Nest structure variation and morphology of adult castes of weaver ants *Polyrhachis* (*Cyrtomyrma*) *rastellata* (Latreille, 1802) (Hymenoptera: Formicidae) in Sri Lanka

Вариации гнездовой структуры и морфологии имагинальных каст муравьев-портных *Polyrhachis* (*Cyrtomyrma*) *rastellata* (Latreille, 1802) (Hymenoptera: Formicidae) на Шри-Ланке

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Ключевые слова: Hymenoptera, Formicidae, муравьи-портные, древесные муравьи, гнездование *Polyrhachis*, растения-хозяева.

Abstract. Structural variation of *P. rastelleta* nests constructed on a Citrus crenatifolia Lush trees that were in the premises of a farm in Gonapola, Western Province of Sri Lanka, a polydomous nest unit on a folded single leaf, a monodomous horizontal nest between two leaves, a hanging nest between two leaves and a nest on the underside of a single leaf, with silk and plant fragments or "spider silk", is described with appropriate colour images. Distinguishing morphological features of dealate queen, winged females and males, workers and the morphology of pupae and larvae are described with their dimensions and colour images. Workers were observed in the highest numbers in each nest. Based on the bimodal frequency histograms of the total length and pronotal width of the workers and significant differences observed (z test; $p < 0.01$) between the mean total length and mean pronotal width of the two groups of workers, major and minor workers were recognized in the species. In addition, several morphological features that distinguish major and minor workers are also described.

Резюме. Гнезда *P. rastelleta* различных структур, возводимые на деревьях Citrus crenatifolia Lush на ферме в Гонапола, Западная провинция Шри-Ланки, описаны и представлены на цветных фотографиях – полидомное гнездо на скрученных листьях, монодомное горизонтальное гнездо между двумя листьями, подвешенное между двумя листьями гнездо и гнездо на нижней стороне одного листа, с шелком или шелком и растительными фрагментами, или заплетенное «шелковой паутиной». Описаны морфологические различия цариц, крылатых самок и самцов, рабочих, а также морфология личинок и куколок. Было изучено большое количество рабочих из каждого гнезда. На основании бимодальных частотных гистограмм общей длины и ширины пронотума для данного вида были выделены две группы рабочих, крупные и мелкие, и описаны некоторые морфологические различия между ними.

Introduction

Ants of the genus *Polyrhachis* Smith, 1857 are hymenopterans that are classified in the family Formicidae and the subfamily Formicinae. According to Dorow [1995] the genus is characterized by the presence of a body more or less armed with spines, elongate antenna, 4-jointed labial palpi, 6-jointed maxillary palpi, stout and inner edge-denticulated mandible, compressed and flattened thorax (but subovate in the females), spinose or hooked thorax, incrassate petiolar node with 2, 3 or 4 spines and absence of ocelli in the workers. *Polyrhachis* ants comprise a significant component of the Southeast Asian ant fauna and include approximately 500 described species, which demonstrate highly diverse nesting habits [Bolton, 1995; Robson, Kohout, 2007]. The arboreal nests that contain flat sheets of larval silk are the most common type of construction occurring in representatives of 6 subgenera, *Cyrtomyrma* Forel, 1915, *Hemioptica* Roger, 1862, *Myrma* Billberg, 1820, *Myrmatopa* Forel, 1915, *Myrmothrinax* Forel, 1915 and *Polyrhachis* Smith, 1857 [Robson, Kohout, 2005]. All species within the subgenus *Cyrtomyrma* form arboreal nests that include larval silk and both monodomous and polydomous nests and single or multiple queen colonies have been described [Kohout, 2006; Robson, Kohout, 2007].

Dorow [1995] stated that *Cyrtomyrma* members have a short thorax of stout appearance, black and shiny body and thorax and/or petiole armed with spines. Recently, subgenus *Cyrtomyrma* was characterized by the presence of a distinct postero-lateral carina separating the gena from the ventral parts of the head, a highly convex, dome-shaped and very finely sculptured mesosoma, propodeal spines, a scale-like petiole usually armed with 4 teeth or spines, abundant gastral or mesosomal pilosity and dense body pubescence [Kohout, 2006]. *Polyrhachis* (*Cyrtomyrma*)

rastellata Donisthorpe, 1938 worker has a black, shiny body, orange brown tibiae, black tarsi, convex rounded alitrunk, thick base of petiolar node sloping sharply to a narrow margin dorsally, two subequal pairs of dorsal petiolar spines, in which the lateral pair is shorter than the dorsal pair and a globose, dorsally convex gaster [Kohout, 2006]. Bingham [1903] and Wheeler and Wheeler [1990] stated that *Polyrhachis* workers were monomorphic. Morphometrics of workers or distinguishing morphological features of other adult castes [Bingham, 1903] and the immature life stages of the species are scarce. However, morphology of 3 sized larvae of *P. rastellata* (Latreille) from Malaysia was described by Wheeler and Wheeler [1990]. According to Kohout [2006] the distribution range of *P.* (*Cyrtomyrma*) *rastellata* Donisthorpe is restricted to India, Sri Lanka, Myanmar and former Indochina including Sumatra and Java. Nesting habits of the species in Sri Lanka is not well-documented.

