



Record of *Chelonus* Panzer (Braconidae: Cheloninae) from central India

Mohd. Yousuf and Puja Ray

ABSTRACT

The genus *Chelonus* Panzer comprises of important larval parasitoids of several lepidopteran pests. Eight species of *Chelonus* viz., *Chelonus (Chelonus) deogiri*, *Chelonus (Chelonus) gastrus*, *Chelonus (Chelonus) dwibindus*, *Chelonus (Chelonus) narayani*, *Chelonus (Chelonus) shafeei*, *Chelonus (Microchelonus) notaulii*, *Chelonus (Chelonus) nr. indicus* and *Chelonus (Microchelonus) scutellatus* were recovered during taxonomic survey of forests and their adjoining agro-forestry areas of Chhattisgarh and Maharashtra. These parasitoids are undoubtedly important as they play an effective role in balancing the ecosystem by keeping a check and control on the population of insect pests. Out of these recorded *Chelonus* species, some of the promising species can be utilized in biological control of key forest insect pests, after going through their further studies on biology, natural field incidence, laboratory efficacy and their mass rearing techniques.

Key words: Biological control, Braconidae, Cheloninae, *Chelonus*, Hymenoptera, lepidopterous pests.

INTRODUCTION

Chelonus Panzer is a larger cosmopolitan genus belonging to sub-family Cheloninae which comprises of solitary koinobiont egg-larval endoparasitoids of Lepidoptera, especially insect pests belonging to Tortricoidea and Pyraloidea. These wasps are easily recognized by their black compact appearance with body size 2-6 mm and robust carapace-like abdomen formed by fusion of the first three metasomal terga covering the rest of the gaster (Dudarenko, 1974). The female wasp has a short ovipositor, occasionally concealed inside the carapace, and antennae thickened in the middle with depressions in the apical flagellar segments. Apparently males can be distinguished from the females by their thin and long body having somewhat setaceous antennae. Wing venation is complete but shifted to the middle part of the wings (radial and 2nd radio-medial cells short); only the 1st anal cross-vein is usually somewhat developed. The post-pectal ridge is well developed (Shaw, 1997). Adults are free-living whereas larvae are parasitic of host larvae. Therefore, they play an effective role in the natural check and balance of pest population in ecosystem from the outbreak of several key insect pests of economic importance to agricultural crops, orchards and forest tree species. The genus *Chelonus* includes a large number of economically important natural enemies of several lepidopterous pests (Swamiappan and Balasubramaniam, 1980; Prasad *et al.*, 1982; Pawar *et al.*, 1983; Baringbing, 1984; Zenner *et al.*, 2006; Heydari and Gharedaghli, 2007;

Kranthi and Russell, 2009). *Chelonus inanitus* is known to be a parasitoid of *Spodoptera littoralis*, *S. exigua* and *S. frugiperda* (Rechav, 1975, 1978; Rechav and Orion, 1975). *Chelonus insularis* is an important biocontrol agent of the fall armyworm, *S. frugiperda*, a pest that causes severe damages in corn fields in South America (Medina *et al.*, 1988). *Chelonus blackburni*, imported from USA in 1976 by the Indian Station of the Common Wealth Institute of Biological Control, Bangalore and released near Bangalore against *Helicoverpa armigera* Hubner, a major pest of cotton (Nagarkatti and Singh, 1989). It has also been recorded later from *Earias* spp., *Pectinophora gossypiella* and *Phthorimaea operculella*, providing substantial control to these pests (Morghan and Crumb, 1941; Rao *et al.*, 1979; Kumar and Ballal, 1990; Ramani and Ballal, 1994). The knowledge of available indigenous species of parasitoids can be very helpful in identifying the potential biocontrol agents. In spite of having the importance in biological control of insect pests, not much work has been carried out on identification of indigenous species of *Chelonus*, especially from central India.

MATERIAL AND METHODS

Taxonomic survey of important forestry and adjoining agro-forestry areas of 16 districts of Chhattisgarh and 28 districts of Maharashtra covering 433 localities of 44 districts was undertaken from 2007 to 2009 for the collection of Braconid parasitoids (Hymenoptera: Ichneumonoidea).

These species were collected by sweeping method. During sweeping, green areas of forestry and agro-forestry lands and green areas near water bodies were taken under consideration. Collected insects were preserved in 70% alcohol. The insects belonging to genus *Chelonus* Panzer were identified on the basis of the earlier work done by Cameron (1907), Gupta (1955), Subba Rao (1955), Rao and Chalikwar (1971), Walker and Huddleston (1987), Narendran *et al.* (1992), Narendran *et al.* (1992), (Kurahde and Nikam, 1993, 1994) and Samiuddin *et al.* (2000a, 2000b).

