Cressa cretica Linn. – in search of *Sanjeevani*

The article entitled 'In search of *Sanjeevani*', published in *Current Science*[1] has prompted me to write these few lines. *Cressa cretica* has been placed at the top of the list of 17 plant species that reflect the features of *Sanjeevani*. *Sanjeevani* is a mythical herb from the epic *Ramayana*, said to posses the ability to 'resurrect' life. However, the every existence of *Sanjeevani* needs to be examined.

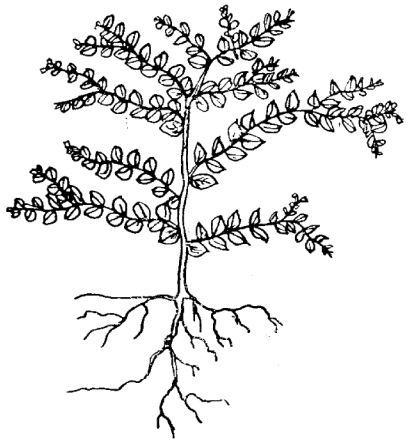

Figure 1. *Cressa cretica.*

During my research of nearly four decades on the ecology of desert plants and plants of inland salines in Rajasthan desert, I have not come across any reference in relation to *Cressa cretica* as *Sanjeevani*. However, I have discovered some grasses, which appear dead, but come to 'life' during the rainy season, as water is a scarce commodity in the Indian desert. Such plants which come to life, are called as 'resurrection plants'. Such a phenomenon has led to the belief that they have a strong potential for resurrecting life. In fact it has been stated that there is a specific group of plants, having potentiality for invigorating dying health.

I reproduce here a rather poor hand drawn sketch of *Cressa cretica* Linn. from my book entitled *Ecological Approaches to Indian Weeds*, published in 1981 (Figure 1). This plant possesses two types of stem: (i) above ground, and (ii) below ground (stolon), the latter sprouts miraculously in favourable conditions, when water is available, and the plant appears to come to life; in fact such plants show resurrection. This species has been missed by the authors from the saline pockets of Rajasthan desert, although they show its distribution in Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu.

The study of *Sanjeevani*, 'buti' is a myth and probably reality lies in the spiritual healing through the hands of Hanumanji, as such resurrection phenomenon has been accepted by other religions and thinkers also. Poikilohydric plants that can dramatically resurrect from almost dead-dry stage to normal condition on hydration, has led to the myth that they can induce 'life' in dead human beings. This may have led to the Sanjeevani concept.

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Artemisinin-based combination therapy for treatment of drug-resistant malaria

Chloroquine-resistant *Plasmodium falciparum* malaria that was first reported in Assam in 1973 is at present widely prevalent for which northeast is considered the corridor for proliferation and has spread to peninsular India[1,2]. There has been steady increase in drug-resistant foci and consequent proportions of *P. falciparum* cases that have risen substantially from 13% in 1978 to 40–50% of reported malaria cases in India at present. In northeastern states, focal disease outbreaks are frequent and associated death toll is largely ascribed to drug-resistant *P. falciparum* malaria[3]. In 1998, we reported development of new potent antimalarial, alpha/beta arteether, an artemisinin derivative extracted from the plant *Artemisia annua* for treatment of drug-resistant malaria[4]. Alpha/beta arteether was evaluated to be markedly superior for rapid parasite/fever clearance time, and was adopted in the control programme restricted for treatment of severe and complicated *P. falciparum* cases. Recent community surveys, however, revealed that the drug was extensively used as monotherapy that was readily available and prescribed by the attending physicians for treatment of malaria cases (Padhan, pers. commun.). Not surprisingly, when the drug was reevaluated in the same population groups, there were signs of delayed parasite clearance suggestive of incipient resistance to this molecule (unpublished data). Concurrently, decreased sensitivity to artemisinin derivatives was also reported in neighbouring southeast Asian countries along the Thai–Cambodia border[5].