I describe here the types and structure of nests (with the images), colony demography, distinguishing morphological features of adult castes including 2 types of workers and the appearance of the larva and pupa of *P. rastelleta* collected from the nests on a Citrus crenatifolia Lush (Rutaceae) trees in the premises of a farm in Gonapola (06°77.864′N / 080°02.367′E, elevation 35 m), Western Province of Sri Lanka.

Material and methods

Based on an inadvertent observation of the presence of the workers, nests of *P. rastellata* were searched carefully on seven Citrus crenatifolia trees in November, 2012 and February, 2014. Vertical distance from the ground to each nest observed on two trees among the seven and measurements relevant to the nest size were recorded. Number of units of each nest was determined by observing the worker movements between the units in the field for 3 hours. Each nest together with living members were carefully detached (except the workers left for foraging) from the two trees, placed in polythene bags and brought to the laboratory and examined further. Number of individuals of each adult caste, larvae and pupae in each nest were recorded. Adult castes and immature stages placed under a Meiji stereomicroscope at suitable magnifications were photographed with a Sony digital camera. Also, total length (TL), head length (HL), head width (HW), eye length (EL), eye width [Dorow, Kohout, 1995], pronotal width, the maximum width across the pronotum (PW) and alitrunk length (AL, from anterior-most point to the posterior-most point in profile) of dealate queens, workers, winged females and winged males were recorded using a scale and a stage micrometer (scale: 1 cm) under a low power stereomicroscope at suitable magnifications. Frequency histograms of total length, pronotal width and alitrunk length of all workers in the collection were also drawn. Significant differences between the mean total length and mean pronotal width of the 2 sized workers indicated by bimodal histograms were tested by the z-test [Fowler, Cohen, 1990]. Cephalic index (CI = HW × 100 / HL) of each caste was calculated. Dry mounted specimens of adult castes and wet preserved (in 70% ethanol) immature stages are currently deposited at the Department of Zoology and Environmental Management, University of Kelaniya, Sri Lanka.