RESULTS AND DISCUSSION

Totally 460 samples of insects were collected during sweeping. Among them, 1867 braconids were sorted out and preserved. Out of these collected Braconids, *Chelonus* species were segregated for the present study. In the present study, taxonomic survey of Chhattisgarh and Maharashtra harbored eight species of *Chelonus* viz, *Chelonus (Chelonus) deogiri*, *Chelonus (Chelonus) gastrus*, *Chelonus (Chelonus) dwibindus*, *Chelonus (Chelonus) narayani*, *Chelonus (Chelonus) shafeei*, *Chelonus (Microchelonus) notaulii*, *Chelonus (Chelonus) nr. indicus* and *Chelonus (Microchelonus) scutellatus* were collected and identified up to species level with *Chelonus (Chelonus) dwibindus* showing highest occurrence and wide distribution. Diagnosis, hosts and distribution of these parasitoids were listed below:

Chelonus (Microchelonus) scutellatus Narendran and Sumodan

Chelonus scutellatus Narendran and Sumodan in Narendran *et al.*, 1992: 4.

Diagnosis: Body length about 5 mm; head 3 times as wide as long, antennae 16 segmented, shorter than the body; OOL: POL = 16:8; eye length: malar space = 21:13; fore wings about 3 times as long as wide; stigma about 2.5 times as long as broad, radial cell on the wing margin slightly more than half as long as the stigma; r is about half as long as the width of the stigma; r: 3SR: SRI = 6: 10: 32; gaster slightly shorter than the head and thorax combined. Ovipositor is not visible in the dorsal view.

Hosts : Unknown

Distribution: India; Kerala (Amalagiri, Mangode, Aralam farm, Maliyankara); Maharashtra (Thane, Kharbaw).

Material examined: India: Maharashtra, Thane, Kharbaw 1 ♀, 25.III.2009, M. Yousuf.

***Chelonus (Microchelonus) notaulii* Rao and Chalikwar**
Chelonus (Microchelonus) notaulii Rao and Chalikwar, 1971: 469.

Diagnosis: Body length about 3.5 mm; head about 2 times as wide as long, antennae 16 segmented; fore wings about 2.5 times as long as wide; stigma slightly less than 3 times as long as broad, radial cell on the wing margin slightly shorter than stigma, r is half as long as the width of the stigma and slightly shorter than the 2-SR; carapace with apex rounded, a little shorter than the head and thorax combined. Ovipositor well exerted and about 1.3 times as long as hind basitarsus.

Hosts: Unknown

Distribution: India ; Maharashtra (Aurangabad, Nagpur); Chhattisgarh (Bilaspur).

Material examined: India: Chhattisgarh, Bilaspur, Kurudon, Arpa River, 1 ♂, 27.III.2008; Maharashtra, Nagpur, Kundhali, 1 ♂, 17.IX.2008, M. Yousuf.

***Chelonus (Chelonus) dwibindus* Rao and Chalikwar**
Chelonus (Chelonus) dwibindus Rao and Chalikwar, 1971: 475.

Diagnosis: Body length about 5.5 mm; head about 2.2 times as wide as long, antennae 25 segmented; POL is slightly shorter than OOL; malar space about 1.5 times the basal width of the mandible; fore wings about 2.5 times as long as wide; stigma slightly more than 2 times as long as broad and as long as the radial cell on the wing margin; r is slightly more than half as long as width of stigma and also slightly more than half as the first transverse cubitus. Carapace is a little shorter than the head and thorax combined, black except yellow band on the basal one-third part of carapace and it is medially interrupted by black area; ovipositor exerted, short and about 1.5 times the length of the hind basitarsus.

Hosts: Unknown

Distribution: India; Maharashtra (Aurangabad, Parbhani, Gadchiroli, Jalna, Yavatmal); Chhattisgarh (Bastar, Kawardha, Rajnandgaon).

Material examined: India: Chhattisgarh, Bastar, Dahikonga, 1 ♂, 19.VIII.2007; Kawardha, Indori, 1 ♂, 15.VI.2008; Maharashtra, Gadchiroli, Vasa, 5 ♂, 2 ♂, 31.VIII.2008; Yavatmal, Aab bori, 1 ♂, 25.XII.2008; Jalna, Bavne Pangri, 1 ♂, 27.III.2009, M. Yousuf.

