Plant-pest status of root-eating ant, *Dorylus orientalis*, with notes on taxonomy, distribution and habits (Insecta : Hymenoptera)[1]

M. L. ROONWAL[2]

(*With three text-figures*)

INTRODUCTION

The history of the economic status of the large root-cutting ant, *Dorylus orientalis* Westwood (Hymenoptera: Formicidae: Dorylinae), in the Indian Region has been curiously controversial. The very first record of it as a plant-pest (potatoes) by Barlow (1899) was immediately disputed by Forel (1899) who then, and also later (1923), maintained that the species is exclusively insectivorous. Subsequently, several entomologists recorded it as attacking various plants in India, Sri Lanka and Burma, but Mukerji (1934) again asserted that it is exclusively carnivorous (eating insects and earthworms) and refused vegetable food. Like several other earlier observers, I have personally seen this ant seriously attacking potato tubers, in Dehra Dun, but here again we have the following denial (*in litt.*, 3 November 1971) from so authoritative a source as the Director, Central Potato Research Institute, Simla:

"We have no recorded reference about these ants as pests of potatoes or about the control measures against them."

In view of this confusion and controversy, I have in the present paper examined briefly, from the available records and from personal observations, the economic status of this ant as a pest of plants, and also added some notes on its control, taxonomic status, geographical distribution, habits and biology.

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[1] Accepted April 1972.

[2] Emeritus Scientist (CSIR), Desert Regioinal Station, Zoological Survey of India, Paota, Jodhpur.

STATUS AS PLANT-PEST, AND CONTROL

Status as plant-pest. In view of the controversy as stated above, I have given below a summary of the available records regarding the attacks of this ant on plants.

1. Barlow (1899).—Damages potatoes (but *see* Forel 1899).

2. Forel (1899, 1923).—(i) (1899, p. 198): Doubts Barlow's (1899) record of damaging potatoes; says it eats only insects. (ii) (1923, p. 17): Doubts its herbivorous nature and considers it as entirely carnivorous.

3. Green (1903, p. 39).—Sri Lanka: Its workers live entirely underground and are confirmed vegetarians. It's a serious pest of potatoes, making galleries in tubers. Also attacks tubers of dhalias and roots of sunflower (*Helianthus* sp.); in later case eating off tender bark below collar.

4. Stebbing (1905, p. 683; 1908, p. 73).—India (Calcutta): Attacks potatoes and "cornflour plants".

5. Lefroy (1906-09): India and Sri Lanka: (i) (1906, pp. 231-232): Attacks healthy living plants, e.g., cauliflowers, cabbages, artichokes, etc., just below soil and completely destroys them. (ii) (1907, p. 128): Damages vegetable crops. Sporadic local pest of vegetable gardens. (iii) (1909, p. 238): Attacks plants, eating them below or at soil-level. Workers also attack workers of the harvest ant, *Pheidole indica*.

6. Dutt (1912, p. 247).—Pusa (Bihar): Damages vegetable crops but not seriously.

7. Rutherford (1914).—Sri Lanka: Attacks kohl-rabi.

8. Fletcher (1914-20).—(i) (1914, p. 274): South India: Attacks growing plants including young coconut palms. Ceylon: Perforates pods of groundnut and consumes contents; also attacks its roots. Attacks sugarcane. (ii) (1917, p. 281): India (Bihar): Regularly attacks cauliflower seedlings below ground. (iii) (1920, p. 35): India (Bihar and Uttar Pradesh): Attacks underground parts of vegetables (potatoes, cauliflower, etc.) and early-sown groundnuts. Ceylon: Attacks roots of potatoes and other vegetables.

9. [Burma] (1918, p. 52).—Burma: Attacks sugarcane setts.

10. Speyer (1918).—Sri Lanka: Attacks vegetables.

11. Hutson (1919-39).—Sri Lanka: (i) (1919, pp. 276-77): Bores in potatoes. (ii) (1920): A pest of potatoes. (iii) (1933a): Attacks carrots, onions and *Arachis* sp. (iv) (1933b, pp. 276-279:) Workers attack underground portions of several vegetables and also some young trees, e.g., citrus. Attack chiefly in May-September. (v) (1936, pp. 293-295): Attacks vegetables, shrubs and trees. (vi) (1937): Attacks ginger rhizomes. (vii) (1939): Severely attacks coconut seedlings; also attacks potato tubers and roots of tree-tomato (*Cyphomandra betacea*).

12. Mukerji (1934).—India (Calcutta): Workers are not vegetarians; seen feeding on live beetle grubs and live earthworms (reared on them in the laboratory); did not eat vegetable food offered.

