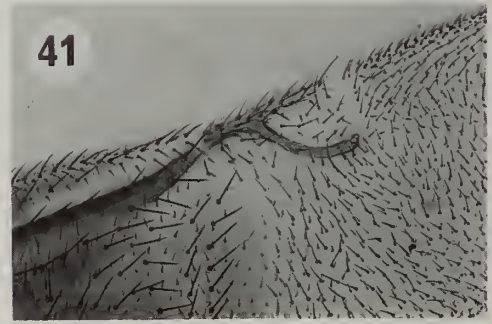
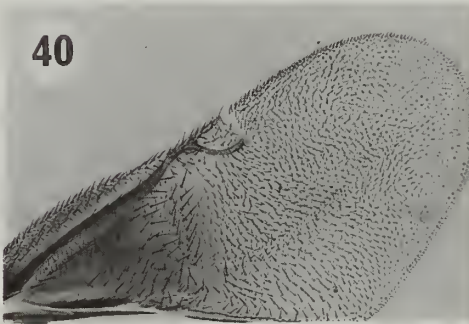
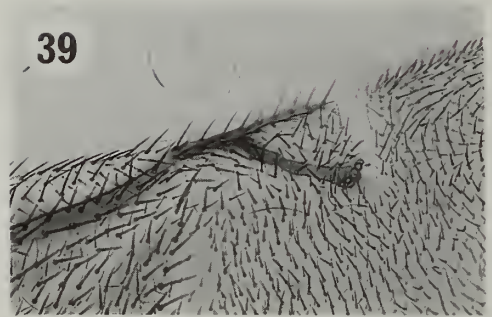
**Figs 20–25** 20, *A. dives*, forewing, ♀; 21, *A. dives*, venation enlarged, ♀; 22, *A. vexans*, forewing, ♀; 23, *A. vexans*, venation enlarged, ♀; 24, *A. phenacocci*, forewing, ♀; 25, *A. phenacocci*, venation enlarged, ♀.



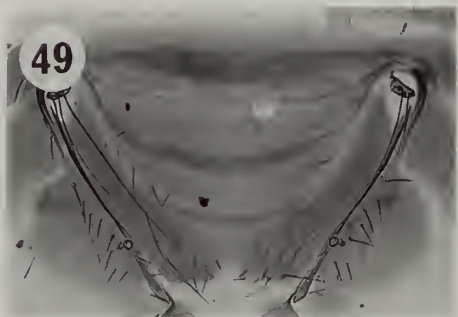
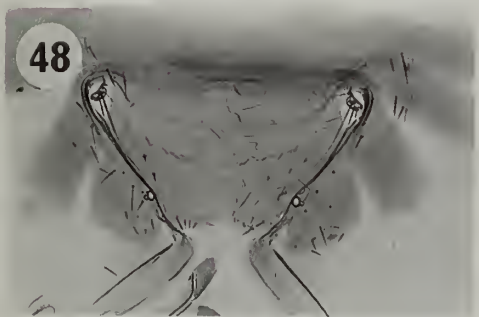
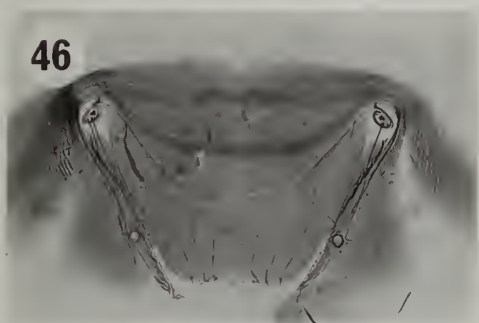
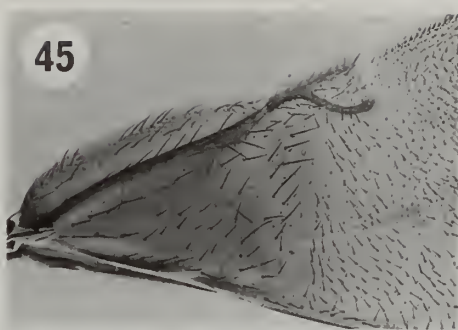
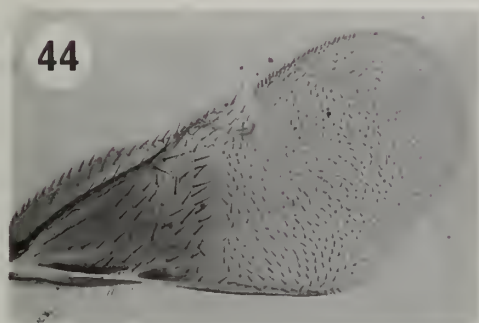
**Figs 26–31** 26, *A. insularis*, forewing, ♀; 27, *A. insularis*, venation enlarged, ♀; 28, *A. pelops*, forewing, ♀; 29, *A. pelops*, venation enlarged, ♀; 30, *A. paulistus*, forewing, ♀; 31, *A. paulistus*, venation enlarged, ♀.



