ANTHOCORIDS (ANTHOCORIDAE: HETEROPTERA) AS EFFICIENT BIOCONTROL AGENTS OF THRIPS (THYSANOPTERA: INSECTA)

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ABSTRACT

The potential of anthocorids as efficient biocontrol agents of thrips of economic importance has been discussed in relation to their prey consumption efficiency, fecundity potential and speed of development.

INTRODUCTION

ANTHOCORIDS known to actively predate on various species of thrips of economic importance and their effective utilisation in biocontrol practices holds considerable promise in view of their colonisation rates, mobility, prey consumption efficiency and high fecundity potential. Among such genera as *Orius* Wolff, *Carayonocoris* Muraleedharan, *Anthocoris* Fallen, *Xylocoris* Dufour, *Scoloposcelis* Fieber etc., which include effective predator species[1], the genus *Orius* is particularly important in view of its wide distribution, with more than seventy species on record all over the world. Of a dozen species reported from India *O. maxidentex* Ghauri, *O. indicus* (L.) and *O. tantillus* (Mots) appear more common.

Prey consumption efficiency

Diversity in the prey consumption rate was evident in the different species of anthocorids based on the developmental stage and sex. Further, each nymphal stage of species such as *O. maxidentex* and *Carayonocoris indicus* Muraleedharan, when provided with different species of thrips as prey also exhibited significant variation in prey consumption rate[2]. Studies on the predator-prey interactions on the basis of data analysis through the randomised block design revealed that such interaction in relation to predatory efficiency was highly significant. The efficiency of predation was low for the I instar nymph of the predator, but high for the adult female.

Both *O. maxidentex* and *C. indicus* were observed to consume more individuals of *Scirtothrips dorsalis* Hood when compared to other species[2]. The feeding behaviour of these predators involves a series of sequential responses from the time of detection of the prey to their consumption. Prey consumption and predation rate differed depending on the developmental stages and sex, as reported earlier[3]. Consumption of greater number of *S. dorsalis* by both these anthocorids is possibly related to the comparatively smaller size of this species, since the prey size has a significant effect on the functional response of the predator[4].

The nymphs and adults of *Orius indicus* (L) feed on *Megalurothrips nigricornis* infesting the flowers of *Cajanus cajan*, the consumption efficiency of the predator increasing with successive developmental stages[5]. Estimation of the feeding capacity of *O. albidipennis* (Reut) when provided with *Gynaikothrips ficorum* Marchal indicated that the amount of food consumed by the nymph is comparatively more at each succeeding instar excluding the second instar in which the amount was the lowest. The lowest feeding capacity of the second instar nymph appears rather to be due to its shorter duration.

Rates of feeding

Observations on the rates of feeding of the four species of anthocorids[3], *Carayonocoris indicus*, feeding on *Haplothrips ganglbaueri Schmutz* and *Frankliniella schultzei* Trybom abounding in the flowers of *Cassia marginata*, *Montandoniola moraguesi* (Puton) feeding on different species of gall thrips, *Xylocoris clarus* (Distant) feeding on litter inhabiting thrips and *Scoloposcelis parallelus* (Motshulsky) feeding on thrips infesting the dead and decaying plant parts, have shown that the earlier instars especially I and II preferred the larvae of thrips, whereas the later instars and adults did not show any preference for larval thrips. The efficiency of the predators depends on three factors *viz*. the voracity of predators, the rate of reproduction and the synchronisation of the predator and prey population[6].

Fecundity potential

The oviposition of the females of both *Carayonocoris indicus* and *Orius maxidentex* was studied with respect to different types of prey, the details of which are evident from the graph (figure 1 A and B). Numbers recorded in figure 1 indicate that the total number of the eggs deposited per female of *O maxidentex* ranged between 24.4 ±0.36 and 42.7 ±0.95, the maximum number being when reared on *Thrips palmi*, and the maximum on *Scirtothrips*

