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Studies on Caulicolous and Ramicolous fungi of Karnataka-II : on Cashew

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The present paper describes and illustrates the morphological characters of five caulicolous and ramicolous fungi from Karnataka viz., *Chaetomium globosum, Diatrypella indica, Cytospora* sp., *Phoma* sp., *Pestalotiopsis* sp. are new host record from India and others are new report from either South India or Karnataka.

Key words : New host record, India, Caulicolous and Ramicolous fungi, *Chaetomium globosum, Diatrypella indica, Cytospora acaciae, Phoma herbarum., Pestalotiopsis heterocornis*

INTRODUCTION

Anacardium occidentale Linn., popularly known as 'Cashew' in English belongs to the family Anacardiaceae. It is a small evergreen tree, native of tropical America from Mexico to Peru and Brazil but now cultivated largely in the states of Andhra Pradesh, Karnataka, Kerala and Tamil Nadu and to some extent in Goa, Maharashtra. Orissa and West Bengal.

Seeds are source of cashewnuts. They find use in confectionery and as dessert, and also edible oil. Cashew apple is juicy, astringent and edible. Juice is fermented and made into liquors, and pulp is used for preserves. Shells or pericarp yield cashew shell oil, which is used in the manufacture of varnishes, gums, inks etc. Oil is used for treating cracks on soles of feet. India is principle supplier of cashew kernels and cashew shell oil is monopolised by India. Sap from bark is made into indelible ink.

In Karnataka cashew occupies an area of 36,554 hectares with an annual production of 15,175 of raw nuts. In India cashew is grown in an area of 7.2 lakh ha. with production of 3.5 lakh metric tonnes with a poductivity of 620 kg/ha (Ghosh, 1999).

MATERIALS AND METHODS

Study of caulicolous and ramicolous fungi infesting cashew, ws carried out during 1887-88 in the Department of Plant Pathology, University of Agricultural Sciences, G. K. V. K., Bangalore 560 065.

During the course of mycological survey from 1987 to 1988 the fungi infesting dead twigs and branches were collected on cashew, at and around Bangalore and Mysore regions. Infested materials were collected from forest of Gandhi Krishi Vignana Kendra (G. K. V. K.), University of Agricultural Sciences, Bangalore, Manasagangothri Campus, Mysore and Agricultural Research Station (A.R.S.), Mudigere. At the time of survey, fruiting bodies induced by fungi on infested for further studies. Before isolating, first the materials were cut into 6-7 cm bits, rinsed with water, air-dried and placed them in a moist chamber. Conditional or ascomatal features were studied under a stereo-binocular microscope. Materials for examination with a compound microscope were prepared by mounting pycnidia or ascomata or conidial materials in lactophenol. Wherever the spores were hyaline, they were stained with dilute cotton blue for

examination. Fungi were isolated from the infested twigs and branches of cashew, obtained at and around Bangalore and Mysore regions of Karnataka. There are number of methods in vogue for isolating a give fungus but the usual method for isolation like single spore isolation technique for coelomycetous, hyphomycetous and ascomycetous fungi was followed. An ascoma was scooped from the infested twigs and cultured for isolation of ascomycetous fungi. They were prepared by soaking them in sterile water for 3 hours, air dried and placed it in inverted petriplates containing potato dextrose agar. Ascoma usually discharge ascospores upwards on to the agar within 24 hours. Masses of ascospores were used to start colonies, which were then transferred to PDA slants and incubated at room temperature.

Another method was used for isolating the ascomycetous fungi. An ascoma was scooped out from the infested twigs or branches and transferred aseptically on to the centre of petriplates containing PDA. The plates were incubated at room temperature. After four days of incubation ascoma germinated and produced colonies, which were then transferred to the edge of PDA slants and sterilized *Typha* leaf bits. Cultures were incubated at room temperature. Since, some fungi do not form readily fruiting bodies on PDA, *Typha australis* Schum & Thonn (=*Typha angustata* Bory & Chaub.) leaf bit inoculation technique was adopted to obtain fruiting bodies for study. Mature leaf bits of *T. australis* were cut to a length of about 5 cm and one end was covered entirely with moist absorbant cotton. Later these leaf bits were inserted into test tubes and sterilized at 15 P. S. I. for 15 minutes. Such leaf bits were inoculated using pure cultures and incubated at room temperature.