***Chelonus (Chelonus) deogiri* Kurhade and Nikam**
Chelonus (Chelonus) deogiri Kurhade and Nikam 1994: 145.

Diagnosis: Body length about 5.5 mm; head about 2.5 times as wide as long; antennae 26 segmented; malar space about 1.3 times the basal width of the mandible; fore wings slightly more than 2.5 times as long as wide; stigma about 2.5 times as long as broad and slightly longer than the radial cell on the wing margin; r is distinctly shorter than

the width of stigma; hind wings about 3.5 times as long as broad; carapace shorter than head and thorax combined, black except two baso-lateral yellowish white spots; ovipositor sheath as long as hind basitarsus.

Hosts: *Helicoverpa armigera* (Kurahde and Nikam, 1994).

Distribution: India; Maharashtra (Aurangabad); Chhattisgarh (Bastar).

Material examined: India: Chhattisgarh, Bastar, Balenga 1, Farsagura 1, 19.VIII.2007; M. Yousuf.

***Chelonus (Chelonus) gastrus* Narendran and Sumodan**
Chelonus gastrus Narendran and Sumodan, in Narendran *et al.*, 1992: 2.

Diagnosis: Body length about 5 mm; head about 2.5 times as wide as long; OOL: POL = 6: 8; antennae 18 segmented; fore wings shorter than the body, about 3.5 times as long as broad; stigma slightly more than 3 times as long as broad, radial cell on the wing margin slightly more than half as long as stigma, r nearly half the length of stigma, r: 3SR: SR1 = 5: 6: 14; gaster slightly shorter than head and thorax combined, carapace black except basal yellow band medially interrupted by brown area; ovipositor not visible dorsally.

Hosts: Unknown

Distribution: India; Kerala (Nilambur, Trichur, Thariyod); Chhattisgarh (Raigarh).

Material examined: India: Chhattisgarh, Raigarh, Tarai Mal, 1, 27.XII.2007; M. Yousuf.

***Chelonus (Chelonus) shafeei* Samiuddin, Haider and Ahmad**

Chelonus (Chelonus) shafeei Samiuddin, Haider and Ahmad 2000a: 239.

Diagnosis: Body length about 3.5 mm; head more than twice as broad as long in dorsal view; distance between posterior ocelli is about 2 times as the distance between anterior to posterior ocelli; antennae 29 segmented; malar space slightly less than 2 times the basal width of the mandible; fore wings about 2.5 times as long as broad; stigma about 2 times as long as broad but slightly shorter than the marginal cell; vein r is as long as 3-SR, about half the width of stigma; hind wings about 4.0 times as long as broad, vein M+CU shorter than 1M; carapace slightly shorter than the length of head and thorax combined, black except one basal yellow band; ovipositor not exerted.

Hosts: Unknown.

Distribution: India; Uttar Pradesh (Aligarh); Chhattisgarh (Koriya, Bastar).

Material examined: India: Chhattisgarh; Koriya, Baikunthpur, 1, 22.XII.2006; Bastar, 1, 19.VIII.2007, M. Yousuf.

***Chelonus (Chelonus) nr. indicus* Cameron**

Chelonus (Chelonus) nr. indicus Cameron 1907: 578.

Diagnosis: Body length about 5mm; antennae 30 segmented; forewings with length of stigma about 2.5 times as long as wide, distinctly longer than the metacarp, r is just shorter than the width of the stigma. r: 2SR: 3SR: SR1 = 10: 12: 9: 29; Hind legs with shorter tibial spur 0.1 times and the longer tibial spur 0.5 times as long as the basitarsus; carapace is longer than the combined length of head and thorax; Carapace black with a basal pale band.

Hosts: Unknown

Distribution: India; Chhattisgarh (Raipur); Maharashtra (Thane).

Material examined: India: Chhattisgarh, Raipur, Mana 1, 22.VIII.2007; Maharashtra, Thane, Oligaon, 1, 25.III.2009, M. Yousuf.

***Chelonus (Chelonus) narayani* Subba Rao**

Chelonus narayani Subba Rao, 1955: 63.

Diagnosis: Body length about 4.5 mm; head in front view slightly wider than long, antennae 24 segmented, slightly longer than the total length of head and thorax; propodeum longer than the meso and meta-thorax taken together; fore wings with stigma less than half as broad as long, radial cell on the wing margin smaller than the stigma; abdomen slightly longer than the thorax; the ventral opening extending almost to apex of carapace. Ovipositor exerted.