13. Ghosh (1936, 1940): (i) (1936, pp. 23-24): India: Attacks bee-hives and eats larvae and pupae [attack is presumably by winged males]. (ii) (1940, pp. 130, 138, 141): Burma: Attacks seedlings of trees, cutting roots and killing plants; also attacks potato tubers and seedlings of coconut palms.

14. Beeson (1941; reprint 1961, p. 386).—India and Sri Lanka: "Appears to be entirely herbivorous", and is occasionally a pest in gardens (particularly of vegetables) and in seed-beds in nurseries; bulbs and tubers are hollowed out.

15. Cherian and Ramachandran (1943).—India: Occasionally attacks bee-

hives for honey and pollen, and also destroys bees and brood.

16. Wilson (1964, pp. 442-443).—Sri Lanka: Workers found underground in disturbed forests and cultivated land.

17. Pruthi (1969, p. 466).—India: Attacks plants; is also carnivorous.

18. Unpublished records.—(i) Forest Research Institute, Dehra Dun: (a) West Bengal (Batasi, 1830 m. Darjeeling District): Attacking oak, *Quercus lamellosa*. (b) Assam: Jiri Forest, Cachar: Found in decaying climber. (ii) Mr. P. L. Chaturvedi, U.P. Institute of Agricultural Sciences, Kanpur (*in litt.*, 28 August 1971): Attacks potato tubers especially in early stages of growth; also vegetable seedlings of cauliflowers, cabbages, etc. (iii) Director, Central Potato Research Institute, Simla (*in litt.*, 3 November 1971): *Not* known to attack potatoes (*sic*!). (iv) Present author: Serious pest of potato tubers in Dehra Dun (February and April).

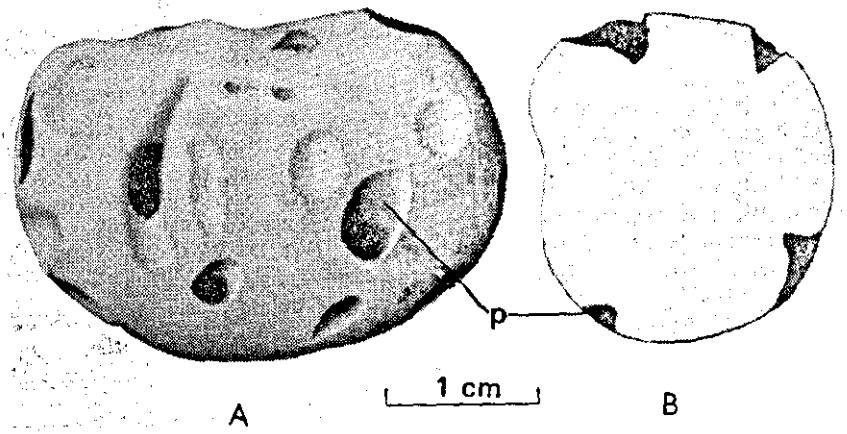
It will thus be seen that in India, Burma and Sri Lanka *Dorylus orientalis* is a plant-pest, sometimes a serious one, of several plants including vegetables, tubers, bulbs, shrubs, trees and also including cash crops such as sugarcane, coconut palm, citrus and groundnut. Tubers of potatoes and bulbs are eaten through hollow (see Figs. A and B, potato), while in other cases the roots and root-collars, especially of seedlings in gardens and nurseries, are eaten. The damage is entirely underground and is done by the workers. (Workers, it should be noted, are not entirely herbivorous; they also eat insects and earthworms, *vide infra*, Habits.).

