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STUDIES ON DISTRIBUTION, HOST RANGE OF RED COTTON BUG DYSDERCUSCINGULATUS (HEMIPTERA: PYRRHOCORIDAE) AND ITS CONTROL IN BIHAR

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ABSTRACT

Organic control programs have been mounted in some region(s) of the world against 13 of the 16 dossier bothers and considerable or fractional achievement has been accomplished in at least one nations for 8. Based on accessible data there regard incredible possibilities for diminishing, in probably a few pieces of the locale, the harm brought about by the accompanying: Leucinodes orbonalis, Nezara viridula, Ophiomyia phaseoli and Planococcus citri. There are additionally valid justifications for accepting that there will end up being significant regular foes for the accompanying: Agrius convolvuli, Anomis flava, Aphis craccivora, Aphis gossypii, Diaphorina citri, Dysmicoccus brevipes, Hypothenemus hampei, Phyllocnistis citrella and Trichoplusia ni. There is by all accounts little possibility for traditional natural control of Dysdercus cingulatus, too little is thought about Deanolis sublimbalis and the possibilities for control of Cosmopolites sordidus are muddled, despite the fact that its absence of vermin status in Myanmar is bewildering.

Keywords: Red Cotton Bug, Dysdercus Cingulatus, Okra, Infestation, Muzaffarpur

INTRODUCTION

The focal points and constraints of this framework were examined by Waterhouse (1993b). Of 160 bug and parasite bugs designated as significant in Southeast Asia, a subset of 47 was appraised as especially so. The point of the current work has been to sum up data pertinent to the possibilities for old style organic control of the most significant of those of this subset of 47 that are thought to have advanced external Southeast Asia. The supposition that will be that huge numbers of these have been presented without a few (now and then with no) of the regular foes that help to control them where they advanced. The odds are a lot of lower for arthropod bugs that advanced in Southeast Asia of presenting powerful, adequately have explicit, life forms from outside the area. Then again, there is motivation to accept that some parasitoids of bugs that are thought to have emerged in, or nearby, the Indian subcontinent may not yet happen all through the eastern locale of Southeast Asia and a few such irritations are managed.

In territorial contemplations of this sort, it is not out of the ordinary that not the entirety of the main 20, or even the best 10, of any one nation's arthropod bugs will essentially be incorporated. Without a doubt, probably a portion of those discarded may well legitimacy the creation of extra dossiers in the event that they are of such significance locally that a natural control program may be supported. ACIAR would be intrigued to learn of vermin that may be considered in this class. The synopsis accounts introduced are intended to empower a quick survey to be made of (I) the principle attributes of the central creepy crawly vermin of agribusiness that are accepted to be outlandish to part or all of Southeast Asia, (ii) what is known about their foes, especially those that have high or moderate degrees of host explicitness and (iii) what the possibilities give off an impression of being for lessening their irritation status by old style organic control.

In order to advance our knowledge of population dynamics, evolution of life history, and the physiological basis of adaptation, research on dispersal polymorphism in insects have played a critical role (Zera&Denno 1997). Many scientists have researched polymorphism in Heteroptera in general (Socha et al. 2005), and Pyrrhocoridae in particular (Socha&Zemek 2003). The red stainer, or red cotton worm, is generally classified as Dysdercuscingulatus (Fab.) (Heteroptera: Pyrrhocoridae). This is a multivoltine insect which, in its lifetime, has five to six gonadotrophic cycles and is one of the main pests of cotton and other malvaceous plants. D. When fed cultivated instead of wild species, cingulatus develops faster, and host plant properties such as feed weight and growth habit (arboreal or herbaceous) could not explain the differences in survival and development rate observed (Kohno & Thi, 2004). The preferred food plant and also the impact of the presence or absence of a scutellar black spot on life history characteristics (development, longevity, sex ratio, fecundity and hatchability) were investigated here.

