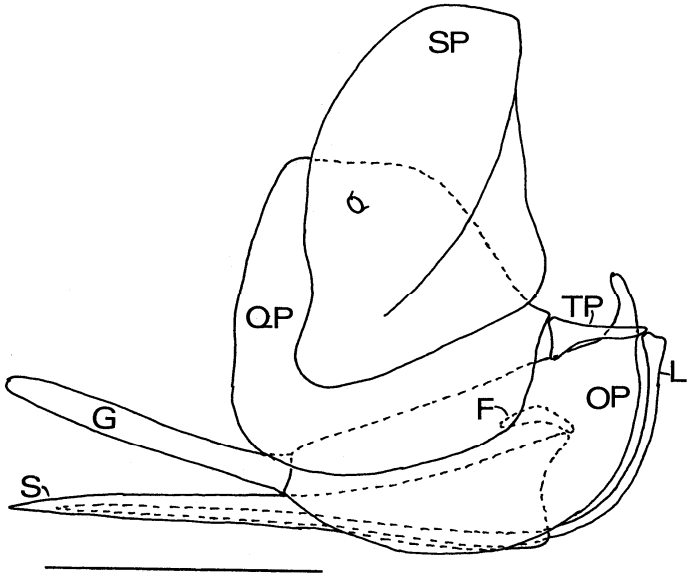
THE ACULEATE HYMENOPTERA OF TRINIDAD, WEST INDIES

Christopher K. Starr[1] and Allan W. Hook[2]

1.Dep't of Life Sciences, University of the West Indies, St Augustine, Trinidad & Tobago; ckstarr99@hotmail.com
2.Dep't of Biology, St Edward's University, Austin, Texas 78704, USA; allanh@stedwards.edu



Stinger of *Synoeca surinama* in left side view. This large, blue-black social wasp has a reputation for aggressiveness and painful stinging. The sting lancets are heavily barbed at the tips, allowing the stinger to remain achored in vertebrate skin, sometimes so durably that the wasp cannot withdraw it. F = furcula. L = sting lancet. OP = oblong plate. QP = quadrate plate. S = sting shaft. SP = spiracular plate. Scale bar = 1 mm. Drawing by C.K. Starr.

Trinidad is a continental island of about 4800 km^2 off the northern coast of South America. Together with Tobago (about 300 km^2) and some associated very small islands, it forms the national territory of Trinidad & Tobago, home to about 1.3 million people. Biotically, the two islands are set apart from the oceanic Lesser and Greater Antilles to the north, having a greater affinity to northern South America (Starr, in press).

The climate and seasonality of Trinidad & Tobago are typical of the humid tropics north of the Equator. Topography is slight, with no hill reaching 1000 m, and the predominant native vegetation is rain forest (Beard 1946).

The biotic inventorying of these islands is very uneven, with a strong bias toward taxa that are well known worldwide. The ongoing *Flora of Trinidad & Tobago* project, initiated in 1928, has now covered most of the vascular plants. Some groups, such as palms (Comeau et al. 2003), have been treated in greater depth. Among the animal groups that may be regarded as completely or nearly completely known, at least at the basic level of national species lists, are the dragonflies (Michalski 1988), termites (Scheffrahn et al. 2003), butterflies (Barcant 1970), freshwater fishes (Phillip & Ramnarine 2001) and all groups of land vertebrates (Alkins 1979,

Ffrench 1991, Murphy 1997). A list of the insects of Tobago is in an advanced state of preparation (C.K. Starr & J.D. Hardy, unpubl.).

Our purpose here is to present an annotated list of the known aculeate hymenoptera of Trinidad. The aculeates, or stinging insects, are a monophyletic group of the insect order Hymenoptera, amounting to about 68,000 known species worldwide. Their outstanding shared, derived feature is the evolutionary transformation of the female ovipositor and its associated glands into a specialized organ for injecting poison, the venom apparatus (Hermann & Blum 1981), the hard, mechanical parts of which form the stinger. The original function of the venom apparatus is evidently in paralyzing prey, but in some lineages it has taken on an additional or substitute defensive function. It is this latter aspect that is well known to farmers, gardeners and naturalists.

The comparative nesting biology of solitary stinging insects is a very active branch of behavioural ecology with its roots in the work of Jean-Henri Fabre (1879-1907). More recent major works include those of Evans (1966s), Iwata (1976) and Krombein (1967).

Several lineages of stinging insects are social, living in durable, structured groups, often of considerable size. These are the social wasps (Ross & Matthews 1991), social bees (Michener 1974) and ants (Hölldobler & Wilson 1990). Until recently, it was considered that true sociality had evolved in only one other group of insects, the termites (order Isoptera) (Wilson 1971). Even now, with sociality known in at least two additional orders, it is apparent that the bulk of independent origins are within the aculeate hymenoptera, a group comprising only an estimated 6.5% of living insect species. Starr's (1985, 1989) hypothesis that this strong taxonomic bias in the origin of sociality is intimately connected with the possession of the venom apparatus remains controversial (Fisher 1993, Kukuk et al. 1989, Schmidt 1990).

The present list supercedes that of Starr & Hook (2003). It is compiled from the literature, unpublished records, and museum specimens. Aside from the honey bee (*Apis mellifera*), one other bee, and a few species of ants, the known species appear to be native to Trinidad or at least to the neotropics.

The first two columns to the right indicate the presence of identified specimens in the collections of the University of the West Indies ("UWI") and CAB-International ("CABI"), respectively. Both are in Trinidad.

The column headed "Tob" indicates species recorded from Tobago.

The last column, headed "Ref", cites published and unpublished sources of records, numbered according to the list of references.

The superfamily and family classification follows Goulet & Huber (1993), except within the Apoidea. The apiform Apoidea follow Michener (2000), while the spheciform Apoidea follow Menke & Fernández (1996). Subfamilies of Formicidae except the poneromorphs are according to Hölldobler & Wilson (1990).

For advice and criticism we thank Barry Bolton, Rob Brooks, Jim Carpenter, Mark Dubois, Don Manley, Jack Neff, Jerry Rozen, Colin Vardy, Phil Ward and Jim Wetterer, as well as various colleagues who provided unpublished results.

CHRYSIDOIDEA

BETHYLIDAE

These slim, mostly very small wasps are especially abundant in the tropics. The female stings the host (usually a moth or beetle larva) into paralysis and lays eggs on it. In some species she remains with the host and exhibits brood care. The small number of recorded species is certainly an artefact of lack of special collecting attention to these wasps in Trinidad.

	UWI	CABI	Tob	Ref
Anisepyris luteipes Kieffer			32	
Anisepyris metallicus Kieffer			32	
Anisepyris trinitatis Evans			32	
Cephalonomia urichi Brues			32	
Dissomphalus digitatus Azevedo			86	
Dissomphalus subdeformis Azevedo			3	
Prorops obsoleta Evans			32	
Rhabdepyris luteipennis Evans			32	

CHRYSIDIDAE (cuckoo wasps)

The adults are mostly shiny metallic green, violet or reddish wasps. Eggs are laid in the nests of other insects, where the larvae are parasitoids or cleptoparasites. There are certainly more species in Trinidad than the one that has thus far been recorded. Kimsey & Bohart (1990) present a genus-level revision of the family.

	UWI	CABI	Tob	Ref
Adelphe nesos Kimsey				44
Amisega bennetti Kimsey				44
Amisega flavicrus Kimsey				44
Amisega perviridis Kimsey				44
Amisega sp.				86
Caenochrysis trinidadensis (Linsenmaier)				44
Holopyga huberi (Ducke)				86

DRYINIDAE

Females of this family are often wingless and ant-like. The larvae are parasitoids of Cicadellidae (leafhoppers) and related families of homoptera. We have no definite records of this family in Trinidad, but it seems very likely that it is present. Specimens identified as *Neodryinus* sp. and *Pseuogonatodes* sp. are in the UWI and CABI collections, respectively.

SCLEROGIBBIDAE

Only about ten species are known worldwide from this family, so that the present record must be treated as tentative. These are small wasps, the larvae of which are ectoparasites of Embiidina (webspinners). As with the Dryinidae, this family is likely present in Trinidad, although it is not definitely know. UWI has specimens identified as *Probethylus callani* Richards.

VESPOIDEA

MUTILLIDAE (velvet-ants)

This is a large, cosmopolitan family. Females are wingless, and it is often difficult to associate the sexes. In some cases, where they were not collected together, the female and male of a species were originally described as different species. Adults of both sexes are stout, very hard-bodied, and usually with a dense covering of hair. The female often has a very powerful sting. The larvae are nest parasites of other insects, especially sphecid wasps and bees.

Species marked with an asterisk in the UWI column are those for which the collection has paratypes (Starr 1993).

