Zeitschrift: Acta Tropica
Herausgeber: Schweizerisches Tropeninstitut (Basel)
Band: 13 (1956)
Heft: 4

Artikel: Miscellanea : Insects in Southern Rhodesian Tobacco culture. Part I, Insects occurring in seed-beds
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DOI: https://doi.org/10.5169/seals-310615

Insects in Southern Rhodesian Tobacco Culture.[1]

Part I: Insects occurring in seed-beds.

By G. H. Bünzli [2] and W. W. Büttiker [2].

A. *Noxious Insects in seed-beds, with remarks relative to Field Tobacco.*

Inspections made of seed-beds of Virginia Tobacco during the seasons 1949-52, sowings cover the months September to December inclusive, offered an opportunity of recording all the insects which visit or dwell inside seed-bed sites.

Insects injurious and benevolent which also occur in Tobacco Field are listed in instances where no further reference will be made in subsequent publications.

RHYNCHOTA.

HOMOPTERA.

Aphidae: Greenflies.

Myzus persicae Sulz. Impairing general growth, affecting quality of leaf. Potential carrier of the Rosette Virus disease (Wickens 1938).

In all sowings, particularly in later ones and in Field Tobacco, very common. Non-pulled plants liable to carry Aphids through the off-season.

Routine control measures of this pest, which is on the increase, are imperative in order to prevent severe infestations of Field Tobacco.

Ropalosiphum maidis Fitch. Occasionally in pure colonies, but more often together with *M. persicae*. Also occurring in abandoned seed-bed sites on regrowth and self-sown plants in the off-season. Other host-plants in Southern Rhodesia: Maize; according to Hall (1934), also *Eleusine indica* (Rapoko grass) and *Hordeum vulgare*.

Macrosiphum sp. Sporadic, usually together with *M. persicae* colonies.

For host-range *Myzus persicae* in Southern Rhodesia vide forthcoming publication.

Aleurodidae: Whiteflies.

Bemisia rhodesiaensis Corb., potential vector of the Tobacco Leaf-curl Disease (Nicotiana Virus 10 K. M. Smith). Indigenous shrubs and annual *Vernonia* species are suspected to be alternate host plants. Difficult to trace primary infestation in seed-beds, but it is advocated—especially for seed-beds situated below an elevation of 3,800 ft—to resort to preventive measures. A severe, but localised, outbreak of Leaf-curl occurred in 1949/50. The first serious and widespread incidence of this pest was in 1930/31 (Hopkins 1931, Storey 1932).

Storey recorded *Bemisia gossypiperda* M. & L. (and possibly other species) as the vector of Leaf-curl. The disease also occurs on Tobacco in the Transvaal, Eastern Cape (Moore 1939) and Nyasaland (Smee 1943).

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[1] Serial papers covering part of the activity (1948-1952) of the Entomological Section of the Tobacco Pest Control Research Scheme sponsored by the Government of Southern Rhodesia and the Rhodesia Tobacco Association.

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An Aleyrodid transmits a similar virus on to Tobacco in Java (THUNG quoted by HOPKINS 1932).

PRUTHI and SAMUEL (1937, 1939, 1941, 1942) in Bihar (Northern India) extensively studied the host range of the Leaf-curl Disease of Tobacco, vector *Bemisia tabaci* Germ. syn. *gossypiperda* M. & L.

HETEROPTERA: True Bugs, none in seed-beds, but present on Field Tobacco.

Pentatomidae:

Nezara robusta Dist., occasional; damage: holes in leaves.

Aspongopus vidualis Fabr., fairly common, strongly suspected to be the cause of wilting of leaves, saliva being phytotoxic. In Florida, QUAINTANCE (quoted by CAPUS et coll., 1929) ascertained similar yellowing and wilting due to *Dicyphus minimus* Uhler (Suck-fly of Tobacco).

Gampsocoris (Berytidae) seldom.

Myridae: (Capsidae).

Gallobelicus (Engytatus) volucer Kirk., most common, feeding and breeding throughout the year (proved on experimental and off-seasons growth) on Tobacco alike one other indet. *Gallobelicus* sp. Natural host-plant *Iboza multiflora* (Benth.) E. A. Bruce. *G. volucer* is also cannibalistic and carnivorous; often together with *Myzus persicae*. ROBERTS (1930) proved experimentally that the saliva of *G. volucer* causes rolling and puckering of the leaf surface but does not transmit Tobacco Mosaic.

LEPIDOPTERA.

Arctiidae:

Spilosoma flava Wllgrn., rare, December.

Sp. metharhoda Wlk., also attacking tobacco in the Philippines.

Noctuidae: Cutworms etc.