Spot inoculation technique was adopted for confirm Koch's postulates. Healthy leaves of cashew surface sterilized in a solution of 1 : 1000 mercuric chloride, washed in sterile water and inoculated with pynidiospore suspension obtained by crushing they pycnidia or ascopores from ascoma or with conidia through wound or injuries made by pin pricking on the laves, uninjured leaves and another laef inoculated with a drop of water was kept as a control. The inoculated plants of injured, uninjured and control were covered by a polyethylene bags for three days and absorbant wet cotton was provided inside to create humidity throughout the period of test. Afterwards the polyethylene bags were removed and inoculated sets were transferred to glasshouse for observation of symptoms. Observations were taken at regular intervals for infection for a period of 15 days.

The cultural characters of all the fungi isolated from the above mentioned hosts were studied on PDA. Aliquot of 20 ml of PDA was poured into 90 mm diameter petriplates. A five mm discs of mycelial mat cut from the periphery of a four-day-old cultures were used for inoculation. The disc was placed topsy-turvy at the centre of the petriplate by means of a sterilized inoculation needle. After inoculation the plates were incubated at 26 ± 1°C for five days. Three replications were maintained for each fungus. The maximum colony diameter was recorded for each plate from the different days and the cultural characters for all fungi on PDA were recorded. Differences in topography type of margin, colour and consistency were recorded. The spores of all the fungi taken from one-month-old-culture grown on sterilized *Typha* leaf bits were mounted in water on a clean slide. Spores were then a fresh clean coverslip was placed over it. One hundred spores without any bias, of each of the fungi were measured under high power calibrated ocular micrometer. Camera lucida drawings were made under high power and or oil immersion for all the fungi. The average size of the spores of all the fungi was then determined. The size of the fruiting bodies and conidiophores were also measured separately.

The specimens studied were deposited in the MYSP Herbarium in Plant Pathology Department, Agricultural College, University of Agricultural Sciences, G. K. V. K., Bangalore and also a few were deposited at CMI, Kew, London. The accession numbers were given along with the descriptions.

RESULTS AND DISCUSSION

Chaetomium globosum Kunze ex Fries, Saccardo, Syll. Fung., 1 : 222, 1882.

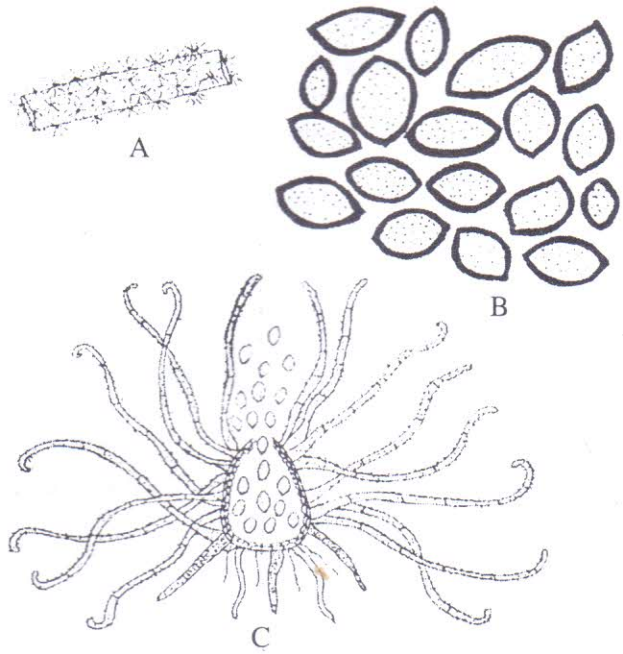

Fig. 1 : *Chaetomium globosum,* A, habital ; B, Conidia (× 1000) ; C, perithecium (× 100)