	UWI	CABI	Tob	Ref
Ephuta emarginata Mickel	*			61
Hoplocrates pompalis Mickel	*			60
Hoplomutilla opima Mickel	*	+		59
Pertyella decora Mickel	*			61
Pseudomethoca crepera (Cresson)				71
Pseudomethoca plagiata (Gerstaecker)	+			61, 71
Pseudomethoca nr. *tournieri* (Kohl)				71
Timulla bitaeniata (Spinola)	+			58
Timulla eriphyla Mickel	*			58
Timulla mediata (Fabricius)	+	+		58
Timulla nisa Mickel	*			58
Timulla rectangulum (Spinola)	+			58
Timulla rufogastra (Lepeletier)	+			58
Traumatomutilla latona Mickel	*			61
Xystromutilla cornigera (Cresson)				71

POMPILIDAE (spider wasps)

This is a large, cosmopolitan family of often quite conspicuous wasps. The females are well known for their painful stings. In the usual pattern, each larva develops from a single paralyzed spider, usually in a cell constructed by the mother wasp. Although nest structure is simpler than in many vespids, sphecids and bees, some species construct free-standing nests of a few cells. Most conspicuous in Trinidad are the large, metallic blue-black species of *Pepsis*, tarantula hunters.

	UWI	CABI	Tob	Ref
Anoplius americanus (Beauvois)				26
Anoplius inculatrix (Cresson)				7
Aporus (Neoplaniceps) sp.				86
Balboana auripennis (Fabricius)				26
Notocyphus alboplagiatus (F. Smith)				7
Notocyphus lucasi Banks				4, 6
Pepsis amyntas Mocsáry	+			97
Pepsis assimilis Banks				95
Pepsis atripennis Fabricius				97
Pepsis cyanescens Lepeletier				97
Pepsis cybele Banks				97
Pepsis equestris Erichson	+			4, 5, 95
Pepsis festiva Fabricius				97
Pepsis frivaldszkyi Mocsáry	+			96
Pepsis gracilis Lepeletier			+	97
Pepsis grossa (Fabricius)	+			96
Pepsis ianthina Erichson	+		+	97
Pepsis terminata Dahlbom				96
Pepsis xanthocera Dahlbom	+			97
Poecilopompilus fervidus (F. Smith)	+			7
Poecilopompilus flavopictus (F. Smith)				26
Poecilopompilus polistoides (F. Smith)				26
Priochilus captivus (Fabricius)	+	+	+	26
Priochilus gloriosum (Cresson)				26
Priochilus nobilis (Fabricius)				26
Priochilus regius (Fabricius)				26
Priochilus sericeiformis (Fox)				26
Priochilus splendidum (Fabricius)		+		26
Priocnemoides praestans Banks				4, 6
Priocnemioides urichi Banks				4
Priophanes fabricii Banks				5
Priophanes major Banks				4, 6
Priophanes ornata Banks				4, 6
Tachypompilus mendozae (Dalla Torre)				26

SCOLIIDAE

These stout, hairy wasps superficially resemble male velvet-ants. Although both sexes are characteristically winged, there can be considerable sexual dimorphism. The larvae are ectoparasitoids of beetle larvae.

	UWI	CABI	Tob	Ref
Campsomeris dorsata (Fabricius)	+			19

Campsomeris hesterae Rohwer	+			19
Campsomeris servillei (Guérin)	+	+		19
Campsomeris wesmaeli (Lepeletier)	+			19
Scolia sp.	+			19

TIPHIIDAE

Adults of this diverse, cosmopolitan family are mainly black. The sexes are often very distinct, so that it may be difficult to associate females and males of the same species. Although only one species is reliably recorded from Trinidad, several others are certainly present, probably representing various genera.

	UWI	CABI	Tob	Ref
Myzine bulbosa Krombein	+			46

VESPIDAE: EUMENINAE

Together with the polistines, these wasps can be distinguished from all other aculeates in Trinidad by the longitudinal folding of the wings at rest. These close relatives of the social polistines are mostly entirely solitary, although there is nest-sharing among adults in at least one of our *Zethus* species. The larvae are provisioned with moth and beetle larvae in specially constructed cells.

Zeta argillaceum is the most conspicuous species in Trinidad on account of its often abundant clusters of pot-shaped mud cells on the walls and ceilings of buildings.

	UWI	CABI	Tob	Ref
Alphamenes campanulatus (Fabricius)				20
Eumenes rufomaculataus Fox				20
Minixi mexicanum (Saussure)				20
Monobia angulosa Saussure				20
Monobia funebris Gribodo				20
Monobia nigripennis Saussure				20
Montezumia azurescens (Spinola)				20
Montezumia cortesioides Willink				20
Montezumia pelagica Saussure				20
Montezumia petiolata Saussure				20
Montezumia trinitata Willink				20
Omicron acapulcense (Cameron)				20
Omicron aequale Giordani-Soika				20
Omicron criticum (Schulz)				20
Omicron flavonigrum Giordani-Soika				20
Omicron histrionicum Giordani-Soika				20
Omicron nanum (Kirsch)				20
Omicron ypsilon Giordani-Soika				20
Pachodynerus guadulpensis (Saussure)	+			20

Pachodynerus praecox (Saussure)				20
Pararhaphidoglossa confluenta (Fox)				20
Pararhaphidoglossa invenusta (Fox)				20
Pararhaphidoglossa tinctura (Fox)				20
Stenodynerus columbaris (Saussure)				20
Stenodynerus cyphosus (Saussure)				20
Zeta argillaceum (Linnaeus)		+		20
Zethus binodis (Fabricius)				13, 20
Zethus brasiliensis Saussure				20
Zethus diminutus Fox				20
Zethus fraternus Saussure				20
Zethus mexicanus (Linnaeus)				13, 20
Zethus miniatus Saussure				13, 20
Zethus westwoodi (Saussure)				13, 20

VESPIDAE: POLISTINAE (social wasps, in part)

In the formal sense, the social wasps are a natural group of three subfamilies, of which only one is naturally present in the neotropics. The present list is complete or very nearly so.

The polistine wasps divide rather neatly into two social syndromes. The independent-founding species (in the New World all *Mischocyttarus* and *Polistes*) characteristically have small colonies, build uncovered, single-comb nests, and found new colonies by means of single queens or groups of queens. The swarm-founding species (all other genera) have larger colonies, almost always build enveloped nests, usually with multiple parallel combs, and found by means of groups of queens and workers. In Trinidad these two groups are known vernacularly as "Jack Spaniards", and "marabuntas" or "maribons", respectively.

In Trinidad, the most abundant social wasps are the independent-founding *Polistes lanio* and *P. versicolor* and the swarm-founding *Polybia occidentalis* (in farmland and suburban areas) and *Angiopolybia pallens* (in forest). All four species are widespread in the northern neotropics.

	UWI	CABI	Tob	Ref
Agelaia cajennensis (Fabricius)				75
Agelaia multipicta (Haliday)	+	+		75, 91
Angiopolybia pallens (Lepeletier)	+	+		75, 91
Apoica gelida Vecht		+		75, 91
Apoica pallens (Fabricius)	+	+		75, 91
Apoica pallida (Olivier)	+	+		75, 91
Apoica strigata Richards				75, 91
Brachygastra bilineolata Spinola	+	+	+	75, 91
Chartergellus nr. *zonatus* Spinola	+			91
Epipona tatua (Cuvier)	+	+		75, 91
Metapolybia cingulata (Fabricius)	+	+		75, 91
Mischocyttarus alfkeni (Ducke)	+	+		75, 91
Mischocyttarus collarellus Richards	+	+		75, 91
Mischocyttarus fitzgeraldi Bequaert	+	+		75, 91
Mischocyttarus injucundus (Saussure)	+	+		75, 91

Mischocyttarus labiatus (Fabricius)	+	+		75, 91
Mischocyttarus metathoracicus (Saussure)	+			91
Mischocyttarus punctatus (Ducke)	+	+		75, 91
Mischocyttarus rotundicollis (Cameron)	+	+		75, 91
Mischocyttarus socialis (Saussure)	+			75, 91
Mischocyttarus surinamensis (Saussure)	+	+		75, 91
Parachartergus colobopterus (Lichtenstein)	+	+		75, 91
Parachartergus fraternus (Gribodo)	+	+		75, 91
Polistes billardieri Fabricius	+			91
Polistes carnifex (Fabricius)	+			75, 91
Polistes goeldii Ducke	+			93
Polistes lanio (Linnaeus)	+	+		75, 91
Polistes major Beauvois	+	+		75, 91
Polistes pacificus Fabricius	+	+		75, 91
Polistes versicolor (Olivier)	+	+	+	75, 91
Polybia occidentalis (Olivier)	+	+	+	75, 91
Polybia quadricincta Saussure	+	+		75, 91
Polybia rejecta (Fabricius)	+	+	+	75, 91
Polybia striata (Fabricius)	+			75, 91
Polybia tinctipennis Fox				75
Protopolybia exigua (Saussure)	+	+		75, 91
Synoeca surinama (Linnaeus)	+	+		75, 91

Our present faunistic knowledge of the ants (Formicidae) of Trinidad is uneven and decidedly incomplete. The lists of army ants (Ecitoninae), probably the Pseudomyrmecinae and perhaps the poneromorphs appear to be acceptably complete, while in the other three subfamilies there are certainly many more species to be recorded.