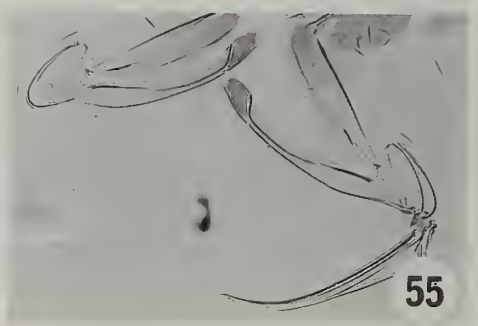
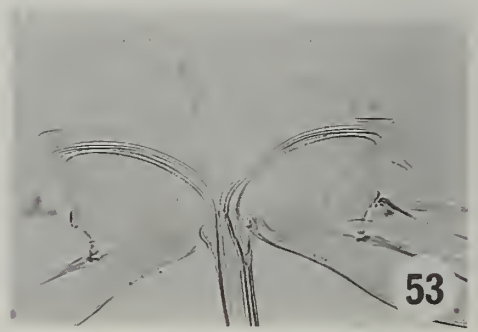
**Figs 32-37** 32, *A. frontalis*, forewing, ♀; 33, *A. frontalis*, venation, enlarged, ♀; 34, *A. bolowi*, forewing, ♀; 35, *A. bolowi*, venation, enlarged, ♀; 36, *A. hyettus*, forewing, ♀; 37, *A. regularis*, venation, enlarged, ♀.



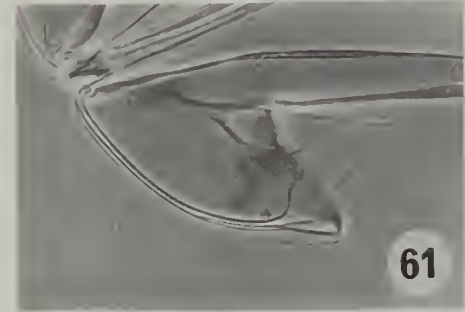
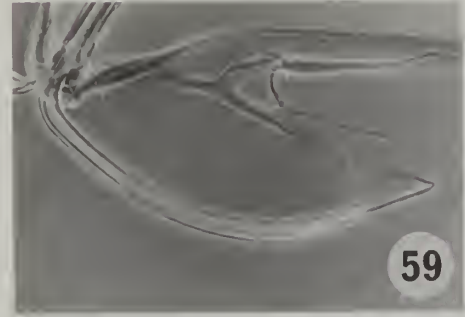
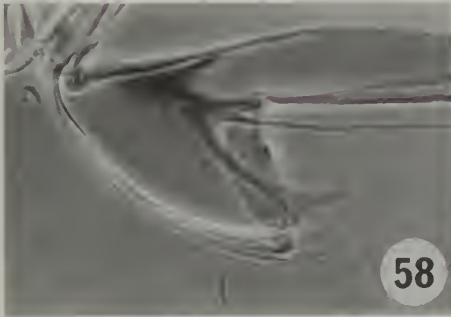
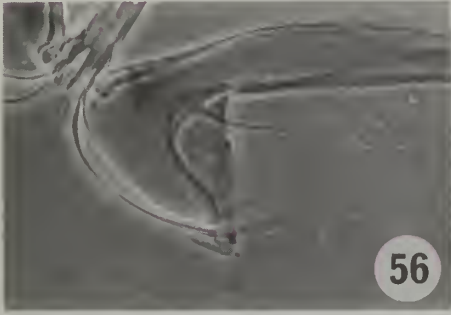
**Figs 38–43** 38, *A. caeruleus*, forewing, ♀; 39, *A. caeruleus*, venation, enlarged, ♀; 40, *A. brasiliensis*, forewing, ♀; 41, *A. brasiliensis*, venation, enlarged, ♀; 42, *A. mitchellae*, forewing, ♀; 43, *A. mitchellae*, venation, enlarged, ♀.