In Southeast Asian countries, the red cotton bug or cotton stainer, Dysdercuscingulatus Fabricius (Heteroptera: Pyrrhocoridae), is the most extreme cotton insect species (Kohno and Bui Thi, 2004). Both insect nymphs and adults have common behaviours and feed on the cotton balls and leaves gregariously and voraciously, thereby producing prominent red clusters. As a result, the balls open irregularly and adversely affect the ginning quality and the seeds' oil content. Moreover, in addition to depositing excreta, the red cotton bug introduces a bacterium, Nematospora gossypii, into bolls that causes red lint staining, making the seeds unfit for sowing (Vasantharaj David and Kumaraswami, 1996). D. Cingulatus is a mobile parasite with several alternate species of host plants belonging to the Malvaceae 2 and Bombacaceae family and with succulent, juicy and oily seeds of other plants (Singh, 2004).

India's cultivation dates back to the civilisation of the Indus Valley. Agriculture's value can be calculated by agriculture's share of national income and job trends. Almost 50% of the rural population relies on agriculture as their primary source of subsistence. In addition, the subsistence of most Indians is also supported by all its associated fields such as lumbering, forestry, floral industry etc. It thus accounts for almost 20% of the Gross Domestic Product (GDP) and provides nearly 60 % of the population with employment (Singh, 2010). Many industries also rely on raw materials from the agricultural sector. The agriculture sector has been steadily transformed during the past two decades and has been an important part of overall economic growth. India has emerged as the largest producer of numerous agricultural products such as wheat, rice and the other main food staples of the world (FAO , 2011) as per the analysis of the Food and Agriculture Organisation of the United States World Agriculture Statistics. India has also gained recognition in meat production, as per the Live stock and Poultry (2011) analysis. However, with the highest growth rates, the production of dried fruits, seafood, sugarcane and a number of vegetables has often dominated the world's other industries. Nevertheless, in the area of cash crops such as sugarcane, tea , coffee, linseeds, ground nut, jute and cotton, India is also doing remarkable. India is estimated to be the world's fifth largest producer of 80% of agricultural products in 2010, including several cash crops such as coffee, sugar and cotton (FAO, 2011 and FAO, 2016).

OBJECTIVES

1. To screen the effective ecofriendly insecticide from the chosen plant products like citronellal, linalool, mahua (illuppai) oil, palmarosa oil, peppermint oil and pungam (kranj) oil based on its LD50 value against Dysdercuscingulatus,
2. To identify the highly toxic synthetic insecticide based on its LD50 value between the two insecticides; endosulfan and imidacloprid, which are widely used to control insect pests of cotton,
3. To understand the synergistic effect of plant products with synthetic insecticides against D. cingulatus,

REVIEW OF LITERATURE

Ansari and Khan (1973) further proved that the contact effect of (1.4 mg/sq.inch) triphenyltin TPTA (acetate) for adult females in D. Cingulatus has shown a greater decrease in both fertility and fertility. Hodjat (1971) noticed that 0.8- 6.0 p.g dieldrin per 5th instar nymphs of D were topically added. Fasciatus suppressed the development of embryos, and 0.6-6.0 jig doses / individual decreased egg fertility. The topical application of lower doses (sublethal) of dieldrin (0.2 to 0.6 ng / nymph) improved the development of eggs, however. Similarly, the comparative impact of sublethal doses of methidathion, carbaryl, methomyl, dicofol, propargite, glyphosate, DEF and sulphur as cotton leaf residues on GeocorispallensStal was analysed by Yokoyama 6 and Pritchard (1984) and reported that females exposed to DEF (defoliant) laid more eggs, while females exposed to glyphosate (herbicide) and methomyl laid more viable eggs. Lntration-50 sublethal concentrations (25-50 ppm of active substance, thiometon) when added to Pyrrhocorisapterus improved ovariole maturation during stimulation of individuals with diapause (Houck and Novak, 1978), while sublethal concentrations (30 ppm) of monocrotophos per 5th instar of D. nymphs were topically applied. Cingulatus reduced the average fecundity and fertility of the emerging females by 18 and 22 percent , respectively. The longevity of the surviving nymphs, adult males and females, however, significantly increased compared to the control (Khowaja et a/., 1994).

