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Parasitism of *Clavigralla* spp. (Hemiptera : Coreidae) eggs by *Gryon clavigrallae* Mineo (Hymenoptera : Scelionidae)

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ABSTRACT : *Clavigralla* spp. (Hemiptera : Coreidae) eggs are laid in clusters. Field collections at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) over three seasons from 1992-93 to 1994-95 showed that cluster size ranges from 2 to 62 eggs with a mean of 17.7 eggs. A majority of egg clusters (72%) contained between 7 and 24 eggs. *Gryon clavigrallae* Mineo (Hymenoptera : Scelionidae) parasitized up to 69 per cent of eggs and up to 100 per cent of egg clusters each season. Overall, more than 39 per cent of *Clavigralla* spp. eggs were parasitized by *G. clavigrallae*. The percentage of egg clusters parasitized and the percentage of eggs parasitized in a cluster were positively correlated with the size of the egg cluster. The percentage of eggs and egg clusters parasitized by *G. clavigrallae* increased through the season.

KEY WORDS : *Clavigralla* spp., egg cluster size, egg parasitoids, *Gryon clavigrallae*

At least two species of *Clavigralla* (Hemiptera : Coreidae), *Clavigralla gibbosa* Spinola and *Clavigralla scutellaris* (Westwood), are widespread and serious pests of pigeonpea in India (Dolling, 1978; Lateef and Reed, 1990). A related species, *Clavigralla tomentosicollis* (Stål), occurs in Africa and is considered a key constraint to pigeonpea and cowpea production (Singh *et al.*, 1990; Omanga *et al.*, 1991). *Clavigralla* spp. deposit eggs in clusters on pods and leaves of pigeonpea. More than 430 eggs/female have been laid by field-collected *C.*

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gibbosa in India but lower fecundity was observed in laboratory reared females (Bindra, 1965; Singh and Patel, 1968). Under laboratory conditions, females lay eggs in clusters of 5 to 10 (Bindra and Singh, 1971). Similar studies by Egwuatu and Taylor (1977) on *C. tomentosicollis* in Nigeria indicated that females lay smaller egg clusters in the laboratory (mean = 7 eggs) compared to the field (mean = 20 eggs).

In India, Bindra (1965) noted that up to 56 per cent of *C. gibbosa* eggs were parasitized by *Gryon fulviventris* (Crawford) (= *Hadronotus antestiae* Dodd) (Hymenoptera : Scelionidae) in Punjab, while Nawale and Jadhav (1978) observed up to 48 per cent of eggs parasitized by *Gryon* sp. in Maharashtra. Matteson (1981) reported seven parasitoid species attacking up to 62 per cent of *C. tomentosicollis* eggs in Nigeria and Tanzania.

The purpose of this study was to investigate the population dynamics of an egg parasitoid of *Clavigralla* spp. and to determine whether parasitoid ovipositional behaviour was influenced by egg cluster size of *Clavigralla* spp.

MATERIALS AND METHODS

This investigation was carried out at the research station of the International Crops Research Institute for the Semi-Arid Tropics, located near Hyderabad, Andhra Pradesh over three seasons, 1992-93, 1993-94 and 1994-95. A total of 3097 *Clavigralla* spp. egg clusters (more than 54,500 eggs) were collected from pigeonpea fields between September and April each season. Samples were taken 1-3 times per week. A total of 89 to 229 egg clusters per week were collected during the main pigeonpea season (standard week 42 to standard week 5). Eggs were held at ambient temperature in the laboratory until a parasitoid or *Clavigralla* nymph emerged. Parasitoids were sent to G. Mineo (Palermo, Italy) for identification and an additional set was deposited at the British Museum (Natural History) , London. Simple correlation (Pearson's) analysis was used to evaluate the effect of egg cluster size on the percentage of egg clusters parasitized and the percentage of eggs parasitized. A t-test was used to compare the size of completely parasitized egg clusters with the size of all egg clusters.