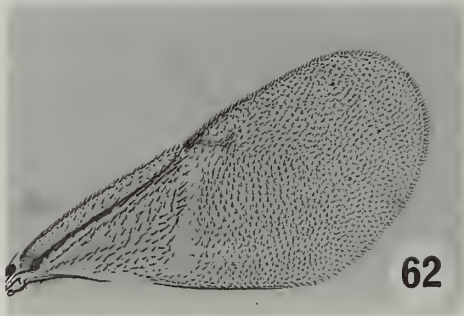
**Figs 44–49** 44, *A. longiscapus*, forewing, ♀; 45, *A. longiscapus*, base of forewing, enlarged, ♀; 46, *A. dives*, apical gastral tergites, ♀; 47, *A. vexans*, apical gastral tergites, ♀; 48, *A. phenacocci*, apical gastral tergites, ♀; 49, *A. insularis*, apical gastral tergites, ♀.



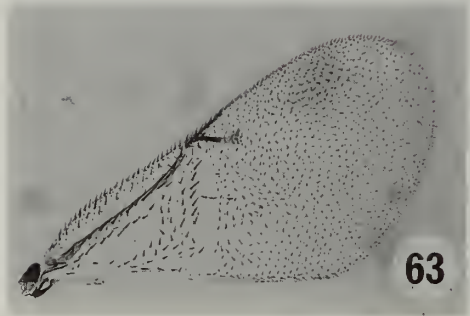
**Figs 50–55** 50, *Aenasius vexans*, ovipositor; 51, *A. vexans*, proximal part of ovipositor, enlarged; 52, *A. dives*, ovipositor; 53, *A. dives*, proximal part of ovipositor, enlarged; 54, *A. insularis*, proximal part of ovipositor, enlarged; 55, *A. phenacocci*, ovipositor.



**Figs 56–61** Proximal part of ovipositor, photographed using phase contrast – 56, *A. dives*; 57, *A. pelops*; 58, *A. insularis*; 59, *A. mitchellae*; 60, *A. paulistus*; 61, *A. frontalis*.



