

## A FAUNISTIC REVIEW OF AUCHENORRHYNCHA ON SUGARCANE

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### ABSTRACT

Sugarcane, native to Papua New Guinea, has been introduced to many lowland tropical areas of the world and in these regions a considerable pest complex has built up. Species of Auchenorrhyncha from the families Delphacidae, Lophopidae, Tropiduchidae and Cercopidae have been noted as pests but, interestingly, rather few cicadellid species. In general, the various species on sugarcane have either been introduced into growing areas, such as the well-known delphacid *Perkinsiella saccharicida* Kirkaldy or, more commonly, have locally adapted to sugarcane, presumably from other grasses. An interesting situation exists in New Guinea where *Saccharum* spp. are native and the delphacid genera *Perkinsiella* and *Eumetopina*, known almost exclusively from sugarcane, are especially rich in species.

### KEY WORDS

Sugarcane, *Saccharum*, Auchenorrhyncha, leafhoppers, planthoppers, cicadas, Cercopidae, froghoppers, Fulgoroidea, *Perkinsiella*, *Eumetopina*, *Pyrilla*, Papua New Guinea.

### INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) has been introduced into many lowland tropical regions. There appears to have been no unified account of Auchenorrhyncha associated with sugarcane, although Fennah (1969) surveyed the Fulgoroidea and Fewkes (1969) reviewed the Cercopidae. This paper is an attempt to summarise information on the species on sugarcane. The bibliography has necessarily been kept as short as possible and has been selected to give significant records and emphasis on review papers.

### SACCHARUM SPP. AND DISTRIBUTION

The perennial grass genus *Saccharum* consists of six Old World species (Purseglove, 1972). Only two of these occur in the wild; *S. spontaneum* L. from N.E. Africa through Asia to the Pacific and *S. robustum* Brandes & Jeswiet ex

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Grassl confined to New Guinea and neighbouring islands. The other four species; *S. officinarum* L. (known as noble canes because of the thick stems), *S. barberi* Jeswiet, *S. sinense* Roxb. and *S. edule* Hassk are all cultigens and apparently cannot survive in the wild state. It is now generally accepted that the commercial sugarcane *S. officinarum* originated in Papua New Guinea, where various forms are grown as a native domestic garden crop (Artschwager & Brandes, 1958). The work of Brandes (in Artschwager & Brandes, 1958) has shown that dispersal by man was made as early as 8000 BC to the Solomon Islands, New Hebrides and New Caledonia and from 6000 BC to Indonesia, Philippines and N. India. Wider dispersal was made from AD 600 to 1100 to other parts of Oceania and commercial growing dramatically extended the range from the 16th century to the present. Strong *et al.* (1977) provide a convenient table of the dates of introduction.

## SUGARCANE PESTS

The most destructive pests are lepidopterous stem-borers in several genera. In some areas "white-grubs", the larvae of Melolonthidae (Coleoptera) are important, as are aphids and scale insects. Auchenorrhyncha species as sugarcane pests are mostly of local importance only. Relatively little space is devoted to the pests of sugarcane in general accounts such as Purseglove (1972), Blackburn (1984), and even less to Auchenorrhyncha species, with the notable exceptions of froghoppers in the Neotropical Region and the transmission of Fiji virus by *Perkinsiella* species (Delphacidae) (see also below). Some very useful accounts of various sugarcane pests are given in Williams *et al.* (1969). Regional accounts have been also useful in the preparation of this review: Malaysia (Lim & Pan, 1980); Papua New Guinea (Szent-Ivany & Ardley, 1963; Bourke, 1969); Pacific (Pemberton, 1963); India (Butani, 1961); Sri Lanka (Rajendra, 1979); Japan (Ito, 1976).

## AUCHENORRHYNCHA ON SUGARCANE

Over 300 Auchenorrhyncha species are listed by Box (1953) as having been found on sugarcane. The largest group is the Fulgoroidea (over 150 spp), with fewer Cicadellidae (83), Cercopidae (60), Membracidae (3) and Cicadidae (3). The list of insects presented by Box does not facilitate discrimination between casual records of insect incidence and actual associations of continuous breeding on the plant. Records of more positive association with sugarcane, such as larval host plant, are summarised and discussed below.

### Fulgoroidea

Among the 150 species recorded by Box (1953) 12 families are represented. Fennah (1969) summarised the economic status of sugarcane Fulgoroidea and discussed the biology of the major pests. He concluded that most of these records are casual associations only and very few species are associated with sugarcane in all stages of their life history. Important pest species are found in three families, Lophophidae, Tropiduchidae and particularly Delphacidae.