To obviate the development and spread of artemisinin-resistance, the World Health Organization (WHO) recommended the use of combination therapies for countries experiencing resistance to conventional monotherapies such as chloroquine, sulphadoxine-pyrimethamine; preferably those containing artemisinin derivatives for *falciparum* malaria[6]. On the basis of therapeutic assessment in malaria endemic countries, WHO currently advocates the following artemisinin-based combination therapies (ACTs): (i) artemether + lumefantrine (AL), (ii) artesunate + amodiaquine (AS + AQ), (iii) artesunate + mefloquine (AS + MQ), (iv) artesunate + sulphadoxine-pyrimethamine (AS + SP). Among these, in 2007, the National Vector Borne Disease Control Programme of India adopted artemisinin-based therapy

Table 1. Changing transmission profiles of malaria in the Sonapur Primary Health Care Centre (Dimoria block) of Kamrup district of Assam, northeast India (Source: State Health Directorate of Assam)

Year	Population	No. of blood-smears examined (% of population checked)	Positive for malaria parasite (%)	Positive for *Plasmodium falciparum*	% of positive blood-smears with *P. falciparum*	Annual parasite incidence (no. of confirmed cases/ 1000 population)
2006	155,721	35,582 (22.8)	2551 (7.16)	1815	71.14	16.38
2007*	166,491	29,307 (17.6)	2152 (7.34)	1145	53	12.90
2008	166,579	33,925 (20.4)	584 (1.72)	279	48	3.50

*Artesunate + sulphadoxine-pyrimethamine (AS + SP) was implemented in 2007 for treatment of *P. falciparum* cases.

by combining sulphadoxine-pyrimethamine (that was already in use) with artesunate for treatment of every confirmed case of *P. falciparum* in high-risk districts of the northeastern states. Therapeutic assessment of this combination in different malaria endemic pockets in northeast that were declared chloroquine-resistant resulted in rapid parasite clearance (cure rate >95%), and was concluded to be safe and effective for treatment of *P. falciparum* malaria[7]. Implementation of the revised drug policy for two years in practice (2007–08) resulted in substantial reduction in case incidences and transmission profile indicating declining trends of *P. falciparum* as evidenced in the Sonapur Primary Health Centre (a typical foothill area that is endemic for drug-resistant malaria) in Kamrup district of Assam (Table 1). Based on the presented results, AS + SP combination therapy has now been implemented in the control programme for most districts of the northeastern states as first line of therapy (Neena Valecha, pers. commun.). Among other combination therapies that were subject to therapeutic assessment, AS + MQ, AL were reportedly just as efficacious[8,9]. In addition, newer alternate combinations are in the pipeline, i.e. artesunate + pyronaridine (AS + PRN)[10] and dihydroartemisinin + piperaquine (Neena Valecha, pers. commun.) that are being developed as fixed dose combinations (FDCs) reportedly are promising with >95% cure rate. These FDC-ACTs or FACTs that offer potential advantages including patient adherence to treatment, decreasing the production costs and prescription errors, are currently the focus of research and development in partnership with stakeholders for making it accessible to the public at an affordable price.

Malaria is a curable illness. Owing to rapid parasite clearance and high cure rate, the large scale deployment of ACTs would prove to be an evidence-based intervention in reducing disease transmission. Providing artemisinin-based combination therapy for every single case of *P. falciparum* can avert impending disease outbreaks, and save lives. In conjunction with effective chemotherapy, the challenge is to develop strong healthcare services where there is need for providing on-the-spot diagnosis and effective treatment; more so to maintain vigilance against counterfeit drugs that have already surfaced in some Southeast Asian countries[11,12]. We strongly advocate sustained political commitment for increased allocation of resources ensuring intensive disease surveillance and case management by monitoring therapeutic efficacy and upgrading drug policy in force to thwart the development and spread of drug-resistant malaria.

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