The definitive general treatment of the biology of ants is that of Hölldobler & Wilson (1990). It includes illustrated keys to the neotropical genera. The validity of names has been checked against Bolton's (1995) catalogue. Asterisks indicate species that are known or supposed to be introduced, according to McGlynn (1999).

FORMICIDAE: AMBLYOPONINAE (ants, in part)

	UWI	CABI	Tob	Ref
Amblyopone lurilabes Lattke				48a
Prionopelta antillana Forel	+			42

FORMICIDAE: CERAPACHYINAE (ants, in part)

As far as is known, members of this subfamily prey on other ants and sometimes termites.

	UWI	CABI	Tob	Ref
Cerapachys neotropicus Weber		+		42

FORMICIDAE: DOLICHODERINAE (ants, in part)

This subfamily and the Formicinae are remarkable, among other things, for the marked reduction of the venom apparatus and loss of the ability to sting.

The most noticeable species in Trinidad are probably *Tapinoma melanocephalum* (especially in kitchens) and a species of *Azteca* that builds conspicuous carton nests in trees, the vicinity of which it defends against all intrusion.

	UWI	CABI	Tob	Ref
Azteca alfari Emery				42
Azteca angusticeps Emery				42
Azteca barbifex Forel				42
Azteca chartifex Forel				42
Azteca coerulipennis Emery				16
Azteca constructor Emery				42
Azteca delpini Emery				42
Azteca foreli Emery				42
Azteca jelskii Emery				42
Azteca trigona Emery				42
Azteca velox Forel				42
Azteca xanthrochroa (Roger)				16
Dolichoderus attelaboides (Fabricius)				42, 91
Dolichoderus bidens (Linnaeus)				42
Dolichoderus bispinosus (Olivier)		+		42
Dolichoderus debilis Emery				42
Dolichoderus decollatus F. Smith				42
Dolichoderus diversus Emery	+			42
Dolichoderus lutosus (F. Smith)		+		42
Linepithema dispertitum (Forel)				42
Tapinoma melanocephalum (Fabricius)		+		42
Tapinoma ramulorum Emery				42

FORMICIDAE: ECITONINAE (New World army ants)

The New World army ants have recently been removed from the subfamily Dorylinae, which is now restricted to the Old World army ants. Among our species, *Eciton burchelli* is by far the most commonly encountered. The two outstanding general treatises on the biology of army ants are those of Gotwald (1995) and Schneirla (1971).

	UWI	CABI	Tob	Ref
Eciton burchellii (Westwood)	+	+		99
Eciton hamatum (Fabricius)				99
Eciton vagans (Olivier)			+	99
Neivamyrmex adnepos (Wheeler)				99
Neivamyrmex emersoni (Wheeler)				99
Neivamyrmex halidaii (Shuckard)				99
Neivamyrmex klugii (Shuckard)				99
Neivamyrmex pilosus (F. Smith)				42
Neivamyrmex punctaticeps (Emery)				99
Neivamyrmex swainsonii (Shuckard)				99
Nomamyrmex esenbeckii (Westwood)				99
Nomamyrmex hartigii (Westwood)				42

FORMICIDAE: ECTATOMMINAE (ants, in part)

The two species of *Ectatomma* are among our most conspicuous ants. They are often seen on flower-heads and other above-ground vegetation, where they typically respond to any approach with a pugnacious alert stance. They are evidently major attendants at honeydew-producting homopterans.

	UWI	CABI	Tob	Ref
Ectatomma ruidum (Roger)	+	+	+	42, 91
Ectatomma tuberculatum (Olivier)	+			42, 91
Gnamptogenys concinna (F. Smith)				42
Gnamptogenys horni (Santschi)		+		42
Gnamptogenys pleurodon (Emery)				42
Gnamptogenys striatula Mayr				42

FORMICIDAE: FORMICINAE (ants, in part)

This is one of two very large, worldwide subfamilies. As in the dolichoderines, the venom apparatus is much reduced. Among the conspicuous species in Trinidad is the very pugnacious *Camponotus atriceps*, often found nesting in old, dry-rotting logs and abandoned nests of the wasp *Polybia occidentalis*.

	UWI	CABI	Tob	Ref
Acropyga berwicki Wheeler				42
Acropyga quadriceps Weber				42
Acropyga rutgersi Bünzli				42
Acropyga trinitatis Weber				42
Acropyga urichi Weber				42
Brachymyrmex heeri Forel				42

Brachymyrmex minutus Forel				42	
Brachymyrmex obscurior Forel				16	
Camponotus ager (F. Smith)				42	
Camponotus atriceps (F. Smith)	+			42, 91	
Camponotus auricomus Roger				42	
Camponotus beebei Wheeler				42	
Camponotus bidens Mayr				42	
Camponotus brettesi Forel				42	
Camponotus canescens Mayr	+			42	
Camponotus claviscapus Forel				42	
Camponotus crassus Mayr				42	
Camponotus excisus Mayr				42	
Camponotus femoratus (Fabricius)				42	
Camponotus godmani Forel				42	
Camponotus latangulus Roger				42	
Camponotus lindigi Mayr				42	
Camponotus mus (Roger)				24	
Camponotus novogranadensis Mayr				42	
Camponotus rectangularis Emery				42	
Camponotus sanctaefidei DallaTorre				42	
Camponotus senex (F. Smith)				42	
Camponotus urichi Forel				42	
Camponotus zoc Forel		+		42	
Dendromyrmex wheeleri Donisthorpe				42	
Paratrechina caeciliae (Forel)				42	
Paratrechina guatemalensis (Forel)				42	
**Paratrechina longicornis* (Latreille)	+	+	+	42	
Paratrechina steinheili (Forel)				42	
**Paratrechina vividula* (Nylander)				42	

FORMICIDAE: MYRMICINAE (ants, in part)

Like the formicines, this is a very large, cosmopolitan group. Classification within the subfamily is in an unsettled state, but one distinctive natural group is the neotropical tribe Attini (leaf-cutter ants), comprising the genera *Acromyrmex*, *Apterostigma*, *Atta*, *Cyphomyrmex*, *Mycetophylax*, *Mycocepurus*, *Myrmicocrypta*, *Sericomyrmex*, *Trachymyrmex* and two others not recorded from Trinidad.

		UWI	CABI	Tob	Ref
Acanthognathus ocellatus Mayr				42	
Acromyrmex octospinosus (Reich)	+	+	+	42	
Apterostigma auriculatum Wheeler				42	
Apterostigma ierense Weber				42	
Apterostigma mayri Forel	+			42	
Apterostigma urichi Forel				42	

Atta cephalotes (Linnaeus)	+	+	+	42
Basiceros conjugans Brown				86
Basiceros militaris (Weber)				16, 42
Basiceros singularis (F. Smith)				42
Cephalotes atratus (Linnaeus)	+	+	+	42, 91
Cephalotes umbraculatus (Fabricius)				24
Cephalotes varians (F. Smith)				24
Codiomyrmex thaxteri Wheeler				42
Crematogaster brasiliensis Mayr				42
Crematogaster brevispinosa Mayr		+		42
Crematogaster carinata Mayr				24
Crematogaster crinosa Mayr				24
Crematogaster limata F. Smith				42
Cyphomyrmex bigibbosus Emery			+	42
Cyphomyrmex faunulus Wheeler				42
Cyphomyrmex minutus Mayr	+	+	+	42
Eurhopalothrix alopeciosa Brown & Kempf				42
Hylomyrma blandiens Kempf		+		16
Lachnomyrmex picinus (Roger)				42
Leptothorax asper Mayr				42
Leptothorax spininodis Mayr	+	+		42
Leptothorax tristani Emery				42
Megalomyrmex bituberculatus (Fabricius)				42
Megalomyrmex drifti Kempf				16
Megalomyrmex incisus M.R. Smith				16
Megalomyrmex silvestrii Wheeler				16
**Monomorium destructor* (Jerdon)				16
Monomorium ebeninum Forel				16
**Monomorium floricola* (Jerdon)				42
**Monomorium pharaonis* (Linnaeus)				42
Mycetophylax conformis (Mayr)	+		+	42
Mycocepurus smithi (Forel)	+	+		42
Myrmicocrypta squamosa F. Smith		+		42
Myrmicocrypta urichi Weber	+			42
Octostruma balzani (Emery)		+		42
Octostruma iheringi (Emery)				42
Oligomyrmex urichi (Wheeler)				42
Pheidole aripoensis Wilson				101
Pheidole biconstricta Mayr				42, 101
Pheidole cephalica F. Smith			+	42, 101
Pheidole coveri Wilson				101
Pheidole exigua Mayr				101
Pheidole fallax Mayr			+	42
Pheidole fimbriata Roger				42, 101
Pheidole flavens Roger		+		42, 101