RESULTS AND DISCUSSION

The number of *Clavigralla* spp. eggs per cluster ranged from 2 to 62 with a mean of 17.7 eggs per cluster. Figure 1 shows the distribution of egg cluster sizes from field collected *Clavigralla* spp. egg clusters. The most frequent size egg cluster encountered was 10 eggs per cluster. Bindra (1965), and Nawale and Jadhav (1978) reared *C. gibbosa* under laboratory conditions and reported a maximum of 33 and a mean of 5 to 10 eggs per cluster. Our results indicate that under field conditions females lay larger egg clusters than reported in these earlier laboratory

studies. The majority of egg clusters (72%) range in size between 7 and 24. Smaller (< 5 eggs) and significantly larger (> 41 eggs) clusters are relatively rare in the field. Egwuatu and Taylor (1977) reported similar results for *C. tomentosicollis* in Africa.

linear relationship between egg cluster size and the percentage of clusters parasitized suggests that *G. clavigrallae* females locate larger clusters more easily than smaller clusters. Van der Schaaf *et al.* (1984) reported a similar positive correlation between the percentage of

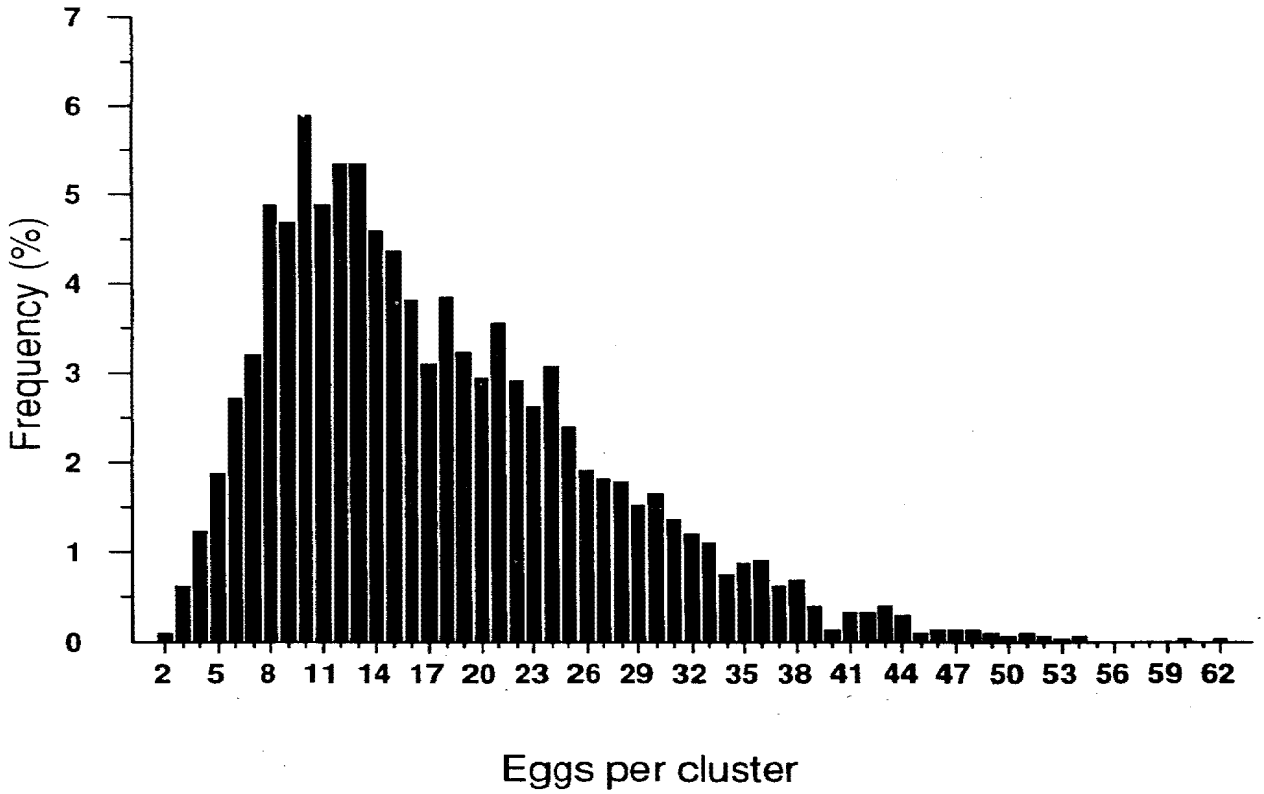

Fig. 1. Frequency distribution of *Clavigralla* spp. egg cluster sizes

Mineo and Caleca (1994) reported that all the parasitoids which emerged from *Clavigralla* spp. were *Gryon clavigrallae* Mineo. The percentage of egg clusters parasitized was positively correlated ($y = 55.28 + 0.711x$; $r^2 = 0.65$; $n = 55$) with size of the egg cluster (Fig.2). The positive,

Mamestra brassicae (Lepidoptera : Noctuidae) egg batches parasitized by *Trichogramma* spp. (Hymenoptera : Trichogrammatidae) and the number of eggs in a batch.