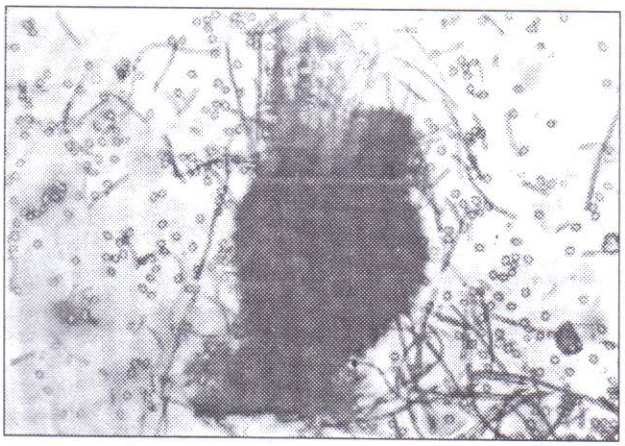

Fig. 2 : *Chaetomium globosum, Photomicrograph showing perithecium and ascospores* (× 100)

Habitat

On dead branches of *Anacardium occidentale,* Hebbal, 22.12.1887 ; Leg. S. S. Madhukeshwara and C. Govindaraju, U.A.S., Bangalore Harb. MYSP 2041. Det. K. M. Ponnappa and P. F. Cannon.

Chaetomium globosum on potato dextrose agar colonies were effuse, dull white to green, with irregular margin, thin, wavy. Perithecia superficial, dark greenish black to brownish black, sub-globose to oval 576-640 (608) × 486-576 (530) µm in size and provided with a circular ostiole. They are attached to the substratum by light brown rhizoid like hyphae and are clothed with hairs laterally and terminally. The terminal hair are diffusely aggregated around the upper half of the perithecium. They are light green or grayish, finely roughned or coarsed, septate, slender less than 200 µm width at the middle, flexuous below, undulate above with often extend beyond the spore mass. The lateral hairs are straight, slightly light coloured, not constricted at septa, about 3 µm wide near the base withoften curved tips. Asci are clavate with narrow stalk, thick walled, octosporous, quickly evanescent, ascospores are irregularly biseriate in asci, one-celled, olivaceous brown, smooth, thick-walled usually lemon shaped, distinctly apiculate at both the ends 8.0 – 11.0 (9.5) × 6.5 – 8.5 (7.5) µm in dimensions. They are extruded in a long cirhus which is supported by the surrounding terminal hairs.

Remarks

The species of the genus *Chaetomium* Kunze ex Fries is very common and ubiquitous, saprophyte on dung and decaying vegetable of all kinds throughout the year.

Chaetomium globosum has a wide host range, very common and ubiquitous. Lodha (1964) reported this fungus on cowdung from Rajasthan. Srivastava (1964) recorded same species on *Lufa acutangula* Roxb., from U. P., on leaves of *Cirnum asiaticum* L., from Bihar (Prasad *et al.,* 1966) ; from seeds of *Trachyspermum amni* (L.) Spraguel., *Coriandrum sativum* L., *Cuminum cyminum* L., etc., from different parts of India (Swarup and Mathur, 1972) ; Sharma *et al.,* (1984) reported that soft rot of *Ziziphus jujuba* (L.) Lam. Non Mill. Caused by *C. globosum* from Agra. This is, therefore, a new record of *Cheatomium globosum* on *Anacardium occidentale,* from India.

Diatrypella indica : Sathe & Srinivasulu, *Sci. Cult.,* **37** : 248, 1971

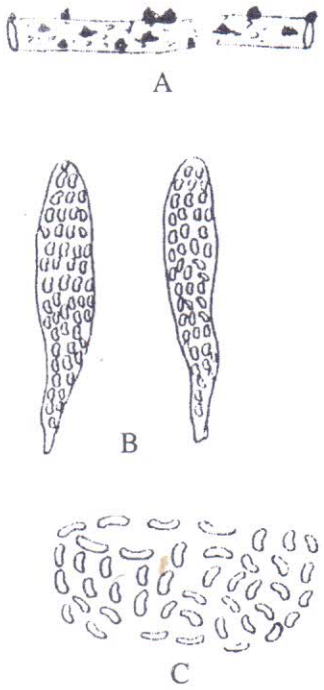

Fig. 3 : *Diatrypella indica,* A, habital ; B, asci and C, Ascospores (× 400)

Fig. 4 : *Diatrypella indica,* Photomicrograph showing perithecium asci and Ascospores (× 200)

Habital

On dead branches of A. *occidentale* ; Mysore, 20.2.1988 ; Leg. S. S. Madhukeshwara and C. Govindaraju, U.A.S., bangalore Herb. MYSP 2038 Det. K. M. Ponnappa.