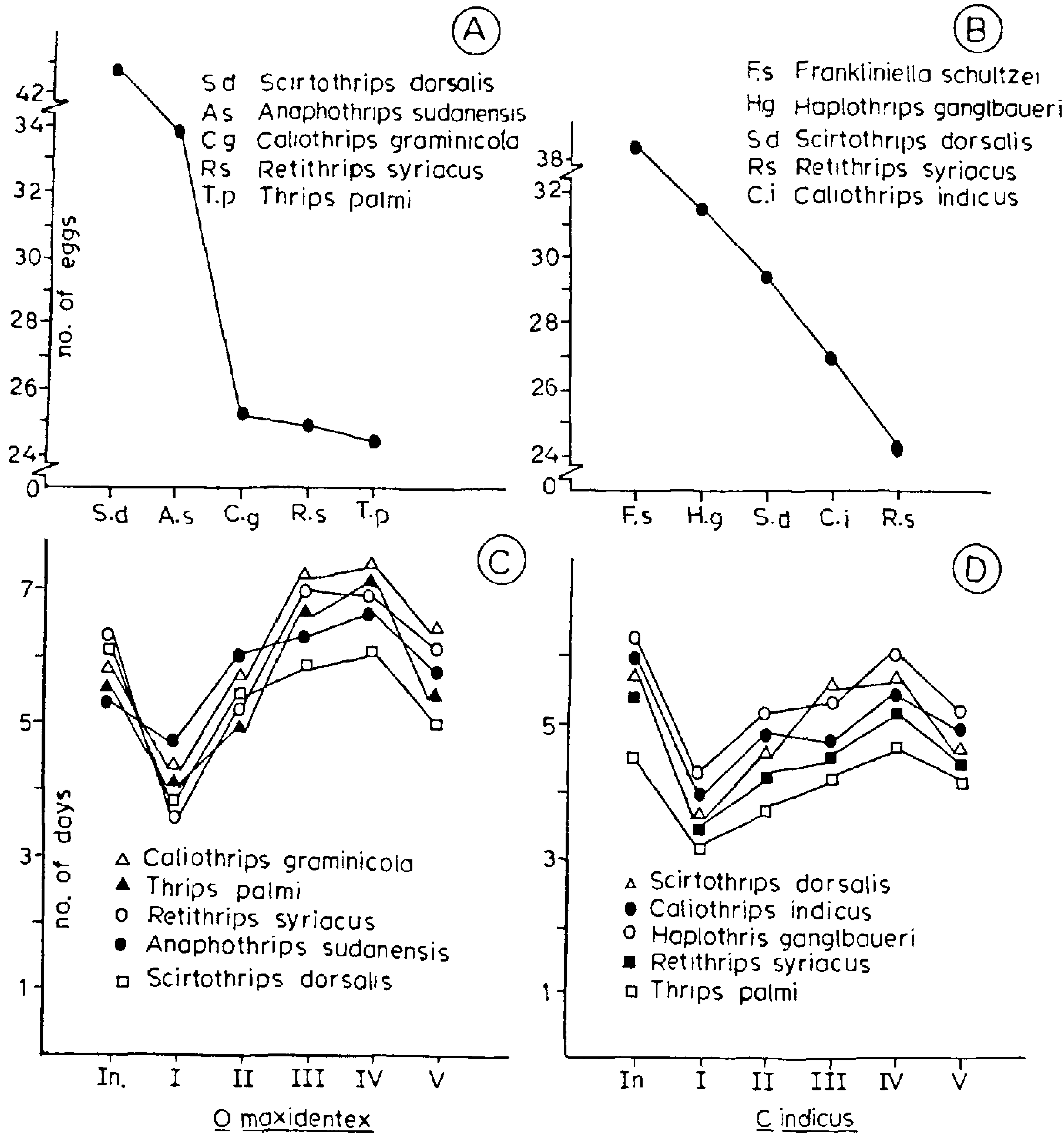

Figure 1 **A.** Fecundity of *O. maxidentex* when reared on different species of thrips. **B.** Fecundity of *C. indicus* when reared on different species of thrips. **C.** Rate of development of *O. maxidentex* when reared on different species of thrips. **D.** Rate of development of *C. indicus* when reared on different species of thrips. In–Incubation period. I–V– Instars of the predator.

dorsalis. In *Carayonocoris indicus* it ranged between 24.3 ±0.21 and 38.3 ±0.58, the minimum number of eggs produced when reared on *R. syriacus* and the maximum on *F. schultzei*.

