BIOLOGICAL NOTES ON SOME COCCINELLIDAE FROM EAST AFRICA.

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Introduction.

During the latter half of 1936 a search was undertaken for predators and parasites that might be of use against certain COCCIDAE which are causing considerable damage to the coconut crop in Seychelles.

Many species of COCCINELLIDAE were collected during this search and certain species were finally selected for trial in Seychelles. The collection which was made has been determined by the Imperial Institute of Entomology and the object of this paper is to place on record certain facts on the distribution and habits of the species encountered.

The first consideration was to search through the coastal coconut belt of East Africa for any insects which might be controlling the scale species known to attack the coconut in Seychelles. At an early stage in the investigation, however, it was found that scale-insects on coconuts were very scarce in East Africa, and that the Seychelles species in particular were quite absent on this host. In these circumstances it was necessary to examine a wide variety of plants for scale attack, but even with this wider view-point scale-insects remained difficult to find. The only plant which was found at all frequently attacked by scales, and could consequently be expected to harbour COCCINELLIDAE, was the introduced *Bambusa vulgaris*. Bamboo clumps were therefore regularly examined, and this accounts for the large number of records from this host.

General Observations on the East African Coccinellidae.

The East African predacious COCCINELLIDAE appear to be very catholic in their requirements as to the species of scale devoured and the host plant visited. From a broader aspect, however, they may be rather easily divided into four food groups, namely: predators, (*a*) of DIASPIDINAE, (*b*) of LECANIINAE and ERIOCOCCINAE, (*c*) of MONOPHLEBINAE, and (*d*) of APHIDIDAE. A fifth group composed of fungus mycelium feeders, and a sixth group of plant feeders were also encountered.

Correlated with the above divisions rather interesting colour pattern resemblances can be detected which, considering the distasteful nature of these beetles, and the frequent association of species with the same geographical range and food requirements, might be regarded as a case of Mullerian mimicry.

It is further interesting to note a tendency for members of a certain food group, but with a different distribution, to conform to a different pattern group. These pattern characteristics were found in practice to be a useful rapid guide to the food required by fresh species collected by random methods. Upon several occasions a suitable scale could be offered to an insect taken in the sweep net by referring it to the correct feeding group as indicated by its pattern.

The COCCINELLIDAE of the coastal regions of Tanganyika Territory, including the Islands of Zanzibar and Mafia, may therefore be arranged in the following manner :—

DIVISION I.—Predators on COCCIDAE which are usually associated with mature plant growth, *i.e.*, leaves and stems. These predators, while normally ovipositing on their respective prey, exhibit a considerable latitude in their feeding habits in the adult stage. Thus it is common for a predator of LECANIINAE to take an interest in DIASPIDINAE, probably nourishing itself on their waxy secretions. Further,

since these two families of scales frequently occur in mixed communities, it is in accordance with the above proposition that the characteristics of the predators of the two groups should be somewhat similar.

Group (*a*).—Predators on DIASPIDINAE, which are round in shape, variable in size, sluggish in movements ; colour shiny black, with the secondary markings, when present, obscure. Species represented :—*Chilocorus distigma, Chilocorus wahlbergi, Lotis bicolor, Serangium kunowi.*

The predators of the DIASPIDINAE from the Usambara Mountains, while mutually resembling each other, differ completely from the above lowland type. These beetles are small, light brown in colour, with edgings or areas of dark brown. The commonest species in this group is one determined as a variety of *Platynaspis kollari.* Other species represented are *Hemipharis cautus, Lotis* sp., *Scymnus* spp., and other genera which have not been determined.

Group (*b*).—Predators on LECANIINAE and ERIOCOCCINAE, which are similar to the first of the above types but more oval in shape, and more active in their movements :—*Exochomus ventralis, Hyperaspis usambarica.*

Exochomus flavipes, the adults of which were only collected upon one occasion, should, on colour pattern grounds, belong to this group. They were, however, taken in association with APHIDIDAE on cotton, but these insects may not be their primary prey, since both the adults of *E. ventralis* and the *Hyperaspis* will eat APHIDIDAE under conditions of captivity.