Agrotis segetis L. (= *Euxoa segetis* Schiff.). Common occurrence throughout all sowings. First eggs laid on cotyledons of weeds before Tobacco seeds have germinated. Danger of influx of egg-laying moth permanent especially on dry grass thatched seed-beds. Onset of early rains enhances the pest.

Routine prophylactic measures strongly advocated.

Agrotis longidentifera Hmpsn. and *A. spinifera* Hubn. sporadic, mostly associated with the predominant *A. segetis*. For potatoes, in addition, *Ariathisa excisa* H.-S. is on record.

Laphygma (Caradrina) exigua Hb., ("Lesser Army Worm"), fairly common, also in young Lucerne; JACK (1915) recorded it on early Potatoes. Typical Southern Rhodesian host-plant on sandy soils ascertained to be the weed *Gisekia pharnaceoides* L. and *Indigofera* sp., the first often being completely defoliated. According to HOWARD (quoted by JACK) the predominant host-plant in the Transvaal is *Amaranthus paniculatus*.

JACK (1935) found *L. leucophlebia* Hmps. causing damage to very young Tobacco seedlings.

Miselia inferior Guen., occasionally in Tobacco seed-beds, also on Potatoes.

Phytometra (Plusia) limbirena Guen., widespread but only occasionally the populations are large enough to create a pest. On Tobacco the semi-looper *Ph. signata* F. has been recorded in Sumatra and *Ph. chalcytes* F. in the Philip-

pines (DAMMERMAN 1929). *Ph. orichalcea* also abundant in Southern Rhodesia (JACK 1915), does not attack Tobacco.

Prodenia litura F. *(littoralis* Boisd.), Tomato caterpillar, not frequent up to December but later common on old Tobacco seedling plants often causing complete defoliation. Also occasionally attacking Field Tobacco.

Heliothis obsoleta F. (*Chloridea armigera* Hb.) Tobacco Budworm = American (Cotton) Bollworm. Occasionally in late sowings more often on Field Tobacco. End December-January eating leaves and buds of young Field Tobacco; later, until May, often severe damage to full grown plants. Exceptionally abundant on flowerheads.

Gelechiidae:

Gnorimoschema (Gelechia) heliopa Lowr., Tobacco Stemborer, incidence infrequent. Primary infestation in seed-bed plants difficult to be recognised except on older plants, i.e. of second or third pullings.

Preventive measures advocated in certain districts for intermediary and late sowings.

Gnorimoschema (Phthorimaea) operculella Zell., Tobacco (Potato) Leafminer, fairly widespread in later sowings but more prevalent in Field Tobacco on heavier soil types, especially on mixed Farms with Potato growing and storing.

Leaf-miners in seed-beds can cause serious damage by proceeding from the still small leaves to the bud; same risk in the Field if transplants too small.

Natural host-plants *Nicandra physalodes* Gaertn. and *Datura stramonium* L.

Control in seed-beds advocated.

HYMENOPTERA.

Formicidae: Harvester ants collecting Tobacco seed.

Nests inside seed-bed sites and/or adjacent lands.

The sowing of seeds in rather coarsely structured surface soil leaves many seeds temporarily uncovered, giving the ants a chance to satisfy their habits, thus creating uneven stands of seedlings, especially in early sowings; in extreme instances, complete resowing has to be resorted to. Seed already provided with a fair quantity of imbibitional moisture or which have germinated, are not collected by these ants.

Pheidole liengmei Forel, very abundant, the most typical seed collector with a distinct preference for small globular seeds (observations made in fallow lands and open veld).

Preventive and remedial measures very often imperative.

Tetramorium setuliferum Em., nearly as frequent as the above species but not exclusively granivorous: carrying also dead insect bodies into their nests. Control measures necessary.

Tetramorium sericeiventre Em., and

Monomorium afrum André., both seed collectors and scavengers, wide spread but of less frequent incidence, in individual instances, however, as troublesome as the first two species.

Pheidole species (two) unidentified, occurrence not general. *Ph. megacephala* F. is on record as Tobacco seed collector from Nyasaland (SMEE 1942).

In Southern Rhodesia CUTHBERTSON (1928) incriminated 6 species (identified by the well-known Rhodesian Myrmecologist G. ARNOLD), to be granivorous in Southern Rhodesian seed-beds i.e. *Pheidole liengmei* F., *Ph. tenuinodis* Mayr.,

Ph. sculpturata Mayr., *Ph. arnoldii* Forel, *Tetramorium sericeiventre* Em. and *Messor barbatus* L. Other records made available by M. C. MOSSOP, Chief Entomologist, Department of Agriculture, Salisbury: *Pheidole prellii* Forel, *Ph. excellans* Mayr. race *rhodesiania* Forel and *Tetramorium setuliferum* Em. In addition to the latter species, CHORLEY (1939) records *Pheidole liengmei* For. race *micrartifex* For. active during October-November.