### Family Delphacidae

Species of Delphacidae from six genera are known to breed on sugarcane. Most notable are species of *Perkinsiella*. Over 30 species of this genus are known, mostly in the Oriental Region, and at least 20 species have been found on sugarcane. Thirteen species are found on sugarcane in Papua New Guinea (Fennah 1979). The most notorious species is *P. saccharicida* Kirkaldy, best known since it almost destroyed the Hawaiian sugar industry after accidental introduction from Australia in about 1900. The story of its partial control by parasites and eventual total control by the mirid egg predator *Tytthus mundulus* (Breddin) after 1921 has been given by Swezey (1936). Swezey (1936) and Pemberton (1951) both reported that total control was achieved and continued by the introduction of *T. mundulus*. *P. saccharicida* is now widespread (CAB, 1987) and remains a potential pest in Australia (Bull, 1972), S. Africa (Harris, 1970), and Mauritius (Williams, 1957). It is recorded as a "major leafhopper pest" in Sri Lanka (Rajendra, 1979) and a "major pest" in Malaysia (Lim & Pan, 1980) and has been recently been found for the first time in mainland USA, in Florida (Sosa, 1982). Some varietal resistance to attack by *P. saccharicida* may be present. The removal of the variety NCo310 from areas in Queensland decreased the incidence of the species to relative insignificance (Bureau of Sugar Exp. Station Report, 1984). It might be considered that the accidental introduction of *P. saccharicida* to Hawaii was highly beneficial to Fulgoroidea research. Its damage to sugarcane led directly to the formation of the Division of Entomology of the Hawaiian Sugar Planters Association and to the employment of Frederick Muir (among other notable entomologists) whose work has provided the foundation of all subsequent Fulgoroidea research.

In Japan *P. sinensis* Kirkaldy is noted as "moderately important" (Takara & Azuma, 1969). Vectors of the important Fiji virus are discussed by Chang & Ota (1979). This disease is transmitted by *P. saccharicida* in Australia (Bull, 1972), by *P. vitiensis* Kirkaldy in Fiji, and *P. vastatrix* (Breddin) in the Philippines. The disease is absent in Hawaii.

Of the seven species of *Saccharosydne*, only *S. saccharivora* (Westwood) is known to breed on sugarcane (Fennah, 1969). The species is known as the West Indian Cane Fly and is found in the West Indies, neighboring parts of N, S and Central America and in Jamaica where it has been a major pest (Metcalf, 1969). Metcalf (1969) reviewed the recorded host plants of *S. saccharivora* and searched for the native host plants in Belize following an outbreak of the species. He concluded that the original host plants, prior to introduction of sugarcane to the area, were *Andropogon bicornis* and *A. glomeratus*. This conclusion is in keeping with the known hosts of the other *Saccharosydne* species.

*Eoerysa flavocapitata* Muir is widely distributed in the Oriental region and has been noted as a sugarcane pest in India (Chatterjee & Choudhuri, 1979), Pakistan (Mirza & Quadri, 1964) and Taiwan (Jiang, 1976). The adults and nymphs are found in the leaf rolls of sugarcane and are frequently ant-attended.

*Eumetopina* spp. resemble *E. flavocapitata* in appearance, being elongate, and slightly flattened. They are also found in leaf rolls and are ant-attended. All five Asian *Eumetopina* species are known only from sugarcane. *E. "flavipes"* Muir [this may be a misidentification] is widely distributed on sugarcane in the Oriental Region and it is recorded as a "major pest" in Malaysia (Lim & Pan, 1980). Recent collecting in PNG has revealed at least nine species from sugarcane. Bourke (1969) states that a *Eumetopina* sp. was sufficiently numerous in the leaf-rolls that it might develop into a major pest. *Eumetopina* spp are now suspected as acting as virus vectors.

*Numata muiri* (Kirkaldy) was originally distributed in Taiwan, S. China, Philippines, Java and Borneo (Fennah, 1969) and it has been introduced into Mauritius, Reunion and Madagascar (Williams, 1957). The biology is described in Williams (1957), and it is concluded that it is "never sufficiently numerous to be harmful to cane growth" (Williams & Mamet, 1962).

Various species of *Tropidocephala* are associated with *Saccharum* spp. Lim & Pan (1980) record *T. saccharivorella* Matsumura as a "major pest" to sugarcane in Malaysia and it is recorded as of minor importance in Sri Lanka (Rajendra, 1979). *T. signata* Distant is also recorded as damaging sugarcane in Sri Lanka (Rajendra, 1979). Three *Tropidocephala* species were recently found on *S. spontaneum* in Java (Wilson, unpublished).

#### Family Lophopidae

Two genera of Lophopidae are found regularly on sugarcane: *Pyrilla* and *Lophops*. *Pyrilla perpusilla* (Walker) is frequently considered to be one of the major pests of sugarcane in India. Fennah (1963) reviewed all *Pyrilla* species in India and concluded that two polytypic species, *P. perpusilla* (Walker) and *P. aberrans* (Kirby) were present. He also recognised sub-species of each species. Generally *P. perpusilla* is considered the sugarcane pest species. The extensive literature has been reviewed by Butani (1964) who gave details of the biology (also summarised by Fennah, 1969). *P. perpusilla* is able to breed on a range of grass species. In the absence of sugarcane during winter months these "alternate hosts" (sensu Butani, 1964) are used for overwintering and migration occurs to sugarcane in the spring. Due to the antiquity of sugarcane cultivation in India it may be impossible to deduce the original hosts of *Pyrilla*. *Pyrilla* species are common only in India. Few records exist for species outside India.