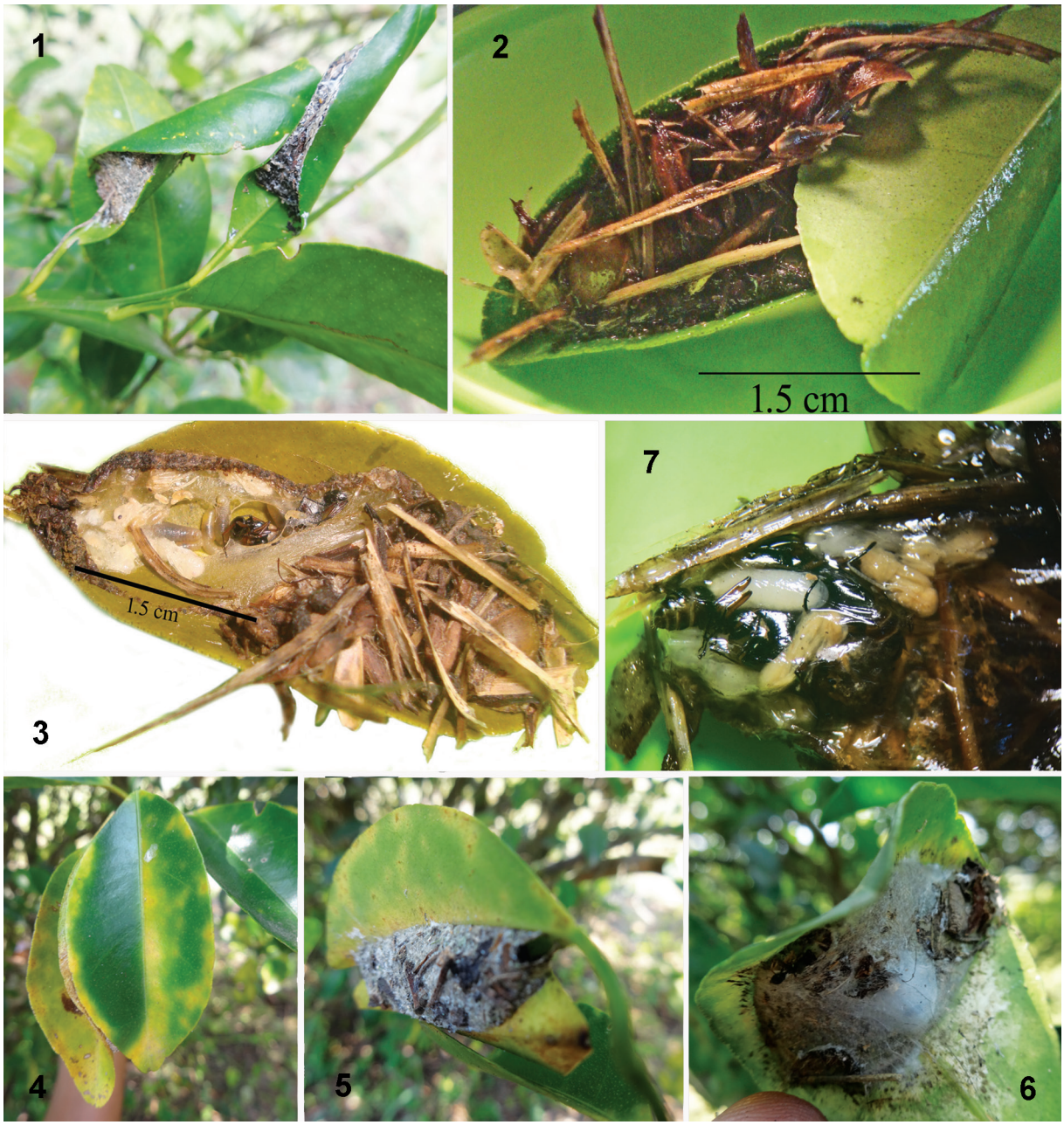
Results

Variations of the nest structure. All nests observed had larval silk reinforced by dead plant fragments (Color plate 13: 1–6). The structure of the nest varied but all nests were of small size. Members of the colony were free and not attached to silk walls. Four different structures of nests were observed among five nests located on the trees (Table 1): a nest on a folded single leaf (structure 1), in which subunits were evident from the movement of workers from one subunit to another (polydomous) (Color plate 13: 1); a horizontal nest between two leaves (structure 2) where dorsal surface of one leaf completely covered the nest but the two leaves were not fastened (monodomous) (Color plate 13: 2, 3); a hanging nest between two hanging leaves (structure 3) where the nest was underneath one leaf and it was partly covered by the other leaf ventrally (Color plate 13: 4–5); a nest on the underside of a single leaf (structure 4) which had spider silk on the outer surface (Color plate 13: 6). Vertical distance from ground to each nest varied from 105 to 160 cm (Mean ± S.D. = 131.5 ± 24.5 cm). Location of each nest was the youngest or the 2nd youngest leaf on a branch. Length and maximum width of nest structure 1 was approximately of 2.3 cm and 3.5 cm, respectively.

Each single leaf-based nest had a small hole (diameter 0.5 mm) at the base of the leaf whereas a middle hole in the silk sheet (as the entrance and exit) was observed in the nest structure 2 (Color plate 13: 3). Each nest was subdivided into chambers and the floor consisted of a uniformly thin silk sheet which was loosely attached to the upper or lower side of the leaf. In the structures 1, 3 and 4, outer nest surface (roof) consisted of an extremely thin silk sheet reinforced with very small fragments of plant tissues and unrecognizable, green or brownish fragments that were embedded among the silk strands at the middle region (Color plate 13: 1, 4–6). In the nest structure 2, workers, larvae and pupae were seen together in the chambers just beneath the silk sheet. The hidden chamber beneath the plant fragments embedded silk sheet, seen only after detaching and turning the nest, was occupied by the dealate queen, mature larvae, mature pupae and several workers (Color plate 13: 7).

Morphometrics and morphology of adult castes and immature life stages. Worker morphology. Dimensions (mm): TL 5.1–5.8, HL 1.5, HW 0.99–1.12, PW 0.75–1.05, AL 1.8–2, EL 0.4, EW 0.4, CI 73.3 (n = 103).