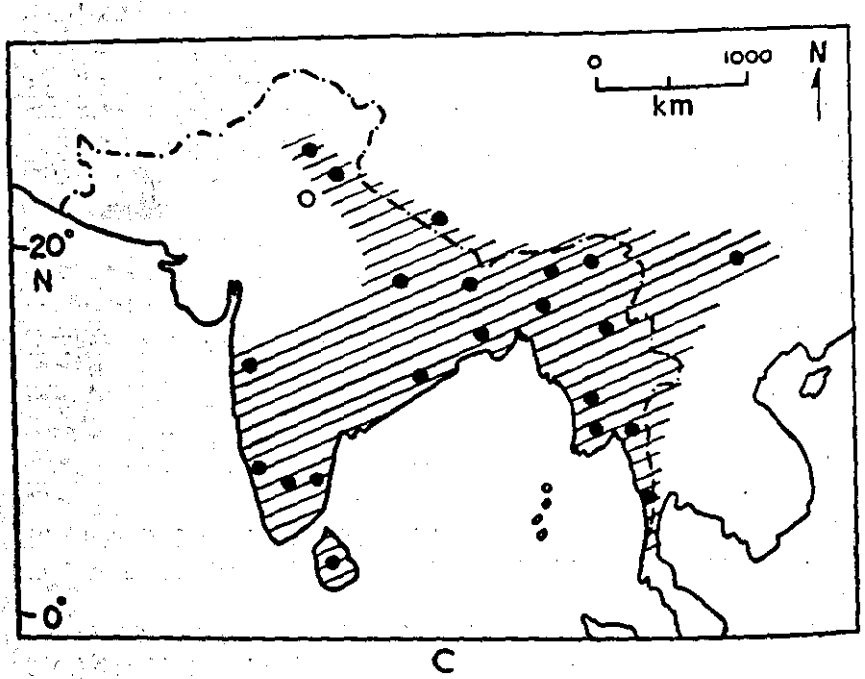
Control. The following is a summary of the available information on control. The ant is entirely a soil pest, doing its damage underground. Control methods must, therefore, be based on treatment of the soil with insecticides and fumigants. The earlier workers (Lefroy, Fletcher, Hutson, Ghosh) recommended the following treatments which they found to be effective:- (i) Add small quantities of crude oil emulsion or kerosene oil emulsion to the irrigation water. (ii) Fumigate soil with petrol before planting (1-2 pints to 30 sq ft), by pouring in small holes and then plugging them. (iii) Before planting, treat a few inches of surface soil with wood-dust or ashes soaked in carbolic acid and diluted with water. (iv) Treat soil with the fumigant paradichlorobenzene at 1 oz to 1 sq yard of soil.

P. L. Chaturvedi (Entomologist, U.P., Kanpur, *in litt.*, 28 August 1971) recommends soil treatment by the following insecticides:- (a) 3 litres of 30 per cent emulsifiable concentrate (E.C.) of aldrin in 1,000 litres of water. Spray this quantity in root region per acre of potato crop. (b) Heptachlor (2 % E.C.). (c) Gamma benzene hexachloride (B.H.C.) (20% E.C., based on lindane). Both to be used as above.

Taxonomic Status and Distribution

Taxonomic status. The synonymies and the more important taxonomic references are given below:





Dorylus orientalis Westwood

FIGS. (A) and (B): Potato tubers showing damage caused by the workers. Dehra Dun. (A) In surface view. (B) In cross-section. FIG. (C): Map of Indian Region and neighbouring areas, showing the approximate geographical distribution (shaded in diagonal lines). Solid circles indicate the major localities where the species has been found.

p., pits excavated by the workers.

Dorylus (Alaopone) orientalis Westwood 1835

1835. *Dorylus orientalis* Westwood, *Proc. zool. Soc. Lond.*, London, *3*, p. 72. "India Orientali".

1840. *Typhlopone curtisi* Shuckard, *Ann. Mag. nat. Hist.*, London, 5, p. 265. Worker.

1840. *Dorylus longicornis* Shuckard, *Ann. Mag. nat. Hist.*, London, *5*, pp. 321-322. Bengal.

1881. *Alaopone oberthueri* Emery, *Ann. Mus. Stor. nat. Genova*, Genoa, *16*, p. 274. Worker. Calcutta.

1889. *Dorylus fuscus* Emery, *Ann. Mus. Stor. nat. Genova*, Genoa, *27*, p. 487. Worker. Rangoon, Burma.

1901. *Dorylus orientalis* Westw. (and *D. curtisi* Sh., *fuscus* Em. and *longicornis* Sh.), Forel, *J. Bombay nat. Hist. Soc.*, Bombay, *13*(3), pp. 462-464. Revision.

1903. *Dorylus orientalis*. Westw., *D.o. fusca* Em. and *D.o. longicornis* Sh., Bingham, *Fauna Brit. India, Hymenoptera*, London, *2*, pp. 3-5.

1964. *Dorylus* (*Alaopone*) *orientalis* Westw., Wilson, *Pacific Insects*, Honolulu, *6*(3), pp. 442-443. Revision.

Field diagnosis

Male (winged): Length of head and body 17-25 mm; of forewing 16-18 mm. Brownish yellow, head dark reddish brown.

Female: Unknown.

Worker: Without wings and eyes. Head and body castaneous brown. Antennae with 9-11 segments (Wilson 9, Sri Lanka, Forel 11). Abdomen elongate, flattened dorsally and thus without a distinct waist. Of two forms, major and minor. Total length: Major 5-11 mm, minor 2.5-3 mm.

Illustrations

The illustrations available in the literature are: (1) Emery (1881, p. 274): Worker, head and antenna, *A. oberthueri*. (2) Bingham (1903, p. 5): Good figure of a ♂ and a worker major. (3) Stebbing (1905, p. 683; and 1908, Pl. XXIII): Figure of a ♂ and a worker (the latter wrongly labelled as ♀). Lefroy (1906, p. 232): Good figure of a worker. This is repeated by several authors, e.g., Lefroy (1907, p. 128), Dutt (1912, p. 247) and Ghosh (1936, p. 24; 1940, p. 130).