Pheidole fraticeps Wilson				101
Pheidole jelskii Mayr			+	101
**Pheidole megacephala* (Fabricius)			+	16, 42, 101
Pheidole mendicula Wheeler				101
Pheidole obscurior Forel				42
Pheidole rugiceps Wilson				101
Pheidole scalaris Wilson				101
Pheidole sculptior Forel				42
Pheidole subarmata Mayr				42
Pheidole susannae Forel				42, 101
Pheidole tenerescens Wheeler				42, 101
Pheidole transversostriata Mayr				42, 101
Pheidole trinitatis Wilson				101
Pheidole triplex Wilson				101
Pheidole tristicula Wilson				101
Pheidole vafra Santschi			+	101
Pheidole zeteki M.R. Smith				101
Procryptocerus hirsutus Emery				42
Procryptocerus hylaeus Kempf				42
Procryptocerus regularis Emery				42
Procryptocerus spiniperdus Forel				42
Procryptocerus subpilosus (F. Smith)				42
Rogeria blanda (F. Smith)				47
Rogeria foreli Emery		+		47
Rogeria lirata Kugler				47
Rogeria scobinata Kugler				47
Sericomyrmex urichi Forel	+			42
Smithistruma hyphata Brown				42
Smithistruma nigrescens (Wheeler)				42
Solenopsis altinodis Forel				42
Solenopsis basalis Forel				42
Solenopsis geminata (Fabricius)		+	+	42
Solenopsis minutissima Emery				42
Solenopsis tenuis Mayr				42
Strumigenys cordovensis Mayr		+		42
Strumigenys denticulata Mayr		+		42
Strumigenys elongata Roger		+		42
Strumigenys gundlachi (Roger)		+	+	42
Strumigenys perparva Brown				42
Strumigenys planeti Brown				42
Strumigenys subedentata Mayr		+		42
Strumigenys trinidadensis Wheeler		+		42
Talaridris mandibularis Weber				42
Tetramorium bicarinatum (Nylander)				14
Trachymyrmex bugnioni (Forel)				42

Trachymyrmex carib Weber				42	
Trachymyrmex cornetzi (Forel)				42	
Trachymyrmex relictus Borgmeier			+	42	
Trachymyrmex ruthae Weber				42	
Trachymyrmex urichi (Forel)	+		+	42	
Tranopelta gilva Mayr				42	
Wasmannia auropunctata (Roger)	+	+	+	42	
Wasmannia rochai Forel				42	
Zacryptocerus clypeatus (Fabricius)				42	
Zacryptocerus conspersus (F. Smith)				16, 42	
Zacryptocerus grandinosus (F. Smith)				16, 42	
Zacryptocerus maculatus (F. Smith)				42	
Zacryptocerus pallens (Klug)				42	
Zacryptocerus pusillus (Klug)				42	
Zacryptocerus spinosus (Mayr)				42	
Zacryptocerus umbraculatus (Fabricius)				42	

FORMICIDAE: PONERINAE

The traditional family Ponerinae has recently been recognized as paraphyletic, so that species now placed in the Amblyoponinae, Ectatomminae and Proceratiinae are removed from it. The traditional Ponerinae are now informally known as the poneromorph ants.

Ponerinae and other poneromorphs are mostly relatively large ants, remarkable for the retention of some primitive habits. Nests are characteristically relatively simple cavities in soil or rotting logs. The venom apparatus is well developed in workers, and species of *Odontomachus* and *Pachycondyla* are almost certainly our most painfully stinging ants.

		UWI	CABI	Tob	Ref
Anochetus emarginatus (Fabricius)			+	42, 91	
Anochetus inermis André	+	+	+	42	
Centromyrmex brachycola (Roger)				86	
**Hypoponera opaciceps* (Mayr)				42	
Hypoponera opacior (Forel)				16	
Leptogenys unistimulosa Roger				42	
Odontomachus bauri Emery		+		17	
Odontomachus brunneus (Patton)				17	
Odontomachus insularis Guérin-Méneville				16	
Odontomachus meinerti Forel		+		17	
Pachycondyla apicalis (Latreille)				42	
Pachycondyla arhuaca (Forel)				86	
Pachycondyla constricta (Mayr)		+		42	
Pachycondyla crassinoda (Latreille)		+		42, 91	
Pachycondyla harpax (Fabricius)		+		42	
Pachycondyla impressa (Roger)				42	
Pachycondyla laevigata (F. Smith)				42	

Pachycondyla stigma (Fabricius)		+		42
Pachycondyla unidentata Mayr				42
Platythyrea angusta Forel				42

FORMICIDAE: PROCERATIINAE

	UWI	CABI	Tob	Ref
Discothyrea icta Weber				42

FORMICIDAE: PSEUDOMYRMECINAE (ants, in part)

This subfamily comprises three genera, the Old World *Tetraponera* and the New World *Pseudomyrmex* and *Myrcidris* (one species, Brazil). They characteristically nest in hollow stems or thorns. The workers are slim, active and resemble wingless wasps. They retain a functional venom apparatus and can often sting painfully.

	UWI	CABI	Tob	Ref
Pseudomyrmex boopis (Roger)				98
Pseudomyrmex curacaensis (Forel)				16, 98
Pseudomyrmex elongatus (Mayr)				98
Pseudomyrmex filiformis (Fabricius)			+	98
Pseudomyrmex flavidulus (F. Smith)				98
Pseudomyrmex gracilis (Fabricius)		+		98
Pseudomyrmex holmgreni (Wheeler)				98
Pseudomyrmex kuenckeli (Emery)				98
Pseudomyrmex laevivertex (Forel)				98
Pseudomyrmex maculatus (F. Smith)				98
Pseudomyrmex malignus (Wheeler)				16, 98
Pseudomyrmex oculatus (F. Smith)				16, 98
Pseudomyrmex perboscii (Guérin-Méneville)				16, 98
Pseudomyrmex sericeus (Mayr)				98
Pseudomyrmex simplex (F. Smith)				16, 98
Pseudomyrmex subater (Wheeler & Mann)				98
Pseudomyrmex tenuissimus (Emery)				16, 98
Pseudomyrmex termitarius (F. Smith)		+		98
Pseudomyrmex urbanus (F. Smith)				16, 98
Pseudomyrmex viduus (F. Smith)				98

APOIDEA - SPHECIFORMES (digger wasps)

Members of this cosmopolitan group are predaceous, stocking their nests with paralyzed arthropod prey (spiders and insects) for their larvae. Prey specificity varies, although most species are restricted to prey from a single insect order, often one or a few families. The majority of spheciformes nest in burrows in the ground. Many others build free-standing nests or are renters, utilizing a great variety of pre-existing cavities. The classification follows

Melo (1999), who divided Sphecidae (s.l.) into three families: Ampulicidae (formerly Ampulicinae), Sphecidae (formerly Sphecinae) and Crabronidae (remaining subfamilies). Menke & Fernández (1996) have recently provided a key to the neotopical genera.

Specimens of at least most of the species recorded by Callan (1990) are deposited in the Smithsonian Institution, USA.

AMPULICIDAE

Both the physical makeup and nesting behaviour of this small family of often rare tropical wasps include many features considered primitive for digger wasps as a whole. They provision with cockroaches.

	UWI	CABI	Tob	Ref
Ampulex raptor F. Smith				18
Ampulex thoracica F. Smith				18
Dolichurus sp.				38
Paradolichurus sp.				38

CRABRONIDAE: BEMBECINAE (sand wasps)

This relatively large group and is physically and behaviourally diverse. In Trinidad sand wasps are commonly found nesting in beach dunes and old sand quarries. Other species, in particular of the Gorytini, appear to prefer nesting along trails in the forest, or in the mounds of leafcutter ants. One tribe (Nyssonini) is cleptoparasitic upon other bembecines and crabronines. Sand wasps have served as fruitful subjects of comparative behaviour studies (Evans 1966). Almost all specimens in the UWI and CABI collections have been identified or confirmed by A.W. Hook.

	UWI	CABI	Tob	Ref
Bembecinus agilis (F. Smith)	+			2, 18
Bembicinus bolivari (Handlirsch)	+			2, 18
Bicyrtes discisus (Taschenberg)	+			18
Bicyrtes variegatus (Olivier)				18
Clitemnestra procerulides (Strand)				2
Clitemnestra vallensis Bohart				2, 12
Epigorytes procerulides (Strand)				2, 12
Epinysson zapotecus (Cresson)	+			18
Foxia sp.				38
Hoplisoides denticulatus (Packard)				18
Hoplisoides iheringii (Handlirsch)				2, 12
Hoplisoides iridipenis (F. Smith)				12, 18
Hoplisoides vespoides (F. Smith)	+	+		2, 12, 18
Microbembex ciliata (Fabricius)	+			18
Psammaletes hooki Bohart	+			2
Pterygorytes triangularis (F. Smith)				2, 12
Rubrica nasuta (Christ)	+			2, 18

Sagenista brasiliensis (Shuckard)	+			12, 18
Sagenista poss. *pilosa* Bohart				12
Stenogorytes venezuelae Bohart				38
Stictia pantherina (Handlirsch)		+		18
Stictia signata (Linnaeus)	+			18
Zanysson dives (Handlirsch)	+			18

CRABRONIDAE: CRABRONINAE

This is the largest group of spheciformes, represented by 45 genera and 751 species in the neotropics (Menke & Fernández 1996). Many are cavity nesters. They hunt a diversity of prey, with many preying on flies. In the neotropics two genera that typically construct free-standing nests of mud, *Pison* and *Trypoxylon*, are very speciose. *Trypoxylon* is of interest on account of the nest-sharing habits of females in some species, including at least two in Trinidad that have yet to be closely studied (pers. obs.).