The chief harvesting ants in Tobacco seed-beds of Queensland are: *Monomorium rotsteini* Forel var. *leda* Forel, *Pheidole impressiceps* Mayr. *Ph. variabilis* Mayr. and *Ph. (Pheidolacanthinus) mjöbergi* F. Some of these ants also harvest cotyledons from seedlings (SMITH and ATHERTON 1944).

Solenopsis geminata Forel, the "Fire ant" is the most widely spread seed robber all over the tropical belt, in connection with Tobacco seed-beds, it actually being called "The Tobacco Ant". This ant, however, is by no means a characteristic harvester.

ISOPTERA. Termites.

Macrotermes and *Microtermes* sp. frequent on new seed-bed sites; before onset of rain disturbing fresh sowings by construction of earth-covered runways on soil surface.

Preventive and remedial measures to be taken.

Macrotermes natalensis Haviland in new lands often attacks Field Tobacco, 2 to 4 ft. high, at ground level, causing the plants to collapse. Living plants including Groundnuts, young trees are attacked by certain species of *Macrotermes, Termes, Microtermes* and *Allodontermes* (Farm. S. Africa, Febr. 1949).

For details of various species collected in S. Rhodesia vide separate publication.

COLEOPTERA.

Meloidae: (Cantharidae) Blister Beetles; adults feeding on leaves, stems and terminal shoots. Larvae devore eggs of grasshoppers.

Cyaneolytta pectoralis Gerst., very common. Control measures to be taken.

C. signifrons Fohr., fairly wide spread. Control measures to be taken.

C. sp. near *signifrons,* less frequent.

C. two species, not identified, occurrence restricted.

Epicauta brevipennis Haag var. *designata* Péi, not frequent.

These Meloids invade the seed-bed sites, usually at night time. Their natural host-plants are lushy blades of grasses, *Cyaneolytta pectoralis* in addition, is fond of herbs such as *Solanum nigrum* L., the latter often being reduced to rudimentary stalks.

Psalidolytta lorigera Gerst., a comparatively better flier than *Cyaneolytta,* fairly common, strongly attracted by light, does not attack Tobacco at all.

Cyaneolytta subcoriacea Muls. has been reported to feed on foliage of Potatoes.

Mylabris oculeata Thunb., *M. tricolor* Gerst. and *M. amplectans* Gerst. of general distribution, also are harmless to Tobacco. The adults are feeding on flowers (pollens) of cultivated plants (peas, beans, cotton) alike *M. pustulata* Thunb. which occurs all over South and South East Asia.

Mylabris (Coryna) hermoniae F. (= affinis Ol.) and *Zonabris guineensis* Mars. destroy cotton flowers.

The soil born larvae of *Mylabris* are useful predators; those of *M. pustulata* Thunb. and *Epicauta ruficeps* Ill. in East Java (DAMMERMAN 1929) and *E. vittata* F. in North America (RILEY 1878) prey on egg-masses of Locusts.

In Europe *Zonabris floralis* Pall. and *Epicauta rufidorsum* Goeze are feeding on flowers of Tobacco.

Lycidae.

Lycus ampliatus Fahrs., *L. terminatus* Dalm., *L. (Chlamydolycus) trabeatus* Guér., *L. subtrabeatus* Bourg.

The representatives of this subfamily of Cantharidae are often met with on seed-bed sites on red loam; they are harmless to Tobacco. Larval development takes place in well decomposed stumps of trees many individuals being found together; adults are attracted by flower heads of Compositae such as *Lopholaena coriifolia* (Sond.) Philips & C. A. Smith, *Erigeron* species. On Golden Rod *(Solidago virgaurea)* in Gardens often several species abound at the same time.

Curculionidae.

Analeurops cuthbertsoni Mshl. Occasional severe infestations with this weevil are liable to cause serious damage on Tobacco seed-beds, new sites only.

Remedial measures imperative.

Mimaulus thesii, Mshl., *M. testudo* Fhs., and *Protostrophus platyops* Mshl. are absent from seed-beds; these species, however, are pests of Field Tobacco.

According to MARSHALL (verbatim) *Protostrophus* is represented in S. Africa by many, strikingly localized species injurious to cultivated plants: *P. spinicollis* Mshl. and *P. amplicollis* Fhs. on Maize, *P. noxius* Mshl. on Wheat and Maize, *P. immerens* Mshl. on Ground-nuts, *P. planatus* Mshl. and *P. instabilis* Mshl. on Orange trees.