Diatrypella indica Sathe. & Srinivasulu of PDA weak old colony off white, rather felty with little aerial growth, margin finely diffused. Ascomata innate – erumpent, black, crustose, slightly roughened by projecting necks ; perithecia embedded in a stroma, flask shaped, black with a distinct wall of its own placed vertically in single layer, with short neck ; ostiolate, 320 – 384 (352) × 280 – 486 (383) µm in size ; ascimany, cylindric to clavate, yellowish ; aparaphysate, polysporus, 40 – 50 (45) × 3.0 – 5.0 (4) µm ; ascospores hyaline, slightly to moderately curved, allantoid, polyseriate, plae yellow in mass measuring 3.0 – 4.0 (3.50) × 1.5 – 2.5 (2.0) µm in dimension.

Remarks

Earlier *D. indica* has been reported on dried stems of *A. occidentale* from Maharashtra.

Cytospora sp.

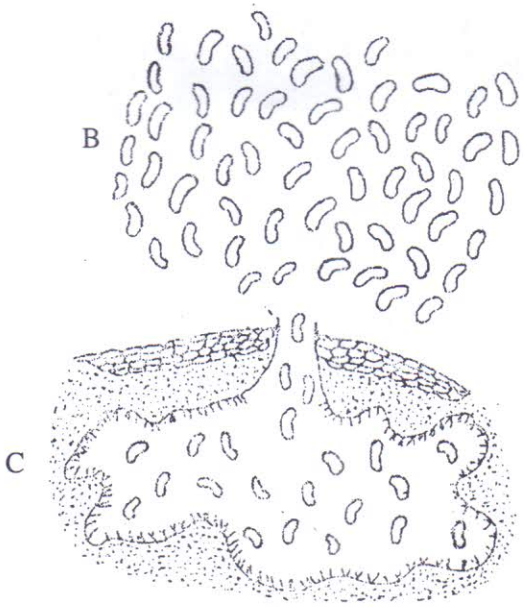

Fig. 5 : *Cytospora acaciae,* A, habital ; B, Conidia (× 1000) ; C, v.s. of conidioma (× 100)

Habital

On dead twigs of *A. occidentale ; E. citriodora* and *S. cumini* ; G.K.V.K., 20.1.1988 ; Leg. C. Govindaraju, U.A.S., Bangalore Harb. MYSP 2034 and Harb. IMI 325656 Det. B. C. Sutton.

Colonies on PDA immersed, effuse with circular margin, silver gray to white. Concentric rings were seen on PDA. Condiomata eustromatic, separate, Sub-epidermal, conical, erumpet, drak brown, multiocular or convoluted, radiating and enlarging from the centre, separated by walls of plae to dark brown texure angularis measuring 384-768 (578) µm deep and 320-640 (480) µm in width ; conidia hyaline to sub-hyaline, single called, allantoid mesuring 3.0–4.0 (3.50) × 1–1.5 µm in dimension ; conidia discharged as cirrhi.

Remarks

Diseases caused by the species of the genus *Cytospora* Ehrenb. Ex Fr. Occurs on dead or living leaves, stems and barks of various fruit trees as well as forest trees.

The pycindial nature of conidiomata, conidial dimensions with minor variation in spore dimensions can be considered to fall within the very well known *Cytospora acaciae* Tilak & Rokde.

Earlier Tilak & Rokde (1966) described *Cytospora acaciae* Tilak & Rokde on dead stems of *Acacia arabica* willd. From Aurangabad. Ramachandra Rao (1967) reported the same fungus on *Syzygium cumini* (L.) Skeels from Aurangabad. Sharma (1971) described *Cytospora mangiferae* Sharma on *Mangifera indica* L., from M. P. Rao and Narendra (1974) described *Cytospora mangiferae-indicae* Rao and Narendra on mango from Poona. Davison and Tay (1983) isolated *Cytospora eucalypticola*from the cankers of *Eucalyptus marginata* from western Australlia. Fraser and Davison (1985) recorded the same fungus from stem canker of *Eucalyptus saligna* in western Australia. However, *Anacardium occidentale*is the new host record for *Cytospora acaciae* from South India.