In full-face view clypeus slightly curved (convex) with several setae. A single pair of anteriorly directed setae attached to the middle of the anterior clypeal margin and a few distinctly shorter setae attached to its lateral margin. Two short setae visible on the posterior margin of the clypeus. Genae pilose. Antennae 12-segmented. Each mandible with 5 strong, teeth-like projections. At least a single seta present between each projection but several setae present on the top level of masticatory border. Frontal



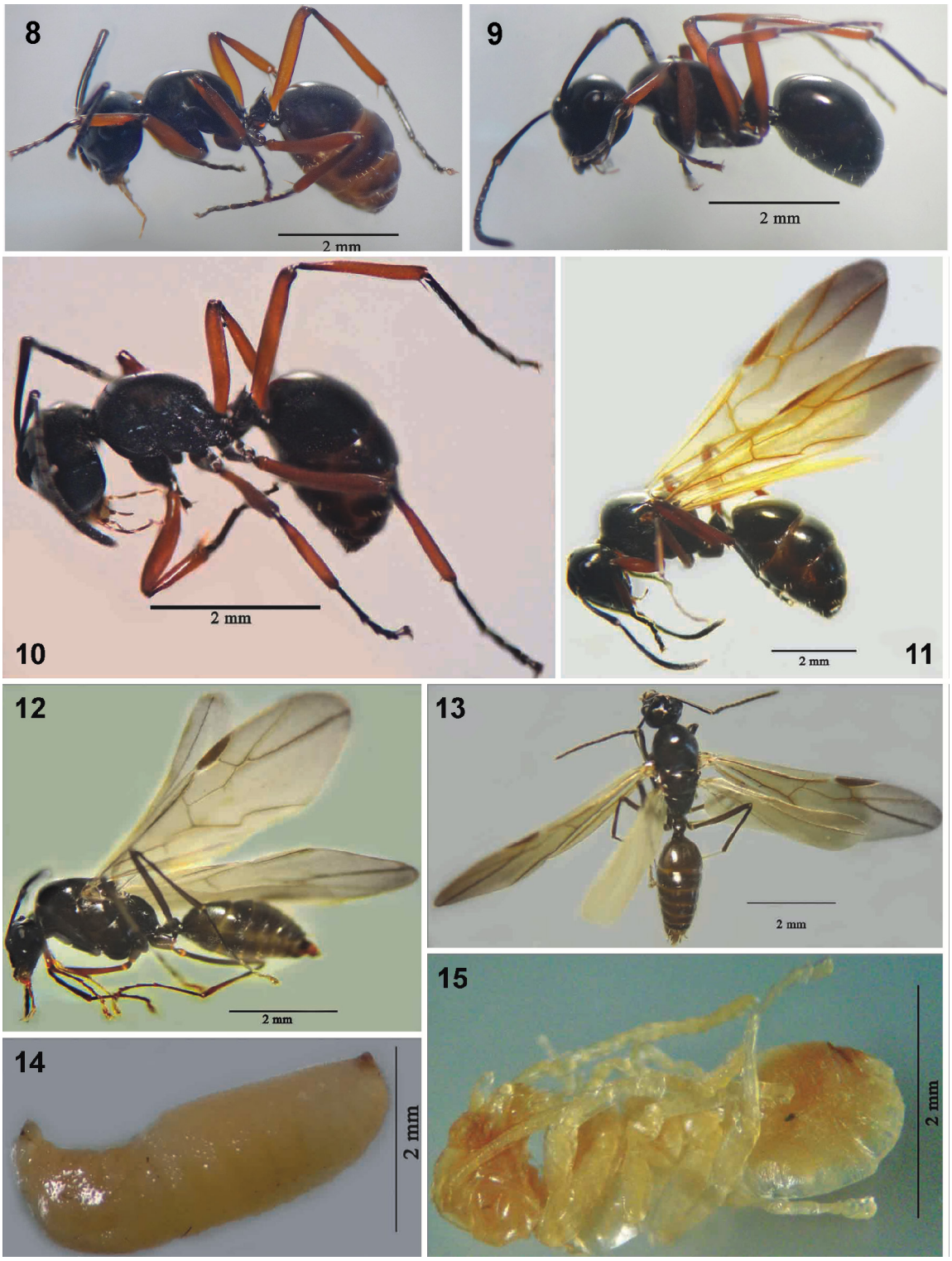
Figs 1–7. Nests of *Polyrhachis rastellata* on Citrus crenatifolia leaves.

1 – nest structure 1 on folded leaves; 2–3 – nest structure 2 on a leaf covered with another leaf: 2 – a nest with the partially removed dorsal cover leaf, 3 – appearance of the nest after removal of the dorsal cover leaf; 4–5 – nest structure 3 on underside of two leaves: 4 – dorsal view, 5 – ventral view; 6 – nest structure 4 on underside of a leaf; 7 – ventral view of a detached nest structure 2 showing the hidden chamber carrying the brood, several major workers and the dealate queen.

Рис. 1–7. Гнезда *Polyrhachis rastellata* на листьях Citrus crenatifolia.