Tenebrionidae:

False Wireworms. Sporadic incidence of larvae in late prepared seed-beds. Intrusion of adults from uncultivated borders, more frequent, especially on marginal vlei-lands and pure grass veld.

Psammodes scrobicollis Fahr.

Psammodes similis Pér.

Control measures indicated; soil pre-treatment of late established seed-beds. In Field Tobacco major pests on light types of substrata.

Gonocephalum simplex v. F. and various other *G.* spp., as well as

Zophosis spp., collectively called "Surface Beetles" are occasional intruders of seed-beds but not significant.

In Field Tobacco *Gonocephalum* and two Helopinini namely

Emyon caelatus Gerst. and one very closely related but unidentified species occur frequently and often inflict severe damage.

Similar pests of Tobacco are caused in Java and Sumatra by *Gonocephalum (Opatrum) depressum* F. and *G. acutangulum* Fairm. (DAMMERMAN 1929), in Bessarabia by *G. intermedium* Fisch. and in Central Europe by *G. pussilum* Fb. (KIRCHNER 1923).

In Rhodesia *G. simplex* also attacks Maize and Potatoes; Wheat and Barley (JACK 1933), in the Union of S. Africa Maize (SAUNDERS 1930), in Kenya young Coffee and Maize (NOTLEY 1934).

Zophosis spp., running swiftly on the soil surface, are far spread but never very numerous.

ORTHOPTERA.

Grasshoppers: Acridiidae (short-horned) and Locustidae (long-horned) (= Tettigoniidae pars).

Nymphs and adults invading seed-bed sites, feeding on seedlings; wide spread but not frequently causing serious damage.

Phymateus viridipes sp. fairly frequent, October-March.

Cyrtacanthacris sp. nymphs and adults, frequent, December-March, also attacking Maize. *C. (Patanga) succincta* L. occurs occasionally as a pest throughout India to Java and China (DAMMERMAN 1929).

Closely related tropical species such as *C. nigricornis* Burm., *C. succincta* L., *C. rosea* d. G., are injurious to a wide range of cultivated plants, but do not attack Tobacco.

Chrotogonus spp., very frequent, July-March.

Euryphymus xanthocnemis Brancs., rare, December-January.

Catantops melanostictus Schaum., most common, end October-February. (Also recorded by CHORLEY [1939] December.)

Oedaleus nigrofasciatus de Ger., fairly frequent, attracted by light, December-February.

O. sp. cf. *plenus* Walk, infrequent, December.

Gryllacris lyrata Kirby (Gryllacrinae) sporadic, September-November, damage not fully ascertained, some species of *G.* are rather beneficial. The Gryllacrid *Udeopsylla robusta* Hold. feed on *Lachnosterna* beetles in America.

In addition to almost all of the above species,

Field Tobacco is also being attacked by

Acrida sp. indet., infrequent, February-(June) *A. turrita* L. known on Tobacco in Africa and Asia.

Zonocerus elegans Thb., frequent, February-April.

Tapesia (?) intermedia Sjös., rather infrequent, January.

Aulacobothrus marshalli Uv., not frequent, January.

Acanthacris ruficornis fulva Sjös., infrequent, February-March, also reported severing the young woody shoots of Cotton (MONTEIL 1934) in Equatorial Africa.

Morphacris sanguinea Thunb., infrequent, January-February.

Cyathosternum roseum Bol., infrequent, February-March.

Caedicia sp., fairly frequent, January-beginning April.

Eurycorypha sp., infrequent, January-February.

Catantops decoratus, nymphs, not frequent, February-March.

Phaneropterinae, one sp., infrequent, January-February.

In Europe *Phaneroptera quadripunctata* Brunn attacks Tobacco. In Luzon *Ph. brevis* Serv. damages Kapok; *Ph. furcifera* Stal. is very injurious to rice.

Elimaea chloris d. H. observed on Tobacco in the East Indies.

Grasshoppers apparently harmless to Tobacco:

Conocephalus sp. frequent, end December-beginning February.

C. saltator Sauss. in Hawaii sugar cane, is an enemy of Leafhoppers etc. (SWEZEY O. H. 1905).

Lamarkiana sp., *Gastrimargus* Sauss., *G. africanus* Sauss.

Pternosciatus gracilis Hild., *Catantops vittipes* Sauss., *Oedalus citrinus* Sauss., *Agrotylus furcifer aurantius* Ur., *Agrotylus patruelis* H. S., *Ochrophlebia* sp., *Acorypha pallidicornis* Stal., *Humbe tenuicornis* Schaum., attacks *Eleusine* in Uganda, *Pteronemabius* cf. *acrobatus, Terpnistria zebrata* Serv., *Enyaliopsis petersi, Maxentius* sp. (Stempelmatidae).