The percentage of eggs parasitized in a cluster was also positively correlated

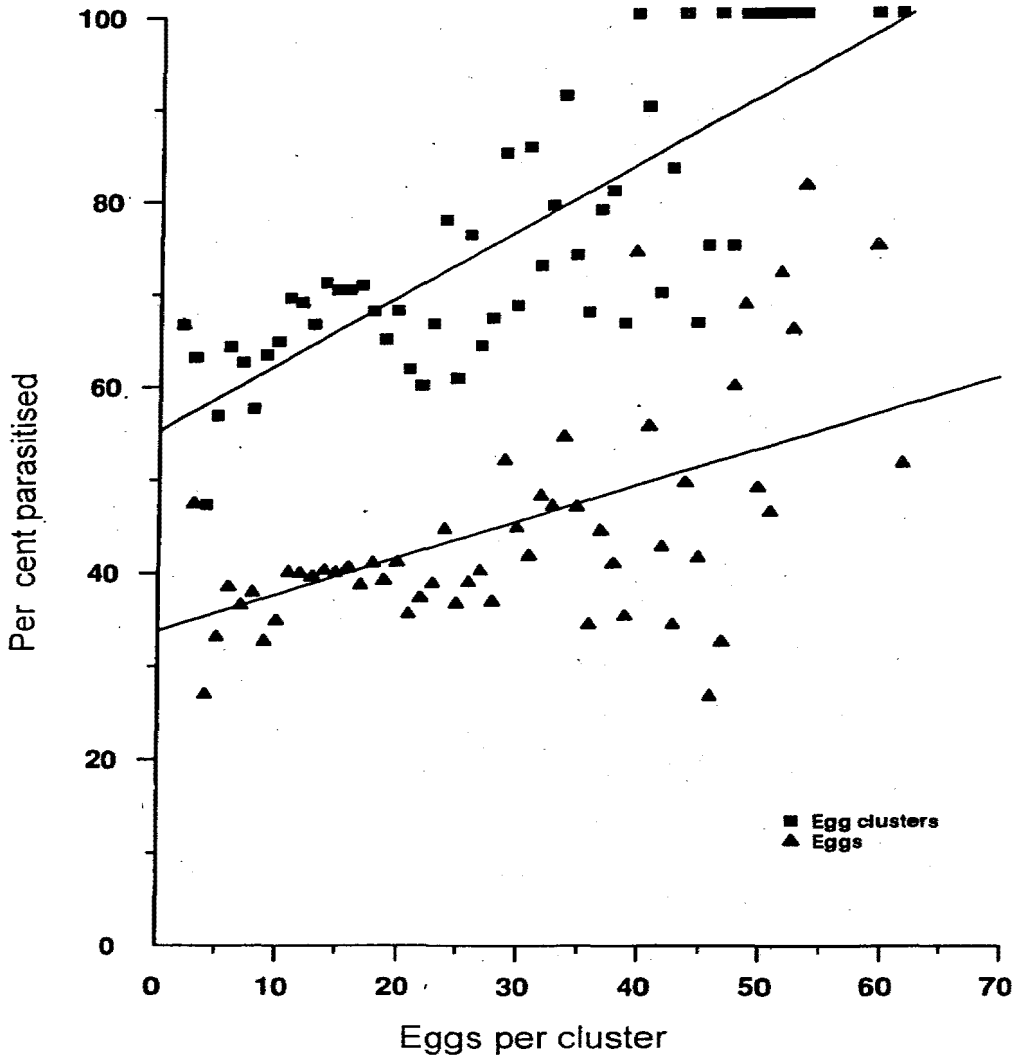

Fig.2. Relationship between the percentage of *Clavigralla* spp. eggs and egg clusters parasitized by *Gryon clavigrallae* and the size of the egg cluster

($y = 33.83 + 0.386x$; $r^2 = 0.26$; $n = 55$) with the size of the egg cluster (Fig. 2) even though, egg clusters in which all eggs were parasitized were significantly smaller than the overall mean cluster size (14.8 versus 17.7 eggs per cluster; t-test, $t = 89.03$; $p < 0.001$). The higher percentage of eggs parasitized in larger clusters could be due to parasitization by more than one female. The complex relationship between egg cluster size and *G. clavigrallae* parasitization presents a trade off to *Clavigralla* spp. Larger egg clusters are more likely to be found by *G. clavigrallae* females than smaller egg clusters and so have a higher percentage of eggs in the cluster parasitized.