Species of the Oriental genus *Lophops* are frequently found on sugarcane but are not considered important pests. *Lophops saccharicida* (Kirkaldy) is recorded from sugarcane in Sri Lanka (Rajendra, 1979) [this record is unlikely to refer to true *saccharicida* Kirkaldy which is an Australian species, originally noted from "sugarcane and grasses"]. In Papua New Guinea "dense populations" of a species of *Serida* [probably actually a *Lophops* sp.] were found on *S. robustum* (Szent-Ivany & Ardley, 1963). Bourke (1969) records the same species as well as a further species listed as "Gen et sp indet".



### Family Tropiduchidae

Since 1963 *Numicia viridis* Muir has been noted as a sugarcane pest in S. Africa (Dick, 1963; Carnegie, 1967). There are many other *Numicia* species in Africa and so far as is known they are confined to wild grasses and do not attack sugarcane.

### Family Derbidae

Box (1953) records 45 derbid species from sugarcane. Probably, as with palms (Wilson, 1987) many derbids congregate to feed as adults but their nymphal stages are elsewhere (e.g. feeding on fungus in rotten vegetation). *Proutista moesta* (Westwood), one of the commonest Asian derbids is frequently noted from sugarcane; e.g. in Sri Lanka (Rajendra, 1979), in India (Butani, 1961), the Philippines (Pemberton, 1963). Bourke (1969) records *Proutista* spp in Papua New Guinea.

### Cicadoidea

Somewhat surprisingly, since cicadas are not usually regarded as crop pests, cicada nymphs have been noted as serious sugarcane pests in several areas since the early 1960's (Table 1). Ito & Nagamine (1981) have reviewed the literature and argue that at least for *Mogannia minuta* in Japan "escape" from predation may be the cause of such outbreaks. It appears possible that the use of organochlorine insecticides may have destroyed natural enemies in some cases.

Table 1. Cicada species recorded as sugarcane pests.

Species	Locality	date	Reference
<i>Yanga guttulata</i> Signoret	Madagascar	since 1962	Montsarrat (1978)
<i>Melampsalta puer</i> (Walker)	Queensland	since 1962	Wilson (1969)
<i>Parnkalla muelleri</i> Distant	Queensland	since 1964	Wilson (1969)
<i>Mogannia hebes</i> Walker	Taiwan	since 1962	Chen & Hung (1969)
<i>Mogannia minuta</i> Mats.	Japan	since 1965	Ito & Nagamine (1981), Ito (1976)
<i>Platypleura kuroi</i> Mats.	Japan	since 1973	Nagamine & Ito (1982)
<i>Proarna bergi</i> Distant	Argentina	since 1969	Costilla <i>et al.</i> (1971)

### Cicadelloidea

Few cicadellids are positively associated with sugarcane judging by the various surveys that have been conducted, in spite of the large numbers of species (83) recorded by Box (1953). This is probably under-recording and various species might occur either breeding on sugarcane, as outbreak pests such as *Yamatotettix* spp. (= *Pruthiana*) [revised by Webb (1986)] or as virus vectors eg. *Cicadulina* species.

### Cercopoidea

Cercopid froghoppers are very serious pests of sugarcane, almost exclusively, in the New World and mostly concerning species of the family Cercopidae. Fewkes (1969) has reviewed the biology and pest status lists 66 species recorded from sugarcane.

### Membracoidea

No species recorded as breeding on sugarcane. The few available records are probably of casual records.

## DISCUSSION

It is clear that a whole range of insects have adapted to feeding on sugarcane as witnessed by the list given by Box (1953). It is also clear that in each area a distinct insect fauna has developed (Long & Hensley, 1972; Pemberton & Williams, 1969). This species accumulation is most evident outside the Oriental region where sugarcane has been introduced in very recent times and may have been rather rapid (Strong *et al.*, 1977). In most, if not all, case the original hosts of sugarcane pests are other grasses. As far as the Auchenorrhyncha are concerned this accumulation is most evident for neotropical cercopids. Interestingly rather few cercopid species are regularly found on sugarcane in the Oriental region. In contrast the number of species of Delphacidae breeding on sugarcane in the Oriental and Pacific regions is impressive and especially so in Papua New Guinea. Here we find the highest concentration of sugarcane-associated *Perkinsiella* and *Eumetopina* species. Papua New Guinea is a large tropical island with many high peaks and deep valleys and in many groups extensive speciation has occurred. Is it a coincidence that PNG is also the supposed original area for sugarcane? I think not. We do not, however, have positive evidence that all these *Perkinsiella* and *Eumetopina* species are confined to sugarcane. As with many records from crop plants emphasis has often, naturally enough, been placed on that particular crop without sufficient attention being placed on searching other plants for the same species. Even if wild plants are well searched the absence of the species is frequently not recorded.

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