Achetidae: Gryllidae.

Crickets, nymphs and adults occur in situ on late and hurriedly prepared seed-bed sites, and as intruders from neighbouring well drained lands, cutting seedling plants.

Protective or remedial measures to be taken.

Brachytrupes membranaceus Dr., on high ground frequent, absent in vlei-lands. General major pest in Field Tobacco. Equal in importance in South and East Asia is *B. portentosus* Licht. (syn. *B. achatinus* Stoll), cutting seedlings of cultivated plants including Tobacco.

Acanthogryllus fortipes W., sporadic, invading seed-beds.

Macrogryllus capitatus Chop. (n. sp.) and

M. consocius W., occasionally attacking young Field Tobacco.

Gryllotalpa africana Pal. B., on red loam. sometimes disturbing growth of seedlings by establishing their tunnels. At nighttime strongly attracted by light. This species and the larger *B. hirsuta* Burm. occur in parts of Asia (Malaya: DAMMERMAN 1929) damaging the roots of sugar-cane and rice, also Potato-tubers.

Gryllus (Acheta) bimaculatus de G., fairly frequent on heavier soil types, seems to be harmless if not benevolent (predator of grasshoppers?). Very wide area of distribution occurring in Africa, Asia and South Europe. DAMMERMAN (1929) reports injury to Coffee and Sugar-cane. In Europe the Tree-Cricket *Oecanthus pellucens* Scop., although normally a predator of small caterpillars and Aphidae, damages Tobacco leaves.

Acheta xanthoneura Gerst., not frequent, does not attack Tobacco.

Blattidae: Cockroaches.

Wide spread, but never numerous, occur on new seed-bed sites with heavy bush adjoining.

Species unidentified, damage doubtful.

In Field Tobacco, on reddish sandy loam, reclaimed from secondary Tree-veld, young plants sometimes severely attacked by these locally called "Black Beetles". Roaches involved:

Gynopeltis cryptospila Walk. and

Calolampra pardalina Walk.

These species, as well as *Cyrtotria marshalli* Shelf., *Derocalymma versicolor* Burm. and *Pseudoderopeltis caffra* Stål., are normally to be found in wooded lands under leaf litter, in humus pockets and in dead tree-stumps.

Forficulidae (Dermaptera).

Earwigs, absent in seed-beds, occur occasionally in Field Tobacco. Several species indet., all of them of subterranean, predacious habits; dwelling in fringes of outcropping rocks and boulders, i.e., zones left uncultivated.

THYSANOPTERA.

Thripidae and Phlaeothripidae not observed in seed-beds. Records taken only during May-June 1949.

Frankliniella schultzei Trybom,

Haplothrips and *Taeniothrips* species indet.,

sometimes all of them concurrently present on Tobacco and also on Sunn-hemp *(Crotolaria juncea)* Sunflower *(Helianthus annuus)* and Beans respec-

tively, the first named being most prevalent; on *Cajanus indicus Taeniothrips* only; on Peas *Frankliniella schultzei* and one *Thrips* sp. indet.

In the Union of S. Africa *F. schultzei* Tryb., with a very wide host range, acts as a vector of the Kromnek Virus disease of Tobacco (MOORE 1933, MOORE and ANDERSSEN 1939, VAN DER PLANK 1944) on cultivated and other plants. To ward off the potential danger of the systemic disease being introduced and spread into Rhodesia HOPKINS (1943) called for an effective "campaign against the Kromnek".

According to WOLF (1935) the disorder described from Argentine by FAUCETT (1921) as corcova on Tobacco is identical with Kromnek.

Crookneck, as described by JOHNSON from Tobacco in N. Carolina (quoted by CAPUS et coll., 1929) appears to occur sporadically in Rhodesia on marginal vlei-lands but its cause remains obscure.

Thrips tabaci Lind, recorded by JACK (1936) in Rhodesia, is almost cosmopolitan; in the U.S.A. and S. Russia sometimes seriously attacking Tobacco (CAPUS et coll. 1929).

The most common *Thrips* on Tobacco in Java and Sumatra are *Th. palmi* Karny, and in Java in addition *Fulmekiola interrupta* Karny (DAMMERMAN 1929). In parts of the U.S.A. *Frankliniella fusca* Hinds is injurious to Tobacco.

APTERYGOTA.

Collembola, Spring-tails. One dull blue-black Podurid sp. indet. Gregarious occurrence of both adult and immature forms sporadic, invading borders of flat seed-beds on badly drained, damp sites with stagnant rainwater.