Chattoraj and Bhise (1980) observed in lepidoptera that the fertility of Spodoptera litura females arose from treated larvae exposed to dieldrin sublethal dose (3 jug) significantly reduced above control. In the laboratory test, exposure to sublethal concentrations of parathion (ethyl parathion) (Lc-30, i.e. 0.0088 percent and Lc-50 i.e. 0.0182 percent) of Spodoptera litura larvae resulted in a decrease in the oviposition and hatching rate of adult females (Patil and Khanvilkar, 1977). In comparison, Harnoto et al. (1984) provided proof from laboratory experiments that the larval stage exposure of S. Carbaryl litura at sublethal doses (75 fig / g) induced the developing females to lay more eggs than those females that formed from larvae that were not exposed to the chemical, and reported an improvement in egg development of up to 47.6 percent. Abdel-Salam and Nasr (1968) concluded that the larvae of trichlorfon, toxaphane or carbaryl treated Egyptian cotton leafworm had an increased developmental period, whereas the deposition of eggs decreased when only toxaphane and carbaryl were used. Similarly, the topical application to Spodoptera littorallis (Boisduval) of sublethal doses of carbaryl (26 ng / larva) produced a detrimental effect on egg hatching, whereas the same treatment induced an increase in pre-oviposition and oviposition as well as male and female longevity (Abo-Elghar et al . , 1972).

Livingston et al . (1978) noted that 3075 ppm benomyl exposure to 7 Trichoplusiani resulted in almost total male sterility. When combined with treated males, 5536 ppm of benomyl for Pseudoplusiaincludens resulted in a 40 percent decrease in hatching. Dabbor and Sayed (1982) noticed that the exposure of black cutworm Agrotisypsilon to trichlorex resulted in a substantial increase in the length of the larvae. Nevertheless, when the larvae were treated with carbaryl and linden, an increase in fertility but a decrease in hatchability was recorded. Pectinophoragossypiella (Saunders), Robertson (1948) reported that DDT was not only effective in killing larvae and adults, but also caused a reduction in the number of eggs produced by surviving treated adults in the search for effective compounds to control the pink bollworm. Later, Williams et al. (1958) discovered a number of insecticides that would kill P. gossypiella adults and reduce the surviving insects' fertility. In addition, DDT was found to produce mortality ranging from 53 to 77 percent at field dosages and reduced the number of eggs produced from 81 to 94 percent per month. The topical treatment to the adult pink bollworm, P. gossypiella (Saunders) of 1 ^l of DDT solution in acetone at 0.125 fxg and 0.25 ng dosage resulted in the development of less eggs and survived for less days than the untreated insects (Adkisson and Wellso, 1962).

Essac et al. (1972) observed that after the application of sublethal doses of carbaryl and methyl parathion, Spodoptera littorallis (Boisduval) adults emerged from the remaining larvae and oviposited more eggs than the control females. On the other side, under similar circumstances, fewer eggs were oviposited by larvae treated with endrin. The topical application of the higher selected sublethal concentrations (1250, 5000, and 10,000 ppm) of cythion (malathion) per 6th instar larvae of Spodoptera litura resulted in a fecundity reduction of 18.2, 13.3, and 10.7 percent and a fertility reduction of 14.97, 13.26, and 12.46 percent , respectively. The same treatment, however, improved the longevity of both the larval and pupal phases (Khowaja et al., 1993). Speyer (1924); Kalandaze (1927); Friederich and Stainer (1930) found that arsenicpoisoned lepidopterous larvae developed into sterile adults that were partial or complete. They laid fewer dose-dependent eggs when the moth Plodia interpunctella (Hubner) was treated with malathion (Soderstrom and Lovitt, 1970). Ferguson (.1942) recorded that the fertility of the southern armyworm, Prodeniaeridania (Gramer), was decreased by copper arsenate, but fertility was apparently unchanged.