Phoma sp.

Habital

On dead twigs and of *Anacardium occidentale ;* G.K.V.K., 25.1.1988 ; Leg. S. S. Madhukeshwara and C. Govindaraju, U.A.S., Bangalore Harb. MYSP 2040 and Harb. IMI 325657. Det. K. M. Ponnappa B. C. Sutton.

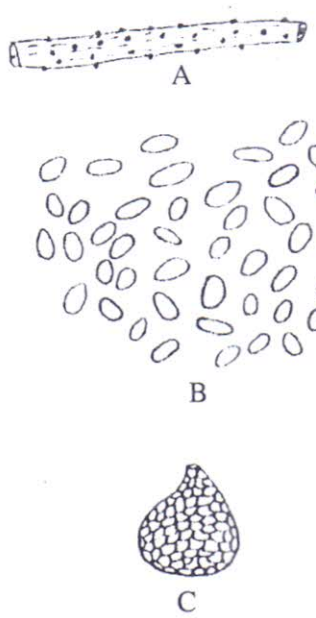

Fig. 6 : *Phoma herbarum,* A, habital ; B, Conidia (× 1000) ; C, conidioma (× 100)

Phoma sp. colonies on PDA immersed, effuse, fluffy todense aerial mycelium, white to pale brown with diffuse margin. Reverse of the petriplate often reddish. Conidiomata pycnidial, semi-immersed, unilocular, brown, sub-globose measuring 64-128 (96) × 64-89.5 (77) µm in dimension ; conidia hyaline, aseptate, thin-walled, eguttulate, ellipsoidal, 4.0–5.0 (4.50) × 2.5–3.0 (2.50) µm in size ; conidia released as cirrhi.

Remarks

Diseases caused by the species of the genus Phoma. Occurs on stems, twigs and leaves and it has a wide host range. A number of them are without boubt plurivorus and a number of them are states of other fungi and other are pathogenic.

The pycindial and conidial dimensions of *Phoma collected* on cashew agree closely with *Phoma berbarum* Westend.

Earlier *P. herbarum* was reported on *Murraya exotica* L., from U.P. (Singh and Singh, 1965) ; on dead twigs of *Artemisia parviflora* L. and *Cosmos sulphurous* Cav., from Pune (Chiplonkar, 1970) ; on

Carica papaya L., from Bihar (Varma, 1975). It has also a wide host range, more than 100 colletions on 35 diferent hosts genera, from soil, air, dung, sewage and other sources from different parts of the world (Sutton, 1980).

However, *A. occidentale* is new host record for *Phoma herbarum* from South India.

Pestalotiopsis sp.

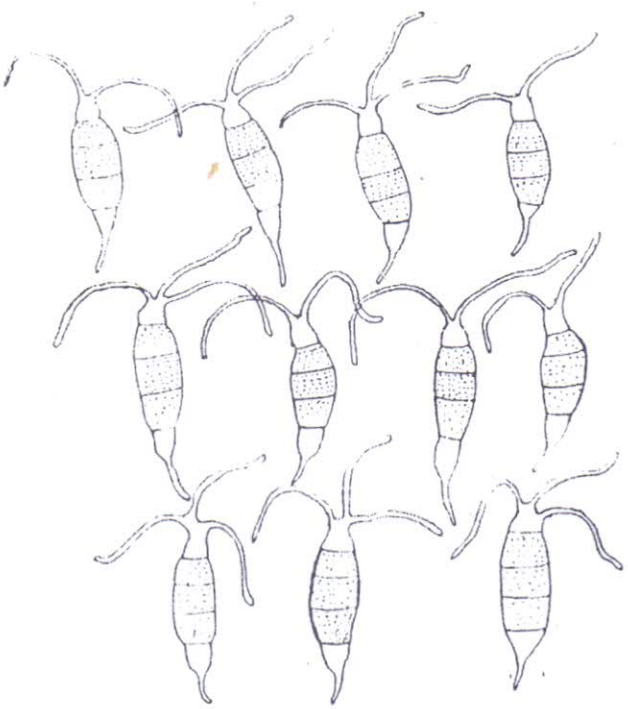

Fig. 7 : *Pestalotiopsis heterocornis*, Conidia (× 400)

Habital

On dead twigs of *A. occidentale ;* G.K.V.K., 25.9.1987 ; Leg. S. S. Madhukeshwara and C. Govindaraju, U.A.S., Bangalore Harb. MYSP 2042 Det. K. M. Ponnappa.