Females of *Orius indicus* laid eggs more commonly in the scars of the pedicel rather than in the peduncle[4]. The number of eggs laid in each scar varied from 1 to 5. Eggs were also laid on the cup-shaped calyx. When females were provided with food only twice a week, eggs were always laid around the base of petals. The number of eggs laid by a single female in a day varied from 0 to 14 with an average of 3 eggs. The total number of eggs laid by a female ranged from 50–88. The egg laying potential of the female of *O. albidipennis* was studied[7] in association with different types of prey such as eggs of *Spodoptera littoralis* (Boisd) and *Earias insulana* (Boisd), *Aphis maidis* Fitsch., *A. gossypii* Glover and *Gynaikothrips ficorum*. The maximum number of eggs was however produced only when fed on thrips. The highest egg laying potential induced by feeding on thrips was associated with the shortest preoviposition period, longest oviposition period and the highest number of daily deposited eggs. Females of *C. indicus* have known to lay 53 eggs in 52 days, *M. moraguesi* 30–74 in 52 days, *X. clarus* 63 eggs in 59 days, *S. parallelus* 40–86 eggs in 61 days[3].

Speed of development

Variations in the life cycle of both the predators were evident when fed on different species of thrips, the details of which are given in the graph (figure 1 C and D), which showed that in the case of *C. indicus*, the shortest duration of life cycle was when fed on *F. schultzei* and longest when fed on *S. dorsalis*. For *Orius maxidentex*, the shortest duration was when fed on *S. dorsalis* and longest when fed on *Thrips palmi*. The duration of instars of both predators also varied with different prey.

The longevity of *O. tristicolor* (White) adults and nymphs increased and more nymphs were produced per female as the food supply of thrips increased. This undoubtedly applied to field conditions also. It is also known that an increase of thrips seems to follow the insecticidal kill of predators. However, the population of *O. tristicolor* still maintained its high correlation with the prey food source. When thrips are abundant in cotton fields, *O. tristicolor* could increase its number and provide a resistant population of biotic agents in cotton fields to help suppress mid and late season of cotton pests[8].

It is well established that the efficiency of predators depends on four factors *viz* the efficiency of consumption, high fecundity rate, quick development and the synchronisation of the predator and prey populations. An overall asessment of the above aspects with special reference to anthocorids indicate that in India species such as *Orius maxidentex*, *O. tantillus*, *O. indicus* and *C. indicus* could be successfully utilised as efficient agents for the control of many species of thrips pests. It is already known from different parts of the world that species such as *Orius insidiosus* (Say), *O. tristicolor* and *O. albidipennis* are effective predators of thrips, and the list of some of the more effective anthocorid species and their prey thrips provided below, would serve to further stimulate interest in this group of insects from the view point of their usefulness as predators. (table 1)

Orius albidipennis (Reut)	Egypt	*Thrips tabaci* Lind. *Gynaikothrips ficorum* Marchal *Retithrips syriacus* (Mayet)
Orius insidiosus (Say)	USA	*Sericothrips variabilis* (Beach) *Frankliniella tritici* (Fitch) *Anaphothrips obscurus* (Muller)
O. maxidentex Ghauri	India	*Scirtothrips dorsalis* Hood *Thrips tabaci* *Stenchaetothrips biformis* (Bag) *Caliothrips indicus* (Bag) *Microcephalothrips abdominalis* (Crawford) *Haplothrips ganglbaueri* Schmutz *Retithrips syriacus* *Anaphothrips sudanessis* (Trybom) *Caliothrips graminicola* (Bag. & Camer.)

		Thrips palmi Karny
O. laevigatus (Fieb)	Egypt	*Hercothrips fasciatus* Perg.
		Thrips tabaci
O. tantillus (Mots.)	India	*Scirtothrips dorsalis*
		Caliothrips indicus
		Haplothrips ganglbaueri
		Microcephalothrips abdominalis
		Stenchaetothrips biformis
O. indicus (L)	India	*Megalurothrips nigricornis*
O. minutus (L)	India	*Thrips tabaci*
		Parthenothrips dracaenae (Haeger)
		Megalurothrips distalis
		Frankliniella schultzei
		Haplothrips ganglbaueri
O. persequens (White)	USA	*Thrips tabaci*
O. tristicolor (White)	USA	*Frankliniella occidentalis* (Perg)
		Frankliniella tritici
Carayonocoris indicus Muraleedharan	India	*Haplothrips ganglbaueri*
		Frankliniella schultzei
		Scirtothrips dorsalis
		Retithrips syriacus
		Caliothrips indicus
Triphleps niger L	USSR	*Haplothrips niger* Osborn
T. minutus L	USSR	*Limothrips denticornis*
		Chirothrips manicatus Hal.
		Dendrothrips ornatus Jabl.
		Oxythrips ajugae Uzel.
		Frankliniella intonsa Tryb.
		F. tenuicornis Uzel
		Taeniothrips inconsequens (Uzel)
		Thrips fuscipennis Hal.

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