DIVISION II.—Predators on COCCIDAE and APHIDIDAE, which are often associated with tender plant growth. The COCCIDAE in this category are usually mealy-bugs (MONOPHLEBINAE). There seems some reason to suppose that a number of COCCINELLIDAE vary their diet (especially in the adult stage) between APHIDIDAE and mealy-bugs, and in any case the similar position on the plant of these two Homopterous groups is sufficient to account for the over-lap in the colour pattern of their predators, whilst still supporting the above thesis.

Group (*c*).—Predators on MONOPHLEBINAE, which are of a uniform rosy or brick red. Species represented :—*Rodolia* spp., including *R.? argodi.*

Group (*d*).—Predators on APHIDIDAE, and also occasionally on ALEYRODIDAE, the pattern and size of which is variable. Red predominates, sometimes tending to orange-yellow, with black stripes or areas ; often variegated. Species represented :—*Cydonia lunata, Brumus suturalis, Platynaspis rufipennis, P. salaamensis, P. kollari, P. capicola.*

Cydonia 4-lineata, the prey of which was not ascertained, belongs to this group as regards pattern, and so it is interesting to find that Paoli (1934, Prodromo Ent. Agrav. Sornal. Ital., p. 269) records this species as preying on *Aphis* sp.

DIVISION III.—Feeders on fungus mycelium. The beetles in this division are predominantly yellow, with or without darker or even black spots and markings. Species represented :—*Thea imbecilla, T. variegata, Dysis orientalis.*

DIVISION IV.—Plant feeders. The phytophagous species collected belonged mainly to the genus *Epilachna*, but the material has not been fully determined. These beetles are large, brick red, rarely dull yellow, and coarsely spotted, or marked with black, these markings tending to obscure the ground-colour so that some forms might be considered to be black coarsely spotted with red or dull yellow. Species determined :—*Epilachna chrysomelina*, F., *E. punctipennis*, Muls., *Solanophila zuluensis*, Crotch.

Other than members of the genus *Scymnus*, nearly all the species collected have been satisfactorily placed in the above groupings, the main exceptions being the following species :—*Alesia amoenula*, by colour pattern belonging to group (*d*), but possibly as Paoli (*l.c.*) suggests, associated with DIASPIDINAE ; *A. striata*, by colour

pattern belonging to group (*d*), but both the larvae and adults feed on the pollen of *Panicum* sp. ; *Ortalia ochracea*, by colour pattern belonging to the fungus-feeders, but though its food habits were not ascertained, this species appear to be predacious.

Enumeration of the Species collected.

In view of the scarcity of scales the coastal districts of Tanganyika did not prove a very lucrative hunting-ground for their parasites and predators. The species of COCCINELLIDAE collected, however, seem to be fairly representative of the district and so it is worth while putting on record such information as has become available. This is best arranged in the form of a table, as follows :—

Coccinellid	Prey or Food	Host-Plant	Type of Country	Districts
Chilocorus distigma, Kl.	*Aspidiotus lataniae*	Coconut	Coconut plantation	Dar - es - Salaam, Bagamoyo, Tanga, Mafia I.
	Ischnaspis longirostris	Oil palm	,, ,,	Dar-es-Salaam
	Pinnaspis bambusae	*Bambusa vulgaris*	,, ,,	Dar-es-Salaam, Tanga, Morogoro, Mafia I.
	,, ,,	Native bamboo	" Miombo " vegetation	Lindi
	Lepidosaphes dispar	Cassava	Cassava fields	Lindi, Mikindani, Masasi
Chilocorus wahlbergi, Muls.	*Aspidiotus lataniae*	Coconut	Coconut plantation	Mombasa, Dar - es - Salaam, Bagamoyo
	Ischnaspis longirostris	Oil palm	,, ,,	Dar-es-Salaam, Tanga
	Pinnaspis bambusae	*Bambusa vulgaris*	Areas of native cultivation	Morogoro, Tanga, Rufiji
	,, ,,	Native bamboo	" Miombo " vegetation	Lindi
	Lepidosaphes sp.	Citrus	Citrus nursery	Tanga
Lotis bicolor, Wse.	—	Coconut	Coconut plantation	Bagamoyo, Mafia I.
	—	Citrus	Citrus nursery	Morogoro, Tanga
	Pinnaspis bambusae	Native bamboo	" Miombo " vegetation	Lindi
Lotis sp. nov. ?	*Pinnaspis* sp.	Ornamental palm	Gardens at Amani	Usambara
Serangium kunowi, Wse.	*Pinnaspis bambusae*	*Bambusa vulgaris*	Areas of native cultivation	Morogoro, Rufiji, Tanga, Mafia I.
	Pinnaspis sp.	Ornamental palm	Gardens at Amani	Usambara
Exochomus ventralis, Gerst.	*Lecanium tesselatum*	*Sapindus* sp.	Town avenue	Tanga
	—	Coconut	Coconut plantation	Dar-es-Salaam
	—	*Bambusa vulgaris*	Areas of native cultivation	Tanga
	? Aphis sp.	Cotton	,, ,, ,, ,,	Lindi
	—	Native bamboo	" Miombo " vegetation	Lindi
Exochomus flavipes, Th.	*Aphis* sp.	Cotton	Areas of native cultivation	Lindi
Hyperaspis usambarica, Wse.	*Lecanium tesselatum* and/or *Pulvinaria* sp.	*Sapindus* sp.	Town avenue	Tanga
	L. viride	*Plumeria acutifolia*	Gardens	Mafia I.
Rodolia ? argodi, Sic.	Mealy-bug	Undet. shrub	Sea coast	Mafia I.
Cydonia lunata, F.	*Aphis* sp.	Cotton	Areas of native cultivation	Tanga, Lindi
ab. *sulphurea*	—	—	,, ,, ,, ,,	Mafia I.
Cydonia 4-lineata, Muls.	—	Coconut	Coconut plantation	Dar-es-Salaam, Tanga

