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Tortoise beetles and their host plants from Pune (Maharashtra State, India) and nearby places (Coleoptera: Chrysomelidae: Cassidinae)

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ABSTRACT. Pune and surrounding area is being surveyed specifically for 'leaf-eating' Cassidinae beetles for over 5 years. So far we have identified 37 different species belonging to 11 genera, two of these species have already been described as new to science. Genus *Cassida* (11) has maximum number of species and following that are genera like *Aspidimorpha* (7), *Chiridopsis* (6) and *Laccoptera* (5). Genus *Notosacantha* is represented by 2 species while genera like *Epistictina*, *Craspedonta*, *Conchyloctenia*, *Capelocassis*, *Oocassida and Rhytidocassis* are represented by only one species each. An attempt is also made to identify the host plant for most species and it appears that Convolvulaceae is the family selected by many Cassidinae around Pune. In addition record of host plants belonging to families like Bignoniaceae and Apocyanaceae and Rhizophoraceae are interesting.

Key words: entomology, bionomy, host plants, Chrysomelidae, Cassidinae, Pune, Maharashtra State, India.

INTRODUCTION

Tortoise beetles belong to the sub-family Cassidinae, of the family Chrysomelidae. These are all leaf eating beetles and are often conspicuously coloured. These beetles are easily recognized due to their characteristic shape.

MAULIK (1919) put together, for the first time, all the Cassidinae (and Hispinae) species of the then British India, in form of the Fauna of British India volume.

There is no recent comprehensive Fauna of Cassidinae (for India) after MAULIK, although several new species have been described from India after 1919. Major revision of Cassidinae of the World and preparation of the World Catalogue has been recently completed by BOROWIEC (1999). This catalogue lists all the major taxonomic papers published on Asiatic Cassidinae, gives all the synonyms and known distribution of each species as well as names of host plants (wherever known). The reader is therefore referred to World Catalogue for those details (electronic, revised version of the catalogue is available under Internet address www.biol.uni.wroc.pl/cassidae/katalog%20internetowy.index. htm).

There was no previous attempt to collect tortoise beetles of this area. A Minor Research Project Grant from University Grants Commission (to HVG) allowed us to carry out this work. A few species have been reported from this area as well as from other parts of India, as stray collections, in previous publications (BOROWIEC 1990, 1996, 2001; BOROWIEC and TAKIZAWA 1991); however this is the first consolidated report of the surveys, specifically carried out for Cassidinae, for more than 5 years in and around Pune.

METHODS

Since 1995 we have started a survey of this group of beetles in and around Pune (about 150 km around Pune). We regularly visit the various areas, in and around Pune, which possess appropriate vegetation and look for tale-tell marks on the leaf. Since these insects are leaf eating beetles, presence of large holes on the leaves indicate their possible presence. The area is then thoroughly checked and the beetles are collected by hand-picking. After proper preservation the beetles are identified using the Fauna and the other relevant literature. Host plants (the plants on which insects complete life cycle are treated as host plants), are similarly collected and identified using available keys. Basic identification being mainly carried out using COOKE's well known Flora of the Bombay Presidency.

RESULTS AND DISCUSSION

This study has already resulted in description of 3 new species, namely *Chiridopsis nigropunctata* from Kas, near Satara (BOROWIEC and GHATE 1999), *Chiridopsis rubromaculata* from Rehekuri, near Ahmednagar (BOROWIEC et al. 2001) and *Notosacantha chandrapurensis* from Tadoba, Chandrapur (ŚWIĘTOJAŃSKA, GHATE and MARATHE, 2001). In addition we have, for the first time, described in detail the life history stages of an interesting Cassidinae member, namely *Notosacantha vicaria* (RANE et al. 2000). Similar observations on other two beetles, namely *Conchyloctenia nigrovittata* and *Epistictina reicheana* have also been published recently (RANE et al. 2001; GHATE and RANADE 2002). Detailed description of the first and last instar larvae, along with notes on bionomy,

for many species of the genus *Chiridopsis* has been undertaken and first part of this work will be soon published (GHATE et al. 2003 in press). Similarly detailed larval morphology for *Craspedonta leayana* (LATREILLE), has also been completed (ŚWIĘTOJAŃSKA and GHATE 2003, in press).

Here we are listing the Cassidinae beetles that we have collected in Pune and surrounding area only, as explained above. No species is listed just from previous literature. A list of beetles collected elsewhere, far away (more than 200 km and even in other States) from Pune, will be published separately. The current taxonomic name of the beetle, as per BOROWIEC (1999), is given in bold italics while the name used by MAULIK (1919) is given below each current name. Locality and other records are also provided for every species.

It is interesting to note here that most of these species were formerly known only from South or North-East India. For example, *Cassida flavoguttata* was known only from Nilgiris until we reported it from Kas, near Satara (RANE et al., 1999). Similarly *Laccoptera quatuordecimnotata* was known, until recently, from Southern States of India (see also ŚWIĘTOJAŃSKA 2001). *L. foveolata*, another conspicuous beetle, was known only from Myanmar (formerly Burma) and no one has collected/reported fresh specimens since the original description of the species. *Cassida cognobilis*, another interesting species, described by SPAETH from "Hindoustan, Ramaud", is only recently reported again from North East (BOROWIEC, 2001).

On the other hand, *Craspedonta leayana* (a serious pest of *Gmelina* trees in some parts) was reported from Pune over 110 years ago (see MAULIK 1919) and it still appears every year along with monsoon rains. Even comparatively large and attractive looking species like *Aspidimorpha sanctaecrucis*, *A. inuncta* and *Conchyloctenia nigrovittata* have missed the attention of entomologists. It is true that invertebrates are receiving less attention while documenting biodiversity. These insects, which grow and complete their life cycles on plants that are mostly weeds, need better attention as potential controllers of the unwanted vegetation. It is sad that every year we have to witness mass scale destruction of their habitat, both in urban and forested areas.