1 – гнездо структуры 1 на скрученных листьях; 2–3 – гнездо структуры 2 на листе, покрытом другим листом: 2 – гнездо с частично отодвинутым покрывающим листом, 3 – внешний вид гнезда после удаления покрывающего листа; 4–5 – гнездо структуры 3 на нижней стороне двух листьев: 4 – вид сверху, 5 – вид снизу; 6 – гнездо структуры 4 на нижней стороне листа; 7 – гнездо структуры 2, вид снизу после удаления нижнего листа, видны скрытые камеры с потомством, несколько крупных рабочих и королева.

Color plate 14 Nest structure variation and morphology of adult castes of weaver ants *Polyrhachis* (*Cyrtomyrma*) *rastellata*



Figs 8–15. *Polyrhachis rastellata*.

8 – major worker, lateral view; 9 – minor worker, lateral view; 10 – dealate queen, lateral view; 11 – winged female, lateral view; 12–13 – male: 12 – lateral view, 13 – dorsal view; 14 – larva; 15 – pupa.

Рис. 8–15. *Polyrhachis rastellata*.

8 – крупный рабочий, вид сбоку; 9 – мелкий рабочий, вид сбоку; 10 – царица, вид сбоку; 11 – крылатая самка, вид сбоку; 12–13 – самец: 12 – вид сбоку, 13 – вид сверху; 14 – личинка; 15 – куколка.

Table 1. Colony demography observed in each nest structure of *P. rastellata* (n – number of subunits of each nest).
Таблица 1. Демография колонии для каждого из видов гнезд *P. rastellata* (n – количество секций в гнезде).

Caste / life stage Каста / стадия развития	Structure 1 Структура 1 (n = 2)	Structure 2 Структура 2 (n = 3)	Structure 3 Структура 3 (n = 1)	Structure 3 Структура 3 (n = 3)	Structure 4 Структура 4 (n = 4)
Dealate queen / Царицы	3	1	–	–	–
Winged female / Крылатые самки	–	6	6	2	–
Winged male / Крылатые самцы	–	3	3	2	–
Major worker / Крупные рабочие	10	23	9	15	4
Minor worker / Мелкие рабочие	10	15	4	6	7
Pupa / Куколки	1	5	1	4	8
Larva / Личинки	4	8	5	2	10

carinae with raised margins. Sides of head in front of eyes weakly convex, rounding into slightly convex occipital margin posteriorly. Compound eyes in full-face view lies in line with the cephalic outline. Ocelli lacking but positions of lateral ocelli marked by faint punctures. Alitrunk convex from pronotum to propodeum. Pronotum dorsally has its maximum width across narrowly rounded angular humeri. Mesosoma in profile with pronotum convex posteriorly. Mesonotum and propodeum slightly convex. Promesonotal suture distinct. Metanotal groove is indicated by weak impression seen laterally. Propodeum unarmed. Propodeal dorsum sloping down to a steep declivity. Anterior face of petiole almost straight, its posterior face slightly convex. Petiolar dorsum armed with a middle pair of distinctly taller and attenuating spines and a pair of shorter lateral spines. Subpetiolar process almost rectangular, slightly concave and with a pair of setae anteriorly, acute posteriorly. Narrowly rounding anterior face of first gastral segment in profile lies in line with the alitrunk dorsum and with a ventral, anteriorly-directed curved spine. Figure 16 shows two clearly separated groups of workers according to the total length and pronotal width observed among them. Mean total length and mean pronotal width of the larger workers were significantly higher than that of smaller workers (z-value for total length = 32.34; z-value for pronotal width = 12.3; $p < 0.01$). Histogram of alitrunk length only showed 2 sized groups.

Major workers had a slightly longer body and alitrunk and a massive gaster than that of minor workers (Color plate 14: 8). They lack ocelli and their compound eyes lied just above the mid-length of the head. Gaster of major workers was of elongate, globose shape and the black tergite of the 1st gastral segment formed 1/3 of the length of whole gaster in profile. Other segments of the gaster were of mixed black and orange brownish towards its tip. Minor workers were smaller in appearance and shorter. They lack ocelli and their compound eyes situated clearly above the mid-length of the head, close to the top of the vertex (Color plate 14: 9). They had a shorter, globose, black gaster and their 1st gastral segment forms about half of the total length of gaster.

Morphology of dealate queen. Dimensions (mm): TL 6–6.2, HL 1.5, HW 1–1.2, AL 2, EL 0.4, EW 0.2–0.4, CI 73.3 (n = 4).