Damage, tiny holes in cotyledons of Tobacco seedlings, usually not serious. Very similar injury caused by *Isotomurus palustris* Müll. var. *maculatus* Schaeff. in Europe (KIRCHNER 1923). MOORE and SMITH (1936) record Spring-tails on Tobacco seed-beds in the Transvaal.

VAN ZWALEWENBURG (quoted by STRICKLAND 1921) found in Hawaii species of the genus *Isotoma* to be injurious "to fine cane roots especially when the normal supply of dead and rotting rootlets from a past season's crop is exhausted".

Bourletiella (Smynthurus) sp. *B. schultzei* Bör. occurs in S. W. Africa.

Smynthurus hortensis Fitch. is known as a pest in the U.S.A. on Onions (BOURCART 1926), Cabbage, Cauliflower etc. (MATHESON 1944), and Tobacco, very young plants in seed-beds being partially to completely defoliated (quoted by METCALF et FLINT 1951).

S. viridis, the "lucerne flea" feeds on the leaves of various plants especially Leguminosae (IMMS 1942); it occurs in Europe, Australia and parts of S. America (MATHESON 1944).

Thysanura: Bristle-tails. One *Ctenolepisma* sp. indet., occurrence sporadic, no extensive damage except occasionally on borders of seed-bed sites, very difficult to trace due to extreme agility and noxious activity being confined to night-time. Cotyledons of very young plants are eaten up, only part of the Hypocotyl above ground left.

C. terebrans Silv., *C. corvina* Silv. occur in S. W. Africa.

In Field Tobacco on virgin bush-veld or on long fallowed land with prolific woody regrowth *Ctenolepisma grandipalpis* Esch. is of common occurrence, feeding on decaying organic matter; suspect to be harmful to weak Tobacco plants during spell of dry weather.

The common Silverfish of S. Europe, i.e. *C. ciliata* Duf. also is largely saprophagous in habit.

MYRIAPODA.

Diplopoda, Millipedes.

Incidence in seed-beds not frequent. Natural food largely dead plant material and humous substances. After hibernation, with onset of the rains, adults of large species feed on lushy grass blades, intrude seed-beds and attack Tobacco plants. Other than hand collecting no effective remedial measures known.

In Field Tobacco rather common, small and juvenile forms occasionally reaching the level of a pest by cutting underground part of Tobacco stem or climbing into the heart and eating the bud leaves of young plants; symptoms often mistaken for damage done by larvae and adults of False Wireworms (Tenebrionidae).

Millipedes collected from 87 localities (1949-1952) belong to the following species:

Odontopygidae:

Chaleponcus limbatus Att., prevalent on all types of soil, also in Bean and Maize lands.

Odontopyge or *Stortophorus* species indet., red loams, also injurious to Potato tubers.

Gen. et sp. indet., rare, light sandy substratum.

Harpagophoridae:

Poratophilus robustus Att., red loam. A pair of specimens collected in the globular mating burrow on the 2 February, 1952 and kept in the laboratory was observed in copula on the 3, 5, 16, 17, 21 and 22 February and 3 and 16 March; the ♂ died in June.

Spirostreptidae:

Alloporus sp., most conspicuous large species, ♀ up to 22 cm. and 1.5 cm. broad, prevalent on heavier soils, often migrating in daylight during the wet season, an important producer of black humus, feeding mainly on dead leaves and empty pods of trees but occasionally also eating sappy fruits under or on trees. Reported to be injurious to many vegetables and garden plants. In lands under field crops reserves of feeding grounds around large termite mounds and along wind belts of indigenous trees.

The giant amongst all Millipedes, i.e., *Spirostreptus seychellarum* Desj. records in the ♀ a length of up to 28 cm. and is almost 2 cm. broad.

According to ANDERSSEN (1946), in the U. of S. Africa "Millipedes have become of considerable economic importance in recent years, however, on crops like potatoes, beet roots, carrots, turnips and commercial flowering crops belonging to the family Liliaceae, damage being reported to an increasing extent."

MOLLUSCA.

Stenogyridae: Snails.

Achatina sp. (near *fulica* Fer.,) Giant Snail, fairly widespread but never numerous, feeding on a wide range of annual plants, indigenous and cultivated. Occasional intruders of Tobacco seed-beds. Also present in Field Tobacco but extent of damage not ascertained. *A. cebra* occurs in Nyasaland.

The typical *A. fulica* Fer., apparently larger than the Rhodesian variety, is indigenous in East Africa and was introduced into India (Bengal), Ceylon

(about 1900) and the Malay Peninsula (1922) where it is a serious pest of many cultivated plants including Rubber.