Of the species reported here, some (like *Chiridopsis bipunctata* and *Cassida circumdata*) are found right in the heart of the city. *Aspidimorpha* species (except species like *A. inuncta* and *A. fuscopunctata*), *Oocassida pudibunda*, *Rhytidocassis*, *Cassida exilis* inhabit roadside vegetation on outskirts of the main city. Species of *Laccoptera* and *Notosacantha* as well as *Epistictina reicheana*, however seem to be still restricted to less disturbed (such as hilly areas and less urbanized peripheral areas) or forested area. None of these species appear to be pests destroying useful vegetation (exception being *Craspedonta*). In fact, these insects are feeding on green biomass which otherwise is left to decay after rains are over, there being few other herbivores feeding on these plants. Perhaps Cassidinae are then important primary consumers of the ecosystem.

This paper also adds new host plants where previously some other host plants were known for a given species; at the same time for many species host plants

were unknown before and these are new records. What appears from the data so far gathered is that some species like *Craspedonta*, *Epistictina*, *Chiridopsis ventralis*, *Laccoptera sulcata* and *Capelocassis dorsata* are monophagous (restricted to one plant species). On the other hand, species like *Aspidimorpha furcata*, *Cassida circumdata*, and *Chiridopsis bipunctata* show restricted oligophagy in that different plants are accepted but all belong to family Convolvulaceae.

LIST OF SPECIES

Subfamily: Cassidinae
Tribe: Notosacanthini

1. *Notosacantha severini* (Spaeth, 1913)

Hoplionota severini, Spaeth

Several examples and entire life cycle during July-September of 98 and 99 from Mulshi (Pune);

Host plant: Apocyanaceae: no. 5.

The larva feeds on the mesophyll layer of leaf by formation of a mine. The development of larva is completed within the single leaf and the prepupal larva comes out of the mine and forms a separate pupal mine. The adult feeds on the upper surface of the leaf by irregular scraping and feeding on the mesophyll below. These plants grow in plenty in the areas of heavy rainfall.

2. *Notosacantha vicaria* (Spaeth, 1913)

Hoplionota vicaria, Spaeth

Several examples and entire life cycle collected during July-September, Mulshi, (Pune);1 example from Kas (Satara), 7.XI.2000 (see Rane et al. 2000).

Host plant: Rhizophoraceae: no. 3; Euphorbiaceae: no. 30.

The larva feeds on the mesophyll layer just like that of *N. severini* larva. The adult feeds on the upper surface of leaf by scraping the epidermis. The feeding marks appear like elongated stripes.

Both the species of *Notosacantha* prefer plants with somewhat thicker, smooth-surface leaves.

Tribe: Basiprionotini

3. *Craspedonta leayana* (Latreille, 1807)

Calopepla leayana, Latreille

Several examples and entire life cycle studied during July to October, Pune. This species is regularly found during rainy season on the campus of the University of Pune, and a couple of other places nearby.

Host plant: Verbenaceae: no. 22.

Feeding pattern: Fig. 1.

The larvae and adults feed from the underside of leaf by making irregular, moderate sized holes (4-9 mm diameter) in the leaf lamina. Early instars feed only by scraping the lower epidermis. In August when the larval population is at the peak, larval feeding leads to complete skeletonization of the leaf, leaving only the veins and the mid rib. These insects are strictly monophagous and are a serious pest of *Gmelina*.

4. *Epistictina reicheana* (Guérin, 1844)

Epistictia reicheana, Guerin

10 examples and partial life cycle obtained from Amba valley, Dist. Raigad, X.2000, S. Thakur & V. Gour-Broome. So far known only from one forested area near Pune.

Host plant for Amba valley population: Bignoniaceae: no. 31.

Feeding pattern: Fig. 2.

The adults feed at the margin of the leaf and cut large, irregular holes that reach even up to the midrib.

Tribe: Cassidini

5. *Aspidimorpha* (*Aspidimorpha*) *furcata* (Thunberg, 1789)

Aspidomorpha furcata, Thunberg

Several examples and entire life cycle studied during July- September in Pune; several examples from Junnar, 8.VII.2001; 1 example from Amba valley, 22.IX.2001. One of the most common species.

Host plants: Convolvulaceae: no. 7, no. 14, no. 16, no. 17, no. 18.

Feeding pattern: Figs 8-12.

The larvae and adults feed on the lower surface of leaf. The feeding pattern is in the form of small circular holes (2-4 mm diameter) present very close to each other. The feeding pattern on *Merremia* is in the form of small oval and comparatively larger holes in the leaf lamina.

6. *Aspidimorpha* (*Aspidimorpha*) *fuscopunctata* Boheman, 1854

1 example from Amba valley, 23.X.2001.

Host plant: Pupa and adult found on: Convolvulaceae: no. 8.

7. *Aspidimorpha* (*Aspidimorpha*) *indica* Boheman, 1854

Aspidomorpha indica, Boheman

1 example from Kas (Satara), II.99, R. Marathe; 1 example, Mulshi, 25.XII.98; 1 example from Talegaon - Bhimashankar Road, VI.2001, S. Thakur; 1 example from Bhimashankar, K. Kunte, 10.II.2002.

Host plant: unknown.

8. *Aspidimorpha* (*Aspidimorpha*) *inuncta* Boheman, 1854

Aspidomorpha inuncta, Boheman
Aspidomorpha spaethi, Maulik (synonymized by Borowiec, 1999: 189).

Five examples and partial life cycle studied during August 2000, in Sinhagarh area, Pune. At present known only from one locality in Pune; a very rare species.

Host plant: Convolvulaceae: no. 8.

Feeding pattern: Fig. 13.

The larva feeds on the lower surface of leaf by scraping the hairy leaf lamina and then by making holes. The feeding pattern of adults is in the form of somewhat irregular holes. It forms small or large holes of uneven, serrated margins (holes are about 12-30 mm long) from the lower side at the periphery of the leaf lamina. The host plant of this species is found only in the areas with heavy rainfall.

9. *Aspidimorpha* (*Aspidimorpha*) *lobata* Boheman, 1854

1 example, Pune, VIII.1997; 2 examples from Dighi, Pune, IX.97; 8 examples from Mulshi, IX.2001; 1 example from NDA road, 19.X.2001, Meren., several examples from Pashan area, August 2002.

