

BIO-ECOLOGY OF *MIMEGRALLA COERULEIFRONS* MACQUART (DIPTERA : MICROPEZIDAE) ASSOCIATED WITH GINGER *ZINGIBER OFFICINALE* ROSC. RHIZOMES¹

K. M. ABDULLA KOYA

National Research Centre for Spices, Calicut, India 673-012

(Received 2 March 1988)

The bio-ecology of *Mimegralla coeruleifrons* Macquart (Diptera : Micropezidae) associated with rhizome rot affected ginger rhizomes (*Zingiber officinale* Rose.) was investigated. The egg, larval and pupal periods ranged between 3-4, 9-13 and 8-11 days respectively. The maggots were present only in rhizomes affected by rhizome rot disease. The maggots were also recorded from other species of Zingiberaceae and *Colocasia* sp. Aspects of adult behaviour such as mating and oviposition have been studied. Two hymenopteran parasites were recorded from pupae. A brief description of different stages is also provided.

(Key words: ginger, *Zingiber officinale*, rhizome rot disease, rhizome maggots, *Mimegralla coeruleifrons*)

INTRODUCTION

Ginger (*Zingiber officinale* Rosc.) is an important spice crop which is widely grown in Kerala. The crop is attacked by about 20 species of insect pests during different stages of its growth. Among them seven species of dipteran maggots have been reported to cause damage to the rhizomes by various workers. They include *Calobata* sp. (Micropezidae) (FLETCHER, 1914), *Chalcidomyia atricornis* Mall and *Formosina flavipes* Mall (Chloropidae) (MALLOCH, 1927), *Celyphes* sp. (Celyphidae) (NAIR, 1975), *Mimegralla* sp. nr *coeruleifrons* Macquart (Micropezidae), *Eumerus* sp. (Syrphidae) (ANONYMOUS, 1977) and *Eumerus albifrons* Walker (SATHIAMMA, 1979). The maggots are generally seen in rhizomes affected by rhizome rot disease caused by *Pythium* spp., *Fusarium* spp. and *Pseudomonas solanacearum*. Surveys conducted in all major ginger growing areas in Kerala during 1984-1985 indicated that *M. coeruleifrons* was the pro-

minent species occurring in 26.4 per cent of the samples examined (ABDULLA KOYA, Unpublished). Very little information is available on the biology of *M. coeruleifrons*. In view of the association of the maggots with rhizome rot of ginger, detailed studies on the bio-ecology of *M. coeruleifrons* were conducted at National Research Centre for Spices, Calicut and the results are reported here.

MATERIALS AND METHODS

Life history:

Gravid females of *M. coeruleifrons* were collected from the field and released in nylon mesh cages of 1 × 1 × 1 m size containing glass troughs filled with moist soil for egg laying. Ten per cent honey solution soaked in cotton wool was placed in cages for feeding adult flies. The eggs that were laid in soil were collected with a camel hair brush after moistening the soil which facilitated easy collection of the same. The eggs were kept in petriplates for hatching. Crushed ginger rhizome was provided as food material for the emerging larvae. Adequate moisture

¹Contribution No. 86 of National Research Centre for Spices, Calicut-673 012.

was provided in the petriplates by placing moistened cotton wool. Measurements and descriptions of egg, larva, pupa and adult stages were carried out by observing the same under stereomicroscope and trinocular research microscope. Measurements of mouth hook of the larvae were also taken daily for determining the number of instars. The studies were conducted in the laboratory under a mean temperature of 24.9–30.8°C and relative humidity of 81.9–90.2 per cent. Observations on mating and oviposition behaviour, sex ratio, mode of survival during off-season and alternate food materials were carried out in the field at the NRCS Experimental Farm, Peruvannamuzhi.

RESULTS AND DISCUSSION

Egg:

The eggs were white and spindle shaped; chorion was sculptured with longitudinal lines; the posterior end was round and the anterior end pointed. The egg hatched in 3–4 days. Eclosion occurred through longitudinal split of the chorion which extended from the anterior end upto 3/4 of the egg. During eclosion head came out first followed by a wriggling movement of the body which helped the remaining portion to come out. The entire process of hatching took 8–10 minutes and occurred generally during the forenoon.

Larva:

Newly hatched larvae were transparent and pale white. There were three instars. Later instar larvae were creamy white. A pair of prominent dark brown spiracles was seen at the posterior end. The duration of 1, 2 and 3 instars were 3, 2 and 6 days respectively (range : 3, 2 and 4–8 days, respectively). The maggots fed voraciously on the crushed ginger kept in the petriplates. In the field the maggots were observed to tunnel inside the ginger rhizomes and feed on the internal

contents completely leaving the rind portion. Field observations indicated that the maggots were unable to infest healthy rhizomes, but were found to feed on rhizomes affected by rhizome-rot disease.

Pupa:

Pupation occurred within the food material and in the field within the infected rhizomes; however, pupation was found to occur in the soil rarely. The pupae were elongate; nascent pupae were pale brown which soon turned dark brown. The pupal period lasted for 8–11 days.

Adult:

The abdomen, thorax and legs of adult flies were brownish black and with pale black patches on the wings. Males were smaller than females. Females could be identified by the presence of the elongated last segment of the abdomen which is used as ovipositor. The tarsi of first pair of legs were white and were generally held in front of the insect and were constantly moved about. The measurements of egg, larva, pupa and adult are presented in Table 1.