The dealate queen (Color plate 14: 10) with black head, alitrunk and 1st gastral segment and the rest of the gaster of black mixed orange brownish, orange brownish palps, femora and tibiae was similar to a worker in appearance but its alitrunk was broader and slightly longer. It had a pair of compound eyes and 3 ocelli on the vertex. Scars of the shed wings were prominent on the mesonotum and metanotum. Petiolar node had two subequal pairs of spines and the middle pair was longer. The 1st gastral segment formed 1/3 of the whole gaster.

Morphology of winged female. Dimensions (mm): TL 8–9, HL 2, HW 1–2, AL 2–3, EL 0.3–0.5, EW 0.2–0.4, CI 75 (n = 14).

It has a 12-segmented antenna, 3 ocelli on the vertex, 6-segmented maxillary palps and 4-segmented labial palps. A pair of compound eyes in full-face view extends beyond the cephalic outline. Heavily sclerotized mandible bears well-developed 5 teeth-like projections along the masticatory margin and the 1st distal projection is the largest among them; teeth-like projections gradually become smaller towards the base of the mandible. Numerous long setae present along the masticatory margin. Two pairs of hyaline wings present (Color plate 14: 11). The forewing length ranged from 7 to 8 mm and its maximum width ranged from 2 to 2.5 mm. A conspicuous stigma was observed on the forewings. The hind wing length was 5 mm whereas its maximum width was 1.5 mm. Massive pronotum forms a larger part of the alitrunk. Petiolar node had two pairs of broad-based short spines that are of almost similar height. Ventrally, a v-shaped pore present at the tip of the gaster.

Morphology of winged male. Dimensions (mm): TL 6.1–6.5, HL 1, HW 1, AL 2, EL 0.4, EW 0.4, CI 100 (n = 8).

Males had a smaller and shorter head and a shorter body than that of winged females but narrower and longer body (including narrower gaster) than those of workers. Antennae 13-segmented. Three ocelli present on the vertex. A pair of compound eyes in full-face view protrudes beyond the lateral margin of the head. Masticatory margin of the mandible has a wavy ridge but lacks teeth-like projections. Dorsal surface of the mandible bears long setae. Maxillary palp 6-segmented; labial palp 4-segmented. Pronotum massive. Alitrunk stout and bears a pair of hyaline forewings with a prominent stigma and hindwings (Color plate 14: 12, 13). The forewing length ranged from 6 to 6.2 mm and its maximum width ranged 2 to 2.2 mm. The length and maximum width of hind wing ranged from 4 to 5 mm and 1 to 1.5 mm, respectively. Its petiolar node has a pair of broad-based, extremely lateral, very short spines and 2 dorsal slightly-raised tubercles. Well-developed accessory reproductive appendages are present at the tip of the gaster.

Morphology of larvae and pupae. Larvae were of yellowish brown and apodous (Color plate 14: 14). Their