Hosts: *Helicoverpa armigera*, *Corcyra cephalonica*, *Chilo zonellus* (Chatterjee and Misra, 1974).

Distribution: India; New Delhi; Rajasthan; Maharashtra (Bhandara, Buldhana, Thane).

Material examined: India: Maharashtra, Bhandara, Shri Nagar Village, 1, 1, 28.VIII.2008; Buldhana, Kolwad, 2, 20.III.2009; Thane, Kharbaw 1, 25.III.2009, M. Yousuf.

These species of *Chelonus* Panzer are widely distributed and well acclimatized in central India. The larval parasitoids belonging to the genus *Chelonus* are valuable biological control agents that can be integrated easily with conventional management practices, in order to manage the key insect pests and helping in reducing the use of insecticides for the control of important insect pests. After careful studies on their host range and mass multiplication techniques, selected species of *Chelonus* can be utilized in biological control of key insect pests. Along with the studies on important aspects like biology, laboratory

efficacy, mass multiplication and field efficacy of these parasitoids; care should also be taken to preserve these natural bio-control agents.

ACKNOWLEDGEMENTS

We are extremely thankful to Dr. A. K. Mandal, Director TFRI, Jabalpur, and Dr. K. C. Joshi, Group Coordinator Research and Head, Forest Entomology Division, TFRI, Jabalpur, for providing necessary research facilities and encouragement. Financial support from Council of Scientific and Industrial Research (CSIR Project No. 37(1296) / 07/ EMR II) is also acknowledged.

REFERENCES

- Baringbing, W. A. 1984. Studies on *Chelonus* sp. a parasite of the coconut moth *Batrachedra arenosella*. *Tropical Pest Management*, London, **30** (2): 207.
- Cameron, P. 1907. On the parasitic Hymenoptera collected by Major C. G. Nurse in the Bombay Presidency. *Journal of Bombay Natural History Society*, **17** (3): 578-597.
- Chatterjee, P. N. and Misra, M. P. 1974. *Natural Insect enemy and plant host complex of forest insect pests of Indian region*. Indian Forest Bulletin. No.265 (New Series), Entomology. FRI Publication., 232 **PP**.
- Dudarenko, G. P. 1974. Formation of the abdominal carapace in braconids (Hymenoptera, Braconidae). *Entomological Review*, **53**: 80-90.
- Gupta, V. K. 1955. On a new species of *Chelonus* (Braconidae: Parasitic Hymenoptera) from India. *Agra University Journal of Research Science*, **4**: 209-211.
- Heydari, A. and Gharedaghli, A. 2007. Integrated Pest Management on Cotton in Asia and North Africa. Published by Inter-regional Network on Cotton in Asia and North Africa (INCANA). 76 **PP**.
- Kranthi, K. R. and Russell, A.K. 2009. Changing Trends in Cotton Pest Management. In: *Integrated Pest Management: Innovation - Development Process Volume 1* (Rajinder Peshin and Ashok, K. Dhawan eds.), Springer Netherlands, 499 - 541 **PP**.
- Kumar, P. and Ballal, C. R. 1990. Influence of laboratory hosts on the biological attributes of *Chelonus blackburni* (Hymenoptera: Braconidae). *Entomophaga*, **35**: 329 - 333.
- Kurhade, S.M. and Nikam, P.K. 1993. On two new species of *Chelonus* Panzer (Hymenoptera: Braconidae) from India. *Journal of Bombay Natural History Society*, **90**(3): 474 - 478.
- Kurhade, S. M. and Nikam, P. K. 1994. A new species of genus *Chelonus* Panzer (Hymenoptera: Braconidae) from India. *Entomon*, **19** (3 - 4): 145 - 147.
- Medina, T. M. C., Camacho P. D., Luque, Z. J. E. and Siabatto, P. A. 1988. Ciclo de vida y descripción de *Chelonus insularis* Cresson (Hymenoptera: Braconidae), parásito de *Spodoptera* spp. *Revista Colombiana de Entomología*, **14**: 13-21.
- Morghan, A. C. and Crumb, S. E. 1941. The tobacco split worm. *Bulletin of U.S. Department of Agriculture* Washington D. C., **59**: 7.
- Nagarkatti, S. and Singh, S.P. 1989. Importation and establishment of new natural enemies of *Heliothis* spp. (Lepidoptera : Noctuidae) into India. In: *Proceedings of workshop on biological control of Heliothis: Increasing the effectiveness of natural enemies*. New Delhi, India. 11-15 November, 1985. Far Eastern Regional Research Office, U.S. Department of Agriculture, New Delhi, India, 375 - 385 **PP**.
- Narendran, T.C., Sumodan, P. K. and Rema, C.G. 1992. A study of Indian species of *Chelonus* Panzer (Hymenoptera: Braconidae). *Journal of the Zoological Society of Kerala*, **2** (2): 1-9.
- Pawar, A.D., Prasad, J., Asre, R. and Singh, R. 1983. Introduction of exotic parasitoid, *Chelonus blackburni* Cameron in India for the control of cotton bollworms. *Indian Journal of Entomology*, **45**: 436 – 439.
- Prasad, J., Pawar, A. D. and Sharma, R. K. 1982. Biocontrol trials with an exotic egg larval parasitoid *Chelonus blackburni* Cameron on *Heliothis armigera* (Hübner) at Mundhal, Hissar, Haryana. *Journal of Advanced Zoology*, **3**: 160 –161.
- Ramani, S. and Ballal, C. R. 1994. Influence of change of host on handling time and its variation in *Chelonus blackburni* Cameron (Hymenoptera : Braconidae). In: *Biological control of insect pests* (Goel, S.C. ed.) *Proceedings of the National Symposium on Advances in Biological control of Insect Pests*, 81- 86 **PP**.
- Rao, K.J., Thontadarya, T.S. and Rangadhamaiah, K. 1979. A note of the survival and parasitism of the egg-larval parasite *Chelonus blackburni* Cameron (Hymenoptera: Braconidae) on some lepidopterous hosts. *Current Research*, **8**: 48 - 50.
- Rao, S. N. and Chalikwar, M. R. 1971. Studies on parasitic Hymenoptera (Braconidae) from Marathwada, III. Three new species of *Chelonus* Panzer, *Oriental Insects*, **5**(4): 469 - 476.
- Rechav, Y. 1975. Biological and ecological studies of the parasitoid *Chelonus inanitus* (L.) (Hymenoptera : Braconidae) in Israel. I. Distribution, abundance and parasitism in natural host populations. *Entomophaga*, **20** (4): 365 – 372.
- Rechav, Y. 1978. Biological and ecological studies of the parasitoid *Chelonus inanitus* (L.) (Hymenoptera :