MATERIALS AND METHODS

Red cotton bug nymphs were harvested from the Okra field and confined to jars (25 cm in diameter) with philtre paper on the bottom and closed with muslin cloth at the mouth of the container. Fresh seeds of Okra were provided at intervals of 2 days before the adults were born. Newly established adult couples were independently confined in jars with philtre paper on the bottom to acquire eggs. To preserve the humidity, moist cotton was given under philtre paper and fresh seeds of Okra were given every day. To observe egg laying, jars were tested regularly. Twenty eggs were collected from the jar after egg laying and kept in petri dishes. A period of incubation was recorded. The nymphs were moved to other petridishes after hatching and fresh okra seeds were given to them. Until the adults' emergence, different nymphal stages and nymphal period were reported. Now, male and female adults have been raised to observe their longevity separately. In order to measure fecundity, the amount of eggs deposited by each female was also measured. During the year 2016-17, tests were carried out in the laboratory at temperate 26-280 C and 72-76 percent humidity.

D. Adults and nymphs of cingulatus were collected from cotton fields in Thalapathi Samuthiram, Sivanthipatti, Killikulam and Alangulam, Tirunelveli District, Tamil Nadu, India, and preserved in plastic containers (20 x 10 x 15 cm) under laboratory conditions (27± 2 oC, 70-75 percent RH, 11L:13D photoperiod) on soaked cottonseed. Newly evolving adults (> 3 hr) were divided into males / females with two spots and males / females with three spots. Two-spotted males with two-spotted females (2M2F), three-spotted males with three-spotted females (3M3F), two-spotted males with three-spotted females (2M3F), and three-spotted males with two-spotted females (3M2F) were both variations together. Ten pairs of male and female bugs were picked randomly from the stock and each pair was housed in a different copulation and oviposition jar and retained until death in the laboratory. Copulation period, number of eggs laid, number of hatching nymphs, and male and female adult longevity were reported. From each category, sixty first-instar nymphs were then separately preserved, five per plastic container (500 ml capacity), with 12 replications in each category. Water and soaked cottonseeds, replaced every 24 hours, were supplied to nymphs. Of each type, nymphal developmental period, mortality, number of males and females, and female sex ratio were reported (Sahayaraj et al., 2004). Loose sterilised soil was put up to 2 cm for oviposition purposes within the plastic boxes.

RESULTS AND DISCUSSION

Eggs were laid in small clusters or individually. In colour, they were spherical and yellow. In Table 1, the inquiry data is summarised. The period of incubation ranged from 6 to 7 days. The newly hatched nymphs were pale orange, turning crimson lateron. With its rostrum touching the belly, the early nymph was around 2.5 mm long. The five nymphal instars were there. The duration varied between 2-3, 3-4, 6-7, 9-11 and 14-15 days respectively for the 1st, 2nd, 3rd, 4th and 5th instars. The completion of the complete nymphatic cycle was 34 to 40 days. The length of the overall life cycle ranged from 40 to 47 days. 20-23 days and 16-18 days, respectively, were found for male and female lifespan. Fertility varied from 54 to 64. Adult butterflies, with dirty white translucent wings and black spots on the forewings, were deep to dark brown in hue. The adult female (13–14 mm in length) was larger than the male (11–12 mm in length). From the previous work of Kamble (1971), who researched the life cycle and bionomics of the pest on okra fruit, the findings obtained here for life cycle length on okra seeds were variable. The shift in food might alter the length of the pest's life cycle & biology (Lot, 1956; Kohno and Nagan, 2004). The temperature shift could also change the length of the life cycle and other insect parameters (Schlichting and Pigliucci, 1998) & Kamble (1971) Verma & Patel (2012) researched pest biology and bionomics at 24 + 7.70 C while researching at room temperature (26-280C).