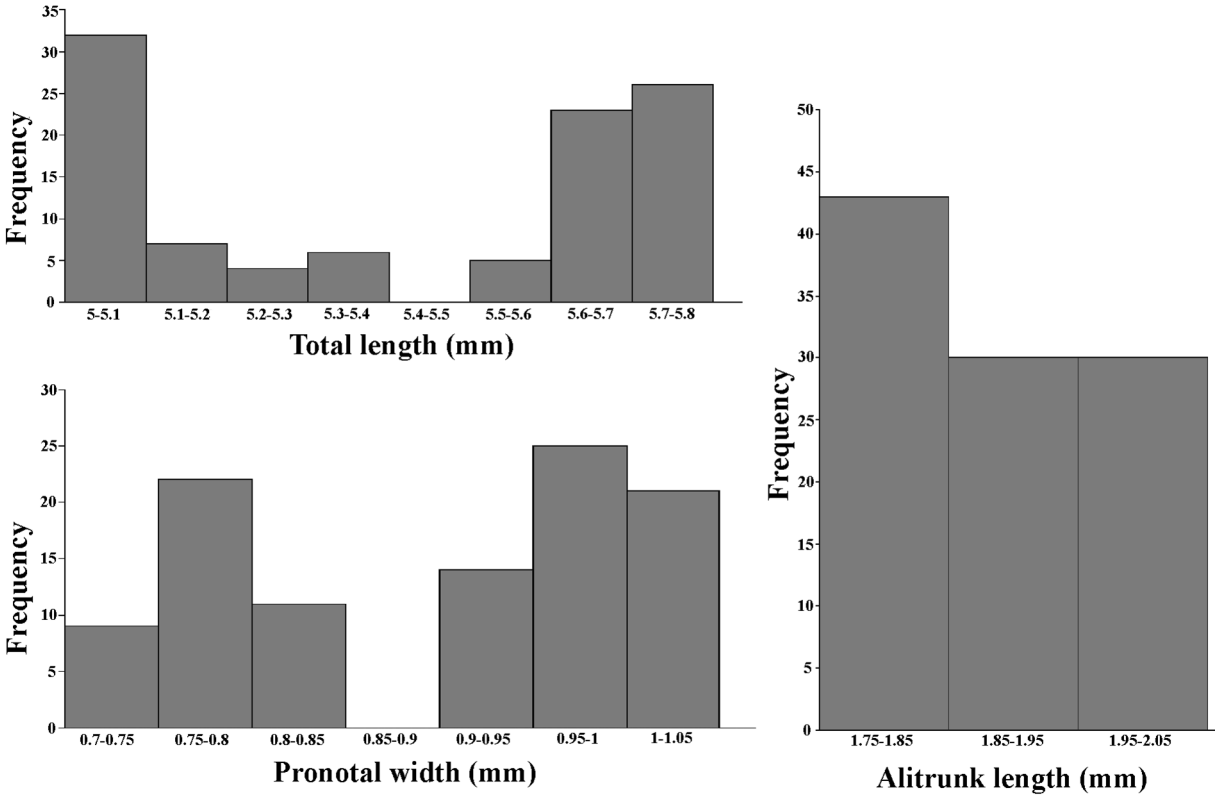


Fig. 16. Frequency histograms of total length, pronotal width and alitrunk length of *Polyrhachis rastellata* workers.
Рис. 16. Гистограммы частот встречаемости общей длины, ширины пронотума и длины мезосомы рабочих *Polyrhachis rastellata*.

integument spinulose. Anteriorly, body has a ventral curvature and a small head. Anus lied postero-ventrally in the segmented body. Total length of the larvae ranged from 3 to 4.2 mm whereas their maximum body width ranged from 0.8 to 1.3 mm (n = 29). Mandibles were moderately sclerotized and of camponotoid shape with striations. Digitiform maxillary apex had apical sensilla. Pupae exarate (Color plate 14: 15), naked and ranged from 4 to 5.5 mm in total body length and from1.2 to 1.6 mm in its maximum body width. Well-developed antennae, a pair of eye spots, mouthparts and three pairs of thoracic legs were present.

Colony demography. Number of subunits of each nest varied from 1 to 5 (Table 1). The nest structure 1 showed polygyny by having 3 dealate queens and had similar number of major and minor workers and very low numbers of immature stages. The nest structure 2 had all adult castes including winged females, winged males and immature stages (Table 1). Both nest structure 3 had immature life stages and all adult castes except a dealate queen. Major and minor workers and immature stages only were observed in the nest structure 4.

Discussion

Two trees among the seven observed had the nest units spread in several branches considerably away from each other and it is not clear how ants select the leaves for constructing the nest units. Structural variation of *P. rastellata* nests were described with the relevant colour images for the first time from Sri Lanka and arboreal nests of the species that were constructed with larval silk and plant fragments that are monodomous or polydomous agree with the nest structure descriptions of Kohout [2006] and Robson and Kohout [2007]. Hidden chambers in the nests and vertical distance to the nest from the ground and nest size measurements were recorded for the first time for the species. The presence of both winged females and males in the colonies indicated that the reproductive period of the species is in November and February months but a continuous future survey is recommended to confirm the observation. Actual number of workers survived in the nests must be higher than the observed numbers because some foragers were probably not in the nests at the time of collecting the nests during day time. Bimodal histograms of total length and pronotal width (Fig. 16) followed by z-test for the mean values of the two groups confirmed for the first time, the presence of major and minor workers of the species contrary to Bingham [1903] and Wheeler and Wheeler [1990]. Morphometrics and morphological description of winged females and males (with colour images) given here for the first time will be very useful in the identification to the species even in the absence of the workers, if encountered in the field after flying away from the colonies.

Morphology of *P. rastellata* worker has been described as having a robust pronotal dorsum which is widest across the shoulders, light to medium red or orange legs, distinctly uneven mesosomal profile with a rather flat or shallowly impressed summit at the promesonotal suture and a weak depression indicating the relative position of the indistinct