62



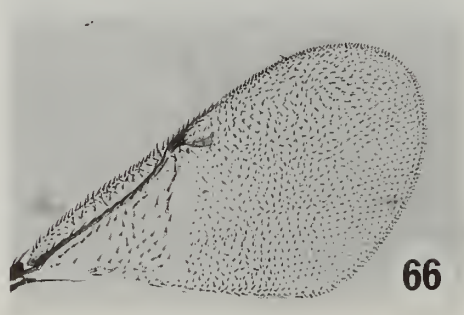
63



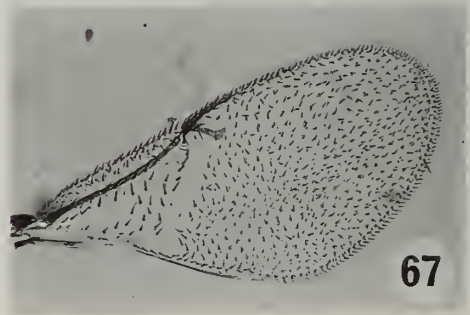
64



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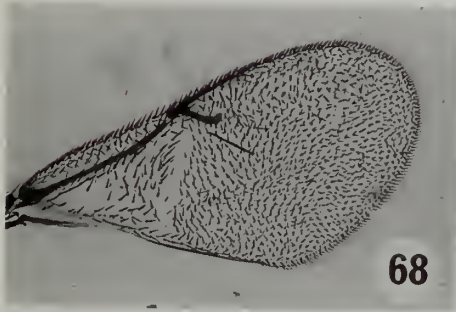
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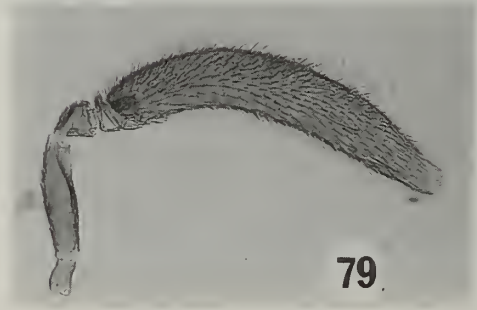
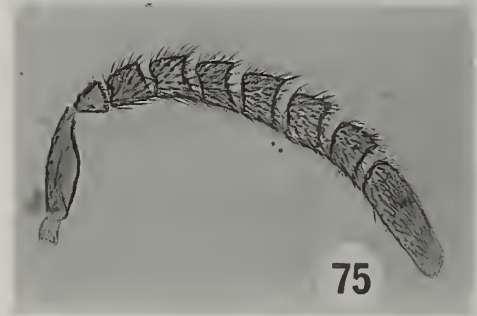
67

Figs 62-67 Forewings, ♂ - 62, *A. vexans*; 63, *A. phenacocci*; 64, *A. bolowi*; 65, *A. brasiliensis*; 66, sp. D; 67, sp. E.





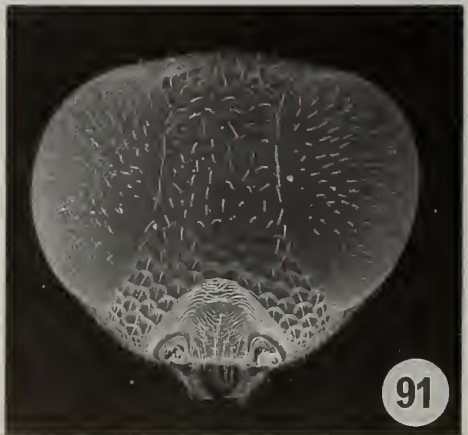