Pestalotiopsis heterocornis (Guba) Madhukeshwara & Govindaraju, comb. Nov. On PDA, mycelium white, raised towards periphery with irregular margin. Reverse of petriplate light yellow. Conidiomata acervular, may scattered or gregarious, globose to lenticular, punctiform, measuring 192-832 (572) × 192-512 (352) µm, sub-epidermal, sooty on maturity ; conidia 4-euseptate (5-celled) fusiform, tapering towards the extremities, 22.5-25.5 (24.5) × 5.0-6.5 (5.5) µm in dimension ; three intermediate cells pale brown, olivaceous, concolourous, 13.5–16.0 (15.0) µm inlength, bearing 2 to 3 widely divergent appendages on a prolongation of apical cell and atenuated, the other one or two apendages filliform laterally divergent, arising from slope and peak of apical cells, unequal in size, 14.5-24.0 (19.0) µm in length and joined at the apex of apical cell, basal hyaline cell rather long, tapering, sometimes obtuse, 3.0-5.0 (4.0) µm in length and with lower single pedicel measuring 2.5-5.0 (3.5) µm length.

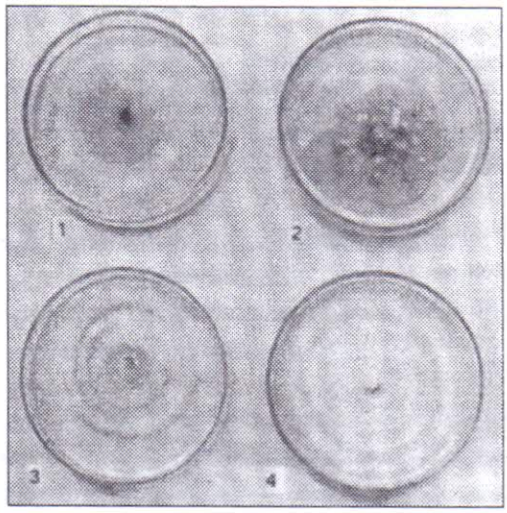

Fig. 8 : Photograph showing growth characters of different fungi on cashew
1. *Cytosopora acaciae*
2. *Chaetomum globosum*
3. *Pestalotiopsis heterocornis*
4. *Diatrypella indica*

Remarks

The morphology of ascomata, colonies on PDA, asci and ascospores dimensions are almost same with the type species.

This is a new monotypic record from South India. Guba (1961) described a new species of *Pestalotia* de not on the leaves of *A. occidentale*from Sao Paulo, Brazil collected during January 1935 as *Pestalotia heterocornis* Guba. In the recent ontogenic system of classification *Pestalotia* is diferent from *Pestalotiopsis.* The former genus *Pestalotia*is characterised by eustroma (Sphaeropsidales) conidia 5-distoseptate, 4-median cells pigmented and the conidiogenous cells being

annellidic. Whereas *Pestalotiopsis* is delimited by acervular conidiomata (Melanconiales), conidia 4-euseptate, three median cells coloured and the conidogenous cells not annellidic. Hence the fungus under study is best placed in *Pestalotiopsis*.

Disease caused by the species of the genus *Pestalotiopsis steyaert* mainly occur on leaves, but rarely on stems and branches.

The study has shown abundant biodiversity of fungi living on the dead leaf and stem parts of cashew. The cultural characters of the fungi studied are shown in Plate 3. The study has revealed some new and note worthy fungi from the angle of taxonomic Bilgrami *et al*., 1981 ; 1991 and Bulter, 1997) and pathological viewpoint. It is helpful for the database researchers on biodiversity. The fungi described have practical utility in the field of decomposition studies.

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