	UWI	CABI	Tob	Ref
Anacrabro poss. *meridionalis* Ducke	+			38
Aulacophilus eumenoides Ducke	+			2, 18
Bothynostethus sp.	+			38
Crossocerus callani Pate				2, 18
Ectemnius basiflavus (Brèthes)				18
Ectemnius carinatus (F. Smith)				2, 18
Ectemnius centralis (Cameron)				2, 18
Ectemnius noyesi Leclerq				2
Ectemnius semipunctatus Lepeletier & Brullé)				2, 18
Enoplolindenius pugnans (F. Smith)	+			2, 18
Enoplolindenius haubrugei. Leclercq & Terzo				48b
Entomocrabro callanicus Leclercq				2, 18
Foxita atorai Pate				18
Foxita benitiana Leclercq				18
Holcorhopalum nr. *foveatum* Cameron	+			38
Larra altamazonica Williams				2, 18, 53
Larra bicolor Fabricius				2, 18, 53
Larra godmani Cameron				2, 18, 53
Larropsis rubricatus (F. Smith)				2
Lestica constanceae (Cameron)				18
Liris anticus (F. Smith)	+			2, 18
Liris rubricatus (F. Smith)				18
Liris sp. 3 of Hook	+			38
Liris sp. 4 of Hook	+			38
Liris sp. 5 of Hook	+			38
Motes anticus (F. Smith)				2
Nitela amazonica Ducke	+			2, 18, 102
Nitela guiana (Williams)				2

Nitela intermedia Zuijlen				2
Oxybelus callani Pate	+			2, 18
Oxybelus polyceros Pate				18
Oxybelus sp. 3 of Callan and Hook	+			38
Pae amaripa Pate				2
Parataruma leclercqi Kimsey				18
Pison cameronii Kohl	+			2, 18, 52
Pison cooperi Menke	+			2, 18, 52
Pison cressoni Rohwer				2, 18, 52
Pison duckei Menke	+			2, 18, 52
Pison gnythos Menke	+			2, 18, 52
Pison maculipenne F. Smith				2, 18, 52
Pison pilosum F. Smith	+			2, 18, 52
Quexua ricata Leclercq	+			18
Rhopalum sp.	+			38
Tachysphex inconspicuus (Kirby)	+			2, 18, 70
Tachysphex iridipennis (F. Smith)	+			2, 18, 70
Tachysphex ruficaudis (Taschenberg)	+			2, 18, 70
Tachytes amazonus F. Smith				10, 18
Tachytes chrysopyga (Spinola)	+			2, 10, 18
Tachytes excellens Cameron	+			2, 10, 18
Tachytes fraternus Taschenberg	+			10, 18
Tachytes nr. *frontalis* F. Smith	+			38
Tachytes hades Schrottky	+			38
Tachytes leprieurii (Spinola)				10, 18
Tachytes pretiosus Cameron)				10, 18
Trypoxylon nr. *agamemnon*	+			38
Trypoxylon albitarse Fabricius	+	+		2, 18, 73
Trypoxylon nr. *bogotense*	+			38
Trypoxylon capitale Richards				18, 73
Trypoxylon cocorite Richards				2, 18, 73
Trypoxylon cornigerum Cameron			+	2, 18, 39, 73
Trypoxylon nr. *crudele*	+			38
Trypoxylon fabricator F. Smith				2, 18, 73
Trypoxylon fitzgeraldi Richards				2, 18, 73
Trypoxylon fugax Fabricius	+			38
Trypoxylon fuscipenne Fabricius				18, 73
Trypoxylon grenadense Richards				18, 39
Trypoxylon lactitarse Saussure	+			2
Trypoxylon leucarthrum Richards				2, 18, 73
Trypoxylon maidli Richards	+			2, 18, 73
Trypoxylon manni Richards	+	+		2, 18, 73
Trypoxylon marginatum Cameron	+			38
Trypoxylon moraballi Richards		+	+	2, 18, 73
Trypoxylon nitidum F. Smith	+		+	2, 18, 39, 73

Trypoxylon olfersi Richards		+	+	39
Trypoxylon pachygaster Richards				2, 18, 73
Trypoxylon pectorale Richards				18, 73
Trypoxylon punctiventris Richards		+	+	39
Trypoxylon rubrifemoratum Richards				2, 18, 73
Trypoxylon rufidens Cameron			+	2, 18, 39, 73
Trypoxylon rugifrons F. Smith		+		38
Trypoxylon salti Richards		+	+	2, 39
Trypoxylon schmidti Richards		+		2
Trypoxylon scrobiferum Richards		+	+	39
Trypoxylon staudlingeri Richards		+	+	39
Trypoxylon trinidadense Richards				2, 18, 73
Trypoxylon urichi Richards				2, 18, 73
Trypoxylon fabricator-group 1 of Hook		+		38
Trypoxylon fabricator-group 2 of Hook		+		38
Trypoxylon fabricator-group 3 of Hook		+		38
Trypoxylon fiebrigi-group 1 of Hook		+		38
Trypoxylon figulus-group 1 of Hook		+	+	39
Trypoxylon marginatum-group 1 of Hook		+	+	39
Trypoxylon marginatum-group 2 of Hook		+		38
Trypoxylon marginatum-group 4 of Hook		+		38
Trypoxylon oculare-group 1 of Hook		+		38

CRABRONIDAE: PEMPHREDONINAE

These are small to minute wasps. Most species appear to prey on homoptera. Of special interest is the genus *Microstigmus*, which includes the only known eusocial spheciform wasp, *M. comes* of Costa Rica (Matthews 1991). At least two of our species give evidence of female nest-sharing and possibly eusociality (pers. obs.).

	UWI	CABI	Tob	Ref
Incastigmus neotropicus (Kohl)	+		+	2, 29
Incastigmus prophorodontis Finnamore				2, 29
Incastigmus pyrrhopyxis Finnamore			+	2, 29
Incastigmus trichodocerus Finnamore				2, 29
Microstigmus arlei Richards				91
Microstigmus guianae Rohwer				91
Microstigmus myersi Turner				2, 18, 74
Microstigmus theridii Ducke				2, 18, 74
Mimumesa modesta (Rowher)				2, 18
Pluto smithii (Fox)				2, 18, 30
Pseneo aureolus Lith	+			30
Pseneo longiventris (Cameron)	+			2, 30
Psenulus sp.				30, 38
Stigmus sp. L of Finnamore	+			30

Stigmus sp. M of Finnamore	+			30
Stigmus sp. N of Finnamore	+			30

CRABONIDAE: PHILANTHINAE

Both genera recorded from Trinidad are of interest on account of their communal nesting behavior. *Cerceris binodis* males remain with the mate's nest and guard it against parasites and other intruders.

	UWI	CABI	Tob	Ref
Cerceris binodis Spinola	+	+		18
Cerceris callani Krombein	+			2, 18
Cerceris chiriquensis Cameron	+			2, 18
Cerceris cribrosa Spinola	+			18
Cerceris dilatata Spinola	+			2, 18
Cerceris sp. 6 of Hook				38
Cerceris sp. 7 of Hook				38
Cerceris sp. 8 of Hook				38
Trachypus mandibularis Rubio		+		2, 18
Trachypus petiolatus (Spinola)	+			2, 18

SPHECIDAE

Most members of this family construct simple ground or aerial nests. *Sceliphron* spp. often build their distinctive mud nests on or inside buildings; they provision with spiders. Members of *Sphex*, the largest genus in the subfamily, prey on grasshoppers, while some other genera are only known to take cockroaches.

	UWI	CABI	Tob	Ref
Dynatus nigripes (Westwood)				2, 18
Eremnophila binodis (Fabricius)				18
Eremnophila opulenta (Guérin)				18
Isodontia cyanipennis (Fabricius)				18
Isodontia fuscipennis (Fabricius)	+			18
Penepodium sp. 1 of Hook	+			38
Penepodium sp. 2 of Hook	+			38
Podium friesei Kohl				18
Podium fumigatum (Perty)				18
Podium rufipes Fabricius				18
Podium sp. 4 of Hook	+			38
Prionyyx poss. *fervens* (Linnaeus)	+			38
Prionyx thomae (Fabricius)				18
Sceliphron asiaticum (Linnaeus)				2, 18
Sceliphron fistularium (Dahlbom)				2, 18
Sphex dorsalis Lepeletier				18

Sphex poss. *habenus* Say		+		38
Sphex ichneumoneus (Linnaeus)				18
Sphex melanopus Dahlbom				18
Sphex poss. *tepanecus* Saussure		+		38
Sphex tinctipennis Cameron				18
Trigonopsis cooperi Vardy				37
Trigonopsis rufiventris (Fabricius)				2, 18, 94
Trigonopsis vicina (DallaTorre)				2, 18, 94
Trigonopsis violascens (DallaTorre)				2, 18, 94

APOIDEA - APIFORMES (bees)

The outstanding bionomic feature of this group is the switch from paralyzed arthropod prey to pollen as the main brood-food. Associated with this is a tendency to increased density of hairs on the body and a branching of individual hairs; this gives most bees their overall fuzzy appearance.