Small Snails and Slugs ssp. infrequent, confined to badly drained and fairly humous soils, very occasionally damaging young Field Tobacco.

According to DAMMERMAN (1929) *Stenogyra (Opeas) gracilis* Hutt., *Parmarion reticulatus* Hass. (Limacidae) and the slug-like *Vaginula bleekeri* Kef. feed on Tobacco in the East Indies.

In the U. of S. Africa *Lema bilineata* is known to be injurious to Tobacco (NAUDÉ 1951), in Europe: *Helix pomata* L., and *Agrolimax agrestis* L.

To complete the enumeration of insects observed in Tobacco Seed-beds, the following beneficial species are added.

B. *Predators.*

Formicidae.

Dorylinae: Nomadic Ants.

fairly frequent on all types of soil, living entirely subterraneously.

Dorylus (Typhlopone) fulvus West., most frequent.

D. (Rhogmus) fimbriatus, Shuckard, abundant.

D. (Dorylus) helvolus Linn., frequent.

D. (Alaopone) atriceps Sclk., fairly common.

D. (Typhlopone) fulvus West. var. *badius* Gerst., not frequent.

D. (Dorylus) brevipennis var. *Marshalii* Emery, not frequent.

D. (Alaopone) sp. indet., rare.

All the species of the tribus of Dorylinae share exceedingly predatory habits, only two exceptions to the rule being known, namely *D. orientalis* Westw. of tropical Asia which, in addition to being predacious, also attacks some cultivated plants (DAMMERMAN 1929) and *Dorylus (Typhlopone) fulvus* var. *rhodesiae* Forel which is occasionally also attending Membracid larvae (G. ARNOLD, S. Rhodesia). With respect to the latter exception, observations made in Field Tobacco will be recorded in a subsequent paper.

The listed species, casual visitors of Tobacco seed-beds, collect earth dwelling insects, i.e., False Wireworms, Cockroaches, Termites and Harvester-Ants. They also proved extremely useful in almost completely clearing up Cutworm infestations.

Ponerinae:

Paltothyreus tarsatus (Fabricius) Mayr, very frequent, with extensive and deep seated runways, active day and night, below and on soil surface, visiting seed-beds; highly carnivorous, most potent hunter of Tenebrionidae, adults and larvae, Termites, seed-collecting ants, Noctuid-moths, adults and larvae.

Platythyrea cribrinodis Gerst., common; *P. schultzei* Forel, rare; *P. lamellosa* Rog. ssp. *longinoda* Forel, frequent.

Ophthalmopone berthoudi Forel, fairly frequent. A swarm consisting of numerous ♂ only observed 5 May, 1950.

These four species of S. and E. Africa are almost exclusively termitophagous.

Odontomachus haematoda L., not frequent; moves in columns, preying mainly on White Ants. Ubiquitous species.

Gen. et sp. indet., rare, in vlei-lands only, attacking *Gonocephalum simplex* (Tenebrionidae).

Myrmicinae:

Pheidole (megacephala) punctulata Mayr, most abundant in all soil types, preying on Termites, juvenile larvae of Whitegrubs, False Wireworms but also attending subterranean Coccidae (*Pseudococcus brevipes* Ckll. on Pineapple, *P. citri* Risso on the common weed *Bidens pilosa* L.) and occasionally collecting seeds. Common visitor of human dwellings.

Pheidole sp. near *punctulata,* not frequent.

On Field Tobacco observed to attack larvae of *Heliothis obsoleta* F. infesting seed-heads via supporting pegs. The sole ant occasionally climbing Tobacco plants from the soil surface is *Camponotus eugeniae* Forel; no honey dew from *Myzus persicae* Sulz. is necessary to be present in order to make selected plants attractive for sustained visitations.

Pheidole speculifera Em., observed in brick-walled seed-beds and water tanks, numerous individuals dragging Noctuid-larvae and adults to their nests.

Monomorium amblyops Em. ssp. *prossae* Forel and

M. (Xeromyrmex) bicolor Em. ssp. *nitidiventre* Em., not frequent, both termitophagous and scavengers.

Tetramorium guineense F. ssp. *striatum* ?, wide spread, carnivorous but also attending Coccidae *(Margarodes)* on grass roots (*Cynodon dactylon* [L.] Pers. etc.).

Carebara vidua F. Smith, frequent; typical lestobiontic habit, nesting in mounds of *Termes natalensis* Haviland. Large flights of sexuales observed on 25 November, 1950.

Ocymyrmex weitzaeckeri Em. var. *arnoldi* Forel, frequent in Field Tobacco; carnivorous and granivorous. WHEELER (1926) intimates that the typical desert species is probably highly granivorous.