Small egg clusters are less likely to be found, but once found, are more likely to

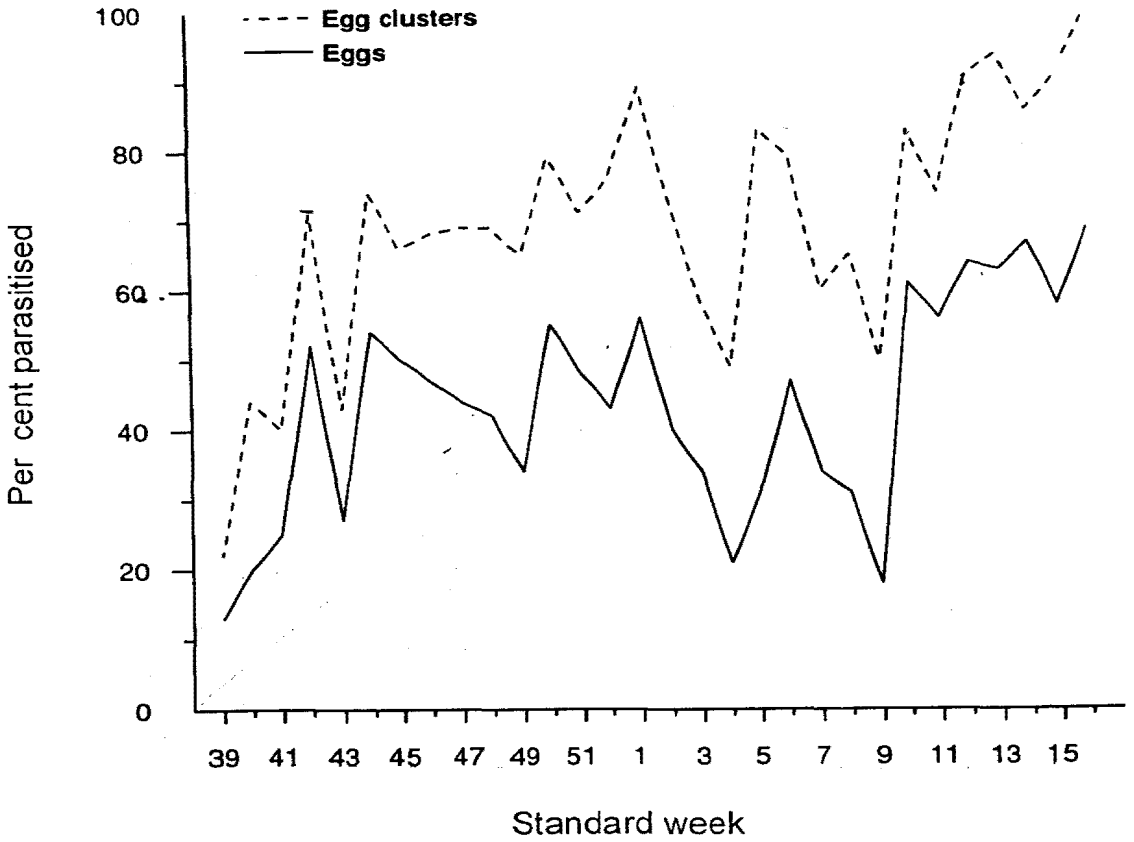

Fig.3. Seasonal variation in the percentage of *Clavigralla* spp. eggs and egg clusters parasitized by *Gryon clavigrallae*

have all eggs in the cluster parasitized. This apparent contradiction is because larger egg clusters are more likely to be located by two or more female parasitoids. Detailed observations of the behaviour and biology of *G. clavigrallae* are needed to fully understand these relationships.