Host plants: Convolvulaceae: probably no. 12 and no. 19 as the Pune and Mulshi examples were found in a population of *A. sanctaecrucis* feeding on these two plants. Dighi specimens were from no. 12. Oothecae and larvae found only on no. 19.

10. *Aspidimorpha* (*Aspidimorpha*) *miliaris* (Fabricius, 1775)

Aspidomorpha miliaris, Fabricius

Several examples and entire life cycle studied during July-September (1999-2001) in Pune. This is the most abundant tortoise beetle.

Host plants: Convolvulaceae: no. 12, no. 16.

Feeding pattern: Fig. 14.

The larvae and adults feed from the lower surface of the leaf by making somewhat circular holes (4-10 mm diameters) in the leaf lamina. When population is at the peak, there is complete skeletonization of the leaf, especially in case of

I. carnea. This beetle is very common and found even in the heart of the city. The larvae are gregarious and at rest show cycloalexic aggregation on the lower surface of leaf. Even pupation of several larvae on one leaf is very common.

11. *Aspidimorpha* (*Aspidimorpha*) *sanctaecrucis* (Fabricius, 1792)

Aspidomorpha sanctaecrucis, Fabricius

Several examples and entire life cycle studied during July-September 1999-2001, in Pune.

Host plants: Convolvulaceae: no. 6, no. 7, no. 12, no. 19 and once only adult found on no. 21.

Feeding pattern: Fig. 15.

The larvae and adults feed only on the peripheral margins from the lower surface of the leaf. The feeding pattern is highly irregular and consists of holes of variable size.

This species is also very common and is often found along with the population of *A. miliaris* on *I. carnea.*

12. *Capelocassis dorsata* (Duvivier, 1891)

Cassida dorsata, Duvivier

Several examples and life cycle studied in Pune over the last 5 years. This beetle breeds almost throughout the year as larvae/pupae were found in all the months of the year. At present this species is known from very few localities, such as Pashan and Taljai around Pune. The hosts plants are themselves very uncommon around Pune. The population on one tree often consists of only a few individuals.

Host plant: Rhamnaceae: no. 2.

Feeding pattern: Fig. 32.

The larvae and adults feed from the upper surface of the leaf by making very small circular holes of about 2 mm diameter in the leaf lamina. The early stages of larvae feed only on the upper surface by scraping. The leaves of this plant are thick and hairy on the lower sides. The species is strictly monophagous and never found on *Zizyphus mauritiana* plants just a few meters away.

13. *Cassida* (*Crepidaspis*) *belli* Weise, 1897

Cassida belli, Weise

Several examples and life cycle studied during July-August (1999-2000) in Sinhagad, Pune. The beetle is common in other places like Malshej Ghat and Lonavala Pune.

Host plants: Lamiaceae: no. 24, Amaranthaceae: no. 29.

Feeding pattern: Fig. 30.

The larvae and adults feed from the lower surface of the leaf lamina. This feeding pattern is in the form of elongated or oblong oval holes situated away from the mid rib. The diameter of the feeding marks is about 6 x 2.5 mm. These insects are found only at places with heavy rainfall.

14. *Cassida* (*Crepidaspis*) *circumdata* Herbst, 1799

Cassida circumdata, Herbst

Several examples (including black form) and life cycle studied in Pashan population, Pune. One of the most common species of a beetle during rainy season, especially August-September. It breeds round the year at suitable places, especially on *I. aquatica,* which grows abundantly in the small Pashan Lake.

Host plants for Pune population: Convolvulaceae: no. 9, no. 16.

Feeding pattern: Figs 28, 29.

The larvae feed on the upper as well as on the lower surface of leaf (mostly prefer upper side), while the adults feed only from the lower surface of the leaf. The feeding is in the form of small, distinctly circular holes of about 3 mm in diameter, very similar to the feeding of *Aspidimorpha furcata*.

15. *Cassida* (*Crepidaspis*) *cognobilis* Spaeth, 1926

7 examples from Ulhas valley, Khandala; 8.I.2002, S.Thakur.

Only adults were found on *Dysoxylum binecteriferum* Hook., (Fam. Meliaceae). Feeding marks are in the form of very fine scrapings in linear fashion on the under surface of the leaf. No larval stages were found associated with this plant hence not treated as true host plant here.

16. *Cassida* (*Crepidaspis*) *devalaensis* Borowiec & Takizawa, 1991

3 examples from Kas, Satara District, 13.IX.2000.

Only adults located on: *Centratherum tenue* (Fam. Asteraceae). No larval stages were found associated with this plant hence not treated as true host plant here.

Feeding pattern: Fig. 31

Only adults were found feeding from the lower surface and cutting very small holes (1 to 1.5 mm diameter) in the leaf lamina.

17. *Cassida* (*Crepidaspis*) *exilis* Boheman, 1854

Cassida exilis, Boheman

Several examples and life cycle studied during August-September (1999-2001) in Pune; 1 example from Ulhas valley, 8.II.2002, S. Thakur. A common beetles during monsoon when roadside vegetation is dominated by plants like *Amaranthus* and *Achyranthus*.

Host plants for Pune populations: Amaranthaceae: no. 26, no. 27, no. 28.

Feeding pattern: Fig. 23.

The larvae feed from the lower surface of leaf while the adults feed from both the upper and lower surface of the leaf making very small holes about 2 mm diameter throughout the leaf lamina. These plants are very common along the roadside during the monsoon season.

The population of this beetle species is restricted to plants belonging to the family Amaranthaceae. These beetles, unlike other Cassidinae, are very active and fly readily when disturbed.

18. *Cassida* (*Crepidaspis*) *flavoguttata* Spaeth, 1914

Cassida flavoguttata, Spaeth

2 examples from Kas, Satara district, 12.X.97, R. Marathe; 3 examples from Lonavala-Bhimashankar forest track, 15.VIII.2000, S. Thakur; 1 example from Kas, Satara district, 13.IX.2000; 9 examples from Amboli, 11. I..2002.

In Kas (Satara) population the adults found feeding on Lamiaceae : *Plectranthes stocksii* Hook., no larval stages found so far.

Feeding pattern: Fig. 24.