Coccinellid	Prey or Food	Host-Plant	Type of Country	Districts
Brumus suturalis, F.	? *Aphis* sp.	Cotton	Areas of native cultivation	Lindi
Platynaspis kollari, Muls. *P. kollari*, var.	*Cerataphis* sp. — *Pinnaspis bambusae*	Coconut — *Bambusa vulgaris*	Areas of native cultivation ,, ,, ,, ,, Secondary forest	*Lindi* Morogoro Usambara
Platynaspis capicola, Cr.	*Cerataphis* sp. ALEYRODIDAE —	Coconut Citrus Banana	Areas of native cultivation ,, ,, ,, ,, ,, ,, ,, ,,	Lindi Mafia I. Mafia (Tchole I.)
Platynaspis rufipennis, Gerst.	*Aphis* sp.	Citrus	Areas of native cultivation	Tanga, Usambara
Platynaspis salaamensis, Wse.	*Aphis* sp.	Citrus	Areas of native cultivation	Tanga
Alesia amoenula, Gerst.	— — —	*Bambusa vulgaris* *Sapindus* Citrus	Areas of native cultivation Town avenue Areas of native cultivation	Rufiji, Tanga Tanga Tanga
Alesia striata, F.	Anthers or pollen	*Panicum* spp.	Coconut plantation	Bagamoyo, Mafia I.
Ortalia ochracea, Wse.	— —	Oil palm Mulberry	Coconut plantation Gardens	Tanga Morogoro
Aulis mitis, Wse., var.	—	*Bambusa vulgaris*	Areas of native cultivation	Tanga
Pharoscymnus semiglobosus, Kirsch	—	—	Areas of native cultivation	Tanga
Hemipharis cautus, Wse.	*Pinnaspis bambusae*	*Bambusa vulgaris*	Secondary forest	Usambara
Nephus njalensis, Sic.	*Pinnaspis bambusae*	*Bambusa vulgaris*	Coconut plantation	Mafia I.
Scymnus trepidulus, Wse.	*Pinnaspis bambusae*	*Bambusa vulgaris*	Coconut plantation	Zanzibar I.
Scymnus guttulatus, Sic.	*Pinnaspis bambusae*	*Bambusa vulgaris*	Cultivated areas	Rufiji, Usambara, Mafia I.
Thea imbecilla, Gerst.	Mycelium ,,	Castor Mulberry	Areas of native cultivation Garden	Mafia (Tchole I.) Morogoro
Thea variegata, F.	Mycelium	Papaw	Coconut plantation	Zanzibar I.
Dysis orientalis, Wse.	Mycelium ,,	Papaw Mulberry	Cultivated areas Garden	Mafia I., Zanzibar I. Morogoro