For a recent review of the natural history of tropical bees, see Roubik (1989). Michener's (1974) treatise on social behaviour of bees remains the definitive review.

Faunistic knowledge of the bees of Trinidad is similar to that of the ants (Formicidae) in its unevenness. The Euglossinae, Meliponinae and probably the Xylocopinae appear to be nearly complete at this basic level, while records from such groups as the Colletidae, Halictidae and probably some genera of Apinae are evidently very spotty.

The classification follows Michener (2000).

APIDAE: APINAE

Included in this subfamily are two groups of especial note.

The orchid bees (tribe Euglossini) are represented here by the genera *Euglossa*, *Eulaema*, *Euplusia* and *Exaerete*. These large, robust bees are mostly either very hairy and contrastingly marked in red, yellow, white and/or black, or smooth and shiny metallic green to blue-green. Males gather fragrance from various orchids, for which they serve as pollination agents.

The stingless bees (Meliponini) are represented by *Lestrimelitta*, *Melipona*, *Nannotrigona*, *Partamona*, *Plebeia* and *Trigona*. These are highly social bees, of which the most conspicuously abundant in Trinidad are *Partamona nigrior* and *Trigona nigra*. The nesting and foraging biology of stingless bees have been treated extensively by Roubik (1989) and Sakagami (1982), among others.

The present list of these two groups appears to be reasonably complete. The highly social *Apis mellifera* (Apini) is an introduced Old World species.

	UWI	CABI	Tob	Ref
Acanthopus palmatus (Olivier)		+		67
Aglaomelissa duckei (Friese)				67
Apis mellifera Linnaeus	+	+		
Centris analis (Fabricius)				67
Centris atra Friese				63, 69

Centris braccata Packard				67
Centris derasa Lepeletier	+	+	+	67
Centris flavifrons (Fabricius)				85
Centris longimana (Fabricius)		+		67
Centris rufosuffusa Cockerell	+	+		67
Centris similis (Fabricius)	+	+		69
Centris smithiana (Friese)				67
Centris smithii Cresson				67
Centris torquata Moure & Seabra				66, 67
Centris varia (Erichson)		+		62, 67
Epicharis fasciata Lepeletier & Serville	+			67
Epicharis flava Friese				67
Epicharis rustica (Olivier)	+	+	+	67, 69
Eufriesia chrysopyga (Mosary)				43, 67
Eufriesia concava (Friese)				43, 67
Eufriesia mussitans (Fabricius)	+			43, 67
Eufriesia pulchra (F. Smith)				43, 67
Eufriesia surinamensis (Linnaeus)	+			43, 67
Euglossa cordata (Linnaeus)	+			67
Euglossa gaianii Dressler				67
Euglossa ignita F. Smith		+		67
Euglossa piliventris Guérin				67
Euglossa townsendi Cockerell				67
Eulaema basicincta Moure				64, 67
Eulaema bennetti Moure				67
Eulaema cingulata (Fabricius)	+	+		67
Eulaema meriana (Olivier)	+			64, 78
Eulaema nigrita Lepeltier				67
Eulaema pseudocingulata Oliveira				67
Eulaema seabrai Moure		+		78
Eulaema stenozoana Moure				64, 67
Eulaema terminata F. Smith				67
Exaerete dentata (Linnaeus)				67
Exaerete smaragdina (Guérin)	+			67
Exomalopsis nigrior Timberlake				67
Exomalopsis pubescens Cresson				67
Exomalopsis (Phanomalopsis) TR-1 of Neff				69
Florilegus condignus (Cresson)	+	+		67, 69
Lestrimelitta limao (F. Smith)		+		23
Melipona favosa (Fabricius)		+	+	23
Melipona lateralis Erichson				23
Melissodes rufodentata F. Smith	+			67
Mesocheira bicolor (Fabricius)				86
Nannotrigona testaceicornis (Lepeletier)				23
Osiris sp. T-1 of Neff				69

Osiris sp. T-2 of Neff				69
Paratetrapedia (Lophopedia) TR-1 of Neff.				69
Paratetrapedia (P.) TR-2 of Neff.				69
Partamona nr. *nigrior* (Cockerell)	+	+		23
Peponapis citrullina (Cockerell)				69
Plebeia nr. *frontalis* Friese			+	23
Rhathymodes acuteiventris (Friese)				69
Rhathymus bicolor Lepeletier & Serville				67
Rhathymus trinitatis Cockerell				67
Thygater sp.				69
Trigona amalthea (Olivier)	+	+		23
Trigona nigra Cresson	+	+		23
Trigonisca sp.				23

APIDAE: NOMADINAE

	UWI	CABI	Tob	Ref
Epeolus (Trophocleptria) sp.				69
Nomada (Hypochrotaenia) sp.				69

APIDAE: XYLOCOPINAE

Xylocopa are commonly known as large carpenter bees, on account of the habit of most species of nesting in tunnels that they chew in dead wood. Their size and frequent loud buzzing at flowers makes them especially conspicuous. Some species show nest-sharing among females, although none is known to be eusocial. None of our species has been closely studied.

Ceratina are commonly known as small carpenter bees.

	UWI	CABI	Tob	Ref
Ceratina chloris (Fabricius)	+			67
Ceratina minima				67
Xylocopa fimbriata Fabricius		+		40, 67
Xylocopa frontalis (Olivier)	+			40, 67
Xylocopa muscaria (Fabricius)	+	+		40, 67
Xylocopa transitoria Pérez	+	+		40, 67

COLLETIDAE

These usually small, solitary bees are relatively inconspicuous. They characteristically nest in burrows in the soil. Among their outstanding features is the habit of lining the borrow with a waterproof glandular secretion very similar to cellophane.

	UWI	CABI	Tob	Ref
Colletes sp. TR-1 of Neff		+		69
Hylaeus orbicus Vachal				84
Hylaeus dictyotus Snelling				67, 84
Hylaeus (Hylaeopsis) TR-1 of Neff				69
Ptiloglossa fulvopilosa (Cameron)		+		67
Ptiloglossa lucernarum Cockerell		+		67

HALICTIDAE (sweat bees)

Members of this large family are common throughout most of the habitable world. They nest mainly in burrows in the soil. Most species are solitary, but there is a great variety of social habits, including eusociality in a few species. A majority of the apparent independent origins of persistent eusociality are within this one family (Michener 1974). None of our species has been studied in Trinidad, and nest structure is a poor predictor of social behaviour.

	UWI	CABI	Tob	Ref
Agapostemon nasutus F. Smith	+	+		65, 67
Augochlora erubescens Cockerell	+	+		65, 67
Augochlora (A.) TR-1 of Neff				69
Augochlora (A.) TR-2 of Neff				69
Augochlora (A.) TR-3 of Neff				69
Augochlora (A.) TR-5 of Neff				69
Augochloropsis trinitatis (Cockerell)				65, 67
Augochloropsis (A.) TR-2 of Neff				69
Augochloropsis (A.) TR-3 of Neff				69
Augochloropsis (Paraugochloropsis) TR-1 of Neff				69
Caenohalictus TR-1 of Neff				69
Habralictus sp.				69
Halictus poeyi Lepeletier		+		67, 69
Lasioglossum trinidadensis (Friese)		+		65, 67
Megalopta poss. *ecuadoria* Friese		+		69
Neocorynura sp. TR-1 of Neff				69
Pereirapis semiaurata (Spinola)		+		69
Pseudaugochlora sp. TR-1 of Neff				69
Temnosoma sp.				69

MEGACHILIDAE (leafcutter bees)

This is a large, cosmopolitan family. Nests are burrowed in the soil or plant stems, in pre-existing cavities, or are free-standing. The cells are usually made from leaf fragments freshly cut from plants. The family includes many cleptoparasitic species. *Megachile lanata* is a widely introduced species, probably from Africa.