- Braconidae) in Israel. IV. Oviposition, host preferences and sex ratio. *Entomophaga*, **23** (1): 95 – 102.
- Rechav, Y. and Orion, T. 1975. The development of the immature stages of *Chelonus inanitus*. *Annals of the Entomological Society of America*, **68**: 457 – 462.
- Samiuddin, A., Haider, A. A. and Ahmad, Z. 2000a. A new species of Cheloninae (Hymenoptera: Braconidae) from India. *Journal of Entomological Research*, **24** (3): 239-242.
- Samiuddin, A., Shujaiddin and Haider, A.A. 2000b. A new species of genus *Chelonus* Panzer (Braconidae: Cheloninae) from India. *Journal of Insect Science*, **13** (1-2): 10-12.
- Shaw, S. R. 1997. Subfamily Cheloninae. In: *Manual of the new world genera of the family Braconidae* (Hymenoptera) (Wharton, R. A., Marsh, P. M. and Sharkey, M. J. eds.) Published by The International Society of Hymenopterists, Washington, DC., 193 - 201 PP.
- Subba Rao, B. R. 1955. A new species of *Chelonus* on *Heliothis armigera* (Fabricius). *Indian Journal of Entomology*, **17**: 63 - 64.
- Swamiappan, M. and Balasubramanian, M. 1980. Studies on mass multiplication and potentiality of *Chelonus blackburni* Cam. a braconid parasite of cotton bollworms. *Entomon*, **5**: 73 – 75.
- Walker, A. K. and Huddleston, T. 1987. *Chelonus chailini* sp. n. (Hymenoptera: Braconidae) from Malaysia, parasitizing gracillariid moth (Lepidoptera). *Bulletin of Entomological Research*, **77** (3): 437-440.
- Zenner, I., Alvarez, A. and Barreto, S. 2006. Influence of parasitism by *Chelonus insularis* Cresson (Hymenoptera: Braconidae) on the susceptibility of *Spodoptera frugiperda* (Smith, J.E.) (Lepidoptera: Noctuidae) to insecticides. *Neotropical Entomology*, **35** (6): 818 - 822.

Mohd. Yousuf and Puja Ray

Forest Entomology Division, Tropical Forest Research Institute, Jabalpur- 482021, Mathya Pradesh, India,
E - mail: yousuf_tfri@yahoo.com