Table 1: Life cycle duration, longevity and fecundity of Red cotton Bug, Dysdercuscingulatus in Laboratory conditions

Stages	**Minimum**	**Maximum**	**Average**
Incubation period	6 days	7 days	6.5 days
Nymphal period			
1st instar	2 days	3 days	2.5 days
2nd instar	3 days	4 days	3.5 days
3rd instar	6 days	7 days	6.5 days
4th instar	9 days	11 days	10.0 days
5th instar	14 days	15 days	14.5 days
Total nymphal period	34 days	40 days	37.0 days
Life cycle duration	40 days	47 days	43.5 days
Longevity			
Male	20 days	23 days	21.5 days
Female	16 days	18 days	17.0 days
Fecundity	54 eggs	64 eggs	59 eggs

Plate -1 Okra Field

Plate -2 Adult Red Cotton Bug

The red cotton bug preferred to feed on cotton, followed by black gram and lady's fingers. In both cotton and black gram, D. cingulatus selected for feeding the lower part of the young and mature leaves, particularly the vein. Bugs had lower search times for cotton (3.0 ± 0.4 mins, n = 7) than black gram (5.1 0.04 mins, n = 7) and lady's fingers (16.0 0.7 mins, n = 7), and these differences were significant (F ± ± 2,18 = 24.0, p

Table 1: Nymphal developmental period (in days) of Dysdercuscingulatus produced by parents of different morphs mated together

	Life stages					
Parents	I	II	III	IV	V	Adult
3M-3F	3.0 ± 0.00	2.9 ± 0.1	4.8 ± 0.3	3.6 ± 0.2	6.8 ± 0.1	21.1 ± 0.7
2M-2F	3.0 ± 0.00	2.8 ± 0.0	4.0 ± 0.2	5.6 ± 0.4	6.5 ± 0.1	21.9 ± 0.7^{NS}
3M-2F	3.0 ± 0.00	4.1 ± 0.1	4.2 ± 0.4	5.2 ± 2.4	7.3 ± 0.7	23.3 ± 0.6 *
2M-3F	3.0 ± 0.00	2.4 ± 0.2	4.0 ± 0.2	3.5 ± 0.2	5.3 ± 0.3	18.2 ± 0.5 *

The influence of the spot polymorphism on the nymphal developmental period (Table 1) was clear. The offspring differed in their development times (F3, 22 = 8.70, pthose of similar parents (2M2F & 3M3F) had moderate development times and did not differ from one another; 2M3F offspring developed more quickly, and 3M2F took longer. Further investigations are necessary to confirm this finding

Females were heavier than the males, and in both sexes, D. cingulatus with two scutellar spots were lighter (males 289.3± 1.5; females 532.2± 3.0 mg)than those with three spots (males 359.2 ± 2.8; females 580.5± 1.7 mg). In a 2-way ANOVA, sex ($F_{1,18}$ = 19.4, p

There were significant differences in sex ratio (χ^2, p0.01) among pairings, malebiased in the 3M2F and 2M3F pairings, and approximately equal in 2M2F and 3M3F (Table 2). During oviposition as adult females,3M3F offspring made deeper egg chambers (1.8 ± 0.1 cm), followed by 2M2F (1.2± 0.1 cm), 3M3F (1.2 ± 0.1 cm) and 2M3F (1.2 0.1 cm). Chamber widths were always 6 to 8 mm.