**Figs 68-73** 68, sp. C, forewing, ♂; antennae, ♂ - 69, *A. brasiliensis*; 70, *A. vexans*; 71, *A. bolowi*; 72, sp. A (clava collapsed); 73, sp. C.



Figs 74-79 Antennae, ♂ - 74, sp. D; 75, sp. E; 76, *A. paulistus*, 77, *A. advena*; 78, sp. O; 79, sp. P.



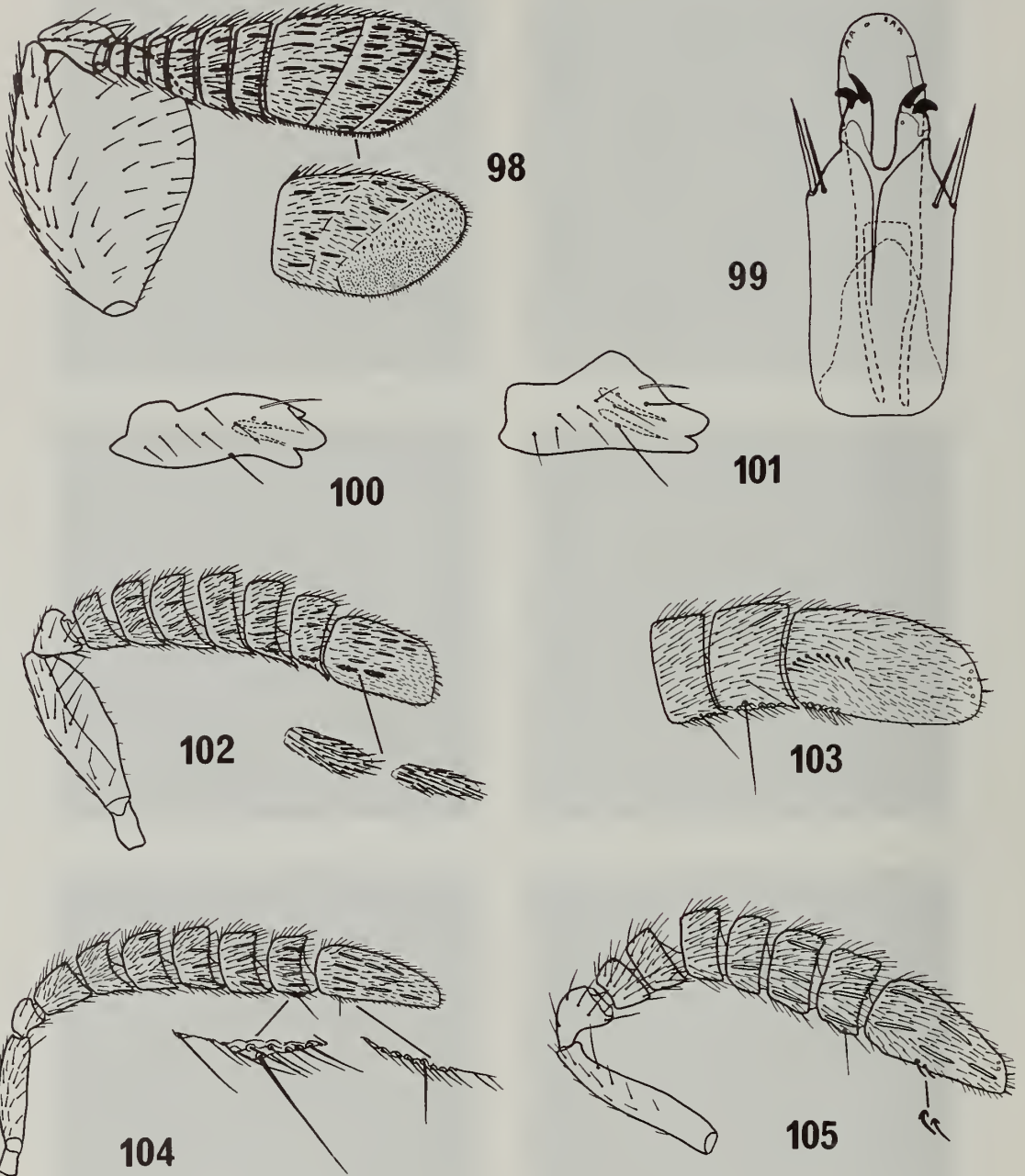
**Figs 80–85** 80–83, antennae, ♂ – 80, sp. M; 81, sp. N; 82, sp. R; 83, sp. T; 84, *A. advena*, genitalia, ♂; 85, sp. P, genitalia, ♂ (taken using phase contrast).