Formicinae:

Plagiolepis (Anoplolepis) custodiens (F. Smith) Santschi, very common, pugnacious, moves hurriedly in definite columns, suspected to collect cutworms and caterpillars, also attends various Scale-insects on trees. Nests in surface soil, shapeless dumps disturbing Tobacco ridges.

Acantholepis longinoda Arnold, rare; suspected predator of very young crickets (*Brachytrupes membranaceus* Dr.).

Carabidae: Ground Beetles.

Scarites natalensis Boh., wide spread on loamy substrata but not very numerous. Larvae and adults subterranean predators of White grubs and False Wireworms in Field Tobacco; also observed in Mozambique feeding on larvae of *Heteronychus plebejus* in Sugar cane. *S. gigas* Schiödte is confined to tropical forests of Africa. *S. procerus* Dej. to Mediterranean countries.

Rhopalomelus angusticollis Boh., infrequent.

Calosoma planicolle Chaud., fairly common.

These two rapacious species, rapidly roaming on sandy soils, feed on Cutworms, mature larvae of *Heliothis obsoleta* F. and other Lepidoptera.

Anthia masilicata Guer. var. *fornassini* Berto. *Anthia burchelli* Hope var. *petersi* Klug., *A. thoracica* F., *A. homoplate* Leq. var. *mellyi* Breme, all these species fairly common, intruding seed-beds at night time in search of insects; Beetles of False Wireworms, Beetles of Whitegrubs, Winged Termites, are caught and thus prevented from egg-laying.

Absent in seed-beds, partly due to artificial watering, are: Cicindelidae, Staphylinidae, Syrphidae, Coccinellidae, Mantidae, Odonata, Centipedes, Hymenopterous and Dipterous Parasites, which, however, occur in Field Tobacco.

The action of beneficial insects, predators and parasites is more conspicuous in Field Tobacco. The relevant species will be enumerated in parts II and III to follow.

Annotation.

Spectacular flights of the Pieridae *Catopsilia florella* F., often interspersed with *Phalantha aetiopica* R. et J., usually occurring in December (CHORLEY 1939) are of no consequences to Tobacco and other crops. These migratory butterflies have been observed, along the Lomagundi Rd. outside Salisbury, resting at night time in the open field and visiting in the forenoon, prior to taking to the wings, the flowers of *Becium obovatum* N. E. Br. and *Orthosiphon bracteosus* Bork., but no breeding has been observed on any plant virgin or cultivated.

Catopsilia crocale Cr. (*Bomona* F.), distributed from India to Australia, is known to feed in its larval stages on Indian laburnum *(Cassia fistulosa)* and other species of *Cassia* (DAMMERMAN 1929).

The casual incidence of quite numerous Cassididae (Tortoise-beetles) in border lands of Tobacco fields on heavier soil types, end December-early January, likewise should not call for alarm, no feeding or breeding taking place on Tobacco. The host plant of *Asphidomorpha 4-maculata* Ol., in the open veld, is *Cissus zombensis* Gilg., larvae and adults of a near related species are feeding on *Thunbergia lameifolia* T. Anderes.

Asphidomorpha militaris F., a most common species in the East Indies, is a pest of Sweet potatoes *(Ipomoea)* and Beans (DAMMERMAN 1929).

ACKNOWLEDGMENT.

The authors are extending their appreciation and thanks for the classification of many of the insects listed above, to:—Sir G. H. K. Marshall, London, Retired Director Imperial Institute of Entomology (Curculionidae); Dr. W. J. Hall, Director of Commonwealth Institute of Entomology, British Museum, London and his staff, i.e. Drs. N. C. E. Miller (Heteroptera), E. D. Pope (Coleoptera gen.), G. E. T. Nixon (Formicidae), T. P. Doncaster (Aphididae) and T. H. C. Taylor (Lepidoptera). Dr. L. Chopard (Paris) was kind enough to identify the Achetidae and name the new Macrogryllus species. We are grateful to Dr. Jeekel (Amsterdam) for the determination of the Diplopoda, to Dr. J. C. Faure (S. Africa) for the Thysanoptera, and to Dr. K. Princis (Sweden) for the Blattidae. We are also indebted to Mr. J. Whellan, Div. Ent. Dept. of Agr., Salisbury (Southern Rhodesia) and Dr. W. G. H. Coaton, Div. Ent. Dept. Agr., Pretoria (Transvaal) for their kind assistance and help. Our best thanks are also due to Dr. Parry Jones, Director of Tobacco Pest Control Research Scheme, Salisbury and the Rhodesia Tobacco Association for permission to publish this paper.

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