	UWI	CABI	Tob	Ref
Coelioxys alatiformis Friese				67
Coelioxys clypeata F. Smith		+		67
Coelioxys cosatricensis Cockerell				62, 67
Coelioxys otomita Cresson				62, 67
Coelioxys panamensis Cockerell		+		62
Coelioxys (Acrocoelioxys) T-1 of Neff				69
Coelioxys (Acrocoelioxys) T-2 of Neff				69
Coelioxys (Cyrtocoelioxys) T-1 of Neff				69
Coelioxys (Cyrtocoelioxys) T-3 of Neff				69
Coelioxys (Cyrtocoelioxys) T-4/5 of Neff				69
Coelioxys (Cyrtocoelioxys) T-6/7 of Neff				69
Coelioxys (Rhinocoelioxys) T-1 of Neff				69
Dicranthidium insulare Urban				69
Hoplostelis bilineolata (Spinola)				57
Hoplostelis cornuta (Bingham)				57, 67
Hypanthidoides (Saranthidium) T-1 of Neff				69
Loyolanthidium albopilosum Friese				67
Megachile candida F. Smith		+		67
Megachile lanata Latreille	+	+		67
Megachile paulista Schrottky				67
Megachile poeyi Guérin	+			67
Megachile prob. *stomatura* Cockerell				21, 69
Megachile (Leptorachis) T-1 of Neff		+		69
Megachile (Melanosarus) T-1 of Neff				69
Megachile (Moureana) T-1 of Neff				69
Megachile (Neochelynia) T-3 of Neff				69

REFERENCES

1. Alkins, M.E. 1979. The mammals of Trinidad. UWI Dep't of Zoology Occasional Papers (2):1-75.
2. Amarante, S.T.P. 2002. A synonymic catalog of the neotropical Crabronidae and Sphecidae (Hymenoptera: Apoidea). Arquivos de Zoologia (São Paulo) 37:1-139.
3. Azevedo, C.O. 1999. Revision of the neotropical *Dissomphalus* Ashmead, 1893 (Hymenoptera, Bethylidae) with median tergal processes. Arquivos de Zoologia (São Paulo) 35:301-94.
4. Banks, N. 1944. Psammocharidae (spider wasps): Notes and Descriptions. Bulletin of the Museum of Comparative Zoology 94:167-87.
5. Banks, N. 1944. The Psammocharidae (Hymenoptera) taken at Kartabo and other localities in British Guiana. Zoologica (New York) 29:97-112.
6. Banks, N. 1945. The Psammocharidae (spider wasps) of northern South America. Boletín Entomológico Venezolano 4:81-126.

7. Banks, N. 1947. Studies of South American Psammocharidae. Part II. Bulletin of the Museum of Comparative Zoology, Harvard Univ. 99:371-486.
8. Barcant, M. 1970. *Butterflies of Trinidad and Tobago.* London: Collins 314 pp.
9. Beard, J.S. 1946. *The Natural Vegetation of Trinidad.* Oxford: Clarendon 152 pp.
10. Bohart, R.M. 1979. *Tachytes* of South America (Hymenoptera, Sphecidae, Larrinae). Transactions of the American Entomological Society 104:435-505.
11. Bohart, R.M. & A.S. Menke 1976. *Sphecid Wasps of the World, a Generic Revision.* Berkeley: Univ. California Press 695 pp.
12. Bohart, R.M. 2000. A review of Gorytini in the neotropical region (Hymenoptera: Sphecidae: Bembecinae). Contributions on Entomology International 4:111-259.
13. Bohart, R.M. & L.A. Stange 1965. A revision of the genus *Zethus* Fabricius in the Western Hemisphere (Hymenoptera: Eumenidae). University of California Publications in Entomology 40:1-208.
14. Bolton, B. 1979. The ant tribe Tetramoriini (Hymenoptera: Formicidae). The genus *Tetramorium* Mayr in the Malagasy region and in the New World. Bulletin of the British Museum (Natural History) 38:129-81.
15. Bolton, B. 1995. *A New General Catalogue of the Ants of the World.* Cambridge: Harvard Univ. Press 504 pp.
16. Brandão, C.R.F. 1991. Adendos ao catálogo abreviado das formigas da Região Neotropical (Hymenoptera: Formicidae). Revista Brasileira de Entomologia 35:319-412.
17. Brown, W.L. 1976. Contributions toward a reclassification of the Formicidae. Part VI. Ponerinae, tribe Ponerini, subtrive Odontomachiti. Section A. Introduction, subtribal characters. Genus *Odontomachus*. Studia Entomologica 19:67-171.
18. Callan, E.McC. 1990. Sphecidae of Trinidad. I. Ampulicinae, Sphecinae and Pemphredoninae. II. Larrinae. III. Crabroninae, Nyssoninae and Philanthinae. Sphecos (20):19, (21):8, (21):8, 12.
19. Callan, E.McC. Unpublished observation.
20. Carpenter, J.M. Unpubl. Synomymic checklist of the Eumeninae of Trinidad.
21. Cockerell, T.D.A. 1917. Descriptions and records of bees. LXXVI. Annals and Magazine of Natural History 20:235-41.
22. Comeau, P.L., Y.S. Comeau & W. Johnson 2003. *The Palm Book of Trinidad & Tobago, Including the Eastern Caribbean.* Lawrence, Kansas: International Palm Society 108 pp.
23. DeDijn, B.P.E. 1998. Why are there so few stingless bee species in Trinidad and Tobago? Interactie (Paramaribo) (4):38-49.
24. Dutra, D.S. & J.K. Wetterer. Unpublished observation.
25. Evans, H.E. 1966a. *The Comparative Ethology and Evolution of the Sand Wasps.* Cambridge: Harvard Univ. Press 526 pp.
26. Evans, H.E. 1966b. A revision of the Mexican and Central American spider wasps of the subfamily Pompilinae (Hymenoptera: Pompilidae). Memoirs of the American Entomological Society (20):1-442.
27. Fabre, J.-H. 1879-1907. *Souvenirs Entomologiques.* Vol. 1-10. Paris: Charles Delagrave.
28. Ffrench, R. 1991. *A Guide to the Birds of Trinidad & Tobago.* 2nd ed. Ithaca: Cornell

Univ. Press 426 pp.
29. Finnamore, A.T. 2002. Revision of the world genera of tribe Stigmini (Hymenoptera: Apoidea: Crabronidae: Pemphredoninae), Part 2. Species of *Incastigmus* Finnamore. Journal of Hymenoptera Research 11:12-71.
30. Finnamore, A.T. Unpublished observation.
31. Fisher, R.M. 1993. How important is the sting in insect social evolution? Ethology Ecology & Evolution 5:157-68.
32. Gordh, G. & Móczár, L. 1990. A catalog of the world Bethylidae (Hymenoptera: Aculeata). Memoirs of the American Entomological Institute (46):1-364.
33. Gotwald, W.H. 1995. *Army Ants: The Biology of Social Predation.* Ithaca: Cornell Univ. Press 302 pp.
34. Goulet, H. & J.T. Huber 1993. *Hymenoptera of the World: An Identification Guide to Families.* Ottawa: Agriculture Canada 668 pp.
35. Hermann, H.R. & M.S. Blum 1981. Defensive mechanisms in the social Hymenoptera. Pp. 77-197 in: H.R. Hermann (ed.), *Social Insects.* Vol. 2. New York: Academic.
36. Hölldobler, B. & E.O. Wilson 1990. *The Ants*. Cambridge: Harvard Univ. Press 732 pp.
37. Hook, A.W. 2006. A new *Trigonopsis* (Hymenoptera: Sphecidae) record for Trinidad, West Indies. Living World (Port of Spain) 2006:53.
38. Hook, A.W. Unpublished observation.
39. Hook, A.W. & C.K. Starr 2006. *Trypoxylon* (Hymenoptera: Crabronidae) in Tobago, West Indies. Caribbean Journal of Science 42:258-60.
40. Hurd, P.D. 1978. *An Annotated Catalog of the Carpenter Bees (Genus Xylocopa Latreille) of the Western Hemisphere (Hymenoptera: Anthophoridae).* Washington: Smithsonian Inst. Press 106 pp.
41. Iwata, K. 1976. *Evolution of Instinct: Comparative Ethology of Hymenoptera.* New Delhi: Amerind 535 pp.
42. Kempf, W.W. 1972. Catálogo abreviado das formigas da Região Neotropical (Hymenoptera: Formicidae). Studia Entomologica 15:3-344.
43. Kimsey, L.S. 1982. Systematics of the bee genus *Eufriesia*. University of California Publications in Entomology 95:1-125.
44. Kimsey, L.S. & R.M. Bohart 1990. *The Chrysidid Wasps of the World.* Oxford: Oxford Univ. Press 652 pp.
45. Krombein, K.V. 1967. *Trap-Nesting Wasps and Bees: Life Histories, Nests, and Associates.* Washington: Smithsonian Institution Press 570 pp.
46. Krombein, K.V. Unpublished observation.
47. Kugler, C. 1994. Revision of the ant genus *Rogeria* (Hymenoptera: Formicidae) with descriptions of the sting apparatus. Journal of Hymenoptera Research 3:17-89.
48. Kukuk, P.F., B. Alexander, G.C. Eickwort, R. Gibson, R.A. Morse, F.L.W. Ratnieks & M. Raveret-Richter 1989. The importance of the sting in the evolution of sociality in the Hymenoptera. Annals of the Entomological Society of America 82:1-5.
48a. Lattke, J.E. 1991. Studies of neotropical *Amblyopone* Erichson (Hymenoptera: Formicidae). Contributions in Science (Los Angeles) (418):1-7.
48b. Leclercq, J. & M. Terzo. 2006. Hyménopteres crabroniens des Amériques du genre *Enoplolindenius* Rohwer, 1911 (Hymenoptera: Crabronidae: Crabronini). Notes Fauniques de Gembloux 59:157-213.