metanotal groove [Kohout, 2008] but current specimens had brownish orange femur and tibia but black tarsal segments (as shown in the relevant figures). The difference may be due to the fresh specimens observed in the current study and old museum specimens described by Kohout [2008]. Dorow and Kohout [1995] described the structure of nests of *P.* (*Hemioptica*) *boltoni* Dorow, Kohout, 1995 and *P.* (*Hemioptica*) *bugnioni* Forel, 1908 from Sri Lanka and the nests of *P.* (*Hemioptica*) *boltoni* were built using a coarsely woven silk net to which small pieces of dead leaves, wood fragments and other detritus were attached and the leaf surface in the nest was not lined with a silk layer as is the case in many other species of *Polyrhachis*. Nest of *P.* (*Hemioptica*) *bugnioni* was made by sealing together the edges of a pair of stipules that were immediately above the internode and the nest consisted of silk and debris spun by the ant larvae. The inner surface of the stipules was not coated with a sheet of silk. Similarly, the nests of *P. rastellata*, described for the first time from Sri Lanka, consisted of silk and plant fragments (pieces of dead leaves or detritus) but the floor of the nest (inner surface of the nest-carrying leaf) also had a thin silk sheet, which separated the nest and the leaf surface. According to Dorow et al. [1990] arboreal *Polyrhachis* species establish nests everywhere where leaves or other appropriate substrates are available and, the currently described *P. rastellata* nests had one major type of nests mentioned by them, the nests in folded or rolled leaves or between two or more adjacent leaves. The ability to weave nests with larval silk circumvents the limiting factor, the availability of nesting sites, allowing the ants to establish colonies nearly everywhere in the leaf region [Dorow et al., 1990]. Presence of several subunits of a nest (polydomous) spread over a large area of an arboreal species, seen in *P. rastellata* in the current study, is an advantage to control a large area without the need for long distance patrols, facilitates reduced distances to food sources and provides protection from enemies or a catastrophy where the remaining subunits would provide shelter to the members [Dorow et al., 1990]. A forager should carry food to the nest and has to travel great distances than if it could rest anywhere. A polydomous colony structure reduces the distances between foraging sites and the nearest nest [Holldobler, Lumsden, 1980]. Flat sheets of larval silk [Robson, Kohout, 2005] and also spider silk in one nest of *P. rastellata* were observed in the current investigation. Although the systematics was not studied in detail, apparently coccids observed in two nests of *P. rastellata* may be trophobionts of the species as mentioned by Dorow and Maschwitz [1990] for Arachne-group of *Polyrhachis* ants.

Normally ants living in mutualistic symbiosis with plants only are specialized on distinct host plant taxa and both ants and plants have developed co-adaptations for their mutual benefit [Dorow, Maschwitz, 1990]. Accordingly, presence of *P. rastellata* on the leaves of Citrus crenatifolia may repel or expel the insect pests that attack the plant (this aspect should be investigated further) and the leaves of the plant provides the nesting substrates for the ant species. Silk nests reinforced by dead plant and soil particles in *P.* (*Myrmhopla*) *dives* and *P.* (*Myrmhopla*) *furcata* were reported by Liefke et al. [1998] but soil particles were never observed in *P. rastellata* nests. Also, those researchers mentioned the use of spider silk in two weaving *Polyrhachis* species as observed in a single nest of *P. rastellata* in the current study.

Morphometrics of *P. rastellata* adult castes have been presented here for the first time but Kohout [2006] mentioned that *P. rastellata* resembled *P. lepida* described in his paper. Kohout [2006] also stated the dimensions of *P. lepida* worker while mentioning its smaller size (TL 5.64–6, HL 1.4–1.5, CI 89–93), distinctly more convex occiput and longer antennal scapes (SI 128–136) than those of *P. rastellata* worker. However, considerable differences were not apparent between TL or HL values for *P. lepida* and the current corresponding values for *P. rastellata*. A larger value of CI than that recorded for *P. rastellata* in here was recorded by Kohout [2006] for *P. lepida* (CI = 91). Bingham [1903], Dorow [1995] or Kohout [2006] did not mention the presence of 2 distinguishable types of workers in 2 species. Also, the latter did not provide morphometrics or morphological descriptions of the winged individuals. Morphology of the adult castes of *P. rastellata* with images was described for the first time from Sri Lanka and also, the presence of major workers and minor workers of the species was confirmed for the first time. Although Bingham [1903] and Dorow [1995] mentioned that queen's petiole was unarmed, a petiolar node armed with 4 spiny projections were seen in the queen as well as in the male of *P. rastellata*.

Based on the length of the larvae observed in the present study they represent an intermediate stage between mature and immature larvae described in Wheeler and Wheeler [1990]. Currently, the body hairs of the larvae were never studied in detail and the very young larvae mentioned by them were not observed.

Loss of cocoon weaving in the species of *Polyrhachis* (*Cyrtomyrma*) was reported earlier and Dorow et al. [1990] reported that any *Polyrhachis* of other subgenera that had naked pupae was never found. It is apparent that *Cyrtomyrma* naked pupae were observed in *P. rastellata* also.

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