Adult behaviour:

Mating and oviposition:

The process of mating involved arousal-mounting – copulation – termination of copulation. A brief courtship occurred leading to arousal of both the sexes. Copulation occurred successively 4–7 times at intervals of 3–6 minutes. The mating pairs remained in copulation for 4–13 minutes each time. Mating occurred throughout the day especially in shaded areas. Mating was observed to be common between 11.00 a.m. and 2.00 p.m. on bright days. They were also observed to fly in the mounted condition, if disturbed. Freshly mated females resisted the attempts of new males by flying away.

TABLE 1. Measurement of egg, larval, pupal and adult stages*.

Stage	Mean	Range	No. observed
Egg (Length × width)	0.776 × 0.171	0.752 — 0.800 × 0.160 — 0.184	20
Larvae (length)			
I instar	2.607	1.224 — 3.980	5
II instar	5.256	6.756 — 9.012	5
III instar	10.224	9.340 — 10.920	5
Mouth hook of larva (length)			
I instar	0.036	0.030 — 0.040	7
II instar	0.077	0.075 — 0.080	7
III instar	0.167	0.140 — 0.185	11
Pupa (Length × Width)	7.783 × 1.616	7.50 — 8.00 × 1.50 — 1.75	15
Adult male (Length × Width)**	11.95 × 1.50	11.00 — 12.50 × 1.50	10
Adult female (Length × Width)	13.65 × 1.75	13.00 — 15.00 × 1.50 — 2.00	10
Adult male — Wing span	16.60	15.50 — 17.50	10
Adult female — Wing span	17.85	17.50 — 19.00	10

* All measurements in mm.

** Width at Throax.

Oviposition occurred soon after mating and eggs were laid singly in the soil up to a depth of 1 cm around the base of the pseudostems near the rhizomes. Females were observed invariably to oviposit near diseased rhizomes. Under laboratory conditions gravid females laid the eggs on the sides of the glass trough and also on cotton wool moistened with honey solution kept for feeding.

laboratory as compared to 20–28 days on ginger. Adults were also observed in the field in moist and shaded areas during this period and exhibited normal activities such as mating, egg laying etc. However, the adult population during this period was considerably low.

Alternate food material:

The maggots of *M. coeruleifrons* were observed in the rhizomes of rot affected turmeric (*Curcuma longa*), wild arrow root, *Colocasia* sp. and wild ginger (*Zingiber* sp.). The maggots have been earlier reported to infest *C. longa*, *C. aromatica* and *C. zeodaria* (ANONYMOUS, 1979). PREMKUMAR et al. (1982) reported that maggots also fed on *C. longa*, *C. aromatica* and *Kaemferia galanga*.

Mode of survival during off-season:

The maggots of *M. coeruleifrons* were observed to grow in fallen and decaying banana flowers, rejected bits and roots of ginger heaped in the field during the period from January to May, when the crop is not in the field. The duration of life cycle (35–45 days) was prolonged when the maggots were reared on banana flowers in the

Sex ratio :

Sex ratio of males and females in the field was about 1:1 and there was not much change throughout the year.

Natural enemies :

Two pupal parasites were recorded. They were *Trichopria* sp. (Diapriidae) and *Spalangia gemina* Boucek. (Pteromalidae) ; the latter has been recorded for the first time. Twelve to twenty adults of *Trichopria* were observed to emerge out from a single pupa of *M. coeruleifrons*. Only one adult of *Spalangia gemina* emerged out from a parasitised pupa.

Trichopria species has also been recorded on *Mimegralla* sp. (ANNONYMOUS, 1977). An unidentified species of spider was also observed to feed on newly emerged adults in the field.

ACKNOWLEDGEMENTS

I am grateful to Dr. I. M. WHITE, Dr. A. POLASZEK and Dr. Z. BOUCEK of Commonwealth Institute of Entomology, London for identifying the insect and its natural enemies.

REFERENCES

- ANNONYMOUS (1977) *Annual Report for 1976*. Central Plantation Crops Research Institute, Kasaragod, India. 283 pp.
- ANNONYMOUS (1979) *Annual Report for 1977*. Central Plantation Crops Research Institute, Kasaragod, India. 204 pp.
- FLETCHER, T. B. (1914) *Some South Indian Insects and other animals of importance considered especially from an economic point of view*. Government press, Madras. 565 pp.
- MALLOCH, J. R. (1927) Some Indian Chloropidae (Diptera) of Economic Importance. *Ann. Mag. Nat. Hist.*, **19**, 577-581.
- NAIR, M. R. G. K. (1975) *Insects and Mites of Crops in India*. Indian Council of Agricultural Research, New Delhi, 404 pp.
- PREMKUMAR, T., Y. R. SARMA & S. S. S. GAUTAM (1982) Association of Dipteran Maggots in Rhizome Rot of Ginger, in: *Proceedings of the National Seminar on Ginger and Turmeric*, 8-9 April, 1980, Calicut (Eds. Nair, M. K., Premkumar, T., Ravindran, P. N. and Sarma, Y. R.) Central Plantation Crops Research Institute, Kasaragod, India 250 pp.
- SATHIAMMA, B. (1979) Occurrence of maggot pests on ginger. *Bull. Ent.*, **20**, 143-144.