Both the percentage of eggs and the percentage of egg clusters parasitized by *Gryon clavigrallae* increased through the season (Fig.3). During the first 6 weeks of the season, the percentage of eggs and egg clusters parasitized increased rapidly to about 45 per cent and 65 per cent, respectively. From standard weeks 44 to 9 (mid-October to end February), parasitism fluctuated widely between 18 to 55 per cent for eggs and 43 to 80 per cent for egg clusters. At the end of the season (standard weeks 10-16) the percentage of both eggs and egg clusters parasitized increased steadily, reaching 70 per cent for eggs and 100 per cent for egg clusters. Similar findings have been reported by Bindra (1965) who observed an increase in *C. gibbosa* egg parasitism from 0 to 56 per cent over a 6- week period. However, egg parasitism rates were generally low (< 20 per cent) in that study.

Matteson (1981) recorded a similar rapid increase in parasitism of *C. tomentosicollis* eggs (up to 62 per cent) over a 5 - week period in Africa.

Gryon clavigrallae is an important egg parasitoid of both *C. gibbosa* and *C. scutellaris*. This study is the only report of *Clavigralla* spp. egg cluster size under field conditions in India. Cluster size is important because larger egg clusters are more frequently parasitized by *G. clavigrallae*. Future studies should focus on the host selection and ovipositional behaviour of the parasitoid.

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REFERENCES

Bindra, O. S. 1965. Biology and bionomics of *Clavigralla gibbosa* Spinola, the pod bug of pigeonpea. *Indian Journal of Agricultural Science*, **35**:322-334.

Bindra, O. S. and Singh, H. 1971. Tur pod bug, *Clavigralla gibbosa* Spinola (Coreidae, Hemiptera). *Pesticides*, **2** (3-4):32.

Dolling, W. R. 1978. A revision of the Oriental pod bugs of the tribe Clavigrallini (Hemiptera : Coreidae). *Bulletin of British Museum (Natural History)*, **36**:281-321.

Egwuatu, R. I. and Taylor, T. A. 1977. Studies on the biology of *Acanthomia tomentosicollis* (Stål) (Hemiptera : Coreidae) in the field and insectary. *Bulletin of Entomological Research*, **67**:249-257.

Lateef, S. S. and Reed, W. 1990. Insects on pigeonpea. In : S. R. Singh (Ed.). *Insect Pests of Tropical Food Legumes*. John Wiley & Sons, New York, pp.193-242.

Matteson, P. C. 1981. Egg parasitoids of hemipteran pests of cowpea in Nigeria and Tanzania, with special references to *Ooencyrtus patriciae* Subba Rao (Hymenoptera : Encyrtidae) attacking *Clavigralla tomentosicollis* Stål (Hemiptera : Coreidae). *Bulletin of Entomological Research*, **71**:547-554.

Mineo, G. and Caleca, V. 1994. New data on some scelionid wasps and description of new species (Hymenoptera : Proctotrupoidea : Scelionidae). *Phytophaga (Palermo)*, **5**:113-135.

Nawale, R. N. and Jadhav, L. D. 1978. Bionomics of tur pod bug *Clavigralla gibbosa* Spinola (Coreidae : Hemiptera). *Maharashtra Agricultural University Journal*, **3**:275-276.

Omanga, P. A., Singh, L. and Shakoor, A. 1991. Production systems, insect pest

damage and grain characteristics of pigeonpea landraces in Kenya. In : Laxman Singh, S. N. Silim, R. P. Ariyanayagam and M. V. Reddy Eds.) "*Proceedings of the first eastern and southern Africa regional Legumes (Pigeonpea) workshop*". Eastern Africa Regional Cereals and Legumes (EARCAL) Program, International Crops Research Institute for the Semi - Arid Tropics, pp. 124-130.

Singh, R. and Patel, H. K. 1968. Bionomics of tur pod bug (*Clavigralla gibbosa* Spinola) on pigeonpea (*Cajanus cajan* Millsp.). *Andhra Agricultural Journal*, **15**:80-87.

Singh, S. R., Jackal, L. E. N., Dos Santos, J. H. R. and Adalla, C. B. 1990. Insect pests of cowpea. In : S. R. Singh (Ed.). *Insect Pests of Tropical Food Legumes*. John Wiley & Sons, New York, pp. 43-89.

Van der Schaaf, D. A., Kaskens, J. W. M., Kole, M., Noldus, L. P. J. J. and Pak, G. A. 1984. Experimental releases of two strains of *Trichogramma* spp. against Lepidopteran pests in brussels sprouts field crop in the Netherlands. *Mededlingen van de Faculteit Landbouwwetenschappen Rijksuniversiteit Gent*, **49**:803-813.