D. cingulatus usually finished oviposition activity within 20-30 mins. Females from 2M2F crosses laid the maximum number of eggs, followedby 3M3F, 2M3F, and 3M2F and these were significantly different (p<0.05)A similar order was also observed for nymphal hatching (p<0.05).Incubation period was very shorter for 3M2F followed by 2M3F2M2F and 3M3F. Statistical analyses among the four groups were significant(P < 0.010) (Table 3)

Table 2: Morph distribution and sex ratio of the offspring of various parental morph matings in Dysdercuscingulatus

Parental morphs	Number of offspring	Offspring with two spots		Sex ratio	Offspring with three spots		Sex ratio	Overall sex ratio
		male	female		male	female		
3M-3F	136	32	42	0.62	36	26	0.38	0.50
2M-2F	120	29	39	0.65	26	26	0.43	0.54
3M-2F	36	32	2	0.11	0	2	0.11	0.11
2M-3F	108	78	30	0.56	0	0	0.00	0.28

Table 3: Combination of various morphs on number of eggs laid, incubation period (in days) and per cent of egg hatching of D. cingulatus

Parental morphs	Mean number of eggs laid	Incubation period	Hatching %
3M-3F	79.8	5.8	75.88
2M-2F	91.8	5.3	77.44
3M-2F	59.0	4.5	62.03
2M-3F	72.0	4.8	58.53
F-value	10.13	34.12	9.45

CONCLUSION

If the reader is perhaps, somewhat uncertain of what conclusions to draw from the extensive data in the foregoing accounts, the studies of Jones et al. (1983a), dealing with the impact of parasitoids and predators on T. ni populations on celery in California, provide valuable insights. He concludes that naturally-occuring entomophagous arthropods do, indeed cause irreplaceable mortality of T. ni and that they should be considered a key part of any Integrated Pest Management program for the crop. Although parasitoids (principally Trichogramma spp., Copidosoma truncatellum and Voria ruralis, but also Hyposoter exiguae, Microgaster brassicae, Cotesia marginiventris and Chelonus insularis) can explain, for this crop, most mortality of eggs and of both small and medium sized larvae, it should not be concluded that predators are unimportant. It is possible that the additional small amount of mortality due to parasitoids is that required to suppress pest density to just below damaging levels. The parasitoids involved have a more restricted host range than the 2 most important groups of egg predators in celery, namely Coccinellidae (Hippodamia convergens and Cycloneda sanguinea) and Anthocoridae (Orius tristicolor) which are both widely polyphagous

REFERENCES

[1] Ahmad, I. and F.A. Mohammad (1983), Biology and immature systematics of red cotton stainerDysdercusKoenigiiFabr (Hemiptera :Pyrrohocoridae) with a note on their phylogenic value Bull Zool. 1 : 1–9.
[2] Boopathi et al. (2011) Seasonal incidence of major insect pests on okra in Mizoram, India The Jour. of Plant Protection Sciencesvol.
[3] 3, No. – 01, PP 54–56 3. Kamble, S.T. (1971) Bionomics of DysdercusKoenigii Fab. J. NewworkEntomol. Soc. 79 : 154–157.
[4] Kohro, K. and Nagan, T.B. (2004) Effects of host plant species on the development of D. cingulatus (Hemiptera :Pyrrhocoridae) Appl. Entamol. Zool. 39 : 183–187
[5] Lot, M. (1956) Longevidate de DysdercusFemcasadultas de DysdercusmendesiBlocte, emcondicoes de laboratorio, Broganita15 : 43–54.
[6] Sochlichting and Pigliucci, M. (1998). Phenotypic evaluation : a reaction norm perspective Sinauer Associates, Sunderland M.A.
[7] Venugopal K.J., D. Kumar, A.K. Singh (1994). Development studies on proteins from haemolymph, fat body and ovary of a photophagous pest. DysdercusKoenigiiJ. Biochem. 10 : 297– 302

[8] Verma, H.S. and Patel, R.K. (2012), Biology of red cotton bug (D. Koenigii) AGRES An international e– journal (2) : 148–156
[9] Verma, et al. (2013) Biology of red cotton bug Dysdercuscingulatus, Insect environment vol. 19 (3) , 140–141