The adults feed from the lower surface and make small, more or less round holes of about 2 to 4 mm diameter.

19. *Cassida* (*Crepidaspis*) *informis* Boheman, 1862

Cassida informis, Boheman

Several examples studied during monsoon season in Mulshi, Pune; 1 example from Amba valley, 22.IX.2001; 2 examples from Amboli, 11.I.2002.

Host plant: Lamiacae: no. 24. (see coments below)

Feeding pattern: Figs 25, 26.

The larvae and adults feed from the lower surface of leaf lamina by making circular or oval holes of about 1.5 to 4 mm diameter. Sometimes, overlapping of feeding leads to formation of irregular holes. The early larval stages feed exclusively by scraping the lower surface and keep only the upper epidermis intact. The host plants and the insect population are abundant in heavy rainfall areas. The population of this insect is found feeding on *Strobilanthes* during late summer, while it is maximum and breeding prolifically on *Pogostemon* in the rainy season.

20. *Cassida* (*Crepidaspis*) *obtusata* Boheman, 1854

Cassida obtusata, Boheman

1 example from Wakadewadi, Pune, VIII.2001.
Host plant: Unknown.

21. *Cassida* (*Crepidaspis*) *saginata* Spaeth, 1914

Cassida saginata, Spaeth

1 example from Koyna, XI.2001, K. Kunte; 1 example from Ulhas valley, 8.I.2002, S. Thakur.
Host plant: Unknown.

22. *Cassida* (*Crepidaspis*) *varians* Herbst, 1799

Cassida varians, Herbst
Cassida syrtica, Boheman (synonymized by Borowiec 1999: 291).

Several examples and life cycle studied during July-September from Mulshi, Bhimashankar, Lonavala and Kas, 2 examples from Amboli, 11.I.2002.
Host plant: Lamiacae: no. 23.
Feeding pattern: Fig. 27.
The larvae feed by scraping the upper surface of rough, thin, leaf lamina, leaving the lower surface intact. The adults feed from the upper as well as lower surface of leaf by making irregular elongated holes.

23. *Cassida* (*Crepidaspis*) sp. (from *C. obtusata* group)

1 example from Tamhini, 18.X.2000.
Host plant: Unknown.

24. *Chiridopsis bipunctata* (Linnaeus, 1767)

Chirida bipunctata, Linnaeus
Chirida promiscua, Boheman (synonymized by Borowiec 2001: 529).

Several examples and life cycle studied during July-October (1999-2001) in Pune. A common species which breeds almost throughout the year on cultivated species of *Ipomoea.*
Host plants: Convolvulaceae: no. 10, no. 12, no. 15, no. 16. Adults with blackish ventrites are observed on plant no. 11 which grows on the coastal, sandy areas. At one place complete life history stages were found on plant no. 15 - *I. coccinea* Linn.

Feeding pattern: Fig. 16.

Early larval stages feed exclusively on lower surface of leaf, while 3rd instar onwards the larvae feed from both sides of leaf. The 1st instar larvae only scrape the lower surface of leaf, while 2nd instar onwards the larvae makes holes in the leaf. The adult feeds from the lower surface of the leaf lamina by making holes of about 3 mm diameter of irregular border.

25. *Chiridopsis bistrimaculata* (Boheman, 1855)

Chirida bistrimaculata, Boheman

Several examples and life cycle stages observed during July-August (1999-2001) in Mulshi, Lonavala and Junnar (Pune).

Host plants: Convolvulaceae: small form on no. 12, no. 16, no. 17, size-wise larger examples with larger elytral spots are found on plant no. 19 at NDA Road, Pune.

Feeding pattern: Fig. 17.

The larvae feed from the lower as well upper surface of the leaf lamina. The feeding of the early larval stages is in the form of scraping. The latter stages form irregular holes in the leaf lamina. The adults feed only from the lower surface of the leaf by making somewhat elongated holes of about 7 mm long and 2 mm wide. The population of these beetles is more in areas with heavy rainfall.

26. *Chiridopsis nigropunctata* Borowiec et Ghate, 1999

Several examples and life history studied from a population collected from Kas, (Dist. Satara = type locality), during July-September of 1998-2000 and 2002 Also collected from Wai and Panchgani on way to Mahabaleshwar (dist. Satara).

Host plant: Convolvulaceae: no. 17.

The larvae and adults feed from the lower surface of the leaf. Early larvae only scrape the leaf but the adults cut large, somewhat elongated holes (of about 6 mm) in between the leaf veins

27. *Chiridopsis rubromaculata* Borowiec et. al, 2001

About 10 examples and life history studied during July 2000 and September 2002. So far collected from only from Rehekuri (= type locality) and nearby areas (Dist. Ahmednagar).

Host plant: Convolvulaceae: no. 19.

Feeding pattern already described and illustrated in Borowiec et al., 2001.

28. *Chiridopsis undecimnotata* (BOHEMAN, 1855)

Chirida undecimnotata, BOHEMAN

Several examples and life cycle studied during July-August of 1999, and 2000, in Sinhagarh area, Pune. The beetle was also collected in places like Talegaon, Bhimashankar, Lonavala and Mulshi in Pune District.

Host plants: Convolvulaceae: no. 7, no. 8, no. 10.

Feeding pattern: Figs 18-19.

The larvae and the adults feed on the lower surface of leaf by removing the hairs of the leaf lamina. The larvae scrape the leaf while the adults make distinct elongated or oval holes that are about 4 mm long and 1.5 mm wide. These beetles and the plants are found in heavy rainfall areas.

29. *Chiridopsis ventralis* (BOHEMAN, 1855)

Chirida ventralis, BOHEMAN

Several examples and life cycle studied during July-September (1998-2001) at Sinhagarh, NDA and Mulshi near Pune.

Host plant: Convolvulaceae: no. 6.

Feeding pattern: Fig. 20.

The larvae and the adults feed on the upper and lower surface of the leaf lamina by making elongated holes (9 mm long and 2 mm wide) parallel to the leaf venation. The early larval stages only scrape the lower surface by removing hairs of the leaf lamina. The beetle is monophagous in wild and never found on other plants.

30. *Conchyloctenia nigrovittata* (BOHEMAN, 1854)

Conchyloctenia nigrovittata, BOHEMAN

Several examples and entire life cycle studied during July to October in Pune during the last 4 years (see RANE et al. 2001).

Host plants: Convolvulaceae: no. 13, no. 16.

Feeding pattern: Fig. 21.

The larvae feed from the lower surface and completely skeletonize the leaf lamina. The adult also feeds from the lower surface but the feeding is restricted to the margins of the leaf lamina. In nature this species is restricted mainly to *I. eriocarpa* but is rarely found on other roadside *Ipomoea.*

31. *Laccoptera* (*Orphnodella*) *foveolata* (BOHEMAN, 1856)

Sindia foveolata, BOHEMAN

Several examples and life cycle stages studied during July-September (1998-2000) in Sinhagarh area; also found in Lonavala, Pune.

Host plants: Convolvulaceae: no. 14, no. 18.

Feeding pattern: Fig. 6.

The early larval stages feed by scraping the lower surface of the leaf lamina. The latter larval stages and the adults feed from the upper as well as on the lower surface of the leaf lamina. The feeding is in the form of large oval marks (about 6-8 mm long and 5-6 mm wide). At the peak of the population there is complete skeletonization of the leaf lamina (keeping only the mid-rib and veins intact).

32. *Laccoptera* (*Laccopteroidea*) *nepalensis* Boheman 1855

Laccoptera quadrimaculata, Thunberg

1 example from Ambavane, near Lonavala, 15.VII 2000.

Host plant: unknown.

33. *Laccoptera* (*Laccopteroidea*) *quatuordecimnotata* Boheman, 1855

Laccoptera quatuordecimnotata, Boheman

Several examples and partial life history studied in Mulshi, Pune; 3 example from Malavali, 19.VIII.2001, P. Mehendale; 1 example from Koyna, 20.XI.2001, K. Kunte.

Host plants: Convolvulaceae: no. 7, no. 17.

Feeding pattern: Fig. 5.

The late larval stages and adults feed from the upper as well as lower surface of leaf lamina. The feeding of the early larval stages is not known. The feeding is usually parallel to the veins and in the form of elongated holes of about 14 mm long and 4 mm wide. The host plants are commonly found in forested areas with heavy rainfall at the outskirts of city limits.

34. *Laccoptera* (*Sindia*) *depressa* Świętojańska, 2001

1 example from Khopoli - Pen road, 2.IX.2001.

So far only a single adult was found feeding on Convolvulaceae: no. 17 but life history stages have not been found so far. It is also known so far from only one locality.

35. *Laccoptera* (*Sindia*) *sulcata* (Olivier, 1808)

Sindia clathrata, Fabricius

Several examples and entire life cycle studied in Alandi and NDA and Law College Hill, Pune, from June to September 1999- 2002; 2 examples from Rehekuri Sanctuary, Ahmednagar Dist, 11.VII.2000

Host plant: Convolvulaceae: no. 19.

Feeding pattern: Fig. 7.

The larvae and adults feed from the lower surface of the leaf lamina by making large holes of about 7 mm long and 5 mm wide. When population is at the peak, only mid rib and a few veins of the leaf remain. The beetle appears monophagous as it is never found on other Convolvulaceae plants. The host plant is always a climber on either *Zizyphus* or *Acacia* plants in somewhat drier areas.

36. *Oocassida pudibunda* (BOHEMAN, 1856)

O*ocassida pudibunda*, BOHEMAN

Several examples and life cycle studied during July-October in Pune, Pashan area, 1998-2001. A very regularly arriving beetle during rainy season. Since 2002 however most host plants have been destroyed from this area.

Host plant: Rhamnaceae: no. 1.

Feeding pattern: Fig. 3.

The larvae feed from the lower surface of the leaf lamina, while the adults feed on both sides of the leaf. Resting beetles often prefer the upper surface of the apical region of the leaf. The feeding of both larvae and the adults is in the form of small irregular scrapings.

37. *Rhytidocassis indicola* (DUVIVIER, 1892)

Cassida indicola, DUVIVIER
Chirida hina MAULIK (synonymized by BOROWIEC 1999: 316).

Several examples and life history studied during July-August 1999, 2000, in Pashan and Baner area, 1 example from Wakad (Pune - Ahmednagar road).

Host plant: Convolvulaceae: no. 16.

Feeding pattern: Fig. 4.

The larvae feed on the upper surface of leaf lamina. The adult feeds from both, the upper as well as lower, surfaces of the leaf lamina by making irregular holes of moderate size.

(Names of collectors, when other than Ghate/ Rane/ Ranade/ Pandit, are given at the relevant place. *Notosacantha chandrapurensis* ŚWIĘTOJAŃSKA et al., 2001 is not included in this list, as it is collected far away from Pune. Thus there are 37 species of Cassidinae beetles in and around Pune. Specimens of all the 37 species are preserved at the Department of Zoology, Modern College).

The numbers of host plants in the list above are the serial numbers of plants given below:

LIST OF HOST PLANTS

I Family: Rhamnaceae

1) *Zizyphus jujuba* LAM. [*Z. mauritiana* LAMK]
2) *Zizyphus xylopyra* WILLD. [*Z. glaberrina* (SEDG)]

II Family: Rhizophoraceae

3) *Carallia integerrima* DC. [*C. brachiata*, (LOUR.) MERRILL]

III Family: Rubiaceae

4) *Ixora brachiata* ROXB.

IV Family: Apocyanaceae

5) *Carissa carandas* L. [*C. congesta* W.]

V Family: Convolvulaceae

6) *Argyreia cuneata* KER.
7) *Argyreia hookeri* CLKE.
8) *Argyreia sericea* DALZ.
9) *Ipomoea aquatica* FORSK. (Some people use *I. reptans* LINN.)
10) *Ipomoea batatas* (LINN.) LAMK.
11) *Ipomoea biloba* FORSK. [*I. pes-caprae* (L.) R. BR]
12) *Ipomoea carnea* Jacq. [*I. carnea* ssp. *fistulosa* (MART. ex CHOISY]. Some people use *I. fistulosa*
13) *Ipomoea eriocarpa* BR.
14) *Ipomoea hederacea* CLARKE [*I. nil* (LINN.)ROTH*]
15) *Quamoclit coccinea* MOENCH (Commonly known as *Ipomoea coccinea* LINN; BENNET gives *Ipomoea hederifolia* LINN.)
16) *Ipomoea sp.*
17) *Lettsomia elliptica* WHITE [*Argyreia elliptica* (ROXB.) CHOISY]
18) *Merremia umbellata* (LINN.) HALL.f.
19) *Rivea hypocrateriformis* CHOIS.
20) *Rivea ornata* CHOIS.

VI Family: Acanthaceae

21) *Strobilanthes ixiocephalus* (BENTH.) BREM.

VII Family: Verbenaceae

22) *Gmelina arborea* ROXB.

VIII Family: Lamiaceae

23) *Leucas linifolia* SRENG. [*L.indica* (L.)R.BR]
24) *Pogostemon purpurascens* DALZ.
25) *Plectranthes stocksii* HOOK.

IX Family: Amaranthaceae

26) *Achyranthes aspera* COOKE [*A. porphyristachya* WALL]
27) *Alternanthera sessilis* (LINN.) R.BR.ex DC.
28) *Amaranthus paniculatus* LINN. [*A. hybridus* L.]
29) *Celosia argentea* LINN.

X Family: Euphorbiaceae

30) *Glochidion ellipticum* WIGHT

XI Family: Bignoniaceae

31) *Stereospermum colais* (DILLW.)

XII Family: Meliaceae

32) *Dysoxylum binecteriferum* HOOK.

XIII Family: Asteraceae

33) *Centratherum tenue* CLARKE [*Phyllocephalum scabridum* (DC)]

With the exception of *S. colais,* the Names of all Host Plants are as per COOKE's Flora while the valid names given in [—] are as per BENNET 1987, [—*] is from SANTAPAU 1967.

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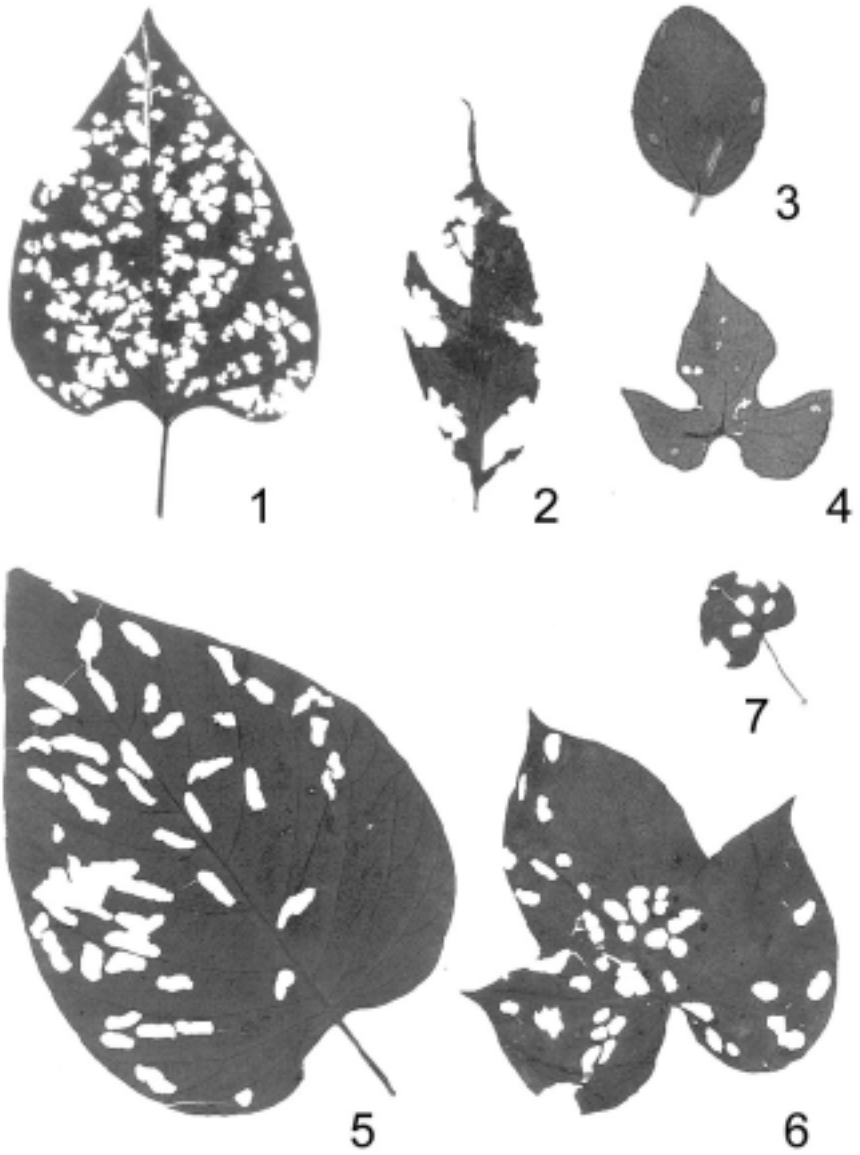
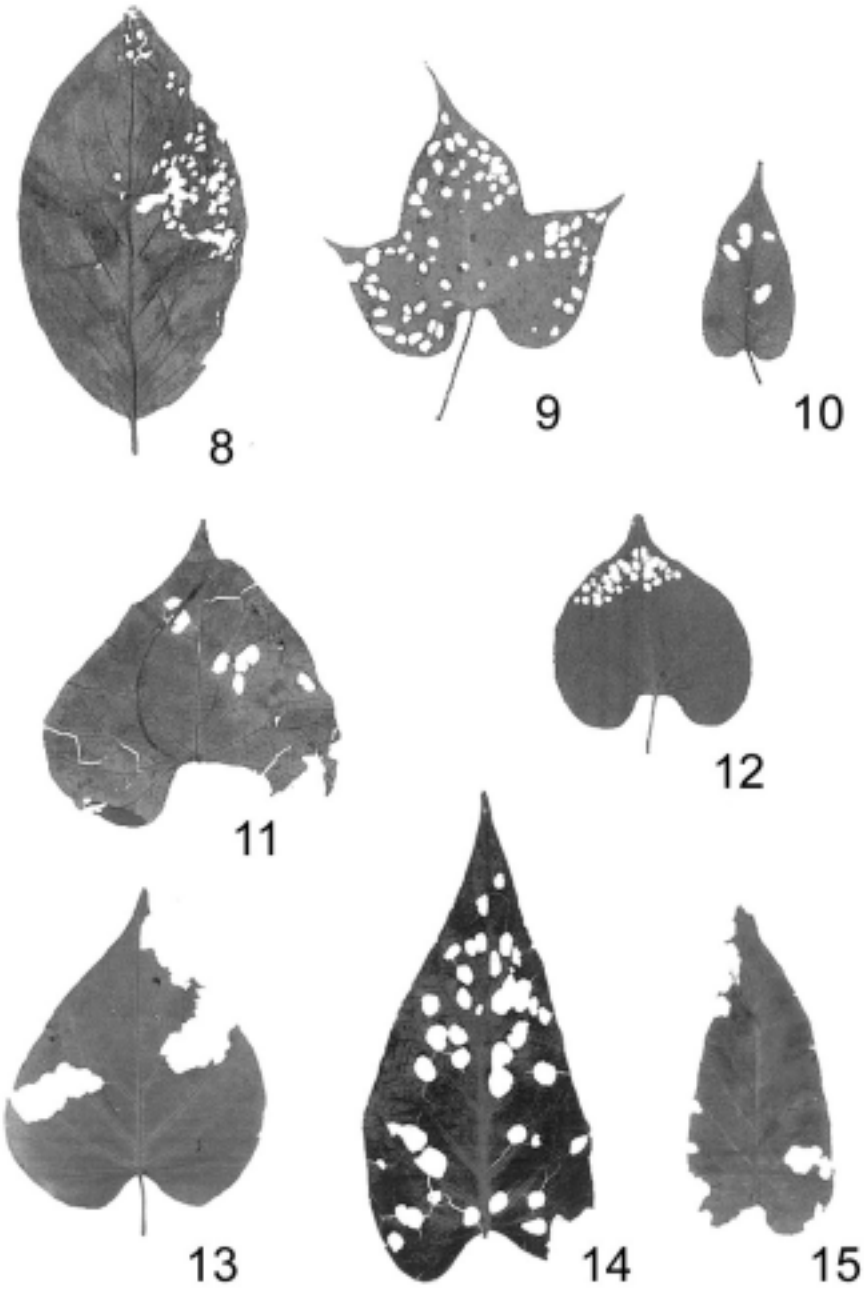
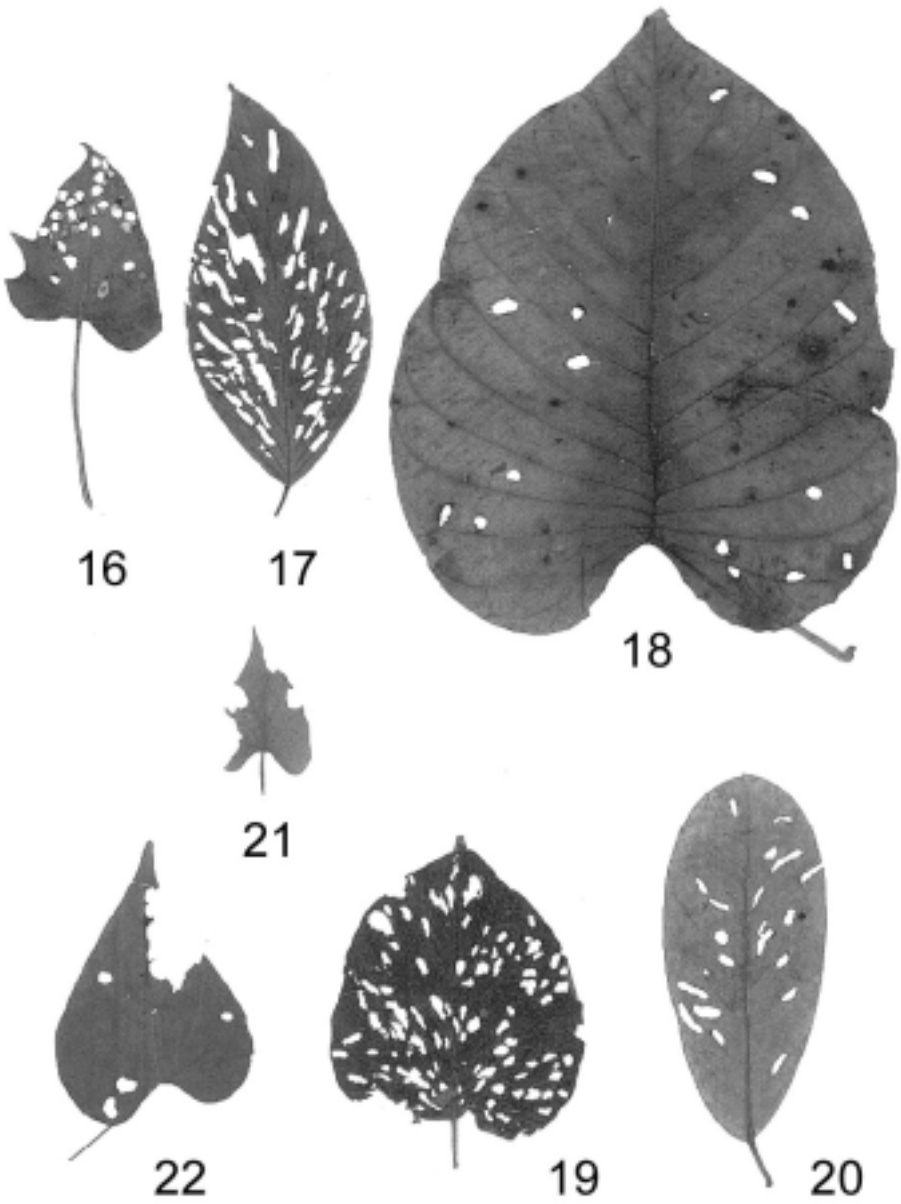


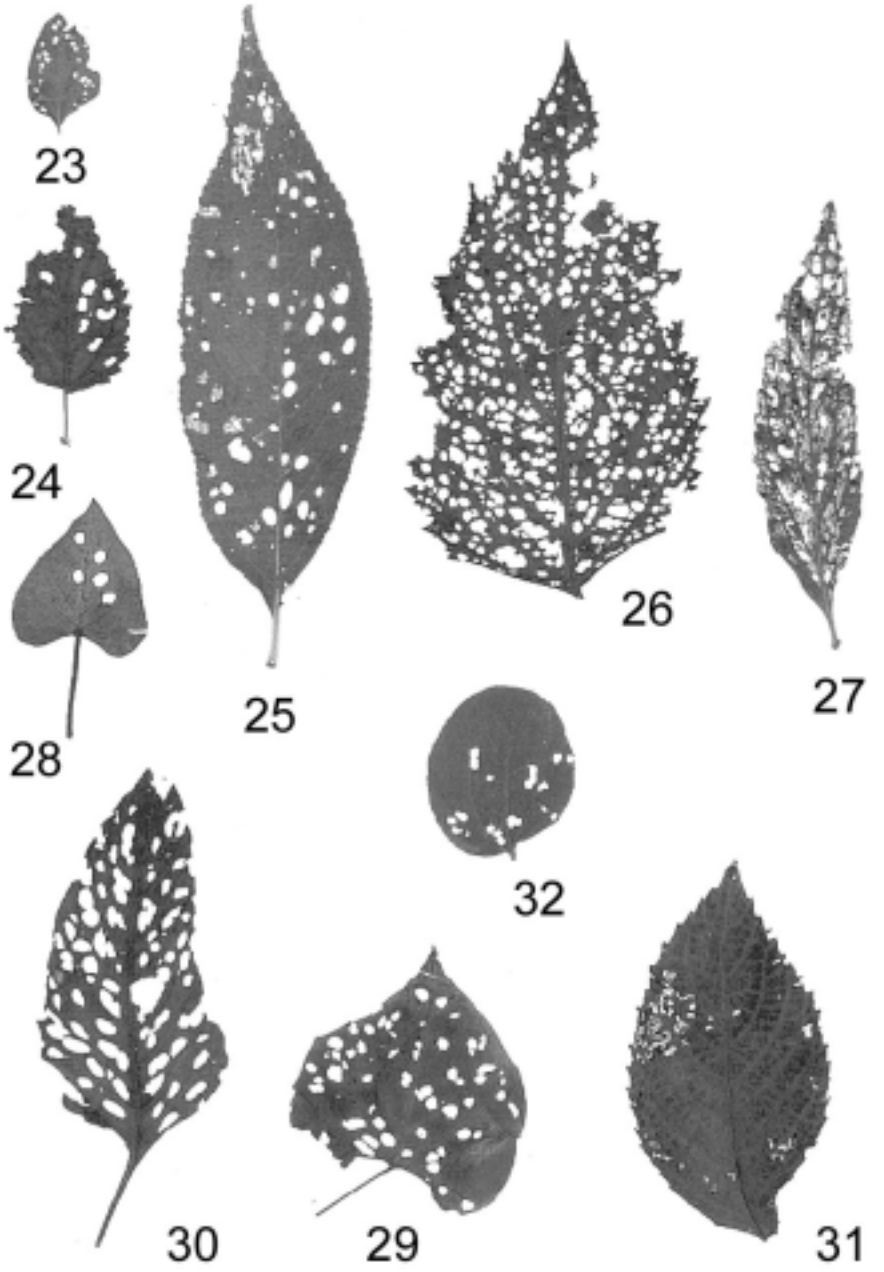
1-7. Feeding patterns: 1 – *Craspedonta leayana* on *Gmelina arborea*, 2 – *Epistictina reicheana* on *Stereospermum colais*, 3 – *Oocassida pudibunda* on *Ziziphus jujuba*, 4 – *Rhytidocassis indicola* on *Ipomoea* sp., 5 – *Laccoptera quatuordecimnotata* on *Argyreia hookeri*, 6 – *Laccoptera foveolata* on *Ipomoea nil*, 7 – *Laccoptera sulcata* on *Rivea hypocrateriformis*



8-15. Feeding patterns: 8-12 – *Aspidimorpha furcata*: 8 – on *Argyreia elliptica*, 9 – on *Ipomoea* nil, 10 – on *Merremia umbellata*, 11-12 – on *Ipomoea* sp.; 13 – *Aspidimorpha inuncta* on *Argyreia sericea*, 14 – *Aspidimorpha miliaris* on *Ipomoea carnea*, 15 – *Aspidimorpha sanctaecrucis* on *Ipomoea carnea*



16-22. Feeding patterns: 16 – *Chiridopsis bipunctata* on *Ipomoea* sp., 17 – *Chiridospis bistrimaculata* on *Argyreia elliptica*, 18-19 – *Chiridopsis undecimnotata*: 18 – on *Argyreia hookeri*, 19 – on *Argyreia sericea*, 20 – *Chiridopsis ventralis* on *Argyreia cuneata*, 21 – *Conchyloctenia nigrovittata* on *Ipomoea eriocarpa*, 22 – *Glyphocassis trilineata* on *Ipomoea* sp.



23-32. Feeding patterns: 23 – *Cassida exilis* on *Amaranthus paniculatus*, 24 – *Cassida flavoguttata* on *Plectranthes stocksii*, 25-26 – *Cassida informis*: 25 – on *Strobilanthes ixiocephalus*, 26 – on *Pogostemon purpurascens*, 27 – *Cassida varians* on *Leucas linifolia*, 28-29 – *Cassida circumdata*: 28 – on *Ipomoea aquatica*, 29 – on *Ipomoea* sp., 30 – *Cassida belli* on *Celosia argentea*, 31 – *Cassida devalaensis* on *Centratherum tenue*, 32 – *Capelocassis dorsata* on *Zizyphus xylopyra*