Geographical distribution. In addition to the records of Forel (1901), Wilson (1964) and others, I have examined examples from the following Indian localities in the collection of the Forest Research Institute, Dehra Dun:- (i) Bernag, 1830 m alt. (Almora District, Uttar Pradesh). (ii) Batasi, *c.* 1830 m alt. (Darjeeling District, West Bengal), *ex "Quercus lamellosa"*. (iii) Jiri Forest (Cachar, Assam), *ex "decaying climber"*. The following are the detailed locality records, countrywise:-

(1) INDIA: *Uttar Pradesh*: Dehra Dun, 610 m.; Berenag (Almora Dist.), 1830 m.; "Siwaliks". *Bihar*: Pusa. *Orissa*: "Orissa". *West Bengal*: Calcutta and vicinity (Calcutta, Sibpur, Barrackpore); Darjeeling; Batasi, *c.* 1830 m.2 (Darjeeling Dist.). *Assam*: Jiri Forest (Cachar

[Silchar] Dist.); Nambour Reserve (Sibsagar Dist.). *Maharashtra*: Poona. *Karnataka*: "Kanara". *Tamil Nadu*: Madras; Coonoor. (2) NEPAL: Amlekhganj, 520 m. (3) BURMA: Tenasserim; Rangoon; Pegu; Moulmein; Bhamo; Kowkareet; Palon; Carin Cheba; Kabo, 120 m. (4) SRI LANKA: Kandy, 600-700 m. (5) CHINA: Meitan, Kweichow (southern China).

On this basis the approximate geographical distribution may be summarised thus: India (whole, except the extreme northern and north-western parts); southern Nepal; Sri Lanka; Burma (south to Tenasserim); east to southern China (Kweichow) (Fig. C). Going up to about 1830 m altitude above sea-level.

HABITS AND BIOLOGY

Swarming

Males swarm at night and are attracted to light (females are unknown). In north India they swarm at the end of the cold weather, in late February (Lefroy 1909). But swarming in April also occurs at Dehra Dun (note in Ledger Files in Entomology Branch, Forest Research Institute, Dehra Dun; extract given below):

> About 820 examples [presumably winged males] emerged in a 10 × 20 feet outdoor cage in New Forest, Dehra Dun, on 10 April 1928. Cage erected in March 1926, and planted with roots and cuttings of teak in June 1926. Possibly at that time a pair (or more) of this ant was introduced in the cage with the soil adhering to the roots. If so, the time between egg-laying and swarming of next brood is about two years. It is hardly likely that the species got entry into the cage through a tunnel from outside; no swarming occurred in the neighbouring cages or in the vicinity.

Season of damage

The season when the workers cause damage seems to vary with climate. In Dehra Dun I observed them attacking the potato crop in early February and again in April. In Sri Lanka, the attack is chiefly in May and September (Hutson 1933b).

Food habits etc.

Workers have the termite-like habit of living entirely underground and making tunnels and galleries through the soil to reach the plant parts. They are largely vegetarian, eating tubers, bulbs, rhizomes, roots and other underground parts of plants. They also eat animal food such as insects and earthworms, but it is not known whether this is habitual or occasional. In the laboratory, Mukerji (1934) reared workers exclusively on beetle grubs and earthworms; they refused plant food. They also occasionally eat larvae and pupae of bees, as well as pollen and honey from bee-hives (Ghosh 1936; Cherian & Ramachandran 1943).

Sometimes they are also known to attack the workers of the harvest ant, *Pheidole indica*, which are carried to the nest where they are killed and cut into pieces (Lefroy 1909). Males are probably carnivorous but no exact information is available.

The nest is made underground rather deep in the soil but little else is known about it.

It will thus be seen that our knowledge of the habits and biology of this ant is very limited and there is scope for considerable work.

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SUMMARY

1. In view of the controversy about the status of the ant *Dorylus orientalis* as a plant-pest (some authors maintaining that it is exclusively carnivorous), all the available information has been re-examined and fresh observations added.

2. It is established that in India, Burma and Sri Lanka the ant (in the worker stage) is a definite, sometimes serious, pest, attacking the underground portions of several plants including economic ones such as vegetables, potatoes, groundnuts, coconut seedlings, citrus and sugarcane setts.

3. Information on its taxonomic status is summarised. There are four synonyms: *D. curtisi* (Shuckard), *D. fuscus* Emery, *D. longicornis* (Shuckard) and *D. oberthueri* (Emery).

4. The geographical distribution is, India (whole, except N and NW parts), S. Nepal, Sri Lanka; Burma and S. China (Kweichow).

5. Notes on habits and swarming are given.

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