49. Matthews, R.W. 1991. Sphecid wasps. Pp. 570-600 in: K.G. Ross & R.W. Matthews (eds.), *The Social Biology of Wasps*. Ithaca: Cornell Univ. Press.
50. McGlynn, T.P. 1999. The worldwide transport of ants: geographic distribution and ecological invasions. Journal of Biogeography 26:535-48.
51. Melo, G.A.R. 1999. Phylogenetic relationships and classification of the major lineages of Apoidea (Hymenoptera), with emphasis on the crabronid wasps. University of Kansas Natural History Museum 14:1-55.
52. Menke, A.S. 1988. *Pison* in the New World: A revision (Hymenoptera: Sphecidae: Trypoxylonini). Contrributions of the American Entomological Institute 24:1-171.
53. Menke, A.S. 1992. Mole cricket hunters of the genus *Larra* in the New World (Hymenoptera: Sphecidae, Larrinae). Journal of Hymenoptera Research 1:175-234.
54. Menke, A.S. & F. Fernández C. 1996. Claves ilustradas para las subfamilias, tribus y géneros de esfécidos neotropicales (Apoidea: Sphecidae). Revista de Biología Tropical 44(Suppl. 2):1-68.
55. Michalski, J. 1988. A catalogue and guide to the dragonflies of Trinidad (order Odonata). UWI Dep't of Zoology Occasional Papers (6):1-146.
56. Michener, C.D. 1974. *The Social Behavior of the Bees: A Comparative Study.* Cambridge: Harvard Univ. Press 404 pp.
57. Michener, C.D. 2000. *The Bees of the World.* Baltimore: Johns Hopkins Univ. Press 913 pp.
58. Mickel, C.E. 1938. The neotropical mutillid wasps of the genus *Timulla* Ashmead (Hymenoptera: Mutillidae). Transactions of the Royal Entomological Society of London 87:529-680.
59. Mickel, C.E. 1939. A monograph of the neotropical mutillid genus *Hoplomutilla* Ashmead (Hymenoptera: Mutillidae). Revista de Entomolia (Rio de Janeiro) 10:337-403.
60. Mickel, C.E. 1941. Monograph of the South American genus *Hoplocrates* Mickel (Hymenoptera: Mutillidae). Revista de Entomologia (Rio de Janeiro) 12:341-414.
61. Mickel, C.E. 1952. The Mutillidae (wasps) of British Guiana. Zoologica (New York) 37:105-50.
62. Mitchell, T.B. 1973. *A Subgeneric Revision of the Bee Genus Coelioxys of the Western Hemisphere.* Raleigh: Dep't of Entomology, North Carolina State Univ. 129 pp.
63. Moure, J.S. 1950. Alguns agrupamentos novos de abelhas neotropicais. Dusenia 1:303-06.
64. Moure, J.S. 2000. As espécies do gênero *Eulaema* Lepeltier, 1841 (Hymenoptera, Apidae, Euglossinae). Acta Biological Paraense 29:1070.
65. Moure. J.S. & P.D. Hurd 1987. *An Annotated Catalog of the Halictid Bees of the Western Hemisphere*. Washington: Smithsonian Inst. Press 405 pp.
66. Moure, J.S. & C.A.C. Seabra 1962. Três esécies novas de *Centris (Ptilotopus)* Klug, 1810 (Hymenoptera - Apoidea). Boletim da Universidade Federal do Paraná, Zoologia. 1(14):1-13.
67. Moure, J.S., D. Urban & G.A.R. Melos (eds.) 2007. *Catalogue of Bees (Hymenoptera, Apoidea) in the Neotropical Region.* Curitiba: Sociedade Brasileira de Entomologia 1058 pp.
68. Murphy, J.C. 1997. *Amphibians and Reptiles of Trinidad and Tobago.* Malabar, Florida: Krieger 245 pp.

69. Neff, J.L. Unpublished observation.
70. Pulawski, W.J. 1974. A revision of the neotropical *Tachysphex* Kohl (Hym.: Sphecidae). Polskie Pismo Entomologiczne 44:3-102.
71. Quintero, D. & R.A. Cambra. Unpublished observation.
72. Phillip, D.A.T. & I.W. Ramnarine 2001. *A Guide to the Freshwater Fishes of Trinidad and Tobago.* St Augustine: Dep't of Life Sciences, Univ. of the West Indies 79 pp.
73. Richards, O.W. 1934. The American species of the genus *Trypoxylon*. Transactions of the Royal Entomological Society of London 82:173-306
74. Richards, O.W. 1972. The species of the South American wasps of the genus *Microstigmus* Ducke (Hymenoptera: Sphecoidea: Pemphredoninae). Transactions of the Royal Entomological Society of London 124:123-48.
75. Richards, O.W. 1978. *The Social Wasps of the Americas, Excluding the Vespinae.* London: British Museum (Natural History) 580 pp.
76. Ross, K.G. & R.W. Matthews (eds.) 1991. *The Social Biology of Wasps.* Ithaca: Cornell Univ. Press 678 pp.
77. Roubik, D.W. 1989. *Ecology and Natural History of Tropical Bees*. Cambridge: Cambridge Univ. Press 514 pp.
78. Roubik, D.W. & P.E. Hanson 2004. *Abejas de Orquídeas de América Tropical / Orchid Bees of Tropical America.* Santo Domingo de Heredia: INBio 370 pp.
79. Sakagami, S.F. 1982. Stingless bees. Pp. 361-423 in: H.R. Hermann (ed.). *Social Insects*. Vol. 3. New York: Academic.
80. Scheffrahn, R.H., J. Krecek, B. Maharajh, J.A. Chase, J.R. Mangold & C.K. Starr 2003. Termite fauna (Isoptera) of Trinidad & Tobago, West Indies. UWI Dep't of Life Sciences Occasional Papers (12): 33-38.
81. Schmidt, J.O. 1990. Hymenopteran venoms: Striving toward the ultimate defense against vertebrates. Pp. 387-419 in: D.L. Evans & J.O. Schmidt (eds.), *Insect Defenses.* Stony Brook: SUNY Press.
82. Schneirla, T.C. 1971. *Army Ants: A Study in Social Organization*. San Francisco: Freeman 349 pp.
83. Snelling, R.R. 1974. Notes on the distribution and taxonomy of some North American *Centris*. Contributions in Science (259):1-41.
84. Snelling, R.R. 1982. The taxonomy of some neotropical *Hylaeus* and descriptions of new taxa. Bulletin of the Southern California Academy of Sciences 82:12-16.
85. Snelling, R.R. 1984. Studies on the taxonomy and distribution of American centridine bees (Hymenoptera: Anthophoridae). Contributions in Science (347):1-69.
86. Snelling, R.R. Unpublished observation.
87. Starr, C.K. 1985. Enabling mechanisms in the origin of sociality in the Hymenoptera: The sting's the thing. Annals of the Entomological Society of America 78:836-40.
88. Starr, C.K. 1989. In reply, is the sting the thing? Annals of the Entomological Society of America 82:6-8.
89. Starr, C.K. 1993. Mickel paratypes at the University of the West Indies. Sphecos (24):21.
90. Starr, C.K. In press. Trinidad & Tobago. In: R. Gillespie & D. Clague (eds.), *Encyclopedia of Islands.* Berkeley: Univ. California Press.
91. Starr, C.K. Unpublished observation.
92. Starr, C.K. & A.W. Hook 2003. The aculeate hymenoptera of Trinidad, West Indies.

Occasional Papers of the Department of Life Sciences, University of the West Indies (12):1-31.
93. Starr, C.K. & A.W. Hook 2006. *Polistes goeldii* (Hymenoptera: Vespidae) is a widespread but rare social wasp. Journal of Hymenoptera Research 15:177-80.
94. Vardy, C.R. 1978. A revision of the neotropical wasp genus *Trigonopsis* Perty (Hymenoptera: Sphecidae). Bulletin of the British Museum (Natural History) (Entomology) 37:117-52.
95. Vardy, C.R. 2000. The New World tarantula-hawk wasp genus *Pepsis* Fabricius (Hymenoptera: Pompilidae). Part 1. Introduction and the *P. rubra* species-group. Zoologische Verhandelingen (332):1-86.
96. Vardy, C.R. 2002. The New World tarantula-hawk wasp genus *Pepsis* Fabricius (Hymenoptera: Pompilidae). Part 2. The *P. grossa*- to *P. deaurata*-groups. Zoologische Verhandelingen (338):1-135.
97. Vardy, C.R. 2005. The New World tarantula-hawk wasp genus *Pepsis* Fabricius (Hymenoptera: Pompilidae). Part 3 The *P. inclyta*- to *P. auriguttata*-groups. Zoologische Mededelingen 79(5):1-305.
98. Ward, P.S. 1992. Ants of the genus *Pseudomyrmex* (Hymenoptera: Formicidae) from Dominican amber, with a synopsis of the extant Antillean species. Psyche 99:55-85.
99. Watkins, J.F. 1992. Ecitoninae: Distribution of New World army ants by genus: species: country: state. Unpubl. list.
100. Wilson, E.O. 1971. *The Insect Societies.* Cambridge: Harvard Univ. Press 548 pp.
101. Wilson, E.O. 2003. *Pheidole in the New World.* Cambridge: Harvard Univ. Press 794 pp.
102. Zuijlen, J.W.A. van 1994. The *amazonica* species group of the genus *Nitela* Latreille (Hymenoptera: Sphecidae: Crabroninae). Zoologische Mededeelingen 68:249-69.