**Figs 86–91** Head, facial view, ♀ – 86, *A. vexans*; 87, *A. frontalis*; 88, *A. bolowi*; 89, *A. caeruleus*, 90, *A. brasiliensis*; 91, *A. longiscapus*.



**Figs 92–97** 92, *A. bolowi*, clava, enlarged showing longitudinal division of sensory area, ♀; 93, *A. caeruleus*, clava, enlarged showing longitudinal division of sensory area, ♀; head, facial view, ♂ – 94, sp. M; 95, sp. N; 96, *A. bolowi*, 97, *A. advena*.



**Figs 98–105** 98, *A. vexans*, antenna (including reverse of clava), ♀; 99, *A. vexans*, genitalia, ♂; 100, *A. pelops*, right mandible, ♀; 101, *A. vexans*, right mandible, ♀; 102, *A. bolowi*, antenna, showing sensory patches on clava enlarged, ♂; 103, sp. G, F5, F6 and clava showing modified areas, ♂ (drawing of badly collapsed antenna and slightly modified); 104, sp. E, antenna, showing modified areas of F6 and clava enlarged, ♂; 105, sp. H, antenna, showing modified area on clava enlarged, ♂.

## INDEX

Synonyms and misidentifications are in *italics*; main citations in **bold**

- Acalypha* 126  
*acuminatus* (Aenasius) 139, 140  
*advena* (Aenasius) 120, 121, 123, 126, 127–128, 129–130, 139, 140, 147, 158, 159, 161  
*aesculifolia* (Manihot) 135  
*Albizia* 128  
*Alchornea* 134  
*alioidera* (Cordia) 137  
*Azteca* 137
- Blepyrus* 136, 142, 144  
*bolowi* (Aenasius) 122, **133–135**, 136, 146, 151, 156, 157, 160, 161, 162  
*Bougainvillea* 132, 137  
*brasiliensis* (Aenasius, Chalcaspis) 122, **136–138**, 148, 152, 156, 157, 160  
*brevipes* (Dysmicoccus, Pseudococcus) 120, 137, 139
- caeruleus* (Aenasius) 122, 134–135, **135–136**, 143, 146, 152, 160, 161  
*calceolariae* (Pseudococcus) 132  
*Carapa* 140  
*cariocus* (Aenasius) 120, 122, 136, 137, 138  
*Cataenococcus* 137  
*Cecropia* 137  
*Chalcaspis* 136  
*cirrha* (Aenasius) 121, **129**, 130  
*citri* (Planococcus) 127  
*clavus* (Pseudanasius) 119, 127  
*colombiensis* (Aenasius) 136, 137  
*Conostegia* 134  
*Cordia* 126, 137  
*costaricensis* (Alchornea) 134  
*Crematogaster* 137  
*curassavica* 126  
*curvispinosa* (Crematogaster) 137
- dives* (Aenasius) 121, **123–124**, 146, 149, 153, 154, 155  
*Dysmicoccus* 120, 137, 139
- Ferrisia* 120, 126, 127, 128, 133, 135, 136, 139, 140
- flandersi* (Aenasius) 125, 126  
*fragilis* (Pseudococcus) 132  
*frontalis* (Aenasius) 121, **133**, 147, 151, 155, 160
- gahani* (Pseudococcus) 132  
*Gliricidia* 127, 135, 136, 139, 140  
*gossypii* (Phenacoccus) 126  
*grenadensis* 126
- Hedera* 132  
*helix* (Hedera) 132  
*herreni* (Phenacoccus) 120, 125, 126  
*hibisci* (Phenacoccus) 125  
*Hibiscus* 125, 126, 135  
*hycttus* (Aenasius) 119, 126, 134, 136, 146, 151
- ianthinus* (Aenasius) 127, 128  
*insignis* (Cecropia) 137  
*insularis* (Aenasius) 121, 129, **130**, 132–133, 143, 147, 150, 153, 154, 155
- kerrichi* (Aenasius) 121, **130–131**, 132
- Lantana* 125, 126  
*lebbeck* (Albizia) 128  
*longiscapus* (Aenasius) 122, 123, 138, **139–140**, 148, 153, 160  
*longispinus* (Pseudococcus) 127, 132  
*lua* (Aenasius) 121, **128–129**
- Macquilla* 127  
*madeirensis* (Phenacoccus) 126  
*Manihot* 135  
*manihoti* (Phenacoccus) 120, 125  
*maplei* (Aenasius) 119, 135, 136, 143  
*maritimus* (Pseudococcus) 120, 132  
*martinii* (Neodiscodes) 119  
*mittchellae* (Aenasius) 122, **138–139**, 148, 152, 155  
*montividentis* 125, 126
- Neodiscodes* 119, 120  
*ncobrevipes* (Pseudococcus) 137  
*nervifolia* (Thervetia) 127
- oleae* (Saissetia) 127
- pacificus* (Aenasius) 139, 140  
*paulistus* (Aenasius) 120, 121, 123, 129, 130, 132, **132–133**, 148, 150, 155, 158  
*pelops* (Aenasius) 121, 129, **131–132**, 148, 150, 155, 162  
*personatus* (Aenasius) 135, 136  
*phenacocci* (Aenasius) 120, 121, 123, **125–127**, 128, 139, 142, 147, 149, 153, 154, 156  
*Phenacoccus* 120, 125, 126, 132, 137  
*Piper* 140  
*Pittosporum* 126  
*Planococcus* 127  
*Pseudanasius* 119, 127  
*Pseudococcus* 120, 127, 128, 132, 137
- regularis* (Aenasius) 136, 146, 151
- Saissetia* 127  
*saman* (Samanea) 128  
*Samanea* 128  
*Sida* 126  
*similis* (Aenasius) 133, 134  
*sociabilis* (Pseudococcus) 132
- tachigaliae* (Blepyrus) 135  
*theobromae* (Aenasius) 136, 137  
*Thervetia* 127  
*tiliaceus* (Hibiscus) 135  
*tomentosa* 127  
*trifolia* (Virex) 128  
*Tussacia* 126
- vadosus* (Aenasius) 139, 140  
*vexans* (Aenasius) 120, 121, 122, **124–125**, 126–127, 149, 153, 154, 156, 157, 160, 162  
*Virex* 128  
*virgata* (Ferrisia, Pseudococcus) 120, 126, 127, 128, 133, 135, 136, 139, 140
- xalcpch* (Conostegia) 134  
*